Lakes: The Mirrors of the Earth

BALANCING ECOSYSTEM INTEGRITY AND HUMAN WELLBEING

Book of abstracts

WLC15 PERUGIA2014

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15TH WORLD LAKE CONFERENCE

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BALANCING ECOSYSTEM INTEGRITY AND HUMAN WELLBEING
Book of Abstracts of the 15th World Lake Conference

Edited by

Process and Publication Coordinators
Chiara BISCARINI, Arnaldo PIERLEONI, Valentina ABETE, Antonello LAMANNA

Process and Publication Assistants
Dordaneh AMIN, Antonio ANNIS

IT Specialist
Adriano ROSSI

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TABLE OF CONTENTS

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Welcome Address by

Lucio Ubertini

Esteemed Invited Guests, Honourable Ministers, Authorities, Fellow Colleagues, Ladies and Gentlemen, after more than 20 years ago, when the 5th World Lake Conference was held in Stresa (1993), we are here again on the soil of Italy but this time in Umbria, the green heart of our dear country. Of course, green is a symbol of a healthy environment and this is tied to also historical development of the sciences of lakes and freshwater at its very embryonic stages. First and foremost, allow me on behalf of the Local Organising Committee, to express our most profound and sincerest gratitude and thanks to ILEC for the confidence reposed in us to host and organize the 15th World Lake Conference of this august body in Perugia.

We are proud to say WELCOME to you all, representatives of about **61** countries from all the five continents of the world to Perugia, Umbria Region and for that matter to Italy.

Now, I would like to share with you all some startling contributions of Umbria region to the development of Lake Science.

This region can boast of many monumental and epochal scientific and technological inventions which decisively contributed to the development of Lake sciences dating as far back as the Etruscan Age, some 1000 years B.C. through to the Roman times top the epoch of Universal Knowledge. The presence of various geophysical processes like the Tiber river, Trasimeno Lake all contributed to ingenious observations dating as far back as the times of Gallileo Galilei. I believe most of you are aware that the first attempt at the quantification of rainfall in a given time interval was carried out by Castelli, observing the rain water over the Trasimeno Lake. This led him to invent the rain gauge in the year 1639. It is important to emphasise that the rain measuring device which is still extremely useful in Meteorology was actually designed in the Saint Peter's Monastery here in Perugia. In a letter to his mentor and friend Galileo, dated June 18th 1639, Castelli described his invention.

Still on Lake Trasimeno, I would also like to share with you another historical feat. The illustrious son of Italy, the Genius of the Renaissance, Leonardo da Vinci mostly known as a painter, sculptor, engineer, architect, and scientist was also a brilliant cartographer. Having studied the Euclid Geometry from 1496 to 1504, knew that transferring a spherical surface onto a plane, at that time, could not be done without errors and he therefore used graphite shading to make visible different orographic levels. Combining arts and science and admiring the immense beauty of the panoramic valleys of Valdichiana and Valdarno Leonardo da Vinci, produced the much celebrated maps of the two valleys including Lake Trasimeno which are presently conserved in the famous Royal Library of Windsor.

My speech would not be complete if I do not touch on an engineering wonder of the region, the "Cascata delle Marmore" (Marble Waterfall) in Terni, dating as far back as the year 271

B. C., and constructed by a Roman Consul Manlio Curio Dentato during the Roman era. The present panorama offered by the waterfall is an epitome of modifications induced by humans on the natural environment in the course of many centuries. This engineering feat consisted in the construction of a drainage canal of reclamation of Piediluco Lake at the confluence of two rivers, the Velino and Nera. Subsequent designs were also advanced to increase the carrying capacity of the structures during floods at different historical moments. It was 1787-1788 that a Terni architect by name Andrea Vici found a lasting solution which gave the cascade its present appearance. Apart from harnessing the fall for hydroenergy production it also serves as a very important tourist attraction. The Marble Waterfalls is not only a historical engineering construction but has become an interdisciplinary laboratory for a three-dimensional mathematical modelling of the water fall in symbiosis with its natural environment. I would like to make a special mention of the University for Foreigners of Perugia involved in freshwater research through the Water Resources Research and Documentation Centre (WARREDOC) which for more than twenty years has carried out research, training and documentation programmes in water and environment, mainly for developing countries under the Italian Development Cooperation of the Ministry of Foreign Affairs; and the UNESCO Chair in Water Resource Management and Culture established in 2013. I would be doing a disservice to myself if I do not mention the institution here in Perugia which I head, the National Research Institute for Geohydrological Protection of the National Research Council and which has become the local organizational seat of USMA2007. Finally I would also wish to mention and thank one of the oldest universities in Italy, the University of Perugia which has offered us its logistical facilities for the scientific programmes of the Assembly and call on all of you to join me in wishing the Rector and the staff, higher and higher laurels during the celebrations of its seven hundred years of existence next year.

I would like to seize this opportunity to express my most profound and sincerest gratitude and thanks to all the members of the many Committees (honorary, local organizing and others) the Authorities at the national, regional and local levels for their unflinching support and cooperation at all the passes of this unique initiative. Specially thanks I would express to the President of Republic of Italy for the High Patronage to the 15th World Lake Conference. Permit me again to thank you all for finding time to be here with us at 15th World Lake Conference not only in the service of science but most importantly for your concerns about our Planet and hope and wish that you would enjoy the very high quality of scientific presentations, both oral and posters, that are awaiting you in about 40 sessions of this World Lake Conference.

Welcome again to Perugia and enjoy your stay.

Foreword by

Masahisa Nakamura

With deep appreciation to the host organization USMA, the University of Perugia, the University for Foreigners of Perugia, the historic City of Perugia, the surrounding communities in the Perugia Province and in the Umbria Region as well as the Italian Government, ILEC is very pleased to have successfully convened this 15th World Lake Conference. One overriding reason why the 15th World Lake Conference is so important is that this Conference commemorates the thirtieth year in its history. Looking back, the inaugural Conference dates back to the Shiga Conference on Conservation and Management of World Lake Environment of 1984 which was held on the shore of Lake Biwa, Japan. The principal aim at that time was to contribute to promoting scientific approaches in the world lake basin management, with particular emphasis given to tackle the challenges of "facilitating interactions among scientists, government officials and citizens on a global scale".

This spirit has been inherited to the succeeding Conferences held in various parts of the world, and this ILEC model has reached a very advanced state this time. While the submissions cover a wide and excellent arrays of highly specialized natural and applied science pursuits on such traditional subject areas as assessment, management and restoration of lake water quality degradation and ecosystem disturbances, the Conference has also been able to attract many contributions that span the science-policy interface with particular emphasis on the socio-cultural and political dimensions of lake basin governance. The sound and solid foundation of scientific pursuits have brought about a variety of governmental policies and nongovernmental engagements that have evolved over the past decades in the form of lake basin governance (software), with innovative structural and nonstructural interventions involving technologies and instrumentations (hardware). However, this time, so many contributions have come from such humanistic disciplines as national and international laws, historical achievements and contemporary implications of lake and water related archeology and architectural science.

We also have a budding notion of "heartware", a term to contrast the above past achievements in software and hardware, that pertains to the shared values among people with common appreciation of historical, cultural, anthropological and even religious implications of lake basin governance. While we still have a long way to go on these new dimensions about to sprout, it is certainly most fitting for the commemoration of this Conference that will inaugurate the new decades of global challenges.

We thank you all for the excellent submissions, wishing also very successful deliberations.

PLENARY LECTURE

Andras Szollosi-Nagy

DSc, PhD, Professor of Stochastic Hydrology, Rector, UNESCO-IHE Institute for Water Education, Delft; Governor of the World Water Council

Biosketch: Professor Szöllösi-Nagy currently serves as Rector of the UNESCO-IHE Institute for Water Education, located in Delft, The Netherlands. Since 2009 he is Professor of Stochastic Hydrology both at UNESCO-IHE and TU Delft. He joined UNESCO in Paris in 1989 as Director of the Division of Water Sciences and Secretary of the International Hydrological Programme (IHP). He held those positions for 20 years. He also served as Deputy Assistant Director General of UNESCO. He was the joint (founding) Editor of the International Journal of Stochastic Hydrology and Hydraulics (Springer). He currently serves on the editorial boards of several technical journals. He is member of the Board of the Stockholm Environmental Institute. He is elected fellow of the World Academy of Arts and Sciences (WAAS). Recipient of several major awards including, the Dooge Award of IWHA and the Prince Albert II of Monaco Environmental Award in the area of freshwater.

Title of Plenary Lecture:

Water: THE Key to Sustainable Development - The Challenge of the Century***?***

Abstract of Plenary Lecture:

The presentation will overview the current global perspective on water resources with an attempt to identify major likely future challenges along with an outline of potential opportunities for solutions. There is a growing consensus in international environmental politics that water is going to be one of the main issues of the 21st Century. Given the projected demands for water

supply, food security, and the likely impacts of climate variability and change, the present water use practices are clearly not sustainable. The presentation will attempt to identify the water security challenges that need to be addressed to establish sustainable water development and management practices for the future, with particular attention to the context of lakes and reservoirs. It will also look into the hydrological impacts of various global change drivers, such as climatic variability and change as well as changes in population patterns and related changes, such as land use change, migration from rural to urban areas. All these changes imply strong non-stationarity. It will be argued that the design methodologies, developed under the hypothesis of stationary hydrological processes, need to be revisited and updated. Mitigation and adaptation measures will shortly be outlined. Of the non-structural measures governance reforms will also be discussed. Recent advances within the United Nations in the area of identifying the Sustainable Development Goals will be reviewed

KEYNOTE LECTURE

Giovanni Seminara,

Full Professor of Fluid Mechanics

University of Genova

Academic Responsabilities

1987-1990 - Chairman of the Joint PhD program in Hydrodynamics, (Universities of Genova, Padova, Firenze, Trento)

1985-1995 - Member of the Scientific Committee of the joint PhD program in Hydrodynamics

1995-1998 - Chairman of the Scientific Committee for Civil Engineering and Architecture, University of Genoa

1995-1996 - Coordinator, National Project of the Ministry for the University, Science and Technology. Fluvial and estuarine sediment transport and morphodynamics

1997-1999 - Coordinator, National Project of the Ministry for the University, Science and Technology. Fluvial and coastal morphodynamics

1999-2002 - Chairman of the Joint PhD program in Fluid Mechanics and Processes in Environmental Engineering, University of Genoa

2001-2006 - Member of the Academic Senate, University og Genoa

Since 2007 - Department Head

Membership of Academies

- Socio (Fellow) of Accademia Ligure di Scienze e Lettere since 2000
- Socio Corrispondente (Fellow) of Accademia dei Lincei since 2001
- Socio Corrispondente (Fellow) of Istituto Veneto di Scienze Lettere ed Arti since 2004

Scientific Committees

- Member of European Mechanics Council (Governing body of the European Mechanics Society, EUROMECH), 1989-1994
- Member of Fluid Mechanics Section of International Association for Hydraulic Research
- Member of Advisory Board European Mechanics Society since 2002

- Member of Scientific Committee CORILA, 2003-2007
- Member of Scientific Committee of European Conference of Fluid Mechanics EUROMECH since 2004
- Member of EASAC Group on Ground Water Resources in Mediterranean Countries
- Member of Environmental Committee, Accademia Nazionale dei Lincei since 2007

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KEYNOTE LECTURE

Pierluigi Viaroli,

Department of Life Sciences,

University of Parma, Italy

Biosketch: Professor of Ecology at the dept. Life Science, University of Parma (Italy). Main research topics are production and decomposition of brackish and freshwater macrophytes and related biogeochemical processes; river-lagoon interactions, scientific support to management of wetlands, quarry lakes and lagoons. He published more than 100 international peer-reviewed papers with IF, and ten conference proceedings and special issues in international journals. He is involved in international programmes, scientific societies and commissions on water quality and coastal lagoon science. He is associate editor of Hydrobiologia and member of the board of Journal of Limnology and Advances in Oceanography and Limnology.

Title of Keynote Lecture:

Quarry lakes and reservoirs in the floodplains: monitoring, research and design of aquatic environments for water quality management and riverscape restoration

Abstract of Keynote Lecture: Clay, sand and gravel extraction in the floodplains has led to the formation of a number of small and generally shallow lakes and reservoirs, which are often eutrophic due to the pressures from farmland and urban areas. These newly formed water bodies provide a unique opportunity for studying the early colonization phases and the evolution of lake communities, to analyze biological interactions, and to evaluate the ecosystem metabolism and its effects on oxygen budgets and biogeochemical processes. the assessment of ecosystem services this kind of lakes can provide in terms of water and ecological quality is a challenging task. Study cases from the Po river, whose watershed hosts some hundreds of lakes accounting for ~15 km^2 total water surface, are presented. The comparison of lakes with different ages (from still in formation to 40 years) allows to evaluate their trophic state evolution in relation to hydrological connectivity, external pressures, internal buffering processes, onset and persistence of

hypolimnetic anoxia. Guidelines for designing lakes aimed at achieving good ecological conditions have been implemented as a scientific support to the quarry exploitation. Furthermore, the ecosystem services provided by quarry lakes have been suggested as potential tools for restoring the riverscape in the lowland areas, where the river margins are for the most part deteriorated and heavily exploited for agriculture, infrastructures and human settlements. In this context, quarry lakes can be used as substitutes of formely existing oxbow and riverine lakes and to reconnect, at least partially, the river channel with its floodplain.

KEYNOTE LECTURE

Alberto Basset,

Department of Biological and Environmental Sciences and Technologies,

University of the Salento, Lecce, Italy

Biosketch: Alberto Basset is Full Professor of Ecology at the University of Salento. His main research interests are in the field of population and community ecology, focusing on biodiversity organisation and ecosystem functioning in aquatic ecosystems. He is currently President of the Italian Society of Ecology and vice-President of the Ecological European Federation and has been served, with different responsibilities, in the boards of many scientific societies. His duties in the international area of biodiversity and ecosystem research include the responsibilities as member of the Board of Directors of the European Research Infrastructure 'LifeWatch' and co-leader of Component 2 of the GEO-Ecosystem Task. He has also editorial responsibilities as member of the editorial board, associate or in chief editor of Scopus/ISI journals in the field of aquatic ecology and conservation.

Title of Keynote Lecture:

Biodiversity and Ecosystem e-Science: opportunities and challenges
Abstract of Keynote Lecture:

Biodiversity and ecosystems, the management and conservation of their related services, have gained in the last decades a high priority in the international political agenda inspiring large-scale initiatives and resulting in the implementation of the environmental policy issues through monitoring plans at national and international scales. A positive cascading effect have been increasingly growing data collections on all components of biodiversity and ecosystems providing an unprecedented opportunity to test new ideas and produce new knowledge capitalising existing data resources.
Taking advantage of this opportunity, the fast development of biodiversity and eco-informatics is offering the tools and facilities to deploy data. These include capabilities to mine existing data from different sources, standardise,

integrate, analyse and model data. Biodiversity and eco- informatics is also offering increasingly accurate facilities to integrate data from very sources, from metabolomics to remote sensing.

e-Science research infrastructures, as LifeWatch in Europe, are building the new global research centres where scientists can find, integrate and use in a near future data on biodiversity and ecosystems coming from equipment as different as DNA sequencer and new Sentinel mission satellites. Global scale modelling has already started and will be strongly boosted from these new e-infrastructures and methodological developments.

However, integrating data, tools into such new capabilities requires major guiding scientific goals that represent intellectual frontiers and challenges for biodiversity research. I see two major challenges for ecological sciences in the next few years to convert the opportunities offered by the innovative technologies into deeper understanding and new knowledge on biodiversity and ecosystems: critically revising milestone concepts in ecology, as the ecosystem concept, producing clear and shared ontologies and cascading data standardisation; and, addressing the architectural layer of biodiversity and ecosystems decoding organisation into the underlying mechanisms and related drivers.

KEYNOTE LECTURES

Aharon Oren,

Department of Plant and Environmental Sciences,

The Institute of Life Sciences,

The Hebrew University of Jerusalem, 91904 Jerusalem, Israel

Biosketch: Aharon Oren (born 1952, Zwolle, the Netherlands) received his M.Sc. degree from the University of Groningen and his Ph.D. from the Hebrew University of Jerusalem (1978). After a post-doctoral period at the University of Illinois at Urbana-Champaign he joined the faculty of the Hebrew University of Jerusalem, and was appointed full professor in 1996. His research interests are the microbiology of hypersaline environments, the physiology and biochemistry of halophilic microorganisms, and systematics and nomenclature of prokaryotes. He is president of the International Society for Salt Lake Research, executive secretary/treasurer and past chairman of the International Committee on Systematics of Prokaryotes, editor-in-chief of the International Journal of Systematic and Evolutionary Microbiology, and editor for FEMS Microbiology Letters and Extremophiles. He was elected Fellow of the American Academy of Microbiology in 2000, and in 2010 he received an honorary doctorate from the University of Osnabrück, Germany.

Title of Keynote Lecture:

Two and a half thousand years of navigation on the Dead Sea

Abstract of Keynote Lecture: The only ship on the Dead Sea today is a research vessel for scientific exploration. In earlier periods many kinds of boats sailed the waves of the saltiest of all lakes. Anchors found on newly exposed shore of the shrinking lake and remnants of a 1st century B.C.E. shipyard are witnesses of extensive navigation in antiquity. A naval battle was fought on the lake in 312 B.C.E and there exists a letter from 134 C.E. mentioning a ship loaded with fruit anchoring near Ein Gedi. A 6th century mosaic map depicts two sailing boats on the lake. Legal deeds from crusader times period prove that a cargo ship was operated by the Knights Hospitaller of Jerusalem. The 1848 Dead Sea exploration by Lt. William Lynch (US Navy) and earlier unsuccessful ventures by Costigan (1835) and Molyneux (1847) used small rowing

boats, but the French expedition of the Duc de Luynes in 1864 brought a custom-built luxury sailing yacht. In the middle of the 19th century a navigation route to India via the Dead Sea was considered as an alternative to the Suez Canal. The first motor ship appeared in 1908, and later a large fleet connected between the operations of the Palestine Potash Company at both ends of the lake. Among the unusual crafts seen on the Dead Sea were a Martinsyde bomber plane equipped with floats instead of wings used as a weapon during World War I, BOAC hydroplanes that landed on the lake in the 1940s on their way to Australia, and the yellow submarine that in 1999 explored the bottom in search for the biblical cities of Sodom and Gomorrah.

Title of Keynote Lecture:

The microbiology of the Dead Sea: changing microbial communities in a rapidly changing environment

Abstract of Keynote Lecture: Today the Dead Sea (total salt concentration ~350 g/l with ~2 M Mg^{2+}, ~1.4 M Na^{+}, ~0.5 M Ca^{2+}, ~0.2 M K^{+} and Cl^{-} as the main anion) supports very little microbial life. Biological monitoring of lake's water column since 1980 has shown that blooms of the unicellular green alga *Dunaliella* and halophilic Archaea of the family *Halobacteriaceae* only develop following significant dilution of the upper water layers after exceptionally rainy winters. Such events occurred in 1980 and even more dramatically in 1992, when up to $3.5x10^{7}$ Archaea per ml in the diluted upper 5-10 meters of the water column colored the lake red. Archaeal blooms were preceded by blooms of *Dunaliella* (up to 8,800 and 15,000 cells/ml, respectively). From 1996 onwards *Dunaliella* was no longer observed and prokaryote numbers remained low. In spite of the increasingly extreme conditions, a small but diverse community of halophilic Archaea still survives in the lake, as shown by culture-independent, 16S rRNA gene-based molecular techniques. The community structure of the Archaea present in 2007 was very different from that in 1992, showing that even in this extreme environment the microbial communities are dynamic, showing changes in species composition as conditions become increasingly adverse. To examine the possible effects of the implementation of the planned Red Sea – Dead Sea conduit on the Dead Sea as an ecosystem, simulation experiments were performed in which Dead Sea water was diluted with Red Sea water, both in the laboratory and under field conditions in experimental ponds at Sedom. The extent of biological development depended on the extent of dilution and on phosphate availability.

KEYNOTE LECTURE

Amilcare Porporato,

Addy Professor of Civil and Environmental Engineering,

Department of Civil and Environmental Engineering, Duke University, USA

Biosketch: Amilcare Porporato earned a Master Degree in Civil Engineering (summa cum laude) in 1992 and his Ph.D. in 1996 from Polytechnic of Turin. He was appointed Assistant Professor in the Department of Hydraulics of the Polytechnic of Turin, and he moved to Duke University in 2003, where he is now Full Professor in the Department of Civil and Environmental Engineering with a secondary appointment with the Nicholas School of the Environment. In June 1996, Porporato received the Arturo Parisatti International Price, awarded by the Istituto Veneto di Scienze, Lettere e Arti. He was Research Associate at the Texas A&M University (USA) in 1998 and Visiting Scholar at Princeton University (USA), Department of Civil and Environmental Engineering, from 1999 to 2001. In 2008-2009 he was the first Landolt & Cie Visiting Chair in "Innovative Strategies for a sustainable Future" at Ecole Polytechnique Federale de Lausanne (EPFL), Switzerland. He was awarded the 2007 Professor Senol Utku' award, the 2010 Earl Brown II Outstanding Civil Engineering Faculty Award, and in 2011 he received a Lagrange fellowship from the Polytechnic of Turin, the CRT bank and the ISI (Institute for Scientific Interchange). In 2012 he was elected an AGU fellow. His main research interests regard nonlinear and stochastic dynamical systems, hydrometeorology and soil-atmosphere interaction, soil moisture and plant dynamics, soil biogeochemistry, and ecohydrology. Porporato has been Editor of Water Resources Research (AGU) (2004-2009), and he is currently editor for Hydrological Processes. He is also member of the editorial board of Advances in Water Resources and the Hydrologic Science Journal. Among other things, he was chairman and convener of the Ecohydrology sessions of

the AGU Spring Meeting in 2001 and 2002 and of the EGU in 2004-2006. Porporato has been part of the Italian research groups of Turbulence and Vorticity and of Climate, Soil and Vegetation Interaction, an adviser for real-time forecasting in the Piedmont Region (Italy), and ecohydrology (US National Academy). Porporato's didactic experience comprises courses in Environmental Fluid Mechanics, Hydraulics, Hydraulic Constructions, Statistical and Physical Hydrology, Ecohydrology, Nonlinear Dynamics and Stochastic Processes. He has also been the didactic coordinator for the International School "Hydroaid: Water for Development", co-organized by the Polytechnic of Turin and the Italian Ministry of Foreign Affairs. Porporato is author of more than 140 peer-reviewed papers, several publications presented at national and international conferences and invited talks. He is also co-author of the book "Ecohydrology of water controlled ecosystems" (Cambridge Univ. Press, 2004) and the edited the book "Dryland Ecohydrology" (Springer, 2005).

Index

MS01-01
Water quality and pollution control

HYDRO-BIOLOGICAL STATUS OF A FRESHWATER BODY AT RURAL AREA OF AHMEDABAD, GUJARAT, INDIA

Chirag A. Acharya

Shri U.P.Arts, Smt. M.G.Panchal Science and Shri V.L.Shah Commerce College, Pilvai, Dist. Mehsana, Gujarat, India

Kotadiya Nikesh G.

M. G. Science Institute, Ahmedabad, Gujarat, India

KEYWORDS: GHUMA LAKE, PHYSICO-CHEMICAL PARAMETERS, WATER QUALITY INDEX AND ALGAL GENUS POLLUTION INDEX

The present study was intended to calculate Water Quality Index (WQI) of a rural freshwater body in Ghuma village, District Ahmedabad, Gujarat, India in order to ascertain the quality of water for public consumption, recreation and other purposes. This paper deals with the study on the influence of environmental parameters on the water quality of water body. There are several ways to assess the quality of water deemed fit for drinking, irrigation and industrial use. Water Quality Index, indicating the water quality in terms of index number, offers a useful presentation of overall quality of water for public or for any intended use as well as in the pollution abatement programmes and in water quality management. A number of parameters affect the usability of water for a particular purpose. In this study Water Quality Index was determined on the basis of various physico-chemical parameters. The water sample from the water body were collected early in the morning at an interval of 30 days and analyzed for 12 physico-chemical parameters by following the established procedure. WQI values in the present investigation were reported 49.61 in monsoon season 59.52 in winter season 58.11 in summer season and overall WQI value was 58.11.Above results were less than 75 (Water Quality Index Level) for different season indicating that the water quality is poor and not totally safe for human consumption. The use of algae as biological indicators of pollution has been studied by rating pollution tolerant algae in the Ghuma lake based on the report of Palmer, (1959). Total of 608 genera count/ml of algae were recorded from Ghuma lake. During monsoon season algal pollution index was 16, in winter season algal pollution index was 19, summer season algal pollution index was 17 and over all algal pollution index was 16.66.

PRESENTATION TYPE: POSTER

COMPARISON OF TREATED WATER QUALITY OUTCOMES OF ECO-RESTORATION PROJECTS IN THREE GEO-CLIMATIC CONDITIONS OF INDIA

Pallavi Patil
Shrishti Eco-Research Institute, Pune, India
Pramod Salaskar
Shrishti Eco-Research Institute, Pune, India
Sandeep Joshi
Shrishti Eco-Research Institute, Pune, India

KEYWORDS: POLLUTED DRAINS, WATER QUALITY, ECO-RESTORATION

Eco-restoration of polluted drains flowing down the lentic-lotic water systems in three different geo-climatic regions of India namely – Rajasthan (semi-arid region of Aravali Ranges), Uttar Pradesh (Gangetic river basin – Himalyan fed rivers) and Maharashtra (rain-fed river basins). Horizontal eco-filtration treatment systems were used to treat the pollution using in-stream green infrastructures in combination with phytoremediation and bioremediation. An extensive water quality assessment programme was conducted (including pre-monsoon and post-monsoon period) to evaluate the water quality upstream and downstream of treatment systems on every polluted drain. The physico-chemical and biological parameters such as pH, Hardness, Total Solids (TS), Electrical Conductivity (EC), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Most Probable Number (MPN), Alkalinity, Dissolved Oxygen (DO), nitrates and phosphates were tested for more than 2 years for each of the project. It can be concluded that there was improvement in DO concentration (3 – 12 times) and significant reduction in TSS, BOD, COD and Fecal coliforms. It can be further deduced that the effectiveness of the treatment was comparatively more in warm seasons than cold seasons. During the monsoon, the ecological treatment was more effective on rainy days than non-rainy days. It was observed that the installations sustained flooding conditions and restored within 3 – 7 days after the floods. In this paper, the effectiveness of various installations is compared based on hydraulic and pollution loadings.

PRESENTATION TYPE: ORAL

APPLICATION OF WATER QUALITY MODEL FOR SELECTION OF RIVER-FLOW PATTERN AND POLLUTION DISPOSAL LOCATION IN A LARGE RESERVOIR

Mark Prabhakar Vuppati

Water Quality Analysis and Modelling Division, Central Water and Power Reseaarch Station, Khadakwasla, Pune, India

Shanti Vaidya

Water Quality Analysis and Modelling Division, Central Water and Power Reseaarch Station, Khadakwasla, Pune, India

KEYWORDS: WATER QUALITY MODEL , RESERVOIR, POLLUTION

Water quality processes in a reservoir are dependent on river flow conditions and physiography of a reservoir. The river flow affects the concentration and distribution of water quality variables in the reservoir. In the present study, three zones within a large reservoir, namely Riverine, Transition and Lacustrine were studied for their suitability for placing a location of Pollution disposal, under three different main river-flow patterns namely Constant, Cyclic flow 1 (increasing trend), Cyclic flow 2 (decreasing trend). Pollution load was given as Biochemical Oxygen Demand (BOD) in 5 different concentrations ranging from 30-700 mg/l, keeping Dissolved Oxygen (DO) constant (6 mg/l). Water quality of outflow water was assessed through variations in BOD and DO. Water Quality Weightage (WQW) method was proposed and used for the evaluation of effectiveness of 3 different river-flow patterns, under 5 pollution loads from 3 pollution disposal zones for pollution management. Among the three reservoir-zones for pollution disposal modeled , Riverine zone was observed to be better for BOD maintenance whereas Lacustrine zone was observed to be better for DO maintenance in outflow waters. With regard to river flow patterns modeled, Cyclic flows were observed to be more suitable for pollution management than constant flow. Within the Cyclic flows, Cyclic flow 1, representing increasing trend, worked better for maintaining DO conditions whereas Cyclic flow 2, representing decreasing trend, worked better for maintaining BOD in outflow waters. The detailed results and possible reasons for the variations are discussed in the paper.

PRESENTATION TYPE: ORAL

INNOVATIVE TECHNIQUE OF WASTE WATER TREATMENT WITH SPECIAL REFERENCE TO ROOT ZONE TECHNOLOGY AT SHAHPURA, BHOPAL, (M.P.) INDIA

Kalpana Kumari Thakur
Barkatullah University, Bhopal, (M.P), India
Avinash Bajpai
Makhanlal Chaturvedi University, Bhopal, (M.P), India
Shailbala Singh Baghel
Department of Chemistry, Sarojini Naidu Govt. P.G. College, Bhopal, (M.P), India

KEYWORDS: ROOT ZONE, CONSTRUCTED WETLAND, EPCO

Fresh and clean drinking water is a basic need for all human beings on the earth, yet it has been observed that millions of people worldwide are destitute of this. Untreated or inadequately treated sewage is a major source of groundwater and surface water pollution in the developing countries. The Shahpura Lake is also known as third lake of Bhopal or Mansarover Lake. The lake has a catchments area of 8.29 km2 and a submergence area of 0.96 km2. It was constructed in the southern part of city near Chuna Bhatti village in year 1974-1975 under the Betwa irrigation scheme. The lake is surrounded by human habitation and receives untreated sewage from various sources. The water quality is depleted day to day not only by sewage inflow but also by mixing of waste generated from washing of cloth and vehicles, domestic waste etc. So it is necessary to treat this waste water before entering to the lake. For this purpose, Environmental Planning & coordination organization (EPCO) constructed a Horizontal surface flow wetland / root zone unit at Ekant Park, Bhopal. The present Root Zone system is designed to treat 70,000 litres/ day of waste water of nalla passing through the Park. This system is consists of pre-treatment (Settling tank-35 m3) followed by Root zone bed (700 Sq. m) with gravels, Reed Plants (Phragmitis Karka) and inlet – outlet arrangement for flow of water. To study the efficiency of system physico-chemical parameter namely DO, BOD, COD, Chloride and Total Hardness were analysed quarterly from June 2012 to May 2013. The result obtained indicates that the Root zone System works effectively for maintaining the ecological balance of the Shahpura Lake and treated water can also be used for recreational activities like washing clothes, fishing, swimming, irrigation etc.

PRESENTATION TYPE: ORAL

PHYSICAL CATCHMENT CHARACTERISTIC AT CALDERA LAKES IN BALI, INDONESIA

Luki Subehi
Research Centre for Limnology, Indonesian Institute of Sciences (LIPI), Indonesia
Hendro Wibowo
Research Centre for Limnology, Indonesian Institute of Sciences (LIPI), Indonesia
Iwan Ridwansyah
Research Centre for Limnology, Indonesian Institute of Sciences (LIPI), Indonesia
Fajar Setiawan
Research Centre for Limnology, Indonesian Institute of Sciences (LIPI), Indonesia
Dini Daruati
Research Centre for Limnology, Indonesian Institute of Sciences (LIPI), Indonesia

KEYWORDS: LAKE BUYAN, LAKE TAMBLINGAN, SEDIMENTATION

Lake Buyan-Tamblingan located at an altitude of 1200 m above sea level, is a potential area for tourism industry, residential and agricultural area. An oval-shaped caldera lake with a diameter of 12 x 7 km, named as "endorheic basin" as a confined basin or closed lake basin. The shape of the caldera is natural container basin morphology and therefore, there is no direct inflow or outflow. The objective of this study is to analysis of physical characteristics catchment at Lake Buyan and Lake Tamblingan. The survey was conducted on October 2013. Rainwater that falls will be collected in a container of water and percolate as groundwater in the basin. There is also a flow of groundwater that flows very slowly out as the springs basin in the lower region. The morphometric showed extensive Lake Buyan 3.67 km2 with a maximum depth of 79.5 m. Those lakes have an area of 1.15 km2 where lake Tamblingan with a maximum depth of 40 m. The average depth of Lake Buyan and Tamblingan is 31.7 m and 23.5 m, respectively. The result of land use changes showed the largest land changes occur in forest cover reached 123.5 ha or less 5% of the previous forest area. Most of the forest cover turned into plantations and agricultural areas. Another land use for 18 years is reduced irrigated fields and plantations decreased 6% from the previous wide. Sedimentation in lakes Buyan and Tamblingan using hydrological models SWAT, sediment load simulation results lakes Buyan and Tamblingan is 134.2 tons/year and 111 tons/year. If allowed to continue these activities then would threaten the sustainability of the lake.

PRESENTATION TYPE: POSTER

SEARCH AND RECOVERY OF SUNKEN VEHICLES IN LAKE KHUVSGOL, MONGOLIA

Richard D Robarts
World Water and Climate Foundation, Saskatoon, Canada
Michio Kumagai
Ritsumeikan University, Otsu, Japan
Charles R Goldman
University of California, Davis, U.S.A.
Khadbaatar Dalifjav

Oyundelger Nataa
Advisor to Member of Mongolian Parliament
Enkh-Amgalan Luvsantseren
Parliament of Mongolia

KEYWORDS: SUBMERGED VEHICLES, HEAVY METALS AND PETROCHEMICAL POLLUTION, UNDERWATER SEARCH TECHNIQUES

Many lakes and rivers in Mongolia have disappeared during the last several decades caused by global warming: by 2003 18 % of the lakes had disappeared and 32 % by 2007. As desertification proceeds, the loss of the country's fresh water resources is a critical issue for conservation of land, vegetation, wildlife and society. Lake Khuvsgol, a large, ancient freshwater lake, has a volume of 480 km3, a retention time of 700 - 1000 years, a maximum depth of 262.4 m, an area of 2,760 km2 and it contains 96% of Mongolia's total freshwater volume of 500 km3. There are several major environmental issues potentially impacting Lake Khuvsgol. One is the presence of sunken vehicles, including oil and fertilizer tanker trucks. Apparently there are more than 15 vehicles, and possibly as many as 64, submerged in the lake due to the breaking of surface ice during past winters when the lake was the only materials transportation corridor from Russia. These need to be located and removed before they can severely contaminate the lake due to corrosion and leakage of nutrients, heavy metals and petrochemicals. In summer of 2013 we searched for 16 vehicles using an eco-sounder, GPS, historical geographical coordinate data and a remotely operated vehicle with cameras. We did not locate any of these as the data proved to be highly inaccurate. Subsequently, with the help of former tanker drivers, we were able to locate two vehicles. In addition, we found large areas of ground water inflow and a fish population greater than expected for this oligotrophic, cold water lake. We propose in 2014 to map the lake bottom using side-scan sonar. Once the vehicles are located we will measure potential pollution in their vicinity. In 2015 we will employ a salvage company to remove the vehicles and concurrently measure any content leakage due to corrosion and vehicle breakage. If the lake becomes contaminated by these pollutant sources it will take a very long time for it to recover. A strong and effective environmental management plan is urgently needed for this Mongolian national treasure.

PRESENTATION TYPE: ORAL

LIFE IN RADIOACTIVE WATERS: THE REMOTE CONSEQUENCES OF THE CHERNOBYL ACCIDENT FOR LAKE ECOSYSTEMS

Dmitri Gudkov
Institute of Hydrobiology, Kiev, Ukraine
Mikhail Kuzmenko
Institute of Hydrobiology, Kiev, Ukraine
Natalia Shevtsova
Institute of Hydrobiology, Kiev, Ukraine
Natalia Pomortseva
Institute of Hydrobiology, Kiev, Ukraine
Alexander Kaglyan
Institute of Hydrobiology, Kiev, Ukraine
Alexander Nazarov
Chernobyl Specialized Enterprise, Chernobyl, Ukraine

KEYWORDS: CHERNOBYL EXCLUSION ZONE, RADIOACTIVE CONTAMINATION, AQUATIC BIOTA

Currently the radioecological situation in the Chernobyl exclusion zone (EZ) is determined primarily by long-lived radionuclides 90Sr, 137Cs, 238Pu, 239Pu, 240Pu and 241Am. Along with natural decontamination processes in aquatic ecosystems such as physical decay of radionuclides and their hydrological transport outside the EZ, there is a change of physical and chemical forms of radioactive substances in soils of catchment areas, their transformation and transition in the mobile and bioavailable state, washout to the closed aquatic ecosystems and accumulation by hydrobionts. This is essentially deteriorates the radiation situation in lake ecosystems, which are some kind of “storage system” of radioactive substances in the EZ and results in increase of radiation dose to aquatic species and manifests in a variety of radiation effects at different levels of biological systems. It is determined that the rate of chromosomal aberrations in the roots of the helophyte plants of the most contaminated lakes on average in 2-3 times and in cells of the pond snail embryos in 4-6 times exceeding the spontaneous mutagenesis level, inherent to aquatic organisms. Leukogram analysis of peripheral blood of fish showed the decrease of part of lymphocytes, responsible for the implementation of immunological reactions. At that it is registered increase in the number of granulocytic elements (neutrophils and pseudoeosinophils), responsible for phagocytic function and involved in allergic and autoimmune reactions. Along with changes in leukograms an increased level of morphological damages of erythrocytes (deformation of nucleus and cell membrane, nucleus and cytoplasm vacuolization, pyknosis and lysis of cells, forming of microcytes, schistocytes, double nucleus cells and micronuclei) was determined, which is generally for pray fish in 4-12 times and for predatory fish in 7-15 times higher than in fish from reservoirs with background levels of radioactive contamination. Analysis of the viability of the seed progeny of the common reed at germination in the laboratory showed that in gradient of absorbed dose rate from 0.03 to 11.95 cGy year-1 for parental plants in lakes, there is a reduction in technical germination (from 93 to 60%), germination energy (from 91 to 30%) and seed viability (from 54 to 38%). At the same time significantly increased the number of abnormalities of seed seedlings: necrosis of roots (from 1.3 to 14.7%); disturbance of gravitropism (from 2.6 to 17.0%); damages of organogenesis (from 4 to 24%) and disturbance of chlorophyll synthesis (from 0 to 2%). Thus, the established dose-related effects in hydrobionts of lakes within the EZ indicates a damage of biological systems at subcellular, cellular, tissue, organ, organism and population levels as a result of chronic exposure to low doses of ionizing radiation. The rate of chromosomal aberrations in cells of aquatic species in many times exceeds the level of spontaneous mutagenesis level to aquatic biota. Increased levels of chromosome damages may be a manifestation of radiation-induced genetic instability, which is one of the main mechanisms for the protection of living organisms from exposure to stressors with subsequent implementation at higher levels of organization of biological systems.

PRESENTATION TYPE: ORAL

PULVERIZING AERATOR EQUIPPED WITH A PHOSPHORUS INACTIVATION SYSTEM

Ewa Osuch
Poznan University of Life Sciences, Poland
Stanisław Podsiadłowski
Poznan University of Life Sciences, Poland
Jacej Przybył
Poznan University of Life Sciences, Poland

KEYWORDS: LAKE RESTORATION, PHOSPHORUS INACTIVATION, PULVERIZING AERATION

The principal threat to lakes of the temperate zone is posed by factors accelerating their eutrophication and causing marked deoxygenation of the deeper layers of water, mainly the hypo- and metalimnion. Among their effects are frequent phytoplankton blooms, including those of blue-green algae, and general deterioration of water quality also affecting the abundance and health status of fish. The chief concern is a disturbed proportion between the amount of complex chemical compounds, especially organic, and the oxygen content of lake waters. Natural processes of water oxygenation are not too intensive, because they are practically limited to the epilimnion layer, connected as they are with the activity of aquatic plants of the littoral and sublittoral zone (which tends to disappear in contaminated lakes) and wind energy (the effect of waving). In summer conditions, with a relatively great chemical activity of bottom deposits, the intensity of those processes is usually inadequate [KLAPPER 2003; LOSSOW et al 1998]. Hence, in 1995 a research was launched in the Institute of Agricultural Engineering of the Agricultural University in Poznań on an integrated lake restoration technology whose core was a self-powered aerator capable of oxygenating also the bottom layers of water (the hypolimnion) of deep lakes. The aerator uses energy obtained from a Savonius rotor mainly to diffuse gases: to release hydrogen sulphide, which usually saturates the hypolimnion water completely, and then to saturate this water with oxygen [PODSIADŁOWSKI et al. 2005]. Even early studies showed the constructed device to be highly efficient in improving oxygen conditions in the bottom zone. They also made it clear that it should be equipped with an autonomous system designed to inactivate phosphorus, one of the principal factors determining the rate of lake degradation. In 2003 the first wind-driven pulverising aerator equipped with such a system was installed in Town Lake in Chodzież. The aim of this work is to present the principles of operation of a wind-driven pulverizing aerator with a phosphorus inactivation system, as well as its general technical characteristics and preliminary results of a study of its performance.

PRESENTATION TYPE: POSTER

GREEN FILTERS: SUSTAINABLE WASTEWATER TREATMENT IN THE BASIN OF LAKE FúQUENE, COLOMBIA

Felipe Valderrama Escallón
Fundación Humedales, Colombia
Yago García
Fundación Global Nature, Spain

KEYWORDS: SUSTAINABLE WASTEWATER TREATMENT, GREEN FILTERS, LAKE FúQUENE, COLOMBIA

Lake Fúquene (3,000ha, 2,550m.a.s.l.), a strategic wetland for the region of the northern Andes in South America is facing the negative effects of the eutrophication of its waters, therefore its ecological integrity and the ecosystem services it provides (drinking water supply, fisheries, transport, raw material for handcrafts, among others) to a population of over 200,000 inhabitants within the basin of the Ubaté-Suarez rivers, are compromised. To address this situation, Fundación Humedales (COLOMBIA), sponsored by the Global Nature Fund (GERMANY), with the technical support of Fundación Global Nature (SPAIN), and the funding from the companies KÄRCHER (GERMANY) and SIKA (SWITZERLAND), conducted a low cost, sustainable, and efficient pilot experience (GREEN FILTERS) to help neutralizing the main threat to lake Fúquene: domestic wastewaters discharges. The chosen technology for wastewater treatment, GREEN FILTERS with floating macrophytes, consists in using plant species, already established in the region, that are planted in long, narrow and shallow channels. After two months of operation, the pilot system located in San Miguel de Sema, Boyacá (500 inhabitants), constituted by a simplified primary treatment and a channel of 140m long, 3.5m wide and 1m deep, obtained an average BOD removal of 90%. The pilot system results incentivized other communities to use similar technologies of high economical, social and environmental viability, which will contribute towards the improvement of water quality in the basins and the protection of high-Andean wetlands in Colombia and Latin America.

PRESENTATION TYPE: POSTER

INFLUENCE OF LIGHT WAVELENGTH AND INTENSITY ON GEOSMIN PRODUCTION OF STREPTOMYCES COELICOLOR A3(2)

Ayako Kanazawa
Graduate School of Life and Environmental Sciences, University of Tsukuba, Japan
Kazuya Shimizu
Faculty of Life Sciences, Toyo university, Japan
Norio Sugiura
Faculty of Life and Environmental Sciences, University of Tsukuba, Japan
Motoo Utsumi
Faculty of Life and Environmental Sciences, University of Tsukuba, Japan

KEYWORDS: ACTINOMYCETES, MUSTY ODOR, GEOSMIN

Actinomycetes are known to produce geosmin and 2-methylisoborneol (2-MIB), both are responsible for musty odor in fresh waters. Light is one of the most important factors for metabolic response of actinomycetes. Previous studies have reported that Streptomyces coelicolor A3(2) produced carotenoid when exposed at blue light (2.4 μmol m-2 s-1), but didn't produce at red light (2.4 μmol m-2 s-1). Both carotenoid and geosmin are terpenoids. Furthermore, isopentenylpyrophosphate is common precursor of geosmin and carotenoid. In this study, we conducted plate culture experiments under different LED light intensity (0, 1, 10, 20 and 30 μmol m-2 s-1) of blue (470 nm) and white light to elucidate the factors that influence on geosmin production. Geosmin production of S. coelicolor A3(2) gradually increased under blue and white light condition between 2.5 and 20 μmol m-2 s-1 light intensity, but the production tended to decrease above 20 μmol m-2 s-1. This result suggested geosmin production of S. coelicolor A3(2) increased when exposed short wavelengths light, but decreased at light intensity above specific level. Also, we conduct plate culture experiments under different light intensity of red (660 nm) and green (525 nm) light to elucidate the factors that influence on geosmin production.

PRESENTATION TYPE: POSTER

ROAD DE-ICING SALT AND ITS EFFECTS ON SURFACE WATER: A CASE STUDY IN NORTHERN ITALY, SUBALPINE LAKE DISTRICT

Michela Rogora
National Research Council (CNR), Institute of Ecosystem Study, Italy
Rosario Mosello
National Research Council (CNR), Institute of Ecosystem Study, Italy
Nico Salmaso
Research and Innovation Centre, Fondazione Edmund Mach, Italy
Leonardo Cerasino
Research and Innovation Centre, Fondazione Edmund Mach, Italy

KEYWORDS: CHLORIDE, LONG-TERM TRENDS, HYDROCHEMISTRY

In the recent period there has been a growing concern about the effects of increasing chloride concentration in surface waters, due to their potential damage to aquatic life. Increasing content of chloride has been observed in several lakes and rivers in urban areas or close to major roads in Europe and US. In Italy the use of NaCl as road de-icing agent is limited to northern regions and mountain areas. However, possible effects of chloride on water quality have never been assessed. Long term series of chemical data exists, including major ions, for the lakes of the subalpine district (Maggiore, Lugano, Como, Iseo e Garda). In this paper we analyse trends affecting Cl and Na concentrations in the deep subalpine lakes during the last 25 years, with the aim to discuss the possible causes of temporal changes. An in-depth analysis is presented for Lake Maggiore. All the lakes considered show positive trends of Na and Cl concentrations, mostly evident in the recent part of the record (since 2000). For Lake Maggiore, the increasing content of these ions in lake water is in agreement with the raising loads from the main tributaries. The use of NaCl as road de-icing agent in winter was identified as the main cause for the observed trends. Cl concentrations in the study lakes are still far from the threshold limit for water quality; however, the positive trends of Cl in these lakes, representing almost 80% of the total freshwater volume in Italy, warrants further investigation.

PRESENTATION TYPE: ORAL

OCCURRENCE OF PERFLUOROOCTANE SULFONATE (PFOS) AND PERFLUOROOCTANOATE (PFOA) IN PERCH (PERCA FLUVIATILIS) FROM VARESE LAKE (NORTH ITALY)

Stefania Squadrone
Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, Italy
Valentina Ciccotelli
Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, Italy
Tommaso Scanzio
Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, Italy
Livio Favaro
Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, Italy
Claudio Foglini
Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, Italy
Marino Prearo
Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, Italy
Maria Cesarina Abete
Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, Italy

KEYWORDS: PFOS/PFOA, PERCA FLUVIATILIS, VARESE LAKE

Perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) are environmental contaminants belonging to a chemical group known as perfluorinated compounds (PFC). PFOS/PFOA are very persistent in the environment and bioaccumulate in humans. The United States Environmental Protection Agency (US EPA) considers both compounds to be carcinogenic and the European Food Safety Authority (EFSA) recently pointed out that they are associated with adverse health effects. Diet is considered the main source of exposure to PFCs, which have been found more frequently in fish compared to other food groups. In fact, aquatic ecosystems represent the final reservoir for PFCs due to their great affinity for sedimentary and living organic matter. In these systems, measured levels of persistent organic pollutants (POPs) could increase along the trophic web, ultimately affecting humans that consume aquatic species. In this study, PFOS/PFOA was detected by LC-MS/MS in muscle samples of Perca fluviatilis collected from Varese Lake. PFOA was not found in any of the investigated samples above the limit of quantitation of 0.50 ng g-1fresh weight (fw), whereas PFOS was detected in all samples with concentrations ranging from 5.4 to 17.2 ng g-1 fw (mean 9.59 ng g-1 fw). A provisional TDI (Tolerable Daily Intake) of 150 ng g-1 body weight per day was proposed by the EFSA Opinion (2008) to be used for a risk assessment. Our bio monitoring results did not show a particularly alarming level of pollution by PFCs. In fact we didn't find PFOS values exceed the TDI proposed by EFSA in fish.

PRESENTATION TYPE: POSTER

SOME PHYSICO-CHEMICAL FEATURES OF FRESH WATER RESOURCES IN MUĞLA PROVINCE (TURKEY)

Nedim Özdemir
Muğla Sıtkı Koçman University, Turkey
Ahmet Demirak

KEYWORDS: ANTHROPOGENIC FACTORS, PHYSICAL-CHEMICAL ANALYSIS, FRESH WATERS

Recently, in settlement areas in Turkey, similar to many other parts of the world, the fresh water systems and natural structures of the sea, especially the ones under the pressure of various organic and inorganic pollutants, are being deformed and these regions which are quite productive in terms of fishery products are getting infertile because of the population growth, industrialization, intense agricultural activities and agricultural malpractices. This study was carried out between May 2009 and April 2011 in these water resources; Kadın Creek, Akcapınar Creek, Yuvarlakcay Stream and Namnam Stream. These stations, selected these fresh waters were investigated for water quality aspects. Water samples, taken from these stations were studied for physico-chemical evidences. Results of the study were determined as: water temperature (12,04-25,29 □C), pH (6,02-8,68), electrical conductivity (348-33232 µS/cm), dissolved oxygen (4,28-9,71 mg/L), BOD5 (BDL-5,31 mg/L), nitrite (BDL-14,66 µmol/L), nitrate (BDL-27,68 µmol/L), ammonia (BDL-21,16 µmol/L), ortho-phosphate (BDL-14,18 µmol/L) and suspended solids (0,01-25,20 mg/L). Physico-chemical data were evaluated in accordance with the Legislation of Water Pollution Control. As a conclusion of this study the pollution in these fresh waters were seen to be mostly influenced by a combination of anthropogenic factors, agricultural pollutants, tourism activities, domestic waste and sewage water. Water management based on fresh waters should be developed and monitoring programmes for surface and ground waters must be achieved.

PRESENTATION TYPE: ORAL

ASSESSMENT OF GROWTH AND TOXIC ION REMOVAL IN TWO WETLAND PLANTS (PHRAGMITES AUSTRALIS AND SPARGANIUM ERECTUM) TREATING LEBANON'S LITANI RIVER CONTAMINATED UPSTREAM

Fadi Karam
Litani River Basin Management Support Program, Lebanon
Nabil Amacha
Department of Water Monitoring and Environmental Studies, Litani River Authority, Beirut, Lebanon
Abdulhalim Mneimne
Department of Environmental Sciences, Faculty of Agricultural Engineering and Veterinary Medicine, Lebanese University, Dekwaneh-El Maten, Lebanon
Hoda Jalloul
Department of Environmental Sciences, Faculty of Agricultural Engineering and Veterinary Medicine, Lebanese University, Dekwaneh-El Maten, Lebanon
Darine Hussein
Department of Environmental Sciences, Faculty of Agricultural Engineering and Veterinary Medicine, Lebanese University, Dekwaneh-El Maten, Lebanon
Joêlle Breidy
Department of Plant Breeding, Agricultural Research Institute, Zahle, Lebanon

KEYWORDS: PHYTOREMEDIATION, ION REMOVAL, AQUATIC ECOSYSTEMS

Pollution of the environment by metals and organic contaminants is an intractable global concern, with cleanup costs running into billions of dollars using the current costly engineering technologies. The availability of technologies alternative, cheap and effective, would significantly improve the prospects of cleaning-up metal contaminated sites. Phytoremediation has been proposed as an economical and 'green' method of exploiting plants to extract or degrade the contaminants in the soil. Phytoremediation is the process of cleansing contaminated effluents, among which domestic waste water, of harmful pollutants and organic matter by running the water through a system of plants, soils and microbes. In this study, we used micro-lysimeters to show the effectiveness of phyto-remediation and toxic ion removal capacity of two wetland plants (Phragmites australis and Sparganium erectum) in treating the contaminated upstream of Lebanon's Litani River and its offshoot Qaraoun Lake. Results showed that the accumulation of pollutants, notably iron, cupper and cadmium, as well as nutrients such as sodium, sulfate and phosphate, was higher in leaves of Phragmites australis plants than those of Sparganium erectum plants. The magnitude of ion removal from water and accumulation in leaves depends on weather conditions, such as relative humidity and temperature of the air. On the other hand, the accumulation of salts in plants' leaves reduced electrical conductivity and total dissolved solids in the treated effluents. Finally, we concluded that phyto-remediation constitutes a bio-manipulation and cost effective technique to reduce water pollution in aquatic ecosystems.

PRESENTATION TYPE: ORAL

HEAVY METAL CONTAMINATION IN FISH OF TSHANGALELE LAKE (KATANGA, DEMOCRATIC REPUBLIC OF CONGO)

Erika Burioli
Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, Italy
Mawazo Koya
Veterinary, Democratic Republic of Congo
Gabriella Monaco
Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, Italy
Claudio Foglini
Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, Italy
Stefania Squadrone
Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, Italy
Maria Cesarina Abete
Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, Italy
Maria Silvia Gennero
Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, Italy
Tommaso Scanzio
Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, Italy
Marzia Righetti
Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, Italy
Marino Prearo
Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, Italy

KEYWORDS: TSHANGALELE LAKE, HEAVY METALS, FISH

Tshangalele Lake is an artificial basin in the Democratic Republic of Congo in Katanga. The lake was declared a Biosphere Reserve in 1982 and classified as Important Bird Area by BirdLife International. The main genera of fish present are Tilapia and Clarias and the high productivity of these waters represent the principal source of animal proteins for the local population. This region is characterized by the presence of numerous metal mines of copper and cobalt mainly, with foreign property. These activities use high quantities of waters that return untreated in the lake becoming a periculous carrier of heavy metal contamination. Because of the difficulties to conduce chemical analysis in this area, the 10 pools of samples of fishes from the lake were investigated at the IZS of Torino. Analysis of samples were conducted by inductively coupled plasma mass spectrometry (ICP-MS) for Al, As, Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb, Se, Sn and Zn, while for Hg, by Direct Mercury Analyzer (DM80). The results of the most dangerous metals showed an high mean contamination for lead (0.83 mg/kg StDev 1.4) with a maximum sample content of 4,3 mg/kg and for cadmium of 0,79 mg/kg. The level of mercury was however very low. Other elements like aluminium, iron and zinc presented also very high levels. With the results of this preliminary study it appears necessary to improve the knowledge of the contamination of this area by heavy metals to defend the right to health of this population.

PRESENTATION TYPE: POSTER

WATER EROSION IN THE LAKE CHAPALA BASIN

Alejandro Juarez
Corazon de la Tierra, Institute of Environmental Development, Mexico
Salvador Ochoa
National Polytechnic Institute (IPN), Mexico
Rene Velazquez
Corazon de la Tierra, Institute of Environmental Development, Mexico
Luis A. Zarate
Corazon de la Tierra, Institute of Environmental Development, Mexico

KEYWORDS: HYDRIC EROSION, HILLSIDE FARMING, FERTILITY

Lake Chapala is Mexico's largest freshwater body, but also one of the most affected by human activities. One of the less studied aspects is the relationship between the lake and the basin of which it belongs, particularly the portion that drains directly into it (sub-basin Chapala, shared between Jalisco and Michoacan states). An important aspect in terms of basin functioning is that refered to water erosion, which creates problems both with fertility loss and siltation of natural water bodies and irrigation infrastructure. Project presented in this paper aimed to quantify water erosion in the watershed's large agricultural areas and and forest surfaces. The method used was the runoff plots, consisted in capturing runoff sediment generated in a restricted area during the rainstorm, which is subsequently weighed. Most soil loss found was 6.38 ton/ha/year at hillside crops, and the lowest occurred in tropical deciduous forest with 5.8 kg/ha/year. Organic matter was one of the components of soil lost during water erosion process, with percentages up to 7.17% in the rainfed crops, with 0.29% of total nitrogen; likewise, the textural component with greatest loss was clay with contents up to 76.2%. Even in areas with less erosion the percentage of organic matter lost is high, up to 19.5% and total nitrogen content of 0.78%.With obtained results it can be concluded that one of the most susceptible soil components to be lost during the erosion process is organic matter, by consequence the most affected nutrient is nitrogen.

PRESENTATION TYPE: POSTER

POTENTIAL USE OF MYRIOPHILLUM SP AS BIOFILTER TO SUPPORT SUSTAINABLE MANAGEMENT OF LAKE

Ignasius D. A. Sutapa
Asia Pacific Centre for Echohydrology (APACE), UNESCO, Indonesia
Eka Prihatinningtyas
Research Centre for Limnology, Indonesia

KEYWORDS: WATER QUALITY, BIOFILTER, MYRIOPHYLLUM SP

In the last five years, there is a genus of aquatic plants Myriophyllum sp. which dominate in some lakes around Jakarta - Bogor - Tangerang – Bekasiin Indonesia, which could affect the water quality of the lake. Myriophyllum sp is an aquatic plant growing under the surface of the water (submersed macrophytes). These plants are rooted and attached to the base composition of the waters with compound leaves as sponges and shaped like feathers of birds. Uncontrolled growth of weeds can be a negative impact on the ecosystem of the lake. The existence of Myriophyllum spcan reduce the level of dissolved oxygen in the waterresulting in low productivity of fish, can also reduce the water volume of the lake as well as reducing the estetic value as a tourist places. This research aims to study the ability of Myriophyllum sp residing in Situ Cibuntu lake as a biofilter to improve the quality of the raw water in water treatment systems.This research shows that Myriophillum sp placed in Seri-tanks were able to decrease the total amount of Coliform and Fecal Coliform from 150cu/100ml and 140cu/100ml to none respectively. The pH level slightly increases from 6.45 to 6.76, the turbidity decreases from 14 NTU to 1 NTU, and the dissolved oxygen (DO) increases from 3.36 mg/l to 3.42 mg/l. Other parameters such as phosphate, total phosphor and COD tend to decrease: 0.0737 mg/l to 0.0148 mg/l, 0.1379 mg/l to 0.0603 mg/l and 11.32 mg/l to 8.89 mg/l respectively.

PRESENTATION TYPE: ORAL

ASSESSMENT OF WATER HEALTH OF SURFACE AND GROUND WATER AND TO MONITOR WITH THE HELP OF RECENT TECHNOLOGY

Mohan Ramachandra
Bangalore University, India

KEYWORDS: CAUVERY RIVER , BANGALORE AND MYSORE CITY AREAS, WATER RESOURCES MANAGEMENT

CauveryRiver is one of the most important fresh water sources in Bangalore and Mysore city areas, water quality and water resources management is required to potential utility of water in fulfilling functions as irrigation, recreational use, human consumption, and ecological function. Water quality is quantified relative to the context of use, and studies include includes chemical, biological, and physical properties, such as nutrients load, coliforms growth, and temperature impact on global warming. the processes affecting water quantity and quality Few of the remedial measures here have been proposed to improve and represent the various activities undertaken to enlighten and educate all sectors of society on environment and facilitate exchange of information on environment issues and foster greater awareness on environmental and water conservation by highlighting the urgency and magnitude of environmental issues facing modern societies.In view of 150000 manholes connecting 4300 km of sanitary line and 4700km water pipelines in Bangalore city which further running 40 km to Byramangala reservoir and spriding nearly 5000 acres Irrigation land.Lack of Coordination and capacitating of treatment plants led lots of bacterial load created public health problems .Therfore in the present work to identify the problems and professed the remedial measures to prevent the further spared the bacterial contamination. The results are discussed with recent developments

PRESENTATION TYPE: ORAL

STUDY ON WATER POLLUTION ALONG THE LENTIC WATERBODIES OF CHELLAGHATTA VALLEYBANGALORE CITY, KARNATAKA, INDIA WITH SPECIAL REFERENCE TOPOLLUTION DUE TO HEAVY METALS

Latha N. Narayan
Bangalore University, India
Mohan Ramachandra
Bangalore University, India

KEYWORDS: ENVIRONMENTAL POLLUTION, PHYSICO-CHEMICAL PARAMETERS, HEAVYMETALS

Monitoring and assessment of fresh water has become anenvironmental concern due to the contamination by human kind, therebydecreasing the suitability of the fresh water. The Lentic waterbodies of Chellaghatta Valley, Bangalore City, Karnataka, India,which include Soulekere, Kaikondahalli, Kasavanahalli, Haralur, Kudlu and ParappanaAgrahara lake is thestudy area of the present investigation.These waterbodies were selected on the basis of their current use and location Soulekere, Kaikondahalli, Kasavanahalli, Haralur lake serves the purpose of supplying domestic water and is located at higher altitude of the city surrounded by agricultural and forest land while Kudlu and ParappanaAgrahara lake were situated at lower altitude, receiving an influx of pollutants from domestic and industrial sewage and runoffs. The study was carried outto understand the various physico-chemical parameters as well as to estimatethe concentration of heavy metals in lake water. It was found that theconcentration of the heavy metals in the lake water substantially increased afterthe religious activities around September to October. These heavy metals havea marked effect on the aquatic flora and fauna which through bio-magnificationenter the food chain and ultimately affect human beings as well.

PRESENTATION TYPE: ORAL

PLASMID-MEDIATED TRANSFER OF HEAVY METAL TOLERANCE GENE TO ESCHERICHIA COLI ISOLATED FROM FATEHSAGAR LAKE, UDAIPUR, RAJASTHAN, INDIA

Ali Asger Bhojiya

Molecular Microbiology Laboratory, Department of Biotechnology, Mohanlal Sukhadia University, Udaipur, Rajasthan, India

Harshada Joshi

Molecular Microbiology Laboratory, Department of Biotechnology, Mohanlal Sukhadia University, Udaipur, Rajasthan, India

KEYWORDS: TRANSFORMATION, FATEHSAGAR, BIOREMEDIATION

Fateh Sagar Lake is the second artificial lake of Udaipur, Rajasthan, India. It is one of the major sources of drinking water to the city of Udaipurwhich is increasingly being contaminated with heavy metals.Heavy metals are introduced into the aquatic system as a result of various human activities like mining, smelting, processing, release of industrial effluents and domestic waste water. The impacts of heavy metal pollution on living organisms are very serious. Heavy metals are bio-accumulative, toxic at high concentrations, have neurological impacts, and some are carcinogenic. The present study was aimed to determine heavy metal tolerance in Pseudomonas and to transfer the heavy metal tolerance genes present on plasmid DNA to previously isolated and identified heavy metal sensitive bacteria. Pseudomonas bacteria isolated from heavy metal contaminated soil of Zawar exhibited extremely high resistance to ZnSO4.7H2O, Pb(NO3)2 and NiCl2.6H2O with MIC value of 10mM, 1mM, 1mM respectively. The plasmid DNA from Pseudomonas strain was isolated and transformed into previously isolated and identified heavy metal sensitive E. coli isolated from fresh water lake Fatehsagar of Udaipur, (Rajasthan) India. After the transformation the sensitive E. coli get heavy metal tolerant. This heavy metal tolerance capacity was further confirmed by recovering the plasmid from E. coli. These transformed E. coli strains could be exploited for the bioremediation of heavy metal polluted environment.

PRESENTATION TYPE: ORAL

ANALYSIS OF PHYSICOCHEMICAL AND BACTERIOLOGICAL PARAMETERS OF PICHHOLA LAKE OF UDAIPUR DISTRICT (RAJASTHAN), INDIA

Inu Rawal

Molecular Microbiology Laboratory, Department of Biotechnology, Mohanlal Sukhadia University, Udaipur, Rajasthan, India

Harshada Joshi

Molecular Microbiology Laboratory, Department of Biotechnology, Mohanlal Sukhadia University, Udaipur, Rajasthan, India

B.L. Chaudhary

KEYWORDS: PHYSICOCHEMICAL, PICHHOLA LAKE, POLLUTION

Udaipur due to its unique and beautiful lake system has an exceptional importance at national and international level. These water bodies, which once considered as divine source of water, are now increasingly being abused and severely polluted which is one of the major concerns to environmentalists. Monitoring water quality is of significant value in determining the potability of water. In the present study an attempt has been made to study the water quality of lake Pichhola of Udaipur (Rajasthan), India for 2 years – 2011 and 2012. Water samples were collected during different seasons like winter, summer and monsoon for analysis of seven physicochemical parameters pH, Temperature, total alkalinity, total hardness, dissolved oxygen, BOD and COD. In addition, the bacteriological parameters like total bacterial count and total coliform count were also detected which are indicator organisms of pollution studies. Total bacterial counts were found in the range of 34.3×103 to 81×103cfu/ml. The range of MPN was found between 340 to 2400/100 ml for total coliform counts. Lakes of Udaipur are the major source of drinking water of the city and study of water quality is of significant value in determining the potability of the lake water. Therefore the water quality of lake Pichhola of Udaipur is taken into account to ascertain the drinking water supply in Udaipur city and it was found that lake water is polluted with reference to these analyzed parameters, as many of these parameters were found above the permissible limits for drinking water. Output of this study will be helpful for suggestion to responsible authority, regarding objectionable findings of water parameters.

PRESENTATION TYPE: ORAL

URBAN ORGANIC WASTE LOADS AND POLLUTION ABATEMENT STRATEGIES FOR CITIES SURROUNDING LAKE VICTORIA

Richard Oyoo
African Union - United Nations Mission in Darfur (UNAMID), Sudan

KEYWORDS: SCENARIOS, MUNICIPAL SOLID WASTE, HUMAN EXCRETA

Lake Victoria, the largest African lake, supports livelihoods of 40 million people. The lake's water quality is threatened by urban pollution. This study assessed the organic loads to Lake Victoria's inshore for six cities, and evaluated plausible scenarios to reduce these loads. A box model was developed, tested, calibrated, validated and applied to assess the current organic loads for each city, and how each scenario performed in reducing these loads. The scenarios are evaluated for specific local conditions in each city. The annual five-day biological oxygen demand, total nitrogen and total phosphorus loads to the lake's inshore by 2011 amounted to about 23kt, 4kt and 2kt, respectively. Kisumu had the highest organic loads, followed by Kampala, Mwanza, Musoma, Bukoba and Jinja. Based on experts' scores and model outputs, the composting scenario and the scenario mixing diverse local organic waste treatment options performed best in reducing organic loads to the lake's inshore. Sensitivity analysis showed that these outcomes are robust.

PRESENTATION TYPE: ORAL

ANTIBACTERIAL ACTIVITY OF LACTOBACILLI AGAINST AEROMONAS VERONII ISOLATED FROM PICHOLA LAKE, UDAIPUR, RAJASTHAN, INDIA

Deepti Khandelwal

Molecular Microbiology Laboratory, Department of Biotechnology, Mohanlal Sukhadia University, Udaipur, Rajasthan, India

Harshada Joshi

Molecular Microbiology Laboratory, Department of Biotechnology, Mohanlal Sukhadia University, Udaipur, Rajasthan, India

B.L. Chaudhary

Department of Botany, College of Science, Mohanlal Sukhadia University, Udaipur, Rajasthan, India

KEYWORDS: AEROMONAS, PICHOLA LAKE, ANTIBACTERIAL

Water microbiology is concerned with the microorganisms that live in water, or they can be transported from one habitat to another by water. Water may harbour many pathogenic bacteria, viruses, protozoa and parasites responsible for the emerging most widespread infections which are leading cause of death worldwide. Aeromaonas veronii is commonly found in freshwater systems. Aeromonas is gram negative, facultative anaerobes which causes aeromonasis in humans and are also pathogenic for aquatic and terrestrial animals. Pichola lake is one of the most beautiful lake of Rajasthan, India. It is an important source of potable water supply for the city. In the present study, an attempt has been made to isolate the lactobacilli from camel milk and detect the antibacterial activity of lactobacilli against previously isolated and identified Aeromonas veronii from lake Pichhola. A total of 10 lactobacilli were isolated and subjected to agar well assay for detection of antibacterial activity. Out of them, 2 isolates showed demonstrable antibacterial activity against Aeromonas veronii. On the basis of biochemical and molecular characteristics these two isolates were identified as Lactobacillus fermentum CMU 31 and Lactobacillus rhamnosus CMU 33. Further investigation may reveal that these lactobacilli isolates could be used as potential probiotics for aquaculture and to manage aeromonasis.

PRESENTATION TYPE: ORAL

BIOSORPTION OF ZN (II) IONS FROM AQUEOUS SOLUTIONS BY WATER HYACINTH (EICHHORNIA CRASIPPES): EQUILIBRIUM AND KINETIC STUDIES

Davis Amboga Anzeze
University of Nairobi, Nairobi, Kenya
John Mmari Onyari
University of Nairobi, Nairobi, Kenya
Paul Mwanza Shiundu
Technical University of Kenya, Nairobi, Kenya
John W Gichuki
Environmental Protection Authority, Rancheria Valley, California, U.S.A.

KEYWORDS: BIOSORPTION, WATER HYACINTH (E. CRASSIPES) , HEAVY METAL IONS

The biosorption characteristics of Zn (II) ions were investigated. Experimental parameters affecting the biosorption process such as pH, contact time, biomass dosage, initial metal ion concentration, and temperature were studied in batch adsorption experiments. Langmuir and Freundlich isotherm models were applied to the adsorption data .The biosorption capacity for E. crasippes was found to be 16.50 mg g-1. The data was also subjected to pseudo-first-order and the pseudo-second-order kinetic models.

PRESENTATION TYPE: ORAL

IMPROVING WATER POLLUTION CONTROL AND MANAGEMENT IN KENYA

Vivian Abungu
Suken International Limited, Kenya

KEYWORDS: WATER QUALITY, MANAGEMENT, NATURAL PURIFICATION

Study shows that despite success stories of pollution control in many developing countries, more than 14 000 people still die every day as a result of poor water quality attributed to pollution and more than 500 Million people in the world still lack access to safe drinking water . The problem of water pollution and quality degradation in these countries is increasingly becoming a threat to human health. In Kenya for instance, Current achievements are highly attributable to the Synergy produced by collaborative forces namely; Legal norms, Self regulations by individual Industries and Public initiative. Despite these efforts, and even with the establishment of National Water Quality Management Strategy (2012 - 2016), much has not improved in the water quality compared to water quantity. With a population of about 38 million and an annual water availability being estimated to be about 647M3 per capita of water , of which a drop of upto, about 250M3 per capita is expected by 2030 when the expected population growth is estimated at 64 million, Kenya faces enormous challenges in managing pollution menace on its limited water quality. A “Sustainable integrated water pollution management approach is thus critical”. As a contributory, this study proposes to explore sustainable investment in natural purification options.

PRESENTATION TYPE: ORAL

MS01-02
Biological aspect and biomonitoring

A BRIEF OVERVIEW OF THE MONITORING NETWORK FOR LAKES IN GREECE

Dimitra Kemitzoglou
The Goulandris Natural History Museum - Greek Biotope Wetland Centre (EKBY) Thermi, Thessaloniki, Greece
Antonis Apostolakis
The Goulandris Natural History Museum - Greek Biotope Wetland Centre (EKBY), Thermi, Thessaloniki, Greece
Efpraxia Mavromati
The Goulandris Natural History Museum - Greek Biotope Wetland Centre (EKBY), Thermi, Thessaloniki, Greece
Militiadis Seferlis
The Goulandris Natural History Museum - Greek Biotope Wetland Centre (EKBY), Thermi, Thessaloniki, Greece
Maria Skopa
The Goulandris Natural History Museum - Greek Biotope Wetland Centre (EKBY), Thermi, Thessaloniki, Greece
Eleftheria Tsadila
The Goulandris Natural History Museum - GAIA Centre, Kifissia, Athens, Greece
Vasiliki Tsiaoussi
The Goulandris Natural History Museum - Greek Biotope Wetland Centre (EKBY), Thermi, Thessaloniki, Greece

KEYWORDS: MONITORING, LAKES, WATER FRAMEWORK DIRECTIVE

The Water Framework Directive (WFD) foresees the operation of monitoring programmes for surface waters and groundwater in order to assess their ecological and chemical status (article 8). In Greece the monitoring network according to the requirements of the WFD has been established in late 2011 (Official Gazette 2017/B/ 09.09.2011) and made operational in 2012. The Greek Biotope - Wetland Centre monitors water quality and quantity of lake water bodies. In particular, in situ measurements, sampling and analysis of biological, physico-chemical, and hydromorphological quality elements are undertaken in 24 natural lakes and 26 reservoirs since spring 2012. Fifty three (53) sampling stations have been established, 27 of which correspond to surveillance monitoring programmes and 26 to operational monitoring programmes. This study aims towards i) a brief overview of the national monitoring network of Greek lake water bodies and ii) the presentation of the first results produced during 2012 and 2013. The dataset covers a gradient of eutrophication, which seems to be the main anthropogenic pressure in Greece and the most widespread anthropogenic pressure on lakes across Europe. The current monitoring network provides a useful start in establishing baseline data that will allow the assessment of ecological status and trends of Greek lakes.

PRESENTATION TYPE: ORAL

PHYTOPLANKTON COMMUNITY STRUCTURE AS BIOINDICATOR TO ASSESS HEALTH CONDITIONS OF MENGKUANG RESERVOIR, PENANG, MALAYSIA

Wan Maznah Wan Omar
Universiti Sains Malaysia, Malaysia
Asieh Makhlough
Ecology Centre of the Caspian Sea, Ecology Department, Iran

A study on the spatio-temporal variation of phytoplankton composition and physico-chemical parameters of Mengkuang Reservoir was conducted from August 2005 to July 2006. Samples were collected monthly at nine sampling stations located at the littoral and limnetic zones of the reservoir. This study assessed water quality of Mengkuang Reservoir by its trophic status according to a modified Carlson trophic Index (CMTSI), and by its biological parameters using Shannon-Wiener diversity index (H') and saprobic index of phytoplankton population. Seasonal variation was observed in electrical conductivity (EC), total suspended solids (TSS), total dissolved solids (TDS), transparency depth, nitrate, gross primary production, and phytoplankton abundance which were higher in rainy season. Carlson modified trophic state index showed that the reservoir was mesotrophic based on chlorophyll a and transparency depth, while based on nutrients it was oligotrophic. Shannon-Wiener's and saprobic indices showed that the reservoir was in Class III (slightly polluted) and Class IIIß (moderately polluted). This study also recorded the presence of certain species of cyanobacteria, which are indicators of toxic and polluted conditions in aquatic ecosystems. This study therefore showed the importance of biological assessments in determining the quality of water bodies.

PRESENTATION TYPE: ORAL

THE USE OF ZOOPLANKTON IN LAKES BIO-MONITORING

Lukasz Slugocki
University of Szczecin, Poland
Robert Czerniawski
University of Szczecin, Poland
Jozef Domagala
University of Szczecin, Poland

KEYWORDS: ZOOPLANKTON, BIOMONITORING, TROPHIC STATE

The suburban lakes are under stronger anthropo-pressure than the lakes localised far from the agglomerations and their status should be carefully controlled. Hitherto the quality of water in natural water reservoirs has been mainly evaluated on the basis of physico-chemical parameters; however, their indications have been found unreliable. Recently, different indicators have been proposed for water quality evaluation, zooplankton included. The quantitative and qualitative composition of zooplankton is affected by water chemistry, lake morphology and by anthropogenic changes in the drainage basin. The value of zooplankton as an indicator originates from their position in the food web, inserted between the top-down regulators and bottom-up forces. Despite being an important and integrated part of the pelagic food web - zooplankton is omitted in ecological status classification according to European Water Framework Directive. The aim of this study was to determine the trophic state of five meromictic lakes in NW Poland among one catchment area. The assessments of the lakes' ecosystems were conducted by Ejsmont-Karabin (2012), and Ejsmont-Karabin & Karabin (2013) Trophic State Index, based on Rotifer and Crustacean. Additionally, the popular Carlson's Trophic State IndexSD (1977) was used. The analysis of zooplankton samples depicts a variation of the trophic status of the studied lakes. The lowest values (mesotrophic) of The Trophic Index were referring to the largest and deepest lakes - except one large lake which was determined as eutrophic. Small and shallow lakes exhibit the properties of meso-eutrophic water.

PRESENTATION TYPE: POSTER

TEMPORAL AND SPATIAL CHANGES OF POTAMO-ZOOPLANKTON COMMUNITIES CAUSED BY A SMALL DAM

Robert Czerniawski
University of Szczecin, Poland
Lukasz Slugocki
University of Szczecin, Poland
Jozef Domagala
University of Szczecin, Poland

KEYWORDS: ZOOPLANKTON, SMALL DAM, SESTON

The influence of small dams on small rivers on the river zooplankton has been recognised as not being as strong as that of large dams in large rivers. Nevertheless, on the basis of studies reporting their effect on communities of macro-invertebrates, ichthyofauna, phytoplankton or macrophytes, the effect of small dams on zooplankton communities in a stream is expected to be similar in character. An attempt was made to analyse the influence of a small dam on the temporal and spatial properties of zooplankton communities by comparing the zooplankton structure established prior to the dam construction and five years after its construction. A small dam, swelling water by even just 1m, was found to induce proportionally similar spatial changes in zooplankton communities as those induced by a large dam. After a few months from the dam's construction, significant changes in the number of taxa and zooplankton density were observed. In particular, the number of planktonic rotifers and larval stages of copepods considerably increased along with the density of littoral taxa of rotifers and crustaceans. Cladocerans appeared in the watercourse only after the construction of the dam and their abundance was significantly greater only in the second year after the construction of the dam. The abundance of all groups of zooplankton increased in subsequent years after the dam's construction. In general, small dams were found to have a great effect on the spatial and temporal changes in zooplankton communities in the stream studied.

PRESENTATION TYPE: POSTER

THE IMPACT OF THE SMALL HYDROPOWER PLANT ON THE GROWTH OF HYDROBIONTS IN THE ARGICHI RIVER, ARMENIA

G. A. Gevorgyan
Scientific Center of Zoology and Hydroecology, National Academy of Sciences of Armenia (NAS RA), Armenia
B. K. Gabrielyan
Scientific Center of Zoology and Hydroecology, National Academy of Sciences of Armenia (NAS RA), Armenia
T. V. Boshyan
Scientific Center of Zoology and Hydroecology, National Academy of Sciences of Armenia (NAS RA), Armenia

KEYWORDS: SMAL HYDROPOWER PLANT, EFFECTS, HYDROBIONTS

The Argichi river, a tributary of Lake Sevan, is situated in the eastern part of Armenia. The aim of the present study was to assess the impact of the small hydropower plant on the growth of aquatic organisms in the Argichi river. Hydrobiological, hydrophysical and hydrological studies were implemented in the Argichi river in October-December 2013. Observations, measurements and samplings were done in the sites situated before and after the small hydropower plant located on the river. Hydrological studies in October and November showed that according to the observation sites situated before and after the small hydropower plant, the velocity of the Argichi river decreased significantly, and the water temperature of the river increased. The hydrobiological studies in October and November showed that according to the Argichi river observation sites situated before and after the hydropower plant, a decrease in the quantitative and qualitative parameters of macrozoobenthos and a reduction in the quantity and the species composition of fishes were registered which may have been conditioned by changes in the hydrological and hydrophysical regimes as well as the impact of the construction works of the newly built hydropower plant. During the observations in December, the Argichi river site situated before the hydropower plant was frozen. In this case, ecological conditions for the growth of hydrobionts were more favorable in the site situated after the hydropower plant than in the frozen site.

PRESENTATION TYPE: ORAL

ASSESSMENT OF A BATTERY OF BIOTESTS FOR ASSESSING THE GENOTOXIC POTENTIAL OF ENVIRONMENTAL POLLUTANTS

Eszter Horváth
University of Pannonia, Department of Limnology, Hungary
Bettina Eck-Varanka
University of Pannonia, Department of Limnology, Hungary
Árpád Ferincz
University of Pannonia, Department of Limnology, Hungary
Gábor Paulovits
MTA Centre for Ecological Research, Balaton Limnological Institute, Hungary
Nora Kováts
University of Pannonia, Department of Limnology, Hungary

KEYWORDS: MICRONUCLEUS TEST, SINANODONTA WOODIANA, GENOTOXIC POTENTIAL EVALUATION

Standard bacterial bioassays are available for genotoxicity testing, such as the SOS-Chromotest®, or AMES test. They are using prokaryotes and the end point is point mutation. The micronucleus (MN) test is conducted on eucaryotes, detecting clastogenicity and genotoxicity induced micronuclei formation as the end point. In our study, the MN tests was employed on Unionids to evaluate the genotoxic potential of several environmental heavy metal pollutants and benzo(a)pyrene, in comparison to the SOS chromotest and the Ames fluctuation test. Two Unionid species were used, the native Unio pictorum and the exotic, invasive Sinanodonta woodiana, in this way their sensitivity could also be compared. Mussel specimens were exposed to a single administration of various sub-lethal doses of chemicals. After 4 days of exposure the number of micronuclei in agranular haemolimph cells was detected and dose-response curves of chemicals were defined. The sensitivities of the mussel species were compared with two way factorial ANOVA, and the sensitivity of the mussel MN test was compared to bacterial toxicity assays by one-way ANOVA and Tukey post hoc test. The genotoxic response - triggered by the studied chemicals - of the two species correspond to each other. The sensitivity of the MN test is comparable to Ames fluctuation test, and in case of the heavy metals is more sensitive than SOS-Chromotest®. However, in order to obtain a complex view of the genotoxic potential of pollutants, the MN test and the Ames test are suggested to apply in parallel, representing both prokaryotes and eucaryotes.

PRESENTATION TYPE: POSTER

TEMPORARY WATERS: BIODIVERSITY, FUNCTIONAL ECOLOGY, VULNERABILITY AND SUSCEPTIBILITY TO CLIMATE CHANGE

Luigi Naselli-Flores

University of Palermo, Department of Biological, Chemical and Pharmaceutical Sciences and Technologies, Section of Botany and Plant Ecology, Italy

Fabio Stoch

University of L'Aquila, Department of Clinical Medicine, Public Health, Environmental and Life Sciences, Italy

KEYWORDS: TEMPORARY PONDS, MANAGEMENT, RESTORATION

Temporary waters contribute to regional diversity disproportionately compared to the Earth's surface they cover. This presentation i) describes the reasons underlying this biological diversity, ii) analyzes the importance of temporary waters as hotspots of biodiversity, iii) stresses how these ecosystems represent a valuable tool to evaluate the impact exerted by human activities on our Planet, and iv) consider the possibility to extend the principles of the Integrated Lake Basic Management developed by ILEC in order to achieve a sustainable management of these ecosystems. Moreover, temporary waters are strongly impacted by the climate change, which modifies their hydroperiod and reduces their spatial density. When these effects are coupled with direct destruction operated by human activities (they are hardly recognized as aquatic ecosystems with an extraordinary rich biodiversity) a large portion of species, whose life cycles are strictly dependent upon the temporary nature of these ecosystems, is endangered. To lower the risk of a significant decrease of biological diversity of inland waters, and to safeguard biodiversity at different spatial scales (e.g. local, regional, national) a sound management of the whole territory, addressed to preserve the existing and eventually to create new temporary ecosystems, can not be further delayed.

PRESENTATION TYPE: ORAL

APPLICATION OF THE SHORE ZONE FUNCTIONALITY INDEX TO THE MANTUA LAKES (ITALY) AND ITS COMPARISONS WITH TWO BIOLOGICAL QUALITY INDICES

Lorella Pascarella
Regional Environmental Protection Agency (ARPA), Mantua, Italy
Lorenza Galassi
Regional Environmental Protection Agency (ARPA), Mantua, Italy
Marco Fioravanti
Regional Environmental Protection Agency (ARPA), Mantua, Italy
Ivano Ansaloni
University of Modena and Reggio Emilia, Italy
Matteo Ruocco
University of Modena and Reggio Emilia, Italy
Roberto Simonini
University of Modena and Reggio Emilia
Daniela Prevedelli
University of Modena and Reggio Emilia, Italy

KEYWORDS: INDEX, MANTUA LAKES, MONITORING

The Shore zone Functionality Index (SFI), proposed by the Italian Institute for Environmental Protection and Research (ISPRA) in 2009, assesses the quality of lake surrounding areas complying with the Water Framework Directive (WFD 2000/60/CE). The method evaluates the functionality of lake surrounding areas providing a useful instrument for land planning and management. In this study, the SFI has been applied to three lakes near the city of Mantua (Lombardia, North Italy) and compared with two other indices: a diatomic eutrophication/pollution index and a biological quality index based on macroinvertebrates. The comparison was carried out in order to verify the connection between the quality of lake surrounding areas and the biological quality of the lake's water body. The application of the method showed very heterogeneous SFI index values along the shore zone of the three lakes: differences in type and abundance of vegetation and land use have led to judgments of functionality ranging from excellent to extremely poor. No correlations were found between the two indices and the SFI demonstrating that the quality of the shore zone of a lake is not necessary connected with the biological quality of the water body. The SFI index appears very promising to assess functional levels of the surrounding areas of lakes, however the method should be always associated with other indices that evaluate the biological quality of the water body in order to provide a wide knowledge to the land planners and managers.

PRESENTATION TYPE: POSTER

GROWTH AND REPRODUCTION CHARACTERISTICS OF THE THREATENED PHOXINUS STRANDJAE DRENSKY, 1926 LIVING IN LAKE DURUSU BASIN (İSTANBUL, TURKEY)

Gülşah Saç
İstanbul University, Institute of Sciences, Turkey
Müfit Özuluğ
İstanbul University, Faculty of Science, Department of Biology, Turkey

KEYWORDS: LENGTH-WEIGHT RELATIONSHIP, CONDITION, GONADOSOMATIC INDEX

Endangered Phoxinus strandjae Drensky, 1926 was only known from the Veleka and Rezve drainages, draining from Istranca to Black Sea in Bulgaria and Turkey, but recently it was proposed that the conservation status of the species should be transferred to Vulnerable (VU)from Endangered (EN). There was not any study about the biological properties of P. strandjae. The purpose of the study is to determine the growth and reproduction characteristics of threatened Phoxinus strandjae Drensky, 1926 living in Istranca Stream, which is the biggest stream emptying to Lake Durusu (İstanbul) with 400 km2 water basin. Fishing was carried out at six stations on Istranca Stream from March 2012 to June 2013, monthly. In total, 608 individuals were collected using electroshock during the sampling period and standard length and body weight of the specimens ranged between 1.2–7.2 cm and 0.0390–10.5960 g, respectively. Female-male ratio of P. strandjae estimated as 1:1.15 and there was not significantly difference between genders (x2=1.47; p>0.05). The length–weight relationship was estimated for female, male and all specimens as W=0.0206×L3.0747±0.0492, W=0.0212×L3.0443±0.0452 and W=0.0197×L3.0994±0,0290, respectively. Ages of the species ranged from 0 to VI with using otoliths. The Fulton's condition factor for female, male and all specimens was 2.291±0.253, 2.257±0.231 and 2.251±0.253, respectively. According to gonadosomatic index (GSI) values, the reproduction season of the species was determined as April, May and June months. First reproduction lengths estimated as 2.99 and 2.89 cm at standard length for females and males. The present study has new record features for the growth and reproduction characteristics of that threatened species

PRESENTATION TYPE: ORAL

TEMPORAL AND SPATIAL VARIATIONS IN SETTLEMENT AND SHELL GROWTH OF LIMNOPERNA FORTUNEI (DUNKER, 1857) (BIVALVIA: MYTILIDAE) IN A SMALL LAKE OF SOUTH THAILAND

Vachira Lheknim
Prince of Songkla University, Thailand
Pimonpan Leelawathanagoon
Prince of Songkla University, Department of Biology, Thailand

KEYWORDS: THAILAND, LIMNOPERNA SETTLEMENT PATTERNS, FRESHWATER LAKE

The golden mussel Limnoperna fortunei (Dunker, 1857) is a native mytilid bivalve in freshwater and brackish environment of China and mainland Southeast Asia, and were introduced into Hong Kong, Taiwan, Japan and South America during the last century. The aims of this study were to determine the temporal and spatial variations of newly settle juveniles and population parameters assessment of L. fortunei in a small lake in south Thailand, within their native environments. Settlement samples were obtained by using 10x10 cm2 scouring-pad panels soaking for one month and replaced by a new one every month between May 2010 and May 2012. Counts of newly settlement were annually significant different, this suggests that the number of larvae in any given year depends on the size of the breeding population of mussels. Juvenile counts from different sites were also difference in any given year, indicating that within-lake dispersal of larvae is high. Higher settlement densities were observed at deeper level than subsurface. Newly settled juveniles among seasons were also differed, this indicating environmental preferences, while settle juveniles were observed all the year rounds. Settlement densities were positively correlated with conductivity. Shell length ranged between 0.5 and 25.0 mm, the constant in the von Bertalanffy growth model were k = 0.300 year-1 and L_∞ = 26.0 mm.

PRESENTATION TYPE: ORAL

THE GASTROPOD FAUNA OF THE THREE MAJOR AQUACULTURE LAKES - TAAL, SAMPALOC AND LAGUNA DE BAY IN LUZON, IS., PHILIPPINES

Ann-Geneve A. Adorable
University of Santo Tomas, Graduate School, Research Center for Natural and Applied Sciences, Philippines
Roberto C. Pagulayan
Angeles University Foundation, Center for Research and Development, Philippines
Rey Donne S. Papa
University of Santo Tomas, Graduate School, Research Center for Natural and Applied Sciences, Philippines

KEYWORDS: FRESHWATER GASTROPODS, T. GRANIFERA, MOLLUSCS

Freshwater gastropods are the least studied molluscan class due to the dullness of their physical attributes. This remains to be the case in the Philippines where updates on the biology of freshwater gastropods are lacking. This study aimed to identify and classify the gastropods present in the three major aquaculture lakes in Luzon Is., namely Lakes Taal, Sampaloc, and Laguna de Bay, through thorough examination of their radula, shell, and digestive system. A total of 3, 896 samples were obtained and 17 species were identified inhabiting the three lakes, with Tarebia granifera dominating the three lakes which comprised 35% of the total samples obtained while the least observed was a planorbid snail, Indoplanorbis exustus which only comprised 0.02% of the samples. Of the three lakes, Lakes Taal and Sampaloc had more similar values for species diversity compared to Laguna de Bay. Furthermore, this study has been able to establish 9 new records; Tarebia granifera, Thiara winterii, Thiara scabra, Indoplanorbis exustus, Thiara sp., Melanoides maculata, Vivipara burroughiana, Bellamya angularis and Pomacea canaliculata - which includes three non-native species. The similarity in the distribution of the gastropods may indicate that the environmental conditions in the lakes are the same. This study shows how gastropod diversity in these three major lakes have already been impacted by changes in water quality and the introduction of non-native species which may have implications on over-all ecosystem health given the role of gastropods as major prey items, fisheries commodity and as final or intermediate hosts of parasites.

PRESENTATION TYPE: POSTER

HEALTH RISK ASSESSMENT OF ENVIRONMENTAL LEAD EXPOSURE AMONG CHILDREN IN FOUR VILLAGES IN SANTA ROSA CITY, LAGUNA LAKE WATERSHED AREA, PHILIPPINES

Lynn Crisanta R Panganiban

University of the Philippines Manila, College of Medicine, Department of Pharmacology and Toxicology, Philippines

Amiel Nazer C Bermudez

Health Futures Foundation, Inc; University of the Philippines Manila, College of Public Health, Philippines

KEYWORDS: LEAD EXPOSURE RATE, BIOMARKER, ENVIRONMENTAL MONITORING

Lead exposure through air, soil, drinking water, and food significantly impacts public health especially among vulnerable populations. This paper aims to assess the extent of lead exposure, and characterize the risk of development of disease among children from four villages in Santa Rosa City, Laguna Lake watershed area, Philippines. Data on environmental lead exposure and biomarkers were collected and analyzed from a cross-sectional study involving mother-child pairs. Laboratory tests showed that all water samples have non-detectable lead levels. All soil samples have lead levels above the US-EPA regional screening levels in residential soil for carcinogenic target risk (1.7 mg/kg) but below the non-carcinogenic target risk (400 mg/kg). Lead levels in 16 fish samples of tilapia (Oreochromis niloticus) and bangus (Chanos chanos) were below the FAO-WHO maximum level (0.3 mg/kg). Twenty-two of 100 children had blood lead levels > 5 ug/dL with a mean of 8.6 ug/dL. Exposure rates to lead were higher with intake of tilapia compared with bangus. Previous works revealed that neurobehavioral effects of lead are observed at levels as low as 2.4 ug/dL such that at present, no blood lead threshold has been identified in children. The hazard quotient cannot be computed because there is no reference dose for inorganic lead set by US-EPA. However, based on observations of JECFA on the association between dietary lead intake and intelligence quotient (IQ), the computed exposure rates are approaching levels that pose a risk of lowering the IQ of children from villages Aplaya, Caingin and Santo Domingo.

PRESENTATION TYPE: ORAL

ASSOCIATION BETWEEN BLOOD LEAD LEVEL AND NEURODEVELOPMENTAL STATUS IN CHILDREN IN FOUR LAKESHORE VILLAGES IN SANTA ROSA CITY, LAGUNA, PHILIPPINES

Lynn Crisanta R Panganiban

University of the Philippines Manila, College of Medicine, Department of Pharmacology and Toxicology; University of the Philippines Manila, National Poison Management and Control Center, Philippines

Amiel Nazer C Bermudez

Health Futures Foundation, Inc. and College of Public Health, University of the Philippines Manila

KEYWORDS: BLOOD LEAD LEVELS, NEURODEVELOPMENTAL STATUS, LAKESHORE VILLAGES

Environmental exposure to lead poses adverse health effects on vulnerable populations because of its long half-life. This paper attempts to determine the association of blood lead levels (BLL) with neurodevelopmental status in children. Data were analyzed from a cross-sectional study involving 100 children from four lakeshore villages in Santa Rosa City, Laguna, Philippines. Twenty two percent of children had BLL > 5 ug/dL with a mean of 4.56 ± 3.01 ug/dL. Multiple comparisons reveal that mean BLL in children from village Sinalhan were highest among the four villages. Using the Wechsler Intelligence Scale for Children-IV, the mean IQ scores for perceptual reasoning, processing speed, and working memory were lower among children with BLL > 5 ug/dL compared with children whose BLL is 5 ug/dL. Moreover, children from villages Sinalhan and Aplaya who had higher mean BLLs were found to have lower IQ scores in both perceptual reasoning and processing speed compared with children from the other two villages. Among the adverse health effects of lead in children, impairment of intellectual capacity is of utmost importance. At present, no blood lead threshold has been identified in children because previous works documented neurobehavioral effects at BLLs as low as 2.4 ug/dL. Based on these findings, children with BLL > 5 ug/dL should be monitored for target organ toxicities. Likewise, nutritional programs including micronutrient supplementation should be strengthened, along with the establishment of a surveillance and referral system on toxic exposures at the village level.

PRESENTATION TYPE: ORAL

CARCINOGENIC HEALTH RISK OF ARSENIC BIOMAGNIFICATION IN FIVE COMMERCIALLY-IMPORTANT FISHES FROM LAGUNA DE BAY, PHILIPPINES

Amiel Nazer Bermudez

Health Futures Foundation, Inc., Philippines; University of the Philippines Manila, College of Public Health, Philippines

Victorio B Molina

University of the Philippines Manila, Department of Environmental and Occupational Health, College of Public Health, Philippines

Ryohei Kada

Research Institute for Humanity and Nature, Japan; Yokohama National University, Japan

KEYWORDS: BIOMAGNIFICATION IN FISH, ARSENIC, CARCINOGENIC HEALTH RISK

This paper examines the potential carcinogenic risk to human health associated with biomagnification of arsenic in five commercially important fish products from Laguna de Bay. Fish samples were collected in eight sampling stations in three major areas of the lake during the dry and wet seasons. Coordinates of sampling site locations were recorded using Global Positioning System and plotted in Geographic Information System digital maps. Analysis of arsenic was conducted using Atomic Absorption Spectrophotometer. The highest life time cancer risk for arsenic was computed for tilapia from sampling station 2B during the dry season with risk value of 8.51x10-5 or about 85 excess cancer cases per 1,000,000 populations. Calculated cancer risks showed seasonal variations that were distinct among the five fish species. Average life time cancer risks associated with fish consumption during dry season showed the following order of magnitude: Tilapia > Bighead carp > Kanduli >Bangus > Dalag. For wet season, the order of magnitude was: Bighead carp > Bangus > Kanduli >Tilapia > Dalag. Correlation analyses showed that fish mean standard size do not have significant effect on the levels of arsenic in fish samples for both dry and wet seasons. This study concludes from the point of view of disease prevention that long-term consumption of five commercially important fish species from Laguna de Bay may cause significant carcinogenic health risk.

PRESENTATION TYPE: ORAL

HEALTH-RELATED EXPERIENCES OF HOUSEHOLDS TRANSIENTLY DISPLACED BY A FLOODING EVENT, SILANG – SANTA ROSA SUB-WATERSHED AREA, LAGUNA LAKE WATERSHED, PHILIPPINES, AUGUST 2012

Noel R Juban
University of the Philippines Manila, Department of Clinical Epidemiology, College of Medicine, Philippines
Amiel Nazer C Bermudez
Health Futures Foundation, Inc., Philippines; University of the Philippines Manila, College of Public Health, Philippines
Leah A Palapar
Health Futures Foundation, Inc., Philippines
Nikolas Leandro R Daguno,
Health Futures Foundation, Inc., Philippines

KEYWORDS: FLOODING, TRANSIENT DISPLACEMENT, HEALTH-RELATED EXPERIENCES

Flooding is a major trigger of global displacements, and results in various health consequences. In August 2012, heavy monsoon rains flooded low-lying areas in the Silang–Santa Rosa sub-watershed area of Laguna Lake. This paper aims to describe health-related experiences of households transiently-displaced by this flooding event. Using questions modified from CDC's CASPER tool, health-related experiences were determined in a post-flooding event survey (2013). Among 385 households, 9.61% (37) were transiently-displaced from their places of residence due to the flooding event. The proportion of transiently-displaced households with at least one member affected by an acute illness was 13.51% (5/37), and is highest for cough, athlete's foot, and sore throat. In contrast, the proportion of non-displaced households with at least one member affected by an acute illness was 37.93% (132/348), and is highest for cough and colds, fever, and headache. Differences in the prevalence of acute illnesses between displaced and non-displaced households were statistically insignificant. For displaced households reporting a psychological complaint in at least one member (7/37, 18.92%), loss of enthusiasm to do work, emotional problems, depressed mood, and loss of appetite were most common. However, non-availability of data on psychological complaints in non-displaced households precludes comparison. Insignificant differences in the prevalence of acute illnesses may be due to timely disease management, less crowding, good water supply and sanitation, intensified disease surveillance, and preventive public health strategies during disasters. Hence, scaling-up of public health surveillance, disaster response, and clinical management of illnesses among households affected by flooding events is recommended.

PRESENTATION TYPE: ORAL

WEAK POINTS IN THE USE OF MACROPHYTIC INDEXES FOR RUNNING WATER QUALITY MONITORING - A CASE STUDY FROM CENTRAL ITALY

Daniela Gigante
University of Perugia, Department of Chemistry, Biology and Biotechnology, Italy
Valentina Ferri
University of Perugia, Department of Chemistry, Biology and Biotechnology, Italy

KEYWORDS: MACROPHYTES, BIOMONITORING, PLANT SPECIES

Due to their remarkable sensitivity to pollution and environmental changes, macrophytes are being increasingly used as biological indicators to support the evaluation of the ecological quality of water bodies. Indexes and protocols based on these aquatic taxa are now widely used in several European countries, including Italy, following the enactment of the European Water Framework Directive (WFD, 2000/60/EC). One of the most applied is the Index Macrophytique Biologique en Rivière (IBMR), which should allow to evaluate the trophic status of natural and artificial rivers, mostly focused on ammonium and orthophosphate content, and organic pollution. IBMR has been selected by the Italian authorities as the official methodology for water control, in accordance with the WFD. However, some studies reported on the absence of significant correlations between IBMR and nutrients. In this frame, the present study was conducted along 15 water bodies in Central Italy, representing a wide environmental variability, with the aim to investigate IBMR's actual effectiveness in providing reliable information on water quality. Besides the application of IBMR's standardized procedure, chemical and physical parameters from the same sites have been analysed and confronted with the calculated values of the used index. Results show a very weak correlation between IBMR and measured parameters, thus suggesting that the use of this index in assessing water quality should be cautious.

PRESENTATION TYPE: POSTER

AMINO ACIDS IN ANTARCTIC LAKES AS PROXIES OF PRIMARY PRODUCTION

Elena Barbaro
University of Venice Ca' Foscari, Department of Environmental Sciences, Informatics and Statistics, Italy
Roberta Zangrando
National Research Council (CNR), Institute for the Dynamics of Environmental Processes, Italy
Marco Vecchiato
University of Siena, Department of Physical Sciences, Earth and Environment, Italy
Clara Turetta
National Research Council (CNR), Institute for the Dynamics of Environmental Processes, Italy
Carlo Barbante
National Reseach Council (CNR), Institute for the Dynamics of Environmental Processes, Italy
Andrea Gambaro
University of Venice Ca' Foscari, Department of Environmental Sciences, Informatics and Statistics, Italy

KEYWORDS: AMINO ACIDS, ANTARCTICA, LC-MS

Amino acids represent an important fraction of organic matter in freshwater ecosystems. To our knowledge, this is the first study to characterise amino acids in lacustrine water collected in Terra Nova Bay (Antarctica)in order to define its distributions and to individuate a relationship with primary production. Antarctica represents an excellent natural laboratory to estimate the natural presence, concentration, and variability of compounds, due to its distance from anthropogenic emissions. We improved an enantiomeric separation of forty underivatised amino acids using HPLC-MS/MS method, performing the most sensitive method to determine l-and d-amino acids in environmental samples at trace levels. Our analytical method was validated through the estimation of accuracy, repeatability, and linear range. The method was applied to samples collected in four different lakes. Lake 14 located at Edmonson Point presented the highest concentration of amino acids in comparison with the other samples considered in this study. Climate changes drastically reduced the lake's area in the last decade and probably this have carried out to a concentration of nutrients with a primary growth. We demonstrated that the influence of the sea on lake 10 at Inexpressible Island produced a small increase in amino acid concentrations. We can conclude that amino acids can be used as markers of primary production. However, it will be necessary to monitor these compounds during the next sampling periods to control the influence of climate change on biological production.

PRESENTATION TYPE: POSTER

IDENTIFICATION OF AQUATIC ECOSYSTEMS INDICATORS FOR EVALUATING MANAGEMENT EFFECTIVENESS OF A NATURAL PROTECTED AREA ON RIVER TIBER

Susanna D'Antoni, Michela Gori, Antonella Arcangeli, Serena Bernabei, Pietro Massimiliano Bianco,
Italian National Institute for Environmental Protection and Research (ISPRA), Italy

Christian Angelici
Natural Reserve of Tevere-Farfa, Italy

Mariachiara Barile, Carlo Belfiore, Giorgio Pace
University of Tuscia, Italy

Giorgio Catenacci
Regional Agency for Environment Protection of Latium (ARPA), Italy

Francesca Causarano

Filippo Chiudioni, Simona de Meo, Desiree Izzi, Stefania Marcheggiani, Camilla Puccinelli,
Italian National Institute of Health, Environment and Primary Prevention (ISS)

Marco Martinoli, Lorenzo Tancioni
University of Tor Vergata, Italy

KEYWORDS: AQUATIC SPECIES AND HABITAT, THREATS MANAGEMENT, MANAGEMENT EFFECTIVENESS EVALUATION

The Tevere-Farfa Natural Reserve (Latium - Italy) is a Ramsar and Natura 2000 site of 2000 ha, established for the protection of semi-natural habitats generated after the construction of an hydroelectric dam. The area was used as case study to: (1) verify the consistency among monitoring results for the assessment of the ecological status and conservation status of aquatic species and habitats (according to EU Water Framework Directive, Habitats and Bird Directives); (2) to identify a set of indicators of pressures and threats to biodiversity; (3) to develop an integrated monitoring method (using data gained according to EU Directives) to assess the management effectiveness of the protected area. 47 sampling stations were used to gain data to analyze 8 indexes of physico-chemical and ecological status (macrobenthos, diatoms, macrophytes, fish) and of birds and aquatic habitats status. Results show that ecological status differ on the basis of the type of index utilized. For onlyseven stations the result status was consistent for all criteria (good/excellent quality), while for all the other stations the status was found to be poor, good or excellentdepending on the considered criteria.Thisdiscordanceisconnected to: differences on biotic elements response (macrobenthos, diatoms, macrophytesand fish)to environmental pressures; different weight given to bioticintegrityorecological functionality on each index. The pressures identified through the monitoring werecompared with those recognized according to "expert judgment" approach (as defined by IUCN/WCPA) and used to evaluate the managementeffectivenessof the protected area.

PRESENTATION TYPE: ORAL

A FIRST APPLICATION OF THE NEW ASSESSMENT METHOD FOR ITALIAN LAKES, EPI-L, IN MEDITERRAEAN ECOREGION

Claudia Vendetti

Italian National Institute of Health,Environment and Primary Prevention, Department of Environmental Quality and Fishfarm Unit, Italy

Aldo Marchetto

National Research Council (CNR), Institute of Ecosystem Study, Italy

Camilla Puccinelli

Italian National Institute of Health,Environment and Primary Prevention, Department of Environmental Quality and Fishfarm Unit, Italy

Filippo Chiudioni

Italian National Institute of Health,Environment and Primary Prevention, Department of Environmental Quality and Fishfarm Unit, Italy

Stefania Marcheggiani

Italian National Institute of Health, Environment and Primary Prevention, Department Environmental Quality and Fishfarm Unit, Italy

Laura Mancini

Italian National Institute of Health, Environment and Primary Prevention, Department of Environmental Quality and Fishfarm Unit

KEYWORDS: LAKES, BENTHIC DIATOMS; EPI-L, DIFFERENT SUBSTRATES

Diatoms are used as indicators for the assessment of environmental conditions according to the Water Framework Directive (WFD) especially for monitoring river water quality while few studies on the use of phytobenthos in lakes are available so far. The aim of this study is the first Italian application of the new index for ecological quality assessment of lake waterbodies using benthic diatoms (EPI-L) and to evaluate its response to different diatom assemblages . EPI-L was calculated by weighted average and calibrated on eutrophication pressure. The study of benthic diatoms was performed in 8 Italian lakes in Mediterranean ecoregion Albano, Bolsena, Bracciano, Martignano, Salto, Scanno, Turano, and Vico. A total of 43 samples were collected in the littoral zone of lakes on three types of substrates, where available, in each site: stones, macrophytes and artificial substrates. For each sample diatom were identified at species level and abundance was estimated counting 400 valves. The impact of habitat type on species assemblages was also evaluated: EPI-L has been calculated for all samples collected by different substrates. Results of this study showed that ecological status assessment method EPI-L can be apply to diatom assemblages from different substrate stones, macrophytes and artificial substrates, giving the same indication of lake trophic status. Finally EPI-L method results a suitable tool for the ecological status assessment of lakes in Mediterannean ecoregion.

PRESENTATION TYPE: POSTER

IMPACT OF UNWANTED ICHTYOFAUNA REMOVAL ON PLANKTON ASSEMBLAGES IN LAKE CHIUSI

Todini Chiara
University of Perugia, Department of Chemistry, Biology and Biotechnology, Italy
DörrAmbrosius Josef Martin
University of Perugia, Department of Chemistry, Biology and Biotechnology, Italy
Pacini Nicole
University of Perugia, Department of Chemistry, Biology and Biotechnology, Italy
Ludovisi Alessandro
University of Perugia, Department of Chemistry, Biology and Biotechnology, Italy
Damiani Daniele
"Lenza Etrusca" Association - Lake Chiusi, Italy
Sammuri Giampiero
Province of Siena, Italy
Elia Antonia Concetta
University of Perugia, Department of Chemistry, Biology and Biotechnology, Italy

KEYWORDS: PHYTOPLANKTON , ZOOPLANKTON, LAKE CHIUSI

Lake Chiusi is situated in the province of Siena (Tuscany, central Italy). This small laminar and mesotrophic lake is characterized by a surface of 4 Km2, an average depth of 5 m and an artificial regulation of water levels. Lake Chiusi is included in the list “Sites Natura 2000” (Direttiva Habitat 92/43/CEE). Herein we report data about plankton assemblages from the pelagic site of the lake in two different years 2006 and 2013. Reducing unwanted fish populations in an eutrophic lake can be a way of curbing algal blooms and oxygen depletion. After 2006 this kind of “biomanipolation” on the lake took place in order to eradicate the non indigenous ichtyofauna. In 2013 the results of this intervention were evaluated by means of plankton samplings and physical-chemical analyses carried out monthly. Species composition of phytoplankton and zooplankton were compared in order to assess the possible changes occurring in plankton composition. The lake was dominated by Cyanophytes and Chlorophytes, both recorded with a dissimilar number of taxa, where a higher number of taxonomic units were found among Chlorophytes in 2013. The biomass density of Cyanophyceae was considerably higher in 2013 than in 2006. Low phytoplankton species diversity was also currently found. The zooplankton composition and biomass density did not show important changes and low values of the diversity were recorded for both years. Cladocera and mainly Copepoda were the most representative taxa at both sampling times. Overall, the results reveal a general shift of dominance towards the filamentous Cyanobacteria species, most likely related to anthropogenic pressure.

PRESENTATION TYPE: POSTER

HYDROLOGICAL VARIATIONS AND ZOOPLANKTON COMMUNITIES OF TROPICAL FLOODPLAIN LAKES: LAKE TEMPE AND LAKE SENTARUM, INDONESIA

Reliana Lumban Toruan
Research Center for Limnology, Indonesian Institute of Sciences, Indonesia
Fachmijany Sulawesty
Research Center for Limnology, Indonesian Institute of Sciences, Indonesia

KEYWORDS: TEMPE AND SENTARUM FLOODPLAINS, ZOOPLANKTON COMMUNITY, HYDROLOGICAL REGIMES

Both Lake Tempe and Lake Sentarum are floodplain lakes of national importance situated in South Sulawesi and West Kalimantan (Borneo), Indonesia with Lake Sentarum is listed as a Ramsar Site of national importance. Both lake experiencing hydrological variations as can be identified during wet and dry seasons. Study on hydrological regimes and its association to zooplankton ecology was done to look at the hydrological characteristic and its association to zooplankton ecology in both lakes. Field study and zooplankton sampling were carried out in two seasons (High water (HW) and Low Water (LW) periods) representing hydrological variations of wet and dry seasons of the floodplains. Rotifer was found to be dominant zooplankton during low water period while micro crustacean was predominant in high water period both in Lake Tempe and Lake Sentarum. Number of species and total abundance were also higher in LW than in HW. In Lake Tempe, 68 zooplanktons were identified during LW consisted of 10 Copepods, 11 cladocers, and 47 rotifers and 48 species were identified during HW consisted of 22 Copepods, 11 cladocers and 15 Rotifers. Rotifer was dominant during LW period which then were shifted by Micro crustacean population, meaning that rotifers was well adapted to low water habitat. Similarly, in Lake Sentarum, rotifers were dominant during LW period where 44 rotifers were identified during the lowest water level, whereas micro crustacean were predominant in high water period where 26 of them were identified at this period.

PRESENTATION TYPE: ORAL

TROPHIC STATUS OF THREE CO-OCCURRING BENTHIVOROUS FISH SPECIES AFTER EIGHTEEN YEARS IN SOUTH EAST SRI LANKAN RESERVOIR

W.A.H.P.Guruge
University of Ruhuna, Department of Zoology, Faculty of Science, Sri Lanka
N.J. De S. Amarasinghe
University of Ruhuna, Department of Zoology, Faculty of Science, Sri Lanka

KEYWORDS: RESOURCE PARTITIONING, GUT CONTENT, BENTHIVOROUS, PELAGIC ZONE

Resource partitioning is an important mechanism allowing species in an assemblage to coexist. Present study was carried out to investigate change of amount of food items in three co-occurring benthivorus fish species namely Puntius chola, Puntius dorsalis and Puntius sarana after eighteen years period. Research was carried out in Tissawewa, a shallow (mean depth = 1.2 m) lowland reservoir of ca 200 ha. Fish were sampled in four macrohabitat, namely A= Bottom layers of open water; B = pelagic zone; C= shallow intermediate zone and D= Littoral zone with vegetation. Fishes were collected monthly from 1991 to 1993 and again nearly eighteen years later, using monofilament multi-mesh gillnets. Contents of the anterior 1/3 part of the gut of fish were analyzed and relative bio volume of food items in the gut was estimated according the points method. Data were analyzed using SPSS statistical package. A change of particular food item from year 1993 to 2012 was analyzed using chi square for each species. Diversity of the food items in P. sarana was higher than that of other two species. Insects, microbenthos and mollusks are the main food items in the gut of benthivorous fish species, but P. sarana consumed significantly more mollusks than other two species. Mollusks presence in the year 1991-93 period in the gut of P.sarana was higher than that of year 2011-12 and significantly different (p

PRESENTATION TYPE: ORAL

EVALUATING BENTHIC RECOVERY DECADES AFTER A MAJOR OIL SPILL IN THE LAURENTIAN GREAT LAKES

Landis Hare
INRS-ETE, University of Quebec, Canada
Karine Bertrand
INRS-ETE, University of Quebec, Canada

KEYWORDS: DEFORMITIES, OIL-SPILL, CHIRONOMUS

The long-term effects of oil spills on freshwater organisms have been little studied. In 1950, a large oil spill (10 million L) covered the harbor area of Parry Sound, Ontario, Canada, the deepest port in the Laurentian Great Lakes. Ecological impacts were not studied at the time, but 25 years later three-quarters of the Chironomus cucini larvae (Insecta, Diptera, Chironomidae) living in the harbor area were reported to be deformed. We returned six decades after the spill and found that the frequency of deformities had returned to background levels, and that the community of burrowing invertebrates appears to have recovered. By dating sediment cores and measuring the depth distribution of oils, we conclude that, although the oil persists six decades after the spill, sufficient uncontaminated sediment has covered the oil so as to put it out of reach of most burrowing animals. Provided that the sediment remains undisturbed, the buried oil is unlikely to exert further negative effects on the biota in spite of the fact that it will likely persist for millenia.

PRESENTATION TYPE: POSTER

CANDIA LAKE (PROVINCE OF TURIN, PIEDMONT, NORTHWESTERN ITALY) AS AN OPEN-AIR LABORATORY: HEAVY METAL CONTAMINATION IN PROCAMBARUS CLARKII

Erika Burioli
Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, Italy
Alessandra Pucci
Province of Turin, Italy
Stefania Squadrone
Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta
Massimo Zucca
Province of Turin, Italy
Alessio Ferrarese
Province of Turin, Italy
Claudio Foglini
Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, Italy
Antonia Concetta Elia
University of Perugia, Department of Cellular and Environmental Biology, Italy
Renata Tarasco
Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, Italy
Gabriele Bovo
Province di Turin
Tommaso Scanzio
Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, Italy

KEYWORDS: PROCAMBARUS CLARKII, HEAVY METALS, CANDIA LAKE

Candia Lake is one the most important wetlands in Piedmont and it has been declared a Site of Community Importance according to the EU "Habitat" directive as rare autochthonous species are present. Regrettably this habitat is endangered by the increasing number of red swamp crayfish Procambarus clarkii, an invasive allochthonous species native of Southeastern United Statesand now present in a large part of Europe. Numeric control of the population of P. clarkii will be carried out from summer 2014 to protect this area, and the question of carcass management was needed to be considered. Local human consumption was proposed as a possible answer and an assessment of heavy metal contamination needed to be performed. In autumn 2013, two samplings of P. clarkii individuals were conduced in four areas of the park, two of them characterized by anthropic activities. The contents of cadmium, lead, mercury, arsenic, chrome, selenium and tin were investigated for muscular tissue and for exoskeleton by inductively coupled plasma mass spectrometry (ICP-MS) and Direct Mercury Analyzer (DM80).The results for regulated heavy metals showed higher mean concentrations in exoskeleton for cadmium (0.079 mg/kg StDev 0.095) and lead (1.23 mg/kg StDev 0.968) than in muscular tissue (cadmium 0.02 mg/kg; lead 0.155 mg/kg StDev 0,085). The level of mercury resulted very low and quantifiable only for one sample. Considering this preliminary analysis, the edible part seems to be safe egarding heavy metal contamination but the levels observed in exoskeleton need to be deepened for biomonitoring.

PRESENTATION TYPE: POSTER

COMPARATIVE STUDY ON PHYTOPLANKTON DYNAMICS ALONG A RESERVOIR CASCADE IN UPPER BHIMA BASIN IN WESTERN INDIA

Mark Prabhakar Vuppati
Central Water and Power Research Station, Khadakwasla, Pune, India
Shanti Vaidya
Central Water and Power Research Station, Khadakwasla, Pune, India
Kishore Kumar Swain
Central Water and Power Research Station, Khadakwasla, Pune, India
Krihna Kumar Gupta
Central Water and Power Research Station, Khadakwasla, Pune, India
Rahul S Jagtap
Central Water and Power Research Station, Khadakwasla, Pune, India

KEYWORDS: RESERVOIR CASCADE, PHYTOPLANKTON, WATER QUALITY

As there has been unprecedented urbanization and industrialization in the upper Bhima basin, water quality of the river and reservoirs became a major concern. A cascade of 3 reservoirs namely Panshet reservoir(PR), Khadakwasla reservoir (KR) and Ujjani reservoir (UR) were selected to investigate phytoplankton dynamics. Water and biological samples and in situ data were collected covering all three seasons from three reservoirs. Water quality and phytoplankton analysis implied that water quality was degrading along the reservoir cascade. Water quality parameters like Conductivity (71.25 to 686.93µS/cm), pH (7.24 to 8.35) DO (7.16 to 6.96mg/l) and Secchi depth (1.89 to 1.38m) observed to be deteriorating from PR to downstream UR. Phytoplankton density in UR was the highest among 3 reservoirs 35870 org/litre, which implicated that the trophic status of UR is increasing. A total of 39 genera, 48 genera and 61 genera of algae were identified in PR, KR and UR respectively. There is gradual increase in percentage of Cyanophyceae from PR to UR indicating the increasing trend in harmful algae. Bacillariophyceae was observed to be the dominant class in PR and KR where as Chlorophyceae was a dominant class in UR. It was observed that there is a gradual deterioration in water quality and phytoplankton composition in a reservoir cascade a we travel down-stream. Shallow reservoirs having more storage capacity and human interference triggers the increase in trophic status and for such reservoirs continuous surveillance is must and remedial measures need to be taken on priority basis. Long-term monitoring for the 3 reservoirs is suggested.

PRESENTATION TYPE: ORAL

THE PRESENCE OF THE NEMATODE EUSTRONGYLIDES EXCISUS (NEMATODA) AT THE SPECIES SILURUS GLANIS AND PERCA FLUVIATILIS FROM VICTORIA LAKE (BRATOVOIEŞTI – DOLJ, ROMANIA)

Claudia Goga
Oltenia Museum Craiova, Romania

KEYWORDS: EUSTRONGYLIDES EXCISUS,, NEMATODE, VICTORIA LAKE

The nematode Eustrongylides excisus Jägerskiöld, 1909 was detected in Silurus glanis and Perca fluviatilis fish species from Victoria Lake (Bratovoieşti - Dolj, Romania). This lake, located 25 km from Craiova, on Rojiştea terrace, is part of a lacustrine complex known as "Adunații de Geormane", which forms an isolated biological unit, linked to the Jiu River by a channel draining the excess water through Marica pool.The study was performed in April of 2013 in order to obtain the ichthyologic material necessary to the subsequent parasitological studies. The parasite was identified after collection, both as a secluded larva surrounded by a dense capsule of connective tissue in the mesentery and free in the abdominal cavity and abdominal wall muscles, in case of two predatory fish species: Silurus glanis and Perca fluviatilis. The identification of the endoparasites was achieved directly by macroscopic and microscopic examination (native preparation blade - slide). Since water quality is a key factor in the transmission of the parasite, eutrophication creates optimal conditions for the numerical increase of the populations of parasitic aquatic oligochaete, as they are part of the food chain of the parasitized fish. This nematodosis is increasingly rare and does not lead to obvious pathological states, but it can degrade the meat commercial aspect and quality.

PRESENTATION TYPE: POSTER

STRUCTURAL PARTICULARITIES OF THE AQUATIC ECOSYSTEM OF A PLAIN CATCHMENT AREA IN SOUTHERN ROMANIA

Olivia Cioboiu
Oltenia Museum Craiova, Romania

KEYWORDS: THE PREAJBA VALLEY, HYDROGRAPHICAL SYSTEM, ROMANIA

Located within a plain area, the Preajba Valley system that belongs to the Jiu hydrographical basin, covers a surface of 30 Km2. This small surface includes a great variety of aquatic ecosystems: springs, streams, rivulets, swamps, and small reservoirs. This complex organization induces the structural-functional characteristics and complexity of the ecosystems. In the area of the rhitron (including the springs and rivulets), there have been identified species of Diatomeae, Ciliata, Testaceae, Ostracoda, Gamarida, Chironomida, Ephemeroptera, Heteroptera. In the area of potamon (the area that covers the hilly and plain sector of the complex hydrographical network), the structure of the biocoenosis is made up of pelagic and benthic communities. In case of phytoplankton, there have been identified more than 70 alga species and in case of zooplankton, 65 species of Ciliata, Rotiphera, Cladocera, Copepoda and 13 large groups of invertebrates, some comprising a great number of individuals (Chironomida 4.600 ind./m2, Ostracoda 1.750 ind./m2, Ephemeroptera 213 ind./m2, Plecoptera 226 ind./m2) in zoobenthos. In case of the reservoirs, the ichtyofauna is represented by 10 species, cyprinids being dominant. The Preajba Valley system is atypical due to its geographical location (plain area) and small surface (30 Km2), but it gathers all the structural-functional characteristic of a large dimension hydrographical system.

PRESENTATION TYPE: POSTER

METAGENOMIC APPROACH TO INVESTIGATE THE STRUCTURAL AND FUNCTIONAL ROLE OF MICROBIAL COMMUNITY IN LAKE CHILIKA: A PRELIMINARY STUDY

Samir Mishra
KIIT School of Biotechnology, Environmental Biotechnology Lab, KIIT University, Bhubaneswar, Odisha, India
Vishakha Raina
KIIT School of Biotechnology, Environmental Biotechnology Lab, KIIT University, Bhubaneswar, Odisha, India
Mrutyunjay Suar
KIIT School of Biotechnology, Environmental Biotechnology Lab, KIIT University, Bhubaneswar, Odisha, India
Gurdeep Rastogi
Chilika Development Authority (CDA), Bhubaneswar, Odisha, India
Tim Vogel
Department of Microbiology and Environmental Engineering, University of Lyon, France
Ajit K Pattnaik
Chilika Development Authority (CDA), Bhubaneswar, Odisha, India
Tapan K Adhya
KIIT School of Biotechnology, Environmental Biotechnology Lab, KIIT University, Bhubaneswar, Odisha, India
A. N. Panda
KIIT School of Biotechnology, Environmental Biotechnology Lab, KIIT University, Bhubaneswar, Odisha, India
L Ray
KIIT School of Biotechnology, Environmental Biotechnology Lab, KIIT University, Bhubaneswar, Odisha, India

KEYWORDS: MICROBIAL DIVERSITY, METAGENOMICS, BIOGEOCHEMICAL CYCLE

Metagenomic Approach to Investigate the Structural and Functional role of Microbial community in Lake Chilika: A preliminary study Samir R. Mishra1, A. N. Panda1, L. Ray1 , Gurdeep Rastogi2, A. K. Pattnaik2, Tapan Kumar Adhya1, T. M. Vogel3, M. Suar1* and V. Raina1* 1 KIIT School of Biotechnology, Environmental Biotechnology Lab, KIIT University, Bhubaneshwar, Odisha, India-751024. 2 Chilika Development Authority (CDA), Bhubaneswar, Odisha, India-751014. 3 Department of Microbiology and Environmental Engineering, University of Lyon, Lyon, France-69002. *vishakha.raina@gmail.com; msbiotek@yahoo.com Brackish water ecosystems are characterized by ecotone regions and rich faunal / floral diversity. The microbial community in such ecosystems contributes essentially to the maintenance of the environment, running of biogeochemical cycles and also the flow of energy in other ecosystems associated with them. However, the microbial diversity of such ecosystems and their role in the environment have not been understood and studied extensively. This primarily was due to a culture dependant approach and lack of high throughput techniques in studying microbial ecology which, until recently is supported by culture independent methods. Metagenomic approaches provide a comprehensive understanding of the structural and functional composition of microbes in the environment, besides delineating their role in the nutrient cycling in lake sediment microcosm, as well as predicting the co-evolutionary relationships with the other species present in the same environment. With the advent of Next Generation Sequencing (NGS), the possibility of processing large amount of data and mining relevant information for answering questions on microbial diversity and microbial activity in a short span of time have been made a reality. Several environmental issues like impact of climate changes on both ecosystem structure and function in tropics, especially in lakes, can be studied better. Hence, to make predictions of impacts of global warming on ecosystem processes in aquatic ecosystems, it is necessary to establish the role of the microbial community structure in conjunction with the biogeochemical cycle to unravel its metabolic function and mineralization

efficiency in a mixed substrates oligotrophic lagoon aquatic system. Here, we report a preliminary bacterial inventory from spatial diversity study of sediment bacteria profiles from 7 and 5 sampling stations distributed over central (avg. salinity- 8.5 ppt) and south (avg. salinity- 14.5 ppt) zones, respectively, of the Chilika Lake during summer season. Metagenomic DNA was isolated from the lake sediments of individual sampling stations of both zones and pooled separately for sequencing by pyrosequencer (Roche 454, USA). The total proportions of sequences (%) obtained were categorized at domain level and at functional level. At domain level, nearly 86% were Bacteria, less than 10% were Archaea and Eukarya and nearly 10% were unassigned sequences. Among bacteria, the relative abundance for dominant phyla in both south and central zones were found to be of Proteobacteria and Bacteroides. At functional level, correlation of carbohydrate (15%) and amino acid (10%) gene sequences were compared between south and central zones for which the correlation values were found to be R2 = 0.995 and R2 = 0.894, respectively. A Principal component analysis of metagenome dataset was conducted with other extreme, non extreme and marine ecosystem data sets via MG-RAST and VAMP database, which suggested that Chilika Lake is unique to have a median presence in comparison to other known ecosystems of the world.

PRESENTATION TYPE: POSTER

THE REGULARITIES OF SYNTHESIS OF LOW-MOLECULAR WEIGHT ORGANIC COMPOUNDS BY WATER MACROPHYTES DEPENDING ON BIOTIC AND ABIOTIC FACTORS

Evgeny Kurashov
St.Petersburg State University, Russia
Julia Krylova
St.Petersburg State University, Russia
Galina Mitrukova
Institute of Limnology RAS, Russia
Alexandra Chernova
I.D. Papanin Institute for biology of inland waters RAS, Russia

KEYWORDS: AQUATIC MACROPHYTES, LOW MOLECULAR WEIGHT ORGANIC COMPOUNDS, GAS CHROMATOGRAPHY–MASS SPECTROMETRY

This work deals with the study of of low-molecular weight organic compounds (LMWOC) of aquatic macrophytes growing on the territory of Russia in different environmental conditions (lakes, ponds and rivers) and geographic regions (Leningradsky, Yaroslavsky and Astrakhan regions). Detection and identification of LMWOC were performed by gas chromatography-mass spectrometry in the programmed temperature mode. The content of detected compounds were evaluated using internal standards (decafluorobenzophenone and benzophenone). The production of LMWOC by macrophytes can be an important factor affecting the composition of aquatic communities and the heterogeneity of their distribution in lakes and other water bodies. In turn, the biological surroundings and growing conditions affect the qualitative and quantitative composition of metabolites of aquatic macrophytes. It is shown that the component composition of LMWOC and their content depend on the abiotic (geographical location of habitats and hydrological regime, the light conditions) and biotic factors (season and vegetation phase, biological environment, distribution in different vegetative organs). Revealed patterns have been obtained under the study of composition of the metabolites in the following species of aquatic macrophytes: Potamogeton natans L., P. pusillus L., Nuphar lutea (L.) Smith. and Ceratophyllum demersum L. Special attention is paid to the functions of LMWOC in aquatic ecosystems (especially allelopathy) and the possibility of their use for the control of cyanobacterial and algal «blooms» in inland waters.

PRESENTATION TYPE: ORAL

NEW METHOD FOR ASSESSING THE STABILITY OF THE STATE OF LAKE ECOSYSTEMS BY THE COMPOSITION OF LOW-MOLECULAR WEIGHT ORGANIC COMPOUNDS OF AQUATIC MACROPHYTES

Julia Krylova
St.Petersburg State University, St.Petersburg, Russia
Evgeny Kurashov
St.Petersburg State University, St.Petersburg, Russia

KEYWORDS: AQUATIC MACROPHYTES, LOW MOLECULAR WEIGHT ORGANIC COMPOUNDS, GAS CHROMATOGRAPHY–MASS SPECTROMETRY

A new method for assessing the stability of the lake environment is proposed as a result of the study of low-molecular weight organic compounds(LMWOC) of aquatic macrophytes. Following a study of the spectrum of LMWOC of several species of aquatic macrophytes (Potamogetonnatans, P.pusillus, Nupharlutea,Ceratophyllumdemersum) using gas chromatography-mass spectrometry it was revealed that the spectra and content of LMWOC determined significantly by the conditions of the habitat of plants (both biotic and abiotic). As this takes place, a research of P. natans and N. lutea in the same phase of vegetation carried out on Lake Suuri (the Karelian Isthmus) for several years have shown that if the environmental conditions in the lake are not changed, the composition and content of LMWOC in a macrophyte remain stable. At the same time, the composition and content of LMWOC in the same species from the neighboring lakes, but with different trophic status and anthropogenic load differed significantly. In contrast, the spectra of LMWOC of P. natans from widely separated lakes (Lake Suuri and small lake in Punkaharju, Finland) can be surprisingly similar, indicating similar habitats. Thus, if to take the samples of macrophytes in the same phase of vegetation in the lake ecosystem, the content of LMWOC can detect, does lacustrine environment change or it is in a stable state. This monitoring method is integral like blood analysis in medicine and it has a number of advantages over the standard methods of monitoring of the state of lake ecosystems.

PRESENTATION TYPE: ORAL

MICROCYSTINS BIOACCUMULATION IN FRESHWATER MUSSELS (UNIO ELONGATULUS) DETECTED BY MATRIX-ASSISTED LASER DESORPTION IONIZATION-TIME OF FLIGHT MASS SPECTROMETRY

Rosaria Lauceri
CNR Institute of Ecosystem Study, Italy
Andrea Lami
CNR Institute of Ecosystem Study, Italy
Giuseppe Morabito
CNR Institute of Ecosystem Study, Italy
Martina Austoni
CNR Institute of Ecosystem Study, Italy
Valentin Pflueger
Mabritech AG, Riehen, Switzerland
Mauro Tonolla
ICM, Bellinzona, Switzerland
Francesca Caviglia
Regional Agency for the Protection of the Environment (ARPA Piedmont VCO), Italy
Agnese Adani
Università di Milano Bicocca, Italy
Nicoletta Riccardi
CNR Institute of Ecosystem Study, Italy

KEYWORDS: MICROCYSTINS , BIOACCUMULATION, MALDI TOF MS

Microcystins, potent toxins produced by some species of cyanobacteria, are a growing problem worldwide posing a serious threat to human health and aquatic biota. The hepatotoxin microcystins (MCs), can enter the aquatic food web through accumulation in various organisms including zooplankton, macroinvertebrates and vertebrates. Freshwater bivalves are filter-feeders and have the potential to bioaccumulate a range of organic and inorganic pollutants found in freshwaters. Because of their capacity to concentrate various toxic and non-toxic trace elements, freshwater bivalves have been exploited as “sentinel organisms” to enhance toxicants detection. The present study aimed at developing in situ early warning system based on bivalves as MCs accumulators (biosentinels), using Matrix-Assisted Laser Desorption Ionization-Time of Flight Mass Spectrometry (MALDI TOF MS) technique as rapid analytical tool to ensure a prompt response and effective risk management. Therefore, we explored the efficiency of MALDI TOF MS, in comparison with traditional methods (HPLC; ELISA immunoassay), for detecting toxins in the bivalve tissues. We studied microcystin–LR (MC–LR) and desmethyl-microcystin–LR (MC–DeLR) assimilation in Unio elongatulus when exposed to Microcystis aeruginosa. Mussels’ tissues were analyzed after short term grazing experiments at high toxic algae concentrations and during long term grazing experiments at low toxic algae concentrations to study the accumulation capacity of the mussels. The results confirm the utility of MALDI-TOF MS as rapid screening method for microcystins detection in organic matrices.

PRESENTATION TYPE: ORAL

ORIGIN OF ORGANIC MATTER IN THE LAKE CHEKO (CENTRAL SIBERIA, RUSSIA)

Francesca Alvisi
National Research Council - Institute for Marine Sciences (CNR-ISMAR), Italy

KEYWORDS: ORGANIC MATTER, PALEOLIMNOLOGY, SIBERIA

Total Organic Carbon (TOC), Total Nitrogen (TN), d13C and d15N analyses were performed on 5 sediment cores collected within Lake Cheko, a small basin 9 km NW of the Tunguska Event (TE) epicentre (Central Siberia, Russia), during the field work carried out in 1999. The aim was to shed light on the origin of organic matter (OM) deposited within the lake and to contribute to reconstruct recent paleolimnological history and environmental evolution of the lake itself and its catchment. OM analyses were performed on 1-2 cm slices all along the core records. Total concentrations ranges between 0,2 and 8,6% d.w. for TOC and 0,02 and 0,67 % d.w. for TN. C/N ratio ranges between 7,6 and 17,9, whereas d13C shows values ranging between –29,73 and -26,47 ‰ and d15N between 0,09 and 3,32 ‰. Two main differences among the study cores are amount, and composition of organic matter along the sedimentary record allowing us to distinguish different units. In particular, macroremains, C/N >10 and very negative d13C values compatible with C3-type Land plants (boreal forest) were interpreted as the results of high energy transport events such as seasonal floods or slope failures, whereas low C/N values should correspond to OM produced within the lake basin by autochthonous organisms. Cross-analysis of obtained data allowed us to reconstruct the recent paleolimnological evolution of the basin that responds in different ways according to periodic events such as seasonal floods and winter stasis, as well as extraordinary events such as fire in the taiga.

PRESENTATION TYPE: ORAL

ECOLOGICAL SUCCESSION INVESTIGATED THROUGH ECOLOGICAL FLOW NETWORKS

Antonio Bodini
University of Parma, Italy
Giampaolo Rossetti
University of Parma, Italy
Cristina Bondavalli
University of Parma, Italy

KEYWORDS: ECOLOGICAL SUCCESISON, FOOD WEB, NETWORK

Ecological succession investigated through ecological flow networks Ecologists used to describe ecosystem development through an orderly process of change called succession. Patterns to characterize this process have been searched for and this effort culminated in a list of features that would accompany ecosystem evolution. This generalization, proposed by Odum, has been criticized as observational studies of successional systems showed that changes in structural and functional characteristics often did not conform to their proposed generalization. To further test the consistency of the trends expected in developing ecosystems we propose here to discuss them in a whole system framework. To this end we used the network approach to describe a lacustrine ecosystem in its developmental trajectory as reconstructed using data collected in 12 years of sampling activity, within the interval from 1986 to 2009. Data about species and dietary habits have been used to build up the food web of the lake: links and their magnitude. The topology and intensity of the links have been converted in the indices of growth and development. These indices were used as benchmark for the attributes of ecosystem development, as classically defined. Their trends seem to confirm some of the expectations but not all. Furthermore, some of the classical attributes, those for which a network counterpart could not be found, were calculated (i.e. Production, Biomass, P/B, Shannon index). Their trends hardly accommodated in the generalized model of ecosystem development. Understanding developmental trends is crucial for ecosystem conservation. Could they be clarified, it will be possible to monitor anomalies, which would signal the presence of stress or disturbance. The network approach is effective in this respect as it creates a whole system framework in which specific features can be accommodated.

PRESENTATION TYPE: ORAL

SMALL LAKES, "VATHRES", IN SAMOTHRACE ISLAND, SE AEGEAN SEA, GREECE. A PARTICULAR ENVIRONMENTAL LANDSCAPE OF PROTECTION AND ENHANCEMENT

Konstantinos Gritzalis
H.C.M.R. - Institute of Marine Biological Resources & Inland Waters, Greece
George Gritzalis
H.C.M.R. - Institute of Marine Biological Resources & Inland Waters, Greece
Evaggelia Anastasopoulou
H.C.M.R. - Institute of Marine Biological Resources & Inland Waters, Greece
Nikolaos Skoulikidis
H.C.M.R. - Institute of Marine Biological Resources & Inland Waters, Greece

KEYWORDS: SAMOTHRACE ISLAND, WATER QUALITY, MACROINVERTEBRATES

Samothrace Island (NE Aegean, Greece), covers an area of 178 Km2 and owns an extensive hydrographic network. Due to the region's topography, geology and to some other processes, waterfalls, gorges, valleys, etc., exist, while several small lakes are formed throughout the entire length of the rivers. The majority of the island is covered by rich and seldom vegetation (Alnus glutinosa, Quercus petrea, etc) and a great diversity of avifauna is present. Among the wetland areas, very small ponds are included (locally known as "vathres"). The most significant are located on the terraces of the rivers Fonias and Tsivdoghianni. From physico-chemical and chemical terms (Dissolved Oxygen, Conductivity, N-NO2, N-NO3, N-NH4, Total Nitrogen, Total Phosphorus, etc), the waters are classified as "Excellent" pursuant to an internationally accepted evaluation procedure, while in these "vathres" rich macroinvertebrate fauna is encountered (Diptera, Coleoptera, Ephemeroptera, Trichoptera, Odonata, Mollusca, Plecoptera, etc). The absence of fish fauna is notable, due to the intense relief and the impetuosity of surface waters. The pressures are considered limited in extent and intensity, with the exception of free pasture, which damages the seedlings of native vegetation. Thus, except of the inestimable cultural heritage (Sanctuary of the Great Gods, statue of Nike - Winged Victory-190BC, etc), of the island, a special management plan based on current environmental data, as well as on an enhanced legislative regime adapted to the particularities of these small wetlands and to local requirements, will be able to protect and preserve these unique microlandscapes.

PRESENTATION TYPE: ORAL

GROWTH FEATURES OF LUCIOBARBUS ESCHERICHII FROM SMALL STREAMS, WHICH FLOW INTO A LARGE RESERVOIR (DARLıK RESERVOIR, NW TURKEY)

Özcan Gaygusuz
Istanbul University, Fisheries Faculty, Turkey
Çiğdem Gürsoy Gaygusuz
Trakya University, Keşan Vocational High School, Turkey

KEYWORDS: FISHBIOLOGY, GROWTH FEATURES, STREAM

Although it is one of the most ecologically important fish species in freshwater systems of northwestern of Turkey, biological features, mainly the growth of Luciobarbus escherichii (Steindachner, 1897)has received very little attention. In this study, some growth properties of L. escherichii inhabiting in the streams of Darlık Reservoir, which is providing important part of water demand of city of Istanbul, Turkey were studied. During the study period between October 2008 and September 2010, 140 L. escherichii individuals were collected by electrofishing. Length-weight relationship, sex distribution rate, and Fulton's condition factor were calculated. Total length values were between 2.2 cm and 22.8 cm while weight values were between 0.14 g and 87.49 g. Length-weight relationship was W=0.0095*TL3.0342 in all individuals. The overall sex ratio of females (n=31) to males (n=68) was 1:2.19, which was statistically different from unity (p 0.05; $\chi 2$ = 13.7). The K value of 0.965 estimated from this study shows that L. escherichii from the study area was in extremely poor condition.

PRESENTATION TYPE: POSTER

MODELLING THE SEASONAL SUCCESSION OF TOXIC CYANOBACTERIA IN KARAOUN RESERVOIR, LEBANON

Ali Fadel

LEESU (UMR MA-102) Université Paris-Est, Ecole des Ponts ParisTech, AgroParisTech, F-77455 Marne-la-Vallée, France

Bruno J. Lemaire

LEESU (UMR MA-102) Université Paris-Est, Ecole des Ponts ParisTech, AgroParisTech, F-77455 Marne-la-Vallée, France

Brigitte Vinçon-Leite

LEESU (UMR MA-102) Université Paris-Est, Ecole des Ponts ParisTech, AgroParisTech, F-77455 Marne-la-Vallée, France

Ali Atoui

Laboratory of Microorganisms and Food Irradiation, Lebanese Atomic Energy Commission- CNRS, Beirut, Lebanon

Kamal Slim

Laboratory of Microorganisms and Food Irradiation, Lebanese Atomic Energy Commission- CNRS, Beirut, Lebanon

Bruno Tassin

LEESU (UMR MA-102) Université Paris-Est, Ecole des Ponts ParisTech, AgroParisTech, F-77455 Marne-la-Vallée, France

KEYWORDS: CYANOBACTERIA, PHYTOPLANKTON SUCCESSION, MODELLING

Lake and reservoir managers are in need of simple tools for predicting harmful algal blooms. But the process-based models described in the literature are often highly complex and require large data sets. Beyond a certain degree, adding processes was shown to reduce model predictive capabilities. In this work, we assess the performance of a simple biological model to describe the succession of cyanobacterial blooms in a reservoir. Our study site is Karaoun Reservoir, Lebanon, a eutrophic reservoir where cyanobacteria Aphanizomenon ovalisporum and Microcystis aeruginosa alternatively bloom. We used the following configuration of the one-dimensional hydrodynamic-ecological modelDyresm-Caedym: both cyanobacteria were simulated, with constant buoyancy for Aphanizomenon ovalisporum, vertical migration dependent on light and internal nitrogen for Microcystis aeruginosa and growth limited by light and temperature for both species. The model was calibrated in summer and autumn 2012 and validated in spring and summer 2013. It showed a good performance for the water level (RMSE 1 m, annual variation of 25 m), water temperature profiles (RMSE 1 °C, range 13-28 °C) and cyanobacteria biomass (RMSE 48 µ L-1 equivaent chlorophyll a, range 0-206 µg L-1. This shows that simple model configurations can be sufficient when few major processes can be identified. This approach could be transposed on other eutrophic lakes and reservoirs to describe the competition between dominant phytoplankton species, contribute to early warning systems or be used to predict the impact of climate change and management scenarios.

PRESENTATION TYPE: ORAL

MS01-03

Lake ecosystem and biodiversity assessment and conservation

SEMI-AUTOMATED IDENTIFICATION AND BIOVOLUME ESTIMATION OF PLANKTON USING AN IMAGING FLOW CYTOMETER (FLOWCAM®)

Brandon Rieff
Fluid Imaging Technologies
Suzanne Delorenzo
Clackamas Water District, U.S.A.
Peter Wolfe
Fluid Imaging Technologies
Harry Nelson
Fluid Imaging Technologies

KEYWORDS: FLOWCAM, CLASSIFICATION, ALGAE

Responding to the need for the “rapid counting and measurement of individual plankton cells in natural populations”, researchers at the Bigelow Laboratory for Ocean Sciences in 1999 developed an imaging flow cytometer (FlowCAM) designed specifically to support aquatic microbial research. Fifteen years later, the need for rapid and precise methods that provide a means to identify, quantify, and determine size structure of plankton communities remains of critical importance in developing an understanding of marine microbial food webs, ecosystem function, oceanic carbon structure, and their responses to environmental conditions. Here we present an update on recent advances made to the FlowCAM’s software that specifically address the image recognition and semi-automated capabilities of the technology for the classification of plankton and estimation of plankton biovolume. Included will be an overview of the methodology along with a review of data from recent studies.

PRESENTATION TYPE: ORAL

THE ASSESSMENT OF ORGANIC POLLUTION DEGREE IN LAKE ARPI (ARMENIA) BY CHEMICAL AND BACTERIOLOGICAL PARAMETERS

Karine Grigoryan
Faculty of Natural Sciences and Geography of GSPI, Armenia
Gor Gevorgyan
Scientific Center of Zoology and Hydroecology of NAS RA, Armenia
Karen Grigoryan
Department of Ecology and Nature Protection of Yerevan State University, Armenia
Karlen Grigoryan
Department of Ecology and Nature Protection of Yerevan State University, Armenia

KEYWORDS: ARMENIA, BACTERIOLOGICAL AND HYDROCHEMICAL PARAMETERS, LAKE ARPI, ORGANIC MATTERS, POLLUTION

Lake Arpi is situated in the northwest of the Republic of Armenia. Being alpine specific ecosystem with its rare flora and fauna it has ensured ecological balance of the adjacent extensive area. Agriculture is the main occupation of the population in the Lake Arpi catchment area. Due to the incomplete mechanisms of waste and wastewater management, the hydroecosystems in the catchment area have been endangered by pollution. The aim of the present study was to establish organic pollution degree and possible pollution sources in Lake Arpi according to the chemical and bacteriological parameters. The water samples were taken once every season (except winter) during 2010 – 2011 from the 3 sites of Lake Arpi. According to the PO (permanganate oxidation), BOD5, CODCr values and the total number of planktonic bacteria in Lake Arpi, the lowest contents of organic matters were registered in the site located about 800 meters to the northwest of the lake from the Bazirkhan river mouth (the 1st observation point), where the water is mainly affected by natural factors, and the concentrations of organic matters in the water of the coastal sites (2nd and 3rd observation points) increased gradually, which is explained by the impact of rural domestic and agricultural discharges. Nonpolluted natural waters mainly contain the small amounts of organic matters. The high concentrations of organic matters can be observed in the waters affected by domestic, agricultural and industrial wastewaters. This allows us to conclude that the content of organic matters in the 2nd observation point of the lake was mainly conditioned by the influence of cattle breeding, and organic matter composition in the 3rd observation point, which is located in the vicinity of the rural area, was mainly formed by the impact of rural domestic and agricultural discharges.

PRESENTATION TYPE: POSTER

DIVERSITY, THREATS AND CONSERVATION OF FISHES IN NAUJAN LAKE NATIONAL PARK, ORIENTAL MINDORO, PHILIPPINES

Bonifacio Labatos
Ateneo de Manila University, Philippines

KEYWORDS: NAUJAN LAKE, FISH DIVERSITY, THREATS

Survey of fish fauna was conducted in the Naujan Lake National Park (NLNP), Oriental Mindoro, Philippines. Study sites include Naujan Lake; its lone outlet, the Butas River; and fifteen river tributaries. Naujan Lake is the fifth largest lake of the Philippines, but unlike the other major lakes of the country, aquatic biodiversity of Naujan Lake is poorly studied. There were 29 species belonging to 26 genera comprising 17 families of fish found in NLNP. One endemic species, Barbodes hemictenus Jordan & Richardson, 1908; one native species, Giuris margaritacea (Valenciennes, 1837); and two introduced species, Poecilia reticulata Peters, 1859 and Poecilia sphenops Valenciennes, 1846 were found to be common in all the surveyed sites. The study revealed that NLNP harbors a diverse community of fish which include diminutive species such as Redigobius tambujon (Bleeker, 1854)and Microphis retzii (Bleeker, 1856). These species due to their diminutive size are heavily affected by changes in their environment, not to mention the impact of introduction of invasive non-indigenous species and the advent of climate change; thus, conservation strategies to protect this area to guarantee their continued existence are of utmost importance. The survey updated the list of fish fauna of NLNP which is crucial for the crafting of law necessary for this area to become a full-pledged component of NIPAS to ensure its maximum protection and rehabilitation.

PRESENTATION TYPE: ORAL

MORPHOMETRIC AND HYDROLOGICAL CONDITIONS OF TROPICAL LAKES IN MALAYSIA AND INDONESIA

Luki Subehi
Research Centre for Limnology - Indonesian Institute of Sciences (LIPI), Indonesia
Nor Aisyah binti Omar
School of Biological Sciences, Universiti Sains Malaysia, Malaysia
Hendro Wibowo
Research Centre for Limnology - Indonesian Institute of Sciences (LIPI), Indonesia
Iwan Ridwansyah
Research Centre for Limnology - Indonesian Institute of Sciences (LIPI), Indonesia
Muzzalifah Abd Hamid
School of Biological Sciences, Universiti Sains Malaysia, Malaysia
Wan Maznah Wan Omar
School of Biological Sciences, Universiti Sains Malaysia, Malaysia
Mashhor Mansor
School of Biological Sciences, Universiti Sains Malaysia, Malaysia

KEYWORDS: LAKE MANINJAU, LAKE TEMENGOR, TROPICAL LAKES

Tropical lake is one of the unique ecosystems which are functioning in both ecological and economic services. As the resettling of water volume, tropical lakes harbor hundred species of fish communities. The objective of this study is to analyze the hydrological characteristics of tropical lakes featuring these two countries. Survey at Lake Temengor (Malaysia) was conducted in January 2014 whereas in Lake Maninjau(Indonesia), the survey was done in November 2013. The results on the survey in Lake Temengor and Lake Maninjau showed that the average depth is 100m and 105m, respectively. Lake Maninjau is a large calderalake that has been formed by volcanic activity. It covers 13,260 ha of area with a height of 461.5 m above sea level and maximum depth of 165 m. The lake water comes from rainfall, small rivers and the surrounding ground water and one outflow in Batang Antokan River. Lake Maninjau plays multi-functional roles including as a source of power plant, fisheries and tourism, as well as water sources for irrigation. In addition, the fast flow of groundwater flow is due to the large ratio between the area of catchment and the water volume of the lake. Meanwhile, Lake Temengor is relatively dendritic in shape. This man-made lake is the second largest lake in Peninsular Malaysia as it covers approximately 15,200 ha of area with a height of 263 m above sea level. Lake Temengor is located at the upper elevation of Perak River basin. There are four consecutive reservoirs along Perak River. Being the most upper reservoir, Lake Temengorreceives water from its surrounding water catchment and headwaters. Temengor Reservoir serves as important hydroelectricity power. The development of the reservoir function then becomes the needs for domestic water supply. Both of these tropical lakes have become famous tourism getaway. The commercial capabilities of these lakes are improved to meet its marketability. In order to maintain the sustainability of the lake, basic ecological information is necessary.

PRESENTATION TYPE: ORAL

EDUCATION AND AWARENESS – THE PRESENCE AND FUTURE KEY TO SUSTAINABLE MANAGEMENT OF KENYAN LAKES

Parita Sureshchandra Shah
University of Nairobi, Department of Geofraphy and Environmental Studies, Kenya

KEYWORDS: COMMUNITIES, INSTITUTIONS, EDUCATION AND AWARENESS

Our wetlands which act as natural resources need to be preserved as they are very important as a habitat to biodiversity and ecological services which they provide. Kenya is known to have some unique rivers and lakes. However the lakes are more pronounced as they are recognised worldwide as tourist hotspots, biodiversity rich zones and habitats for wildlife especially water birds and unique micro-organisms. The country has both fresh and saline water lakes both in and out of the rift valley, although the rift valley is more pronounced. The country has lifted the status of many lakes by designating them as RAMSAR sites in order to make them sustainable. The communities staying around the lakes derive almost all their livelihood from the lakes through fishing. This has also been proved by the Millennium Ecosystem Assessment (MA 2005) report of 2005 which states that 200 million people derive their livelihood from fishing, though this figure includes all water bodies – fresh and salty. The lakes need to be preserved through the creation of awareness and education otherwise these very communities would eventually become the greatest sufferers bearing the brunt of poverty with depletion and degradation of the natural resource (Swiderka et. al. 2008). To-date most researchers have been paying more attention to terrestrial ecosystems and neglecting the aquatic ecosystems. At the same even governments, private institutions and NGOs have greatly focused on terrestrial ecosystems. It is high time that in order to preserve the aquatic ecosystems more attention is needed. This would help revive our water bodies especially lakes which are a life line for many communities. This is why it is important for countries to designate wetlands especially rivers and lakes as RAMSAR sites. The designation should come with education amongst communities living around the water bodies. To add to this, the UN has also highlighted the importance of this resource in the UN MDG. This research has been done on the lakes of Naivasha, Nakuru and Bogoria. The aim of the research had been to see the effectiveness of the MEA domestication and application as the lakes are very important RAMSAR sites in the country. The objective of this study had been to determine the level of community awareness of these MEA sites through education and public awareness programmes. The three sites were selected as all are RAMSAR sites. A questionnaire was used to collect people's responses on education and awareness, the institutions involved in this awareness creation and the management approaches. Frequencies were tabulated for education and institutions in-charge of creating this awareness. Graphs and pie charts were used. Cross-tabulation using chi-square was used to test the hypothesis that there was no difference between education and the community awareness on RAMSAR sites in Kenya. The results indicated otherwise and showed that there was a difference where there was education. The recommendation is that communities must be educated in order to safeguard our wetlands.

PRESENTATION TYPE: ORAL

ZOOPLANKTON OF ABKHAZIA LAKES (WESTERN CAUCASUS)

Olga Derevenskaia
Kazan Federal University; Russia
Mingazova Nafisa M.
Kazan Federal University, Russia

KEYWORDS: ZOOPLANKTON, BIODIVERSITY, CAUCASUS

Lakes of different types have been investigated on the territory of Abkhazia (Western Caucasus) in August-September 2007-2012. Twelve lakes located on the coast, in the foothills and mountains (up to an altitude of 2,000 m) were studied. 27 species have been identified in freshwater lakes, and in salt - 22. Usually, number of zooplankton did not exceed 15,000 ind/m3. The highest values of this index were observed in freshwater lakes (up to 260000 ind/m3 in Lake B.Riza) and in salt lake Inkit (14000 ind/m3). In the cave lakes and salt lakes of zooplankton abundance was extremely low. Zooplankton biomass in most cases did not exceed 0.4 g/m3 and lakes treated α-oligotrophic type. The highest zooplankton biomass was observed in freshwater lakes. In one of the study period the zooplankton biomass in the lake B.Ritsa reached 10 g/m3. Vertically zooplankton unevenly distributed. In Lake B. Ritsa highest density of zooplankton was observed in the epi-and metalimnion, and biomass - in the epilimnion (0-4 m). In lakes M. Riza and Amtkel highest density was in the hypolimnion. In salt lake Skurcha zooplankton is concentrated in the surface layers of water that is due to lack of oxygen (25-30%) in the water column and the presence of hydrogen sulfide. Thus, lakes of Abkhazia are diverse by typology and require further study which will complement the results of the studies.

PRESENTATION TYPE: ORAL

THE THREATENED KUSHESHWAR ASTHAM LAKE

Chandreshwar Prasad Sinha
Indian Institute of Technology Roorkee, India

KEYWORDS: BIODIVERSITY, CONSERVATION, LAKE

The wetland of Kusheshwar Astham, locally called Narail Chaur, lies in the district of Darbhanga in Bihar State (India). It is about 1000 hectares in area and is about 3 metres deep in the central part. Rain and overflow of the local rivers are the main sources of its water. This region presents beautiful landscape and rich biodiversity. It is one of the best lakes in North India. The lake is rich in fish life and is visited by large number migratory birds every winter (October to December). Dolphins and tortoises are also found. The Government of Bihar rightly declared the lake as a bird sanctuary in 1994 but bird preying did not stop. The lake is threatened by many ills. The lake is drained out for reclaiming land for agriculture and irrigation. Climate change is another potential threat. An analytical study of long-term (1901-2002) temperature and rainfall data of Darbhanga, about 60 kilometres from the lake, done by the author indicated that the temperature in the region approximately increased at the rate of 0.0078°C and 0.3477°C per annum during 1901-1970 and 1970-2002 respectively and rainfall decreased at the rate of 0.3477mm and 13.01mm per annum respectively during the two periods. This is a danger signal indicating scarcity of water in future. A suitable management strategy should be devised and implemented without delay. The lake should be listed as a Ramsar site which in turn would help in its conservation and improvement.

PRESENTATION TYPE: ORAL

LIMNOLOGICAL CONDITIONS AND FISH ASSEMBLAGE STRUCTURE OF A TAPI RIVER OXBOW-LAKE, SOUTH THAILAND

Vachira Lheknim
Prince of Songkla University, Thailand
Naratip Tubtimtong
Faculty of Natural Resources, Prince of Songkla University, Thailand

KEYWORDS: THAILAND, LIMNOLOGICAL CONDITIONS, FISH OF OXBOW-LAKE

Han Dum is a permanent oxbow-lake, located in the Tapi River floodplain, south Thailand. Temporal changes in the water chemical parameters were investigated in the Han Dum oxbow-lake and compared with that of the adjacent main river channel in 2013-2014. The oxbow-lake water was not significantly different from that of the main river with regards to concentrations of TOC, TON, Nitrate, Silicate and Phosphate. The concentration of ions in terms of conductivity, alkalinity, pH, as well as, TIC and DO were lower in the oxbow-lake than in the main channel. The differences between the main channel and oxbow-lake decreased with increasing river discharge. There were more than 75 fish species in 27 families collected, dominated by carps in the family Cyprinidae. The fish assemblage structure was compared among the hydrological phase of pre-flooding, minor and major flood and post-flooding. There was a decrease in abundance during the long flood pulse along with the occurrence of piscivores. Fish populations were shown to be slowly recovered in early phase of minor flooding pulse. Species richness and assemblage composition of oxbow-lake fishes were related directly to flood pulse and potential connectivity.

PRESENTATION TYPE: ORAL

THE DIVERSITY OF GASTROPODS AND IT'S ROLE AS INTERMEDIATE HOST OF DIGENETIC TRAMATODES; WITH NOTES ON THE PARASITOFAUNA OF FISHES FOUND IN THE LAKES IN THREE MAJOR AQUACULTURE LAKES OF LUZON, ISLAND, PHILIPPINES – TAAL, SAMPALOC, AND LAGUNA DE BAY

Ann-Geneve A. Adorable

Graduate School, Research Center for Natural and Applied Sciences, University of Santo Tomas, Sampaloc, Manila, Philippines

Jonathan Carlo A. Briones

Graduate School, University of Santo Tomas, Sampaloc, Manila, Philippines

Misako Urabe

School of Environmental Science, University of Shiga Prefecture, Hikone, Japan

Gil A. Cauyan

Department of Biological Sciences, College of Science, University of Santo Tomas, Sampaloc, Manila, Philippines

Roberto C. Pagulayan

Center for Research and Development, Angeles University Foundation, Angeles City, Pampanga, Philippines

Rey Donne S. Papa

Graduate School, Research Center for Natural and Applied Sciences, Department of Biological Sciences, University of Santo Tomas, Sampaloc, Manila, Philippines

KEYWORDS: GASTROPODS, CERCARIA, ACANTHOCEPHALANS

Gastropods comprise 80% of the species belonging to Phylum Mollusca, making it the most diverse class with families inhabiting marine, terrestrial and freshwater ecosystems. Of these, freshwater gastropods are the least studied due to the dullness of their physical attributes, although its ecological importance in the transmission of the life cycle of digenetic trematodes cannot be denied. This remains to be the case in the Philippines where updates on the biology of freshwater gastropods and its role as intermediate host to trematodes are lacking. In order to address this issue, this study aimed to identify and classify the gastropods present, through thorough examination of their radula, shell, and digestive system, as well as to determine their role as intermediate host to digenetic trematodes that are found in the fishes in the three major aquaculture lakes in Luzon Is., Philippines namely Lake Taal, Lake Sampaloc, and Laguna de Bay. The gastropods underwent cercarial emergence through light stimulation to determine the cercaria and the gastropod species from which it had shed from. Parasitofauna of the fishes in the three lakes were also surveyed. Observations on several physical and biological characteristics of the sampling sites were also noted. A total of 3, 896 samples were obtained and 17 species were identified inhabiting the three lakes, with Tarebia granifera dominating the three lakes which comprised 35% of the total samples obtained. The least observed gastropod species in the lakes was a planorbid snail, Indoplanorbis exustus which only comprised 0.02% of the samples obtained. This study has been able to establish 9 new records, three are introduced, for the three lakes with the possibility of identifying a novel species. We incubated 720 of the specimens and had detected cercaria from only 13 gastropods (Family Thiaridae and Planorbidae), producing 1.8% prevalence. Among the five Species of cercaria identified, two belong to the trematode Families of Cryptogonymidae and Notocotylidae, noting a new record for the Philippines. Lastly, the parasitofauna of fishes were surveyed from the 200 fishes in all the three lakes. Fish dissections revealed many species of fish parasites: ecto-parasites such as monogeneans, bivalves, and copepods, and endo-parasites such as cestodes, nematodes, digeneans and acanthocephalans. Acanthocephala compose the bulk (~70%) of all parasites retrieved. This study shows how gastropod diversity in these three major lakes have already been impacted by changes in water quality and the introduction of non-native species which may have implications on over-all ecosystem health given the role of gastropods as major prey items, fisheries commodity and as final or intermediate hosts of parasites. The low prevalence of cercaria, on the other hand, conforms to the natural distribution of these helminth parasites recorded in recent scientific

literature. Hence, this study contributes to the knowledge on the biodiversity of the three lakes and possibly, the entire Philippines.

PRESENTATION TYPE: ORAL

COMMUNITY STRUCTURE OF ZOOPLANKTON IN A DRINKING WATER RESERVOIR

Azma Hanim Ismail
Universiti Sains Malaysia, Malaysia
Russell Shiel
University of Adelaide, Australia
Friedrich Recknagel
University of Adelaide, Australia

KEYWORDS: ZOOPLANKTON , SOUTH PARA RESERVOIR, ROTIFERA

Zooplankton samples have been collected from South Para Reservoir which is a water storage that supplies drinking water to the southern metropolitan area of Adelaide, South Australia. The study was carried out in order to provide the earliest information on zooplankton community in the drinking water reservoir. Over the 18 months of the study, a total of 20 taxa of zooplankton were recorded. Rotifera was the most diverse group, accounting for 10 taxa followed by Cladocera and Copepoda with 6 and 4 taxa respectively. In terms of density, copepods were dominant taxonomic group representing 57% of the total density while cladocerans were around 31% over the whole study period. Rotifers were the least prevalent of total density (12%) even though it became important in relation to total taxa number. The Cladocera group in South Para Reservoir was dominated by Daphnia lumholtzi and Ceriodaphnia cf. quadrangula while Rotifera was dominated by Asplanchna priodonta and Polyarthra dolichoptera. Copepoda were dominated by cyclopoid Microcyclops sp. and calanoid Calamoecia ampulla, making up the largest portion of total zooplankton density. Physical and chemical conditions of the water including water temperature, oxygen concentration, as well as concentrations of nutrients might contribute to the differences in zooplankton composition.

PRESENTATION TYPE: ORAL

A COMPARATIVE STUDY OF PHYTOPLANKTON BIODIVERSITY IN LAKE MANINJAU AND LAKE SINGKARAK, SUMATERA BARAT, INDONESIA

Nor Aisyah Omar
Universiti Sains Malaysia, Malaysia
Faradina Merican Mohd Sidik Merican
Universiti Sains Malaysia, Malaysia
Muzzalifah Abd Hamid
Universiti Sains Malaysia, Malaysia
Siti Norasikin Ismail
Universiti Sains Malaysia, Malaysia
Luki Subehi
Research Centre for Limnology, Indonesian Institute of Sciences, Indonesia
Wan Maznah Wan Omar
Universiti Sains Malaysia, Malaysia
Mashhor Mansor
Universiti Sains Malaysia, Malaysia

KEYWORDS: PHYTOPLANKTON COMMUNITY, BIODIVERSITY, WEED INFESTATION

Maninjau Lake and Singkarak Lake are both natural lakes which function to generate hydroelectric power. Situated in the West Sumatera, Indonesia, they are surrounded by luxurious greenery and offer the ideal getaway from hustle and bustle of city life. Basic ecological information is necessary in order to maintain the sustainability of the lakes. Data regarding the biodiversity of plankton are essential to develop a wise management plan. Analysis of phytoplankton biodiversity in the lakes needs to be conducted as its status can further be identified hence preventing water quality deterioration. These lakes tend to face global problems such as algal bloom (Microcystis sp) and weed infestation (Eichhornia crassipes). The need to analyze the distribution of algae is important as status of lake water can be indicated based on the species identified. The characteristics of the lake represented the phytoplankton community distributed in the water body. A preliminary survey was conducted in both lakes. Phytoplankton samples are taken from three sampling points, both in Maninjau and Singkarak Lake. Fourty litre of water is filtered through Wisconsin plankton net with 30 µm mesh-size to collect the phytoplankton sample below the surface. Lugol is used to preserve the samples. Live samples are also collected and cultured on agar media (BBM and BG-II). Therefore, this comparative study is carried out to identify the status of Lake Maninjau and Lake Singkarak. Moreover, in addition to providing a clean water source to human, the biodiversity of the flora and fauna found within this area needs to be preserved and conserved to support the important ecosystem of nature.

PRESENTATION TYPE: ORAL

FISHERY AND SOCIO-ECONOMIC ASSESSMENTS ON FLOATING CAGE CULTURES IN MANINJAU LAKE, WEST SUMATRA, INDONESIA

Muzzalifah Abd Hamid
Universiti Sains Malaysia, Malaysia
Onrizal
University of Sumatera Utara, Indonesia
Gadis Sri Haryani
Indonesian Institute of Sciences, Indonesia
Siti Norasikin Ismail
Universiti Sains Malaysia, Indonesia
Nor Aisyah Omar
Universiti Sains Malaysia, Indonesia
Luki Subehi
Indonesian Institute of Sciences, Indonesia
Mashhor Mansor
Universiti Sains Malaysia, Malaysia

KEYWORDS: MANINJAU LAKE, FLOATING CAGE CULTURES, ECONOMIC VALUE

With the surface area of 13,260 ha, Maninjau Lake is the second largest lake in West Sumatra after Singkarak Lake. The local communities around Maninjau Lake have used this lake as potential major source of livelihood. This caldera lake constitutes a source of water to local people as most of them engaging in agriculture and aquaculture activities. Maninjau Lake harbours an endemic fish species, Rinuak Psilopsis sp. This tiny fish population are widely distributed in Maninjau Lake. From the personal communications with the local people, they used to catch the fish approximately 0.09 ton/day before. The local communities have also established the floating cage cultures or known as “karamba’ around the edge of the lakeshores. Most of the fish cultured are Nile Tilapia Oreochromis niloticus andcommon carp Cyprinius caprio. To date, there are approximately 16000 units of floating cage cultures with 25m2/unit. A preliminary survey has been conducted in Maninjau Lake by interviewing casually 13 public respondents that own the fish cages with 20 questions. Apparently, the yields from these floating cage cultures have contributed greatly to the economies of the local communities. The economic level of the community has been increasing subsequently for the last ten years. However, the cage cultures can have certain drawback especially when the number of fish cage is over the carrying capacity (CC) of the lake. There are regulations in preventing this phenomenon. Therefore, the carrying capacity of Maninjau Lake should be calculated to tally with the life span of this lake and simultaneously could benefit high if the floating cage cultures are practiced sustainably and managed properly.

PRESENTATION TYPE: ORAL

ENVIRONMENTAL IMPACT OF TRADITIONAL CULTIVATION ON PROTECTED AREAS: THE CASE OF COLFIORITO MASHES

Lara Reale
Dipartimento di Scienze Agrarie, Alimentari ed Ambientali, Università degli Studi di Perugia, Italy
Daniela Gigante
Dipartimento di Chimica, Biologia, Biotecnologie, Università degli Studi di Perugia, Italy
Mauro Roscini
Dipartimento di Chimica, Biologia e Biotecnologie, Università degli Studi di Perugia, Italy
Paola Angelini
Dipartimento di Chimica, Biologia e Biotecnologie, Università degli Studi di Perugia, Italy
Roberto Venanzoni
Dipartimento di Chimica, Biologia e Biotecnologie, Università degli Studi di Perugia, Italy
Francesco Ferranti
Dipartimento di Scienze Agrarie, Alimentari ed Ambientali, Università degli Studi di Perugia, Italy

KEYWORDS: P. AUSTRALIS, COLFIORITO MASHES, TRADITIONAL CULTIVATION

An increasing attention of consumers to the typical products and local varieties was paired, in the last years, to the will of the European community to promote, through a new system of finance, sustainable food production and proper management of natural resources and territory. These assumptions require to improve the knowledge of the environment and its link with the agricultural practices, especially in regions like Umbria particularly suited to traditional agriculture. In this context, the aim of our research was to verify, in the “Piani di Colfiorito” (Colfiorito Marshes), a very important site from both the environmental and economic point of view, the impact of agricultural practices, linked to local crops, on the surrounding natural ecosystem in order to verify their environmental sustainability. We compared some plant traits of Colfiorito Marshes with upstream areas characterized by different quantitative and qualitative agricultural management. This comparison was made using as a bio-indicator the common reed (Phragmites australis). In research carried out in different sites of the close Lake Trasimeno, reed-dominated ecosystems has proven to be very useful indicators to highlight the effects of anthropic intervention. We investigated the quality of stations of P. australis through floristic, vegetational and morphological analysis. Anatomical and cyto-histological studies were carried out in rhizomes and roots and the accumulation of starch was also considered, a very useful parameter for identifying the health status of reed plants.

PRESENTATION TYPE: POSTER

MACROPHYTES AND LAKE SHOREZONE FUNCTIONALITY INDEX (SFI) FOR THE ENVIRONMENTAL QUALITY OF "LAGO LUNGO AND RIPASOTTILE" PROTECTED AREA

Laura Mancini
Italian National Institute of Health, Environment & Primary Prevention Dept. Environmental Quality and Fishfarm Unit, Italy
Filippo Chiudioni
Italian National Institute of Health, Environment & Primary Prevention Dept. Environmental Quality and Fishfarm Unit, Italy
Simona Violino
Tuscia University, Italy
Stefania Marcheggiani
Italian National Institute of Health, Environment & Primary Prevention Dept. Environmental Quality and Fishfarm Unit, Italy
Camilla Puccinelli
Italian National Institute of Health, Environment & Primary Prevention Dept. Environmental Quality and Fishfarm Unit, Italy
Ilaria Fioramonti
Italian National Institute of Health, Environment & Primary Prevention Dept. Environmental Quality and Fishfarm Unit, Italy
Angiolo Martinelli
Environmental protection agency (ARPA-Lazio), Italy
Giovanni Damiani
Tuscia University, Italy

KEYWORDS: MACROPHYTES, SHOREZONE FUNCTIONALITY, PROTECTED AREA

The protected area of Lago Lungo and Ripasottile is one of Parks and Natural protected areas of Latium, located in the Velino valley, created to preserve these wetland and their flora and fauna. The surrounding areas of the two lakes are dedicated to agricultural activities which can represent a risk for these ecosystems. The aim of the study was to assess the environmental quality of the Lungo and Ripasottile lakes by investigating aquatic communities, such as the macrophytes, and hydromorphological functionality. Macrophytes sampling was performed according to standard procedures. Shorezone Functionality index (SFI) was applied to evaluate hydromorphological alterations. The results of this study show that macrophytes colonize only the riparian zone and the first meters of the water , in the central and deeper zones presented high turbidity and silt - clay substrate. Transparency, chlorophyll and base parameters outline a not good Environmental Quality Status. Sediment analysis in Lungo lake shows abundance of organic matter. In Lungo lake it was found Nymphaea alba L., a species rarely found in other aquatic ecosystem of Latium region. This species was associated with Nuphar luteae L.,Phragmites australis Lam. represents most of macrophyte coverage of the riparian zone of both Lungo lake and Ripasottile lake.Shorezone functionality resulted good for the two lakes, thus indicating that the riparian zone represents an important buffer for run off and leaching derived by human activities; anyway, the extension of humid biotopes (wet meadows and trees) and the ecologic network are too weak for biodiversity preservation.

PRESENTATION TYPE: POSTER

DETECTION OF REED-BED DECLINE AT LAKE CHIUSI (CENTRAL ITALY) AND CORRELATION WITH FLOODING AND CHEMICAL PARAMETERS

Daniela Gigante
Department of Chemistry, Biology and Biotechnology, University of Perugia, Italy
Claudia Angiolini
Department of Life Sciences, University of Siena, Italy
Flavia Landucci
Department of Botany and Zoology, Masaryk University, Brno, Czech Republic
Fabio Maneli
Department of Chemistry, Biology and Biotechnology, University of Perugia, Italy
Barbara Nisi
CNR-IGG Institute of Geosciences and Earth Resources, Pisa, Italy
Lara Reale
Department of Agricultural, Food and Environmental Sciences, University of Perugia, Italy
Orlando Vaselli
Department of Earth Sciences, University of Florence, Italy
Roberto Venanzoni
Department of Chemistry, Biology and Biotechnology, University of Perugia, Italy
Lorenzo Lastrucci
Department of Biology, University of Florence, Italy

KEYWORDS: PHRAGMITES AUSTRALIS, DIE-BACK, PALUSTRINE ECOSYSTEMS

Following the detection of reed die-back in some Mediterranean areas, the lacustrine ecosystem of Lake Chiusi, a Site of the EU Network Natura 2000, has been taken into account to check the actual extent of such a threatening phenomenon in Central Italy. Based on the methodological design already applied to other lakes, macromorphological and ecological traits of reed were measured in a representative number of sites; selected chemical parameters were measured in the bottom sediments and interstitial waters at the same sites, and aerial images of the area over 2 decades were digitized and compared. Possible correlations among the whole set of data were investigated using univariate and multivariate statistical methods. Clear symptoms of the typical die-back syndrome were detected in some areas of the reed-beds, including visible retreat and fragmentation from the waterfront, clumped habit, dead buds, reduced size, suggesting that the distribution area of this phenomenon in Central Italy should be enlarged. Results also suggest that permanent flooding is one of the most prominent traits co-occurring with reed die-back. Few chemical parameters seem to play a role in the process, e.g. nitrates, rubidium, nickel, barium, manganese. Although no clear pattern could be identified, results suggest that stressing conditions, combined with the presence of some chemicals, may affect the growth even of an efficient metal accumulator such as common reed.

PRESENTATION TYPE: POSTER

FISH BIODIVERSITY AND INCIDENCE OF INVASIVE FISH SPECIES IN AN AQUACULTURE AND NON-AQUACULTURE SITE IN LAGUNA DE BAY, PHILIPPINES

Maria Lourdes Aralar
Southeast Asian Fisheries Development Center/Aquaculture Department, Philippines

KEYWORDS: BIODIVERSITY, INVASIVE SPECIES, LAGUNA DE BAY

Laguna de Bay is the Philippines' largest inland water and predominantly used for fisheries and aquaculture. Aquaculture in the lake started decades ago and many changes in the lake's ecosystem have taken place since. Most of the dominant species for culture are introduced species in the lake. Other invasive species were also introduced to the lake. A study was conducted to monitor fish diversity in two adjacent, but distinctly different sites in the lake: the West Cove (WC), an open fishery area, with no aquaculture structures and the East Cove (EC) which is an aquaculture site with cages for Nile tilapia, bighead carp, giant freshwater prawn. Fish traps were also installed in both sites and the traps were sampled every two weeks from April 2013 to March 2014. Results of pair-wise T-test show significantly higher Shannon-Wiener Diversity Index (H') and Evenness (J') in WC than EC. No differences in Species Richness (s) and Index of Similarity (I) were observed between the two sites. In terms of total catch per day, significantly higher catch were obtained from EC than WC. In both EC and WC, introduced aquaculture species such as bighead carp had a peak biomass dominance of 98% in EC while Nile tilapia peaked at 77% in WC. Non-aquaculture invasive species such as the Janitor fish Pterygoplichthys sp. peaked at 83% in the EC and the knife fish Chitala ornata at 59% in the WC. Other invasive species found in both sites were Pangasius sp. and the cichlid Sarotherodon melanotheron.

PRESENTATION TYPE: ORAL

ENVIRONMENTAL QUALITY ASSESSMENT OF "POSTA FIBRENO LAKE" PROTECTED AREA

Laura Mancini, Simona de Meo, Anna Maria D'Angelo, Filippo Chiudioni, Elio Pierdominici, Silvana Caciolli, Emilio D'Ugo, Camilla Puccinelli, Stefania Marcheggiani
Italian National Institute of Health, Environment & Primary Prevention Dept. Environmental Quality and Fishfarm Unit, Italy
Nunzia Rossi
Regione Lazio, Italy
Bruno Cicolani
University of L'Aquila, Italy

KEYWORDS: BENTHIC DIATOM, MICROBIOLOGICAL INDICATORS, PROTECTED AREA

This study proposes an integrated approach that aims to evaluate the environmental quality of "Posta Fibreno lake" protected area, through the analysis of biological and microbiological indicators and physical, chemical parameters in order to identify pollution sources. Diatoms were chosen as biological indicators, due to their sensitivity to eutrophication; Enterococci and E.coli were investigated to detect faecal contamination. Posta Fibreno lake is located in Latium Region, Central Italy. It has a particular geology with rocks made by limestone, which has a high calcium carbonate (CaCO3) content and which accumulated over geological time in shallow water. Its temperature is around 10°C throughout the year thanks to this karstic terrain and several underwater springs. In 1983 the protected area was create to preserve it. Seven sites were selected around the lake and two sampling were performed, in spring and autumn. Water and diatom samples were collected following standard procedures. Biological, microbiological indicators, physical and chemical parameters indicated a good environmental status, for the most of the investigated sites; however an increasing of organic pollution, was detected after summer season. It is probably related to seasonally point sources of pollution. This variation has not compromised the environmental quality of the Lake yet, but prevention and restore activities should be planned in order to preserve this ecosystem.

PRESENTATION TYPE: POSTER

NON-INDIGENOUS PLANKTONIC CYANOBACTERIA IN LITHUANIAN FRESHWATERS

Jurate Kasperoviciene
Nature Research Centre, Institute of Botany, Lithuania
Judita Koreiviene
Nature Research Centre, Institute of Botany, Lithuania
Jurate Karosiene
Nature Research Centre, Institute of Botany, Lithuania

KEYWORDS: CYANOBACTERIA, ALIEN SPECIES, LAKES

Global warming and eutrophication may exacerbate not only water blooms caused by cyanobacteria, but also the overspread and establishment of invasive species. The data on non-native cyanobacteria species forming water blooms in freshwaters of Lithuania are not well documented. This study refers on the occurrence of three alien Nostocales species in Lithuanian inland waters: Anabaena bergii var. limnetica, Raphidiopsis mediterranea and Sphaerospermopsis aphanizomenoides. The species have the tropical origin; however, nowadays they are wide-spread in temperate region and can form dense sometimes toxic blooms. They have recently been found new to the flora of Lithuania. All of the studied alien cyanobacteria were rather rare and sparsely distributed within the country. The cyanobacteria occurred in mesotrophic to eutrophic shallow or deep-stratified lakes. R. mediterranea and S. aphanizomenoides became important contributors to phytoplankton in some lakes in summer. R. mediterranea comprising up to 15% of total phytoplankton biomass were foundonly sporadically despite the regular monitoring. Reasons for it outbreaks were not clarified, no marked differences in water chemistry prior its appearance were found. Depending on the prevailing native bloom-forming cyanobacteria in late summer plankton, the alien species exhibited a stable co-existence or they were strong competitors.

PRESENTATION TYPE: POSTER

QUANTILE REGRESSION ANALYSIS AS PREDICTIVE FOR LAKE MACROINVERTEBRATE BIODIVERSITY

Riccardo Fornaroli
DISAT, Università degli Studi di Milano-Bicocca, Italy
Riccardo Cabrini
DISAT, Università degli Studi di Milano-Bicocca, Italy
Silvia Zaupa
CNR Institute of Ecosystem Study (ISE), Italy
Roberta Bettinetti
University of Insubria, Teorethical and Applied Science Dept., Italy
Marzia Ciampittiello
CNR Institute of Ecosystem Study (ISE), Italy
Angela Boggero
CNR Institute of Ecosystem Study (ISE), Italy

KEYWORDS: MACROINVERTEBRATES, TAXONOMY-BASED METRICS, WATER BODIES

In Italy, the Water Framework Directive introduced major changes to water management, by making water resources more efficient and enforceable, so, this study aims to highlight some of the potential implications of its implementation for lake management. In this respect, the Life+ INHABIT project was crucial in launching the monitoring plan of lake macroinvertebrates, standardized at national level. Quantile regression analysis was focused on nine lakes, located in two Italian regions (Piedmont and Sardinia), sampled through the national standardized protocol. In order to link macroinvertebrate community characteristics to their habitat, we measured twenty-one variables that represent chemical, physical and morphological characteristics of the environment. We evaluated the limiting action of such variables and selected sampling depth and oxygen percent saturation as the two variables that best explained the number of taxa present and the macroinvertebrate community diversity of a site. We provided a set of minimum expected values along the sampling depth gradient. These results should be taken into account in the development of ecological indices that must be able to recognize and separate the effects of anthropogenic pressures from any natural variability. Finally, the selected models are able to predict the potential of community diversity as a function of environmental characteristics. All of this evidence can help water managers in deciding to initially invest resources in those lakes where the biological communities is expected to be impaired and to identify which lakes can be considered pristine or in near-pristine conditions.

PRESENTATION TYPE: POSTER

TYPOLOGY AND BIODIVERSITY OF LAKES AND RIVERS OF THE ABKHAZIA REPUBLIC (CAUCASUS)

Nafisa Mingazova
Kazan (Volga Region) Federal University, Russia
Roman Dbar
Institute of Ecology of the Abkhazia Republic
Olga Palagushkina
Kazan (Volga Region) Federal University, Russia
Derevenskaya O.Y.
Kazan (Volga Region) Federal University, Russia
Mingazova D.Y.
Kazan (Volga Region) Federal University, Russia
Nabeeva E.G.
Kazan (Volga Region) Federal University, Russia
Nazarov N.G.
Kazan (Volga Region) Federal University, Russia
Mingaliev R.R.
Kazan (Volga Region) Federal University, Russia

KEYWORDS: BIODIVERSITY OF LAKES, ABKHAZIA REPUBLIC (CAUCASUS), CAVE LAKES

The water objects of Abkhazia presented mountain freshwater karst freshwater and tectonic lakes, plains brackish lakes -lagoons, mountain freshwater rivers, freshwater lakes and streams in karst caves. Many mountain lakes Abkhazia are unique, are standards-clear waters of the planet. More than 50 water objects were studied in 2007-2013 during the Russian-Abkhaz expeditions for hydrobiological and ichthyological study. Phytoplankton of Abkhazia water objects is very diverse. There were identified 256 species of 8 departments with a predominance of diatoms (2007-2011 years). The brackish Skurcha Lake researchers found 119 species (59 diatoms), Inkit Lake - 98 (32), Big Riza Lake - 90 (44), Blue Lake - 40 (27) of 7-8 divisions. In rivers, the number of species is less: Kodor River - 35 species (27), Auadhara River - 31 (20) of 4 divisions; in small rivers and streams met 5-20 species. The caves found 40 species of 7 divisions. Введите текст или адрес веб-сайта либо переведите документ. Отмена Zooplankton vodnykh ob"yektov Abkhazii predstavlen 46 vidami (22- kolovratki, 24 - rakoobraznyye). Naibol'sheye chislo vidov vstrecheno v ozerakh Mzy i Skurcha. Reki i ozera v peshcherakh otlichayutsya chrezvychayno nizkim vidovym bogatstvom zooplanktona. Kolichestvennyye pokazateli zooplanktona nizkiye. Возможно, вы имели в виду: Для солоноватого озеро Скурча обнаружено 119 видов (59 диатомовых), Zooplanktonof Abkhazia water objects (2007-2012 years) represented 46 species (22 - rotifers, 24 - crustaceans). Greatest number of species met in the lakes Mzy and Skurcha. Rivers and lakes in caves remarkably low species richness of zooplankton. The quantitative indicators of zooplankton is low. Inzoobenthos ofwater objectsnoted143species(4 type, 7 classes, 20 orders, 72 families), including Oligochaeta- 11species, polychaete-1, leeches – 6,crustaceans –11,mollusks – 19,insects-93 species (2007-2012 years). In thecavewatersfoundcrustaceansDiacyclops bicuspidatus (Copepoda), gammarusNiphargus alasonius, freshwater shrimpTroglocaris anophthalamus (white in the absence of light). In estuarine fish fauna of 25 Abkhazia rivers revealed 22 species of fish fauna (from 1 class, 6 orders and 8 families) in 2013. Most diverse the Cypriniformes order (13 species). The background species are Alburnoides bipunctatus, Alburnus charusini, Leucaspius delineatus and Phoxinus phoxinus. Thus, a high diversity of types of aquatic ecosystems in Abkhazia (Caucasus) generates biological and taxonomic diversity, presence ofrare species. This work performed in part supported by a grant of the Russian Foundation for Fundamental Research.

PRESENTATION TYPE: ORAL

PROGNOSTIC ASSESSMENT OF DIVERSITY OF SURFACE WATER PHYTOPLANKTONS IN MAGADI HILL RANGE WATER BODIES, BANGALORE

Gayathri Shekar
Bangalore University, India
Mohan Ramachandra
Bangalore University, India
Latha.N Naryan
Bangalore University, India

KEYWORDS: PHYTOPLANKTON,, DIVERSITY INDICES , POLLUTION.

The potential of surface water ecosystems to adapt to ongoing environmental change is largely unknown. Conservation efforts to sustain water resources and aquatic biodiversity will require reliableinformation on the recent status of various indicator species of phytoplanktons. The present study deals with the diversity of phytoplankton of four magadi hill range water bodies in Bangalore. The seasonal fluctuation of phytoplankton community was assessed for a period of one year from January 2011 to December 2011. A total of 95 algal species belonging to 6 taxonomic groups were identified namely, chlorophyceae, cyanophyceae, Bacillariophyceae, Euglenophyceae, Dinophyceae and Chrysophyceae. Out of these 14 species namely, Elakatothrix, Scenedesmus obiquus, Hydrodictyon, Euglena proxima, Phacus caudate, Trachelomonas volvocina, Lepocinclis acuta, Dinobryon social, peridinium, Melosira islandica, Synedra acus, Navicula papula, Microcystis aeruginosa and Merismopedia glauca were common in all the four lakes. The percentage composition and the order of dominance of the groups are as follows, chlorophyceae(47.36%) > cyanophyceae(17.89%) > Bacillariophyceae(16.84%) > Euglenophyceae(12.63%) > Dinophyceae(3.15%) > Chrysophyceae(2.10%). Diversity indices are important in understanding the distribution of planktonic algae in fresh water lakes. Nine diversity indices have been derived using PAST software program. They include Dominance index, Shannon index, Simpson's index, Pielou's Evenness index, Menhinick's index, Margalef's index, Equitibility index, Fisher's alpha index and Berger-Parker index. Highest dominance of the species was observed in valageranahalli lake (60) but species richness was minimum in Malathalli lake (41). Some of the species of phytoplankton can help assessing the health of water body. For instance, more of cyanophycean members can indicate organic pollution of the lake. Similarly like Spirulina, can be taken as indicator of sewage pollution. From this point of view, enlisting of the species of phytoplankton is interesting.

PRESENTATION TYPE: POSTER

ASSESSING THE IMPACTS OF CAGE FISH FARMING ON BENTHIC COMMUNITIES IN SEDIMENTS OF LAKE VOLTA

Ruby Asmah
CSIR Water Research Institute, Ghana
Anthony Y. Karikari
CSIR Water Research Institute, Ghana
Lindsay G. Ross
Institute of Aquaculture, University of Stirling, United Kingdom
Trevor C. Telfer
Institute of Aquaculture, University of Stirling, United Kingdom

KEYWORDS: LAKE VOLTA, AQUACULTURE, SEDIMENT QUALITY

Lake Volta is one of the largest man-made Lakes in the world. It was created in the 1960s for hydroelectric power generation. Its other uses since then have been extraction for potable water supply, irrigation, Lake transport, major source of inland freshwater fish and now fish farming. The study was undertaken to assess the impact of cage fish farming on sediment quality and macro-invertebrate communities in sediments of the Lake. A section of the Lake with about 77 fish farms was selected for the study. Ten sampling sites two of which were reference sites were monitored. Samples were collected in August, October and December 2013. Parameters determined were grain size distribution, pH, total organic carbon, total nitrogen, and the density of macroinvertebrates in the sediments. Sediments at the various sites were largely sandy with traces of clay. The pH of the interstitial waters was slightly acidic in nature with pH values ranging from 4.8 to 5.4. The diversities of macroinvertebrates at all the sites were very poor. Using multivariate analysis, the Shanon Wiener Index was less than 1 for both reference sites and fish farm sites. Chironomidae were the most common macroinvertebrates at all the sites.

PRESENTATION TYPE: ORAL

BENTHIC HETEROTROPHIC FLAGELLATES OF THREE SHALLOW LAKES OF DIFFERENT SALINTY FROM TURKEY

Esra Elif Aydın Dede
Hacettepe University, Biodiversity Research and Application Center, Turkey

Heterotrophic flagellates, one of the focal points of evolutionary studies due to their being the storage of the data of the eukaryotic evolution, are comprised of the protists moving and/ or feeding by the use of flagella and feeding exclusively by heterotrophic means or, if with plastids, then also capable of ingesting particles, and mean an ecological unit then a taxonomic rank. Heterotophic flagellates is a group of protists consist of the omnivourus, carnivourus and herbivourus species. The quantitative studies on their feeding behaviours have indicated that herbivory by nano and microflagellates plays an important role within the carbon flux. Under the light of these quantitative studies it is established that nano and microflagellates, consuming bacterial production, recycle the bacterial carbon. In respect of the study made by Linley et al. in the year 1983, at least the %66 of the bacterial production is consumed by heterotrophic flagellates. Acording to the results of another study made by Kuosa and Kivi in the year1989 %13 of primary production is consumed by heterotrophic flagellates. Furthermore, their small sizes and flexible cells enable them to graze on bacteria in micro-pores, which are inaccessible to larger organisms. Hence, they importantly influence mineralization and nutrient cycling in soils. In order to contribute to an understanding of the geographic distribution of free-living heterotrophic flagellates, we investigated the diversity of heterotrophic flagellates occurring in 3 shallow lakes of different salinity and located in Konya closed basin from 2009 to 2011 (n=24). Heterotrophic flagellate species were isolated from 2 stations of Kozanlı Saz Lake a fresh-water environment, 1 station of Kulu Lake a brackish environment and 2 stations of Tuz Lake a hypersaline environment. As a result of the study 3 genera and 49 species are identified of which 44 are new records for Turkey and 5 are new records from the freshwater environments globally. The distribution of these 52 taxa according to groups is as following: 2 species of Group Choanomonada, 2 species of Group Crptophyceae, 2 genera and 3 species of Group Stramenopiles, 2 species of Group Fornicata, 1 species of Group Jakobida, 5 species from order Kinetoplastida and of 21 species from order Euglenoidea of Group Euglenozoa, 4 species of Group Cercozoa, genus of Group Amoebozoa 9 species of incertae sedis Protista. Distributions of the identified taxa according to super groups and groups, according to lakes and the stations are examined and with the Bray-Curtis dissimilarity analyze the similarities of lakes are discussed. As a result, most flagellates described here appear to be cosmopolitan and the diversity is reduced by the increased salinity.

PRESENTATION TYPE: POSTER

ENVIRONMENTAL STATUS OF ORESTIAS LAKE (GREECE). ECOLOGICAL AND LEGISLATIVE APPROACH

Konstantinos Gritzalis
H.C.M.R. - Institute of Marine Biological Resources & Inland Waters, Greece
Evaggelia Anastasopoulou
H.C.M.R. - Institute of Marine Biological Resources & Inland Waters, Greece
George Gritzalis
H.C.M.R. - Institute of Marine Biological Resources & Inland Waters, Greece

KEYWORDS: ORESTIAS - KASTORIA LAKE, AQUATIC FAUNA - FLORA, AVIFAUNA

Natural lakes consist dynamic and vulnerable ecosystems, of significant value and form an integral bond with humans. In Greece, pursuant to excavations, man, has a distant dynamic past considering its relationship to lakes. Thus, lakes have always been subject to pressures. This study is an overview of Kastoria or Orestias Lake, located in Western Macedonia (Greece), near the town of Kastoria. This lake is of tectonic origin, karstic and formed 10 million years ago (Miocene). It covers an area of 28 km2, has a maximum depth of 4.2 m and the water residence time in the lake is 1.85 years. In the past it has undergone severe pressures and modifications and now it is classified as eutrophic or hypertrophic. With reference to phytoplankton more than 80 taxa exist, represented by different taxonomic groups (e.g. Diatoms, Xanthophyceae, Cyanobacteria, Chlorophyta, Dinoflagellates, Cryptophyceae, Euglenophyceae, etc). In terms of fish fauna, several species inhabit the lake (i.g. Scardinius erythrophthalmus, Lepomis gibbosus, Tinca tinca, Esox lucius, Cyprinus carpio, Leuciscus cephalus, etc), and benthic macroinvertebrate fauna. Also, there is a high diversity of avifauna in the surrounding area (over 200 species, e.g. Pelecanus crispus, Cycnus olor, Mergus merganser, Plegadis falcinelus, etc). Therefore, in order to avoid a further deterioration and to improve its status, a precise implementation of the existing legislation must be in force and a potential revision should be considered after having reviewed and recorded its current environmental status with an emphasis on forming a new special legislative regime towards its protection.

PRESENTATION TYPE: POSTER

MS01-04
Brackish and saline inland waters

INCREASING SALINITY AND NEW LOW-SALINE PHYTOPLANKTON SPECIES IN 3 SHALLOW DANISH FRESHWATER LAKES

Kirsten Olrik
Miljøbiologisk Laboratorum Aps, Denmark

KEYWORDS: ROAD SALTING IMPACT ON DANISH FRESHWATER LAKES, INCREASING SALINITY IN DANISH FRESHWATER LAKES, NEW LOW-SALINE SPECIES IN DANISH FRESHWATER LAKES

New N2-fiixing Cyanobacteria species for Denmark, and species that are characteristic for brackish water, have recently been found in the shallow freshwater Lake Bagsværd, North of Copenhagen, Lake Buesø near Roskilde, and Lake Bromme Lille near Sorø. Reference values of salinity in the three lakes only exist from Lake Bagsværd 1974, where the yearly mean in 1974 was 0.050 g Cl-1 L-1 = 0.050 o/oo (Olrik 1976). Measurements of salinity in the lake 2005-2006, and 2012, show that it has risen by a factor 2.6 to 0.120-0,130 o/oo. In Lake Buesø (2008) the salinity was 0,100-0,110 o/oo, and in Lake Bromme Lillesø (2009) it was 0,200-0,250 o/oo (Danmarks Miljøportal). In Denmark, the use of road salting in winter was introduced in 1960. Since then, it has increased to an average of 300.000 Tons yr-1 = 7 Tons km2 Yr-1, in hard winters up to 500.000 Tons = 11.6 Tons km2 Yr-1(GEUS 2010). The proportion of road salt seepage into surface water and groundwater in Denmark is poorly known. So far, the salinity in the three lakes in this paper is still within the freshwater boundary 0.5 o/oo,but the increase in salinity in Lake Bagsværd by a factor 2.6 since 1974 documents that it is rising and probably will continue to do so. This paper shows that the freshwater flora in the lakes is under beginning stress from more salt tolerant species with an increase in number and biovolume of mesohalobe Cyanobacteria and diatoms from the salinity range 0.1 - 1 o/oo.

PRESENTATION TYPE: ORAL

ARITIFICIAL SUBSTRATES FOR THE SAMPLING OF DIATOM COMMUNITIES IN TRANSITIONAL WATERS

Camilla Puccinelli
Italian National Institute of Health, Environment & Primary Prevention Dept. Environmental Quality and Fishfarm Unit, Italy
Stefania Marcheggiani
Italian National Institute of Health, Environment & Primary Prevention Dept. Environmental Quality and Fishfarm Unit, Italy
Pamela Mancini
Italian National Institute of Health, Environment & Primary Prevention Dept. Environmental Quality and Fishfarm Unit, Italy
Filippo Chiudoni
Italian National Institute of Health, Environment & Primary Prevention Dept. Environmental Quality and Fishfarm Unit, Italy
Raffaele Scenati
Italian National Institute of Health, Environment & Primary Prevention Dept. Environmental Quality and Fishfarm Unit, Italy
Roberto Giuseppetti
National Institute of Health, Environment & Primary Prevention Dept. Environmental Quality and Fishfarm Unit, Italy
Laura Mancini
National Institute of Health, Environment & Primary Prevention Dept. Environmental Quality and Fishfarm Unit, Italy

KEYWORDS: ARTIFICIAL SUBSTRATES, SAMPLING , BENTHIC DIATOMS

Diatoms are sensitive algae to environmental changes of aquatic ecosystems: freshwater diatoms are well studied, those who live in transitional waters are poorly known. Considering also the requirements of the Water Frame Directive an extension of the knowledge on structure of benthic diatom communities is necessary to future assessment of ecological status in these ecosystems. Standard procedure for sampling and treatment of diatom communities of transitional water have not been development yet. This study aims to set methods for diatom sampling, using artificial substrates. Artificial substrates have been composed by 10 slides of plexiglass linked by a metal string, far 7 mm from each other, aiming to investigated the effect of light, turbidity and deep on diatom communities. This study was performed on Orbetello Lagoon, substrates were placed in 4 sites and were collected after one month in order to allow the colonization of diatom communities. Diatom were identified at species level and abundance was estimated. A total of 35 freshwater, brackish and marines species were identified. Diatom community structure changed along the 10 slides: from the abundance of planktonic species on the surface to the only presence of those and abundance of benthic species. Due to the lack of natural available substrates more suitable for diatom such as stones, pebbles and macrophytes in transitional water, artificial substrates resulted as a useful tool in order to be able to compare data from different ecosystems.

PRESENTATION TYPE: ORAL

INFLUENCES OF MICROCYSTIS AERUGINOSA (KüTZING) ON ZOOPLANKTON POPULATION IN KüçüKçEKMECE LAGOON (TURKEY)

Zeynep Dorak
Istanbul University, Faculty of Fisheries, Turkey
Latife Köker
Istanbul University, Faculty of Fisheries, Turkey
Özcan Gaygusuz
Istanbul University, Faculty of Fisheries, Turkey
Reyhan Akçaalan
Istanbul University, Faculty of Fisheries, Turkey
Meriç Albay
Istanbul University, Faculty of Fisheries, Turkey

KEYWORDS: MICROCYSTIS, ZOOPLANKTON, WATER QUALITY

The aim of this study is to determine the composition and abundance of zooplankton in relation with the abundance of Microcystis aeruginosa and environmental conditions at the deepest part of the hypereutrophic Küçükçekmece Lagoon. Microcystis is a well-known cyanobacterial genus frequently producing hepatotoxins named microcystins. It can form harmful algal blooms in freshwater bodies and also some estuaries worldwide. Microcystins affect human health and wildlife adversely. The bloom of Microcystis and its toxins effect zooplankton growth and survival. Their nutritionally poor food quality and large diameter of colonies, makes them difficult to ingest by zooplankton species. Both the changing environmental conditions and Microcystis bloom may explain the alteration of zooplankton composition and abundance in the field studies. During the study period, a total of 24 zooplankton taxa were found in the lagoon. Rotifera (especially Keratella cochlearis 46.72%) were determined as the most abundant group in the zooplankton fauna and Copepoda were the second one (30.97%) with the abundancy of Acartia clausi (14.52%). On the other hand, Microcystis cell numbers reached their maximum value in June at the surface with increasing light and temperature. Results were evaluated statistically. As a result, abundance of total zooplankton were affected negatively by Microcystis abundance.

PRESENTATION TYPE: ORAL

ENVIRONMENTAL POLLUTION OF THE FUSARO LAKE IN "CAMPI FLEGREI"

Ettore d'Elia
Naples University Federico II, Italy

KEYWORDS: BRACKISH WATER LAKES, POLLUTION, RECLAMATION OF LAKES

The “campi flegrei” is a north-western area of Naples (Italy) of volcanic origin (“flegreo”, in ancient greek "φλεγω", means “burning”) to-day extinct but with some more phenomena (gas leaks; micro-earthquakes - in the years 1982-84 not less than 10,000 shocks, more than a hundred felt by the population -; “bradiseism”; etc.). Geologically there are large deposits of volcanic stones as the gray and yellow campano tufa. The area has huge historical, landscaping and territorial importance while: warm and healing spring waters; impressive archaeological ruins of the Roman imperial age; wonderful ruins of residential villas of roman emperors and senators; amphitheatres; etc. There are also some small brackish waters lakes whose most important is the FusaroLake, separated from the sea by a narrow sandy dune. It has a volume of about 3 million cu.m and sea bathing establishments dunes are along the sand while the hinterland is heavily urbanized. On the lakebed are sewage and inorganic sludge discharged by sewers and torrent’s rain waters arriving from the about 890 hectars hydrological catchment area. The connection with the sea occurs by three artificial outlets - today almost completely obstructed - which regulated the entrance and the flow of sea water. The fish and mussel farms, activities that took place from the roman times, are now virtually non-existent for the sanitary hazards induced by sewage pollution) and, as evidenced by chemical, physical and biological analysis, the ecosystem is altered without any use for productive purposes. At the time are beginning heavy works of reclamation of the lake, as the opening of the outlets and the regulation of the movement of sea waters by sluices, the construction of new sewers and a constant survey of the whole ecosystem.

PRESENTATION TYPE: ORAL

BALTIC SEA IS A SISTER SEA TO ARAL SEA. VIEW FROM BIOLOGY, HYDROLOGY AND PALEOLIMNOLOGY

Nikolai Aladin
Zoological Institute RAS, St. Petersburg, Russia
Igor Plotnikov
Zoological Institute RAS, St. Petersburg, Russia
Zaualkhan Ermakhanov
Aral branch of Kazakh Research Institute of Fishery, Aralsk, Kazakhstan

KEYWORDS: BALTIC SEA, ARAL SEA, SALINE LAKES

Zone of critical salinity, otherwise alpha α-horohalinicum zone in the Baltic Sea and the former Aral Sea occupies or occupied most of their waters. Both water bodies can be called “critical” seas. Our studies are based on the following scientific approaches: general theory of osmoregulation and osmotic tolerance of aquatic organisms; IL2BM (Integrated Lentic and Lotic Basin) concept; ecophysiological views. We also rely on paleolimnological data. Baltic is young sea. During glacial age it was cold lake having got connection with the World Ocean only recently. Baltic retains many lacustrine features. It is small and semi-closed. Its waters have smooth salinity gradient. Biodiversity is relatively low but unique and requires special protection. In the sea there are oligohaline and mesohaline waters with specific biota. Gulfs of Finland and Bothnia are the most freshened. Central Baltic is mesohaline. Only Kattegat and Sound are polyhaline. Baltic is more lake than sea. Its unique brackish ecosystem needs to be raised and get the same protected status as the Caspian one. The Aral Sea is also young (some tens of thousands years). It is saline lake of arid zone, terminal reservoir of Amu Darya and Syr Darya. Its hydrological regime is determined by rivers. For natural reasons and because of irrigated agriculture development in the riverine basins Aral underwent regressions and transgressions, but only modern regression was catastrophic for biota. Nowadays dam in the former Berg Strait allowed partial restoration of the Northern Aral. Baltic and Aral are sister water bodies.

PRESENTATION TYPE: ORAL

CASPIAN SEA IS A BROTHER SEA TO BALTIC AND ARAL SEAS. VIEW FROM BIOLOGY, HYDROLOGY AND PALEOLIMNOLOGY

Nikolai Aladin
Zoological Institute of RAS, St. Petersburg, Russia
Yuri Chuikov
Astrakhan Pedagogical University, Russia
Igor Plotnikov
Zoological Institute of RAS, St. Petersburg, Russia

KEYWORDS: CASPIAN SEA, BIOTA, SALINE LAKES

Critical salinity zone, otherwise α-horohalinicum zone, in modern Caspian occupies most of its northern water area. Northern Caspian can be called “critical” water body. Our studies are based on the following scientific approaches: general theory of osmoregulation and osmotic tolerance of aquatic organisms; IL2BM (Integrated Lentic and Lotic Basin) concept and ecophysiological views. We also rely on paleolimnological data. Caspian is very old sea. There were transgression periods and strong freshening of it when α-horohalinicum zone occupied almost the whole sea. But there were regression periods when α-horohalinicum zone was much smaller. Caspian sometimes had connection with the World Ocean through the ancient Manych Strait. Caspian retains many lacustrine and marine features simultaneously. Nowadays Caspian is the largest in the World saline lake and terminal reservoir for many rivers. Caspian waters have smooth salinity gradient and unique brackish endemic biota. Biodiversity of Caspian is very high; it is unique and requires special measures to protect it. In Caspian there are oligohaline/brackish Northern Caspian and mesohaline Middle and Southern Caspian with specific biota. The most saline is hypersaline Gulf of Kara-Bogaz-Gol. Although Caspian is much older than Aral and Baltic, it can be considered as a “brother” water body to the both of them. Many immigrants from Caspian can easily adapt to conditions of Baltic and Aral. Invasive species from Caspian are coming to Baltic in ballast waters or attached to ships and naturalized easily. Caspian creatures introduced by man in Aral also found here a second home.

PRESENTATION TYPE: ORAL

MICROBIOLOGICAL STUDY ON RESTORATION OF ORGANIC POLLUTED SEDIMENTS WITH MAGNESIUM HYDROXIDE

Xia Dong
Graduate School of Engineering, Nagasaki University, Japan
Tomoaki Itayama
Graduate School of Engineering, Nagasaki University, Japan

KEYWORDS: SULFATE-REDUCING BACTERIA, MAGNESIUM HYDROXIDE, SEDIMENT IMPROVEMENT

In recent years, the deterioration of sediment environment became increasingly apparent and had fallen into a malignant circle. The hydrogen sulfide produced from polluted sediments in saline or brackish lakes specially causes a big damage to benthos and fishes. In particular cage aquacultures were frequently attacked when lack of dissolved oxygen in the bottom layer occurs. Magnesium hydroxide has been applied to improve such polluted sediments, because it was empirically known that hydrogen sulfide production was suppressed.It is, of course, easy to suppose that the action is correlated with the activity of sulfate-reducing bacteria in the sediment. In this study, we carried out the column experiments to analyze on the effect of magnesium hydroxide for sulfate-reducing bacteria and the other bacteria related with sulfur cycle in the sediment using quantitative PCR and other molecular ecological techniques.

PRESENTATION TYPE: ORAL

MS01-05S

Special Session - Alien species: an increasing threat to freshwater ecosystems?

INVASIVE EXOTIC FISHES IN INDIA WITH AN EMPHASIS ON AFRICAN CATFISH MENACE IN KARNATAKA, SOUTHERN INDIA

Nagappa Basavaraja

Department of Aquaculture, Karnataka Veterinary, Animal and Fisheries Sciences, College of Fisheries, Mangalore, India

In India, like in several countries, several exotic fishes have found entry officially or clandestinely, with most of them finding their way through the latter means. While grass carp, silver carp and common carp have helped boost freshwater aquaculture production, trouts have contributed to eco-tourism as a sport fish apart from forming a good food fish. The introduction of silver carp in the Govind Sagar reservoir (Himachal Pradesh) and Kalyani reservoir (Madhya Pradesh), has negatively impacted, resulting in the decline of the population of catla, the dominant native species, due to overlapping feeding habits. The presence of common carp in different lakes of Kashmir and Manipur States has significantly affected the population of the native trout (Schizothorax spp.). The infestation of tilapia in Amravati and Vaigai reservoirs and Powai and Jaisawand lakes has eliminated almost all other species, including the major carps and the indigenous catfishes, due to its prolific breeding and omnivorous feeding habits. In Karnataka, the Jawa tilapia has become a menace in irrigation tanks, rivers and reservoirs, thereby drastically reducing the native fish fauna and hence has been considered a pest. It accounts for about 15-20% of the total gill net catch of the V.V. Sagar reservoir of Karnataka. It is perceived that its prolific breeding, parental care, overlapping feeding habit and faster growth rate have resulted in the disappearance of some local varieties of fishes that were sharing similar niche in the water bodies, thereby posing a great challenge for effective control and management. In several other States, the tilapia is regarded as a weed-fish due to its competition with native species. It is now well established in major tanks and reservoirs coming under Krishna, Cauvery, Godavari and West flowing river drainages, including estuaries. Natural hybridization between the non-native and native species has changed the composition of fish fauna of inland waters of India. Natural hybrids of common carp are available in the rivers of Ganga and Yamuna, whereas hybrids of Indian major carps and Chinese carps are found in reservoirs and lakes. Due to its ease of breeding in captivity, adaptability to varying environmental conditions and relatively faster growth rate, the common carp has spread over the length and breadth of the Karnataka State and contributes significantly to the inland fish production of the State. This is one of the predominant species that is bred and stocked in most of the water bodies. Presently, this species constitutes 43% of total seed stocked in various water bodies in the State. It is found to have brought about decline of the endemic fishes and also eliminated indigenous fish as exemplified by the total disappearance of Puntius dubius in Krishnarajasagar reservoir and a marked decline in the population of other indigenous fishes like P. carnaticus, Cirrhinus cirrhosa and Labeo fimbriatus. The sucker-mouth catfish (Pterygoplichthys multiradiatus), introduced as an ornamental fish, has found entry into the inland waters of Kerala State such as Vembanad Lake in Kochi and water bodies of Vylathur village in Thrissur and the Chackai canal in Thiruvananthapuram. Due to its phytophagous nature, it is presumed that it might adversely affect the other herbivorous fish fauna. The presence of the red-bellied pacu (Piaractus brachypomus) has been reported from the Periyar river in Kerala and the Dimbhe reservoir near Pune, Maharashtra. Pacu is known to cause economic losses to fishers by damaging their gear, particularly cast nets and gill nets. Farmers culture pacu in polyculture with carps, per se carnivorous. Similarly, Piranha, Pygocentrus nattereri is found to have established in natural water bodies of Kerala. Due to its highly invasive nature, the Ministry of Agriculture, New Delhi, has already banned this species. The giant African catfish, Clarias gariepinus was secretly brought into most of the States of India owing to its much faster growth rate than the native cat fish, Clarias batrachus. But it was soon found to be a major threat to the native fish fauna and hence its seed production, farming and marketing has been banned. Despite the ban, it has been gaining popularity among the farmers of Punjab, Uttar Pradesh, West Bengal, Andhra Pradesh, Orissa, Bihar, Karnataka, Assam and other States as an economically viable alternative species to Indian major carps. C. gariepinus accounted for nearly 16% of the total catch from the river Yamuna in a single day, with weights ranging between 1 and 2 kg. Though not officially introduced, it has made its entry into Karnataka through seed supplies from Andhra Pradesh and West Bengal, the leading

States in farmed fish production of the country. In the Hemavathi reservoir of Karnataka, specimens weighing 25-30 kg are often caught using gill net and the cultivation of this fish still goes on clandestinely on the outskirts of Bangalore, Kolar, Hassan, Tumkur, Haveri, Mangalore etc. C. gariepinus is also available in the neighbouring district of Kasaragod in Kerala. It has invaded rivers, reservoirs and tanks, causing a threat to aquatic biodiversity and has even lead to a reduction in the number and size of specimens of indigenous fishes from our waters. The Guppy, Lebistes reticulatus is reported to have established in irrigation tanks, rivers and reservoirs of Shimoga, Davangere, Chickmagalur and Chitradurga districts of Karnataka. Wild collections of this fish are routinely supplied to municipalities/corporations for releasing in open waters as a measure to control malaria. In some places, it has been considered an ideal fish for controlling malaria rather than an ornamental fish. The mosquito fish (Gambusia affinis), another larvicidal fish, has practically eliminated the indigenous species in Ooty Lake in Tamil Nadu, damaging the economy of the lake area. In Karnataka, it has escaped into open waters like swamps, marshes, wells and wastewaters of Mangalore and has become a pest in aquaculture ponds. The Giant gourami (Osphronemus gourami) occurs naturally in the freshwaters of Southeast Asian countries. In India, it was first introduced in Calcutta during the first half of the nineteenth century from Java and is used as an ornamental fish in garden ponds. It is also available in natural waters.

PRESENTATION TYPE: ORAL

EXCRETION OF NITROGEN AND PHOSPHORUS BY GAMBUSIA HOLBROOKI UNDER LABORATORY CONDITIONS

Nirmal Singh
University of Jammu, India

KEYWORDS: GAMBUSIA HOLBROOKI, N AND P EXCRETION, PHYTOPLANKTON BOTTOM UP CONTROL, LAKE NAINITAL.

Nirmal Singh Department of Zoology, D.S.B. Campus, Kumaun University, Nainital-263002 India Present address: P. G. Department of Sericulture, Poonch Campus, University of Jammu, Poonch - 185101 (J&K) India, E-mail: nirmalsingh1981@yahoo.in Abstract Experiments were performed under laboratory condition to assess the rates of Nitrogen and Phosphorus excretion by male and female Gambusia holbrooki. The effects of feeding (fed and unfed fish) and time since feeding (0, 4, 8 and 24 hours) on the N and P excretion rates and N:P ratio excreted were also examined. Results showed that N and P excretion rates significantly increased after feeding and declined thereafter for both the two categories of Gambusia. The P excretion rate decreased more rapidly after feeding than did the N excretion rate, thereby increasing the excreted N:P ratio with time since feeding. Males excreted more N and P in comparison to females on mass specific basis. The data of the present investigation were compared with other studies on nutrient excretion by different fishes. It was concluded that nutrient excreted and recycled by Gambusia could be an important source of nutrients (bottom up control) for Lake Nainital.

PRESENTATION TYPE: POSTER

ROLE OF FISHPONDS IN THE SPREAD OF NON-INDIGENOUS INVERTEBRATES IN THE SOUTHERN CATCHMENT AREA OF LAKE BALATON

Nora Kováts
University of Pannonia, Department of Limnology, Hungary
Árpád Ferincz
University of Pannonia, Department of Limnology, Hungary
Eszter Horváth
University of Pannonia, Department of Limnology, Hungary
Bettina Varanka
University of Pannonia, Department of Limnology, Hungary
Árpád Benkő-Kiss
University of Szeged, Institute of Farming and Rural Development, Hungary
András Weiperth
MTA Centre for Ecological Research, Danube Research Institute, Hungary
Gábor Paulovits
MTA Centre for Ecological Research, Balaton Limnological Institute, Hungary

KEYWORDS: LAKE BALATON, BIOLOGICAL INVASIONS, FISHERIES MANAGEMENT

Lake Balaton is the largest shallow freshwater lake in Central Europe. It is located in West-Hungary, with a total area of 596 km2, and mean depth of 3.25 m. In addition to being a unique water body, it is also a multi-purpose lake which performs both ecosystem and economic services, of which fishery management is of high importance. On the south-west of Lake Balaton streams and canals form a very complex system, as several fish ponds have been built on them. One species associated with fish stocking is the exotic Chinese pond mussel (Sinanodonta woodiana), which was first reported from Lake Balaton in 2006, since than, it has become dominant in the western basin of the lake. In 2013 summer a systematic study was conducted to describe bivalve communities of these streams and ponds, with special regard to S. woodiana, and to find possible connections between fish ponds and S. woodiana introduction. During the survey, not only possible infection centres were identified but the spiny-cheek crayfish (Orconectes limosus), a new invasive for Lake Balaton was detected in one of the fishponds. Its spread to the lake itself seems likely.

PRESENTATION TYPE: POSTER

INVASIVE ALIEN FISH, NILE TILAPIA (OREOCHROMIS NILOTICUS) AND ITS POSSIBLE IMPACT ON NATIVE FISH CATCHES OF SUBTROPICAL LAKES (PHEWA, BEGNAS AND RUPA) OF POKHARA VALLEY, NEPAL

Md Akbal Husen
Nepal Agricultural Research Council, Nepal

KEYWORDS: INVASIVE FISH, NILE TILAPIA, NATIVE FISH

This paper discuss with the increasing trends of Nile tilapia (Oreochromis niloticus) in total fish catches and their possible affect on native fish species of three Lakes (Phewa, Begnas and Rupa)of Pokhara Valley. The fish catch landing data from the year 2006-2011 was analyzed to know the trends of Nile tilapia. Nile tilapia introduction was accidently in the lakes of Pokhara valley and it appears in catches during the year 2003.There was increasing trends of Nile tilapia and decreasing trends of native fish species catches in total fish catches from lakes of Pokhara valley. The over recruit nature of Nile tilapia has been regularly increasing their population in these lakes in recent years. In total fish catch, the invasive fish Nile tilapia (Oreochromis niloticus) contributions has increased by 40.1%, 65.0 % and 12.02% in Phewa, Begnas and Rupa lakes respectively in the year 2011as compared to the year 2006. This indicated that Nile tilapia has now established and become invasive in these lakes. The impacts of Nile tilapia on localized species have been well documented. However, Nile tilapia (Oreochromis niloticus) have been providing much in monetary in recent year than earlier. Besides, it is impossible to calculate in that way for native fish value. The native fishes of Pokhara valley lakes are high valued and it also provides direct livelihood to 200 Jalari household living around the Lakes.

PRESENTATION TYPE: ORAL

DIETARY INTERACTIONS BETWEEN NON-NATIVE AND NATIVE SPECIES IN A SMALL TEMPERATE WATER COURSE (SARıçAY STREAM, SOUTH-WEST TURKEY)

Ali Serhan Tarkan
Muğla Sıtkı Koçman University, Faculty of Fisheries, Kötekli, Muğla, Turkey
Uğur Karakuş
Muğla Sıtkı Koçman University, Faculty of Fisheries, Kötekli, Muğla, Turkey
Nildeniz Top
Muğla Sıtkı Koçman University, Faculty of Fisheries, Kötekli, Muğla, Turkey
Lorenzo Vilizzi
Ichth-Oz Environmental Science Research, Irymple Vic, Australia

KEYWORDS: ENDEMIC SPECIES, FEEDING ECOLOGY, HABITAT PREFERENCES

Non-native freshwater fishes are being increasingly introduced worldwide, raising substantial management concerns for global biodiversity. To survive and adapt to new environments, non-native fishes must access adequate food resources, likely resulting in interspecific food competition. Topmouth gudgeon Pseudorasbora parva and pumpkinseed sunfish Lepomis gibbosus are two common non-native species that have recently expanded their distributional ranges and are currently regarded as potential invasive species in Turkey. Although both species are known to have established in Turkish waters since the 1980s, there is limited information on their biology and distribution. In this study, the feeding ecology and dietary interactions of P. parva and L. gibbosus with three native endemic species (Oxynoemacheilus sp., Squalius fellowesii and Petroleuciscus symrnaeus) were examined in Sarıçay Stream (Muğla Province). The most abundant species were L. gibbosus and S. fellowesii, and the least abundant P. parva and Oxynoemacheilussp. Both non-native species and Oxynoemacheilus sp. fed predominantly on insects, whereas S. fellowesii and P. symrnaeus preferred mainly macrophytes and detritus. Significant interspecific dietary interactions between the two non-native species as well as between these and Oxynoemacheilus sp. were detected. Also, a relatively wider dietary spectrum for the non-native relative to the native species was recognised. The results show limited dietary interaction between non-native and native species, but a significant one between the latter. These differences can be attributed to habitat segregation of native vs. non-native species across the study stream. Further studies (e.g. based on isotope analysis) are needed to understand the long-term patterns of dietary shifts in the examined species.

PRESENTATION TYPE: ORAL

TWO NOXIOUS INVASIVE SPECIES EICHHORNIA CRASSIPES AND POMACEA CANALICULATA HAVE INFESTED LAKE MANINJAU, SUMATERA

Siti Norasikin Ismail
School of Biological Sciences, Universiti Sains Malaysia, Penang, Malaysia
Mashhor Mansor
School of Biological Sciences, Universiti Sains Malaysia, Penang, Malaysia
Luki Subehi
Research Center for Limnology, Indonesian Institute of Sciences, Cibinong, Indonesia
Riky Kurniawan
Research Center for Limnology, Indonesian Institute of Sciences, Cibinong, Indonesia
Fachmijany Sulawesty
Research Center for Limnology, Indonesian Institute of Sciences, Cibinong, Indonesia
Muzzalifah Abd. Hamid
School of Biological Sciences, Universiti Sains Malaysia, Penang, Malaysia
Nor Aisyah Omar
School of Biological Sciences, Universiti Sains Malaysia, Penang, Malaysia

KEYWORDS: INVASIVE SPECIES, INFESTATION, LAKES

Lake Maninjau with an area 13,260 ha is one of the largest lakes in Sumatera. It is a relatively large lake with the maximum depth 165 m. This caldera lake has been popular with tourists including the international tourists. Unfortunately due to the massive aquaculture activities, apparently the lake water quality is deteriorating. Consequently the infestation of invasive species is increasing at a faster rate. During the recent observations from 14/3/2014 to 17/3/2014 at 10 sites, Ninety percent of the lake is covered with Eichhornia crassipes and fifty percent are Pomacea canaliculata. Eichhornia crassipes or water hyacinth originated from Amazon basin and currently have caused problems in 52 countries in the world particularly countries in tropical area. It is an aquatic floating weed and can propagate very fast. On the other hand, Pomacea canaliculata is known as golden apple snail. The populations are recorded to infest rice fields, ponds and lakes. The eggs are recorded to adhere to colonies of water hyacinth, fishing nets, bamboo poles and shoreline trees. The presence of these alien species may be due to the increase in fishing activities particularly along the shore. Although the fishing activities have provided good income for the local communities, however the increase of these biological invasive agent could degraded the lake water quality. Perhaps this phenomenon can be analog as a cancer of the lake ecosystem.

PRESENTATION TYPE: ORAL

THE TROPHIC POSITION OF THE INVASIVE CRAYFISH PROCAMBARUS CLARKI GIRARD, 1852 IN THE TRASIMENO AND BOLSENA LAKES (CENTRAL ITALY): A PRELIMINARY ASSESSMENT BY STABLE ISOTOPES ANALYSIS

Giorgio Mancinelli
Department of Biological and Environmental Sciences and Technologies, University of Salento; Centro Ecotekne, Italy
Salvatrice Vizzini
Department of Earth and Marine Sciences, University of Palermo, Italy
Alessandro Ludovisi
Department of Cellular and Environmental Biology, University of Perugia, Italy
Massimo Lorenzoni
Department of Cellular and Environmental Biology, University of Perugia, Italy

KEYWORDS: PROCAMBARUS CLARKII, TROPHIC POSITION, STABLE ISOTOPES

In recent decades the Louisiana crayfish Procambarus clarkii has gradually invaded Italian freshwater environments. Several studies have been performed to assess the impact of this species on invaded ecosystems. Noticeably, in other European countries useful information regarding the trophic role of this species within invaded communities have been obtained through the analysis of C and N stable isotopes. Here, we present preliminary data on the isotopic signature characterizing P. clarkii in two lakes of central Italy, i.e., the Trasimeno and Bolsena lakes. Stable isotope analysis were performed on samples collected in December 2013 and March 2014, on crayfish of different sizes and sexes, together with representatives of the native macrobenthic community and of the fish fauna (ie , Tinca tinca). The results showed that, in both study sites, P. clarkii is characterized by an omnivorous diet, testified by the d 15 N values, indicating that the species occupies a position higher than the benthic fauna and close to the one characterizing T. tinca, suggesting that it can exert multiple impacts at different trophic levels of the food web of both lakes. This trophic plasticity is confirmed by the significant seasonal variations in the isotopic signature of the crayfish and, in addition, by a considerable size-related increase in the nitrogen d 15 N values, suggesting an ontogenetic shift in the trophic niche. These data, even though preliminary, provide a stimulating basis for further analyses and future studies aiming at a robust assessment of the ecological impact of this invasive species in Italian freshwater habitats.

PRESENTATION TYPE: ORAL

CURRENT STATUS OF SINANODONTA WOODIANA (LEA, 1898) IN POLAND

Maria Urbańska
Department of Zoology, Institute of Zoology, Poznań University of Life Sciences, Poznań, Poland
Wojciech Andrzejewski
Division of Inland Fisheries and Aquaculture, Institute of Zoology, Poznań University of Life Sciences, Poznań, Poland

KEYWORDS: INVASIVE SPECIES, SINANODONTA WOODIANA, POLAND

Sinanodonta woodiana (Lea 1838) is a species present in Polish waters with natural thermal conditions since at least 1992 however the first record of this species was in artificial heated waterbodies. It is regarded as an alien species showing the full characteristics of a typical invasive species. Due to the observed increase in a number of species locations it is suspected that it may become common. This situation may result in changing the population state of native species and habitat transformations, as mussels play a key role in the formation and functioning of aquatic biocenoses. Till now at least 25 locations of the Chinese pond mussel have been confirmed in Poland. In addition to these reports about new locations of this species, several types of research have been conducted. These included both morphological characteristics, reproduction, habitat preferences and the density and distribution as well as variability at the genetic level. Natural enemies, parasites and symbionts of the Chinese pond mussel have been also reported. Current knowledge about Polish populations will be shown as well as cross-country survey's statistical results concerning habitat preferences and biometrical measures. We will present the comparative genetic outcomes that indicate a way of distribution for the Polish population. We are going to demonstrate the analyses of survey and growing rate. The knowledge of Sinanodonta woodiana spread, biology and habitat characteristics determining its occurrence should be a key task to enable prediction of the consequences of its presence and to find ways to limit its occurrence.

PRESENTATION TYPE: ORAL

TWENTY FIVE YEARS OF DREISSENA SPP. IMPACTS ON NATIVE UNIONIDAE IN THE LOWER GREAT LAKES: DREISSENID SPECIES MATTERS

Lyubov Burlakova
SUNY Buffalo State, USA
Brianne L. Tulumello
SUNY Buffalo State, USA
Alexander Y. Karatayev
SUNY Buffalo State, USA
Robert A. Krebs
Cleveland State University, USA
Donald W. Schloesser
U.S. Geological Survey, Great Lakes Science Center, USA
David T. Zanatta
Central Michigan University, USA
Wendy L. Paterson
Central Michigan University; SUNY Buffalo State, USA
Traci A. Griffith
Central Michigan University, USA
Mariah W. Scott
Central Michigan University, USA

KEYWORDS: INVASIVE SPECIES, UNIONIDSE, DREISSENA

Determining when and where impacts of invasive species would be most ecologically detrimental is critical for the development of global management priorities to protect native species prior to future invasions. Freshwater bivalves from the Order Unionoida have declined over the past century and invasion of dreissenid mussels has greatly accelerated the decline. The purpose of this study was to evaluate the effect of Dreissena polymorpha and D. rostriformis bugensis on unionids in the lower Great Lakes region after 25 years of invasion that nearly extirpated unionids. We collected data on dreissenid infestation of more than 4000 unionids from 26 species at over 200 sites in lakes Erie, Ontario and St. Clair, the Detroit River, and inland lakes in Michigan in 2011-2012 using standardized methodology and compared to published data collected in early 1990s. We found that occurrence and intensity of unionid infestation by Dreissena recently declined, and the number of dreissenids attached to unionids in the lower Great Lakes is currently almost ten-fold lower than in the early 1990s. We also found that infestation caused by dreissenids depends on the dominant Dreissena species in the lake: D. polymorpha infested unionids much more often and in greater numbers than D. r. bugensis. Consequently, the proportion of infested unionids, the number and weight of attached dreissenids were all lower in waterbodies dominated by D. r. bugensis. This is the first large-scale systematic study that revealed the differences between two taxonomically and functionally related invaders that has large consequences for native communities they invade.

PRESENTATION TYPE: ORAL

ZEBRA VERSUS QUAGGA MUSSELS: SPREAD, POPULATION DYNAMICS AND ECOSYSTEM IMPACTS

Alexander Karatayev
SUNY Buffalo State, U.S.A.
Lyubov E. Burlakova
SUNY Buffalo State, U.S.A.
Dianna K. Padilla
Stony Brook University, U.S.A.

KEYWORDS: ZEBRA MUSSEL, QUAGGA MUSSEL, IMPACT

Dreissena polymorpha, the zebra mussel, and Dreissena rostriformis bugensis, the quagga mussel, continue to spread, both in Europe and North America, at virtually all spatial scales, causing serious economic damage and altering the aquatic communities and ecosystems they invade. While the zebra mussel is among the best studied freshwater invertebrates, we do not always have comparable information for quagga mussels, which limits our ability to predict the spread and ecological impacts of this important freshwater invader.Although zebra and quagga mussels are closely related species, share a common native habitat, life history, and dispersal potential, the zebra mussel rate of spread has been higher than that of quagga mussel at most spatial scales throughout their invasion history. The estimated lag time between initial introduction and maximal population size is 5 times shorter for zebra mussels than that for quagga mussels, which may be an important factor affecting the speed with which this species can spread. The ecological impacts of both species are associated with their role as ecosystem engineers, and the magnitude of their effects is determined by the population density in a given waterbody. The ecological effects of quagga musselsmay be similar to those of the zebra mussel, or they may be greater given that quagga mussels appear to utilize a wider range of habitats within lakes than do zebra mussels, and are therefore capable of attaining much larger overall population sizes, particularly in lakes with large profundal zones. Shortly after initial invasion, as populations increase both zebra and quagga mussels will have their largest and most obvious effects on communities, and most of the impacts will be direct effects. After the initial stage of invasion, impacts are less predictable, and more likely to be caused by indirect effects through changes in the ecosystem. Because the vast majority of observations of quagga mussel impacts on aquatic communities and environments have been conducted in waterbodies previously colonized by zebra mussels, it is very difficult to distinguish between the effects of zebra and quagga mussels.

PRESENTATION TYPE: ORAL

EUTROPHICATION AND DREISSENA INVASION AS DRIVERS OF BIODIVERSITY: A CENTURY OF CHANGE IN A DIVERSE MOLLUSC COMMUNITY

Vadim Karatayev
Cornell University, USA
Alexander Karatayev
Great Lakes Center, SUNY Buffalo State, USA
Lyuba Burlakova
Great Lakes Center, SUNY Buffalo State, USA
Lars Rudstam
Cornell University, USA

KEYWORDS: BIODIVERSITY, DREISSENA, EUTROPHICATION

As long-term monitoring studies of benthic communities are rare, we have a very limited understanding of how these species are affected by the strongest and most widespread anthropogenic press disturbances in freshwaters - eutrophication and dreissenid invasion. Molluscs in particular are one of the most diverse (~1053 species) freshwater taxa in North America - and the most threatened, with over two thirds of all species imperiled. We examine the current diversity and structure of the diverse (31 species) mollusc community in Oneida Lake, and conduct a historical analysis using several unique datasets spanning the past century to determine the extent and mechanisms by which eutrophication and Dreissena invasion impacted the community. We found major shifts in community structure and species richness, primarily characterized by changes in the diversity (~45%) and density (~95%) of gastropods grazing on benthic algae. These transformations were concomitant with major shifts in ecosystem turbidity caused by cultural eutrophication and Dreissena introduction. Our analysis highlights turbidity as a likely master variable in regulating the abundance and diversity of benthic grazers via bottom-up effects.

PRESENTATION TYPE: ORAL

PROPAGULE PRESSURE CORRESPONDS WITH OCCURRENCE OF NON-INDIGENOUS SPECIES ACROSS BROAD TAXONOMIC GROUPS IN FRESHWATER HABITATS

Angela Boggero
National Research Council, Institute of Ecosystem Study, Verbania Pallanza, Italy
Alberto Basset
Department of Science and Biological and Environmental Technology, University of Salento, Lecce, Italy
Martina Austoni
National Research Council, Institute of Ecosystem Study, Verbania Pallanza, Italy
Enrico Barbone
Apulian Regional Agency for the Environmental Prevention and Protection (ARPA),Bari, Italy
Luca Bartolozzi
Entomological Department, Natural History Museum of the University of Florence, Zoological Section "La Specola", Florence, Italy
Isabella Bertani
Department of Life Sciences, University of Parma, Parco Area delle Scienze, Parma, Italy
Alessandro Campanaro
National Forestry Service, National Center for Biodiversity Study and Conservation, Marmirolo MN, Italy
Antonella Cattaneo
Département de Sciences Biologiques, Université de Montréal, Montréal, Québec, Canada
Fabio Cianferoni
Entomological Department, Natural History Museum of the University of Florence, Zoological Section "La Specola", Florence, Italy
Giuseppe Corriero
Department of Biology, University of Bari “Aldo Moro”, Bari, Italy

KEYWORDS: ALIEN SPECIES, INVASION ECOLOGY, PROPAGULE PRESSURE

The relative role of Propagule pressure (i.e. introduction effort), Abiotic and Biotic variables as determinants of the occurrence of alien, non-indigenous species differs among studies, hindering the synthesis of emergent patterns in invasion ecology. In order to produce a broad and general assessment, we propose a macroecological approach in which we analyse the occurrence of alien species in all biota (microorganisms, plants and animals) across several habitats in freshwater ecosystems in Italy. We determined that propagule pressure, expressed as the proximity to major inhabited areas, was by far the best predictor of alien species occurrence, whereas differences in the biotic and abiotic features of the receiving community had negligible effects. This is the first study providing broad-scale support for the propagule pressure hypothesis across a wide range of taxa. Considering that many previous studies did not formally consider propagule pressure, our results may explain the apparent idiosyncrasy in results from species-specific studies. Our results could also be used to forecast the sensitivity to invasion of protected and non-protected areas.

PRESENTATION TYPE: ORAL

PROCAMBARUS CLARKII: SITUATION IN EUROPEAN LAKES AND MAIN EFFECTS ON THE ECOSYSTEMS

Catherine Souty-Grosset

Université de Poitiers, Laboratoire Ecologie & Biologie des Interactions- UMR CNRS 7267, Equipe Ecologie Evolution Symbiose, France

Elena Tricarico

Dipartimento di Biologia, Università degli Studi di Firenze, Firenze, Italy

Laura Aquiloni

Dipartimento di Biologia, Università degli Studi di Firenze, Firenze, Italy

Ivan Vedia Jimenez

Dept. Environmental Biology, School of Sciences, University of Navarra, Pamplona, Spain

Rafael Miranda

Dept. Environmental Biology, School of Sciences, University of Navarra, Pamplona, Spain

Pedro Anastácio

Institute of Marine Research, Dept. of Landscape, Environment and Planning, University of Évora, Évora, Portugal

Christoph Chucholl

Fischereiforschungsstelle BW (Fisheries Research Station, Lake Constance), Langenargen, Germany

Menno Soes

Bureau Waardenburg, Postbus 365, 4100 AJ Culemborg, the Netherlands; NCB Naturalis, Postbus 9517, 2300 RA Leiden the Netherlands

KEYWORDS: RED SWAMP CRAYFISH, IMPACTS, MANAGEMENT

The red swamp crayfish, Procambarus clarkii, is currently recorded from 15 European countries. Populations are most prevalent in Italy, Portugal, Spain, France and the Netherlands, but the species is also present in England, Belgium, Switzerland, Germany and Austria, as well as in a number of islands (i.e. São Miguel- Azores, Cyprus, Majorca, Sardinia, Sicily and Tenerife). On top of being a vector of crayfish plague, which is responsible for large-scale disappearance of native crayfish species, it can cause severe impacts on aquatic ecosystems, such as estuaries, marshes, canals, artificial lakes (dams), gravel pit lakes, ponds and fishponds, due its rapid life cycle, dispersal capacities, burrowing activities and high population densities. This invasive crayfish is a polytrophic keystone species that can exert multiple pressures on lake ecosystems. Most studies deal with the decline of macrophytes, increase of water turbidity, reduction of detritus biomass, and predation on several species (amphibians, molluscs, and macroinvertebrates) highlighting how this biodiversity loss leads to unbalanced food chains. At a management level the species is considered as (1) a devastating digger of the water drainage systems in south-central Europe, (2) an agricultural pest in Mediterranean territories, consuming, for example, young rice plants, and (3) a threat to the restoration of water bodies in north-western Europe. We discuss the implication for the general management of lakes, including the need for a trade regulation, implementing legislation, developing public education strategies and coordination of stakeholders, as well as for specific actions as distribution surveys, site protection/habitat restoration, and fisheries controls.

PRESENTATION TYPE: ORAL

ALIEN BIVALVE MOLLUSCS OCCURRENCE, POPULATION DYNAMICS AND IMPACT: LAKE MAGGIORE (ITALY) AND DANUBE RIVER (BULGARIA) CASE STUDIES

Teodora Trichkova
Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences (IBER-BAS), Sofia, Bulgaria
Rosaria Lauceri
National Research Council – Institute of Ecosystem Study (CNR-ISE), Verbania-Pallanza, Italy
Lyubomir Kenderov
National Museum of Natural History, Bulgarian Academy of Sciences, Sofia, Bulgaria
Zdravko Hubenov
Biological Faculty, Sofia University, Sofia, Bulgaria
Vesela Evtimova
Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences (IBER-BAS), Sofia, Bulgaria
Alexander Kotsev
Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences (IBER-BAS), Sofia, Bulgaria
Irene Guarneri
National Research Council – Institute of Ecosystem Study (CNR-ISE), Verbania-Pallanza, Italy
Salvatore Calvaruso
National Research Council - Institute of Ecosystem Study (CNR-ISE), Verbania-Pallanza, Italy
Nicoletta Riccardi
National Research Council - Institute of Ecosystem Study (CNR-ISE), Verbania-Pallanza, Italy

KEYWORDS: FRESHWATER BIVALVES, POPULATION FEATURES, HABITAT CHARACTERISTICS

Nowadays, the presence of alien species is a worldwide problem, especially when the presence of the new species has the character of a biological invasion which threatens biological diversity and affects ecosystem services thus causing environmental, economic and social damages. The freshwater bivalve Dreissena polymorpha is included among the 100 World's Worst Invasive Alien Species (IUCN/SSC ISSG), and Corbicula fluminea and D. polymorpha are listed among the 100 Worst Invasive Alien Species in Europe (DAISIE). Further, the Chinese Pond Mussel Anodonta woodiana and the Quagga Mussel Dreissena rostriformis bugensis are becoming globally spread in last decades, causing biodiversity and economic losses. Here we show how different environments, such as a large subalpine lake, Lake Maggiore (Northern Italy) and the second longest river in Europe, Danube River (Bulgaria), are affected by similar problems: the invasion by non-native freshwater bivalves; and how these different habitats influence the occurrence and population dynamics of the invaders. Presence-absence maps have been prepared to present the distribution of the bivalve alien species (C. fluminea, D. polymorpha, A. woodiana and D. rostriformis bugensis) in the two different freshwater bodies, Lake Maggiore and the Danube River (Bulgaria). In addition, to evaluate the potential impact of C. fluminea, which is rapidly becoming the dominant littoral species in Lake Maggiore, a field and mesocosm study of its population dynamics and reproductive cycle is presented. The results from the study of quantitative parameters and habitat characteristics of C. fluminea and other alien bivalves in the Bulgarian sector of the Danube River and its tributaries are also presented.

PRESENTATION TYPE: ORAL

INVASION SUCCESS OF ALIEN FISHES IN SARDINIAN RESERVOIRS

Flavio Orrù
ENAS (Ente Acque della Sardegna), Italy
Paola Buscarinu
ENAS (Ente Acque della Sardegna), Italy
Francesca Piras
ENAS (Ente Acque della Sardegna), Italy
Maria Antonietta Dessena
ENAS (Ente Acque della Sardegna), Italy

KEYWORDS: SPECIES INTRODUCTIONS, ALIEN FISHES, RESERVOIRS

The Island of Sardinia is located in the Central-Western part of the Mediterranean Sea and, as in many Mediterranean-type climate regions, river discharge (strongly dependent on rainfall) is moderate-to-high during the winter and very low in summer. Throughout the Island there are a large variety of running waters only flowing at certain times of the year, and only one natural lake is present. Because of the scarcity of water resources (mainly during dry seasons), since the early ‘900 more than 50 dams have been constructed. Dams and reservoirs have contributed significantly in fulfilling basic human needs, furthermore they have converted lotic habitats into lentic ones. Since reservoirs have been available, introductions of alien freshwater fishes have taken place as result of restocking programs by governmental agencies and unauthorized, deliberate or accidental, releases by private individuals. A continuous increase in the number of introductions of alien species adept at occupying new artificial habitats has been observed since the 1960s-70s. Recent sampling surveys made it possible to record the presence of 15 alien freshwater fish species in Sardinian reservoirs, of these, 14 appear to have successfully established self-sustaining populations. Cyprinids and predatory fish have become widespread in rivers, canals and still waters, also characterized by strongly stressed species-poor native fish communities. Environmental conditions seem to be highly suitable for further invasions and no measures to control introduction and dispersal are really active. Temporal trends of introduction, major distribution pathways, real and potential threats are also described and discussed.

PRESENTATION TYPE: ORAL

PHYLOGEOGRAPHY OF THE INVASIVE CORBICULA FLUMINEA IN ITALIAN FRESHWATER ECOSYSTEMS

Cidália Gomes

CIIMAR/CIMAR - Interdisciplinary Centre of Marine and Environmental Research, University of Porto, Porto, Portugal

Irene Guarneri

CNR – Institute of Ecosystem Study, Verbania Pallanza, Italy

Vitor Vasconcelos

CIIMAR/CIMAR - Interdisciplinary Centre of Marine and Environmental Research, University of Porto, Porto, Portugal; FCUP - Faculty of Sciences, University of Porto, Porto, Portugal

Lúcia Guilhermino

CIIMAR/CIMAR - Interdisciplinary Centre of Marine and Environmental Research, University of Porto, Porto, Portugal; ICBAS - Institute of the Biomedical Sciences of Ab

Nicoletta Riccardi

CNR – Institute of Ecosystem Study, Verbania Pallanza (VB), Italy

Agostinho Antunes

CIIMAR/CIMAR - Interdisciplinary Centre of Marine and Environmental Research, University of Porto, Porto, Portugal; FCUP - Faculty of Sciences, University of Porto, Porto, Portugal

KEYWORDS: C. FLUMINEA, MTDNA, COI GENE

Corbicula fluminea is a non-indigenous invasive species that has rapidly spread from its native range to non-native worldwide freshwater ecosystems.It is considered to be one of the most important invasive bivalve due to the negative impacts caused in the native faunas of invaded ecosystems.Records indicate that in Northern Italy, C. fluminea was first detected in 1995, subsequently in Lake Garda and Lake Maggiore in 2002 and 2010, respectively. Even though the establishment of these C. fluminea populations from Northern Italy has been previously reported, the genetic variability has not been assessed thus far. Therefore, it is fundamental to investigate the genetic variability between populations of C. fluminea from Lake Garda and Maggiore, by assessing the variation of the mtDNA COI gene relatively to other populations worldwide. Moreover, data from other Corbicula species from the native and invaded range will be also compared usingpopulation genetics and phylogeographical inference methodologies. The obtained results provide insightful genetic knowledge of C. fluminea populations inhabiting these two freshwater ecosystems – Lake Garda and Lake Maggiore – and are useful to understand the invasive behaviour of this species as well as their genetic relationships.

PRESENTATION TYPE: ORAL

GENOTOXICITY OF GLYPHOSATE-BASED HERBICIDES ASSESSED BY THE COMET ASSAY ON THE KILLER SHRIMP DIKEROGAMMARUS VILLOSUS COMPARED TO THE NATIVE ECHINOGAMMARUS VENERIS (CRUSTACEA, AMPHIPODA)

Valentina Iannilli
ENEA Unità Tecnica AGRI-ECO, C.R. Casaccia, Rome, Italy
Leonardo Latella
Museo di Storia Naturale of Verona, Verona, Italy
Francesca Lecce
ENEA Unità Tecnica AGRI-ECO, C.R. Casaccia, Rome, Italy
Patrizia Menegoni
ENEA Unità Tecnica AGRI-ECO, C.R. Casaccia, Rome, Italy

KEYWORDS: DIKEROGAMMARUS, GLYPHOSATE, COMET ASSAY

The main object of the present study is to evaluate differences in sensitivity between a native species, Echinogammarus veneris and the invasive amphipod Dikerogammarus villosus to glyphosate toxicity. The ability of a novel species to become established within a community may depend on its relative tolerance to the novel environment and its contaminants. Therefore, a potential approach for assessing the ecological impacts of an invading species on a community is the comparison of its response with that of an analogous native species. Glyphosate-based herbicides represent the most extensively used worldwide, however, their aquatic toxicity data are relatively scarce. In 2013 glyphosate and its breakdown product (AMPA) were the most detected pesticides in Italian surface waters. The species E. veneris was recently proposed as suitable species to assess toxicity of freshwater environments in Mediterranean area due to its distribution, abundance of populations and ease of breeding. D. villosusis a species native to the Ponto-Caspian region that invaded central and western Europe, it is included among the 100 worst invasive species in Europe. To evaluate the genotoxic effects of exposures to glyphosate, D. villosus and E. veneris were exposed in vivo to three concentrations. The experiments was conducted to assess DNA damage in hemolymph cells by alkaline comet assay (silver stained). In the course of this study, differences in genotoxic responses were observed in the various experiments, possibly due to differences in pollutant sensitivity between the tested species.

PRESENTATION TYPE: POSTER

A NEW FERAL POPULATION OF TRACHEMYS SCRIPTA IN NORTHERN ITALY?

Claudio Foglini
Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta , Italy
Roberta Salvi
Università Cattolica del Sacro Cuore, Istituto di Agronomia, Genetica e Coltivazioni erbacee, Piacenza, Italy

KEYWORDS: SLIDER TURTLES, REPRODUCTION, CMR MODEL

Trachemys scripta subspecies are massively imported in Europe as a pets, and often released in nature in great number by owners, outside their native range. Now slider turtles are listed as a worldwide major treath for other species and freshwater habitats. In Italy, free-living populations are established in many lakes, rivers and wetlands, and in some areas successful reproduction has been reported. In small urban and periurban parks, human-made or semi-natural wetlands often host slider turtles at high density, with negative impact on freshwater ecosystems. This study was conducted to estimate the consistency of the population hosted into the artificial lakes and ponds of the Parco Nord Milano (Milan Province, Lombardy, Italy). The presence of slider turtles in the park has long been known, but the overall number of individuals, their sex-ratio and their reproductive status were unknown. The turtles were captured with basking traps during multiple capture-recapture sessions, from April to August 2013. The specimens trapped were measured, weighed, sexed and marked with small notch on carapace. The overall number of individuals for each wet zone was estimated with the CMR model for close populations provided by the software Noremark, and the number of potential breeders was estimated by plastron length, according to literature. We marked 156 slider turtles (Trachemys scripta spp.) and, although we did not find clear evidence of successfull reproduction, surprisingly we identified seven individuals with straight carapace lenght (SCL) between 21 and 47 mm.

PRESENTATION TYPE: POSTER

EVOLUTION OF THE DIKEROGAMMARUS VILLOSUS (SOWINSKY, 1894) INVASION IN LAKE GARDA (NORTHERN ITALY)

Ilaria Marchi

Museo Civico di Storia Naturale di Verona, Verona, Italy

Marco Bertoli

Laboratorio Ittiobenthos, Dipartimento di Scienze della Vita, Università di Trieste, Trieste, Italy

Federica Giacomazzi

Unità Operativa di Microbiologia e Biologia Ambientale - Servizio Laboratorio di Verona, Agenzia Regionale per la Prevenzione e Protezione Ambientale Veneto (ARPAV), Verona, Italy

Chiara Zampieri

Unità Operativa di Microbiologia e Biologia Ambientale - Servizio Laboratorio di Verona, Agenzia Regionale per la Prevenzione e Protezione Ambientale Veneto (ARPAV), Verona, Italy

Valentina Iannilli

ENEA C.R. Casaccia, Unità Tecnica AGRI-ECO (Gestione sostenibile degli agro-ecosistemi), Roma, Italy

Francesca Lecce

ENEA C.R. Casaccia, Unità Tecnica AGRI-ECO (Gestione sostenibile degli agro-ecosistemi), Roma, Italy

Leonardo Latella

Museo Civico di Storia Naturale di Verona, Verona, Italy

KEYWORDS: BIOLOGICAL INVASION, DIKEROGAMMARUS VILLOSUS, LAKE GARDA

The “killer shrimp” Dikerogammarus villosus is an amphipod crustacean native to the Ponto-Caspian region, which was observed for the first time in Lake Garda and in the nearby watercourses during the 2003. Findings of D. villosus in Tuscany (Central Italy) in 2008 demonstrate that this invader has quickly spread throughout Italy, becoming a serious threat for the survival of indigenous species which share similar microhabitats. Indeed, native Echinogammarus stammeri was segregated from the littoral zone of Lake Garda to higher depths due to competition, especially in the lower basin but also likely in the northern. Ten years after the first record and monitoring, we have checked the distribution of D. villosus and E. stammeri, to verify the evolution of the invasion. A quantitative study was carried out from June to September 2013, in seven sampling sites placed both in the southern and sorthern basin, at maximum depth of 1,5 m, where densities of D. villosus and E. stammeri (ind m-2) was investigated and quantitative comparisons with previous data were done. Finally, a sampling campaign was conducted in sublittoral and profundal environments (100 m maximum depth) at stations located in the southern and eastern side of the lake and qualitative confrontations were performed.The “killer shrimp” Dikerogammarus villosus is an amphipod crustacean native to the Ponto-Caspian region, which was observed for the first time in Lake Garda and in the nearby watercourses during the 2003. Findings ofD. villosus in Tuscany (Central Italy) in 2008 demonstrate that this invader has quickly spread throughout Italy, becoming a serious threat for the survival of indigenous species which share similar microhabitats. Indeed, native Echinogammarus stammeri was segregated from the littoral zone of Lake Garda to higher depths due to competition, especially in the lower basin but also likely in the northern. Ten years after the first record and monitoring, we have checked the distribution of D. villosus and E. stammeri, to verify the evolution of the invasion. A quantitative study was carried out from June to September 2013, in seven sampling sites placed both in the southern and sorthern basin, at maximum depth of 1,5 m, where densities of D. villosus and E. stammeri (ind m-2) was investigated and quantitative comparisons with previous data were done. Finally, a sampling campaign was conducted in sublittoral and profundal environments (100 m maximum depth) at stations located in the southern and eastern side of the lake and qualitative confrontations were performed.

PRESENTATION TYPE: POSTER

MS01-06
Phytoplankton dynamics

CHANGES OF THE LAKE BLED TROPHIC CONDITION DURING THE LAST 20 YEARS

Špela Remec Rekar
Slovenian Environmental Agency, Slovenia
Tina Eleršek
National Institute of Biology, Slovenia

KEYWORDS: PHYTOPLANKTON, BIOLOGICAL METHODS, EUTROPHICATION CONTROL

In accordance with the Water Framework Directive (Directive 2000/60/EC) and on the bases of the national water quality monitorong data, the Lake Bled trophic state was determined with the new Ecological status assessment system for lakes using phytoplankton in Slovenia. Represented are dynamics of different taxonomic groups of phytoplankton in the Lake Bled for the period 1994-2013, with the main stress on cyanobacteria (Cyanophyta) which was the dominat phytoplankton group in the Lake Bled before and also long years after the introduction of three eutrophication control measures at Bled. Presented are also the mycrocystine concentations isolated from the lake phytoplankton material, which contained more than 90% of Planktothrix rubescens biomass.

PRESENTATION TYPE: POSTER

IDENTIFYING MORPHO-FUNCTIONAL GROUPS FOR LAKE GENEVA - A KEY FIRST STEP TO MODEL PHYTOPLANKTON DYNAMIC SUCCESSION UNDER A CHANGING CLIMATE

Nicole Gallina
University of Geneva, Switzerland
Orlane Anneville
French National Institute for Agricultural Research (INRA), UMR 042 CARRTEL, France
Deniz Özkundakci
Leibniz Institute of Freshwater Ecology and Inland Fisheries (IGB), Berlin, Germany
David Hamilton
Department of Biological Sciences, University of Waikato, New Zealand

KEYWORDS: NUMERICAL MODELLING, PHYTOPLANKTON, CLIMATE CHANGE

Predicting the stochastic pattern of the phytoplankton community remains a challenging task when modeling lake ecosystems due to their extremely diverse behavior. Grouping phytoplankton into functional groups not only has the advantage to better represent their ecological behavior and succession, but moreover reduces the number of assessing entities allowing a more representative overview of the entire community. This study represents a first dynamic modeling approach of functional groups of the phytoplankton community in deep, mesotrophic Lake Geneva using the DYRESM for hydrodynamic processes, further coupled to CAEDYM for investigations involving the biological and chemical processes. Lake Geneva plays an important environmental role as it is the largest lake in central Europe in the peri-Alpine region, representing an essential resource for drinking water supply. It is hypothesized that climate change will affect the phenology of the phytoplankton communities and promote an increase in biomass. Furthermore, the emergence of potentially toxic cyanobacteria is forecasted, with potential to contribute to considerable deterioration of water quality. Our aim was to produce an accurate predictive management tool for Lake Geneva and to assess the ecological state of the lake under present as well as under future climatic conditions, with focus on the phytoplankton community and its successional sequence. For this purpose, Morpho-functional groups of phytoplankton specific for Lake Geneva were identified using a novel method. Morpho-functional groups appear to be an appropriate level of state variable representation in this type of modeling approach to enable valuable insights into emerging environmental drivers such as climate change.

PRESENTATION TYPE: ORAL

IS MINIMUM TEMPERATURE THE MAIN DRIVING FACTOR OF CLIMATE-INDUCED ON PHYTOPLANKTON DYNAMICS?

Xiaofeng Cao
Peking University, China
Wang Jie
Peking University, China
Huang Yi
Peking University, China

KEYWORDS: CLIMATE CHANGE, PHYTOPLANKTON DYNAMICS, MINIMUM TEMPERATURE

Phytoplankton are the primary energy source for aquatic ecosystems and also of global significance for climate regulation and biogeochemical cycling. A wide range of studies have shown links between fluctuations in climate and ecological processes that affect phytoplankton dynamics. Phytoplankton play a central role in trophic transfers through aquatic food webs, it is especially important to understand how climate change affects links between physical processes and plankton dynamics in lake ecosystems. The purpose of this paper is to present the current understanding of climate-induced on phytoplankton dynamics by satellite remote sensing, which can provide a valuable tool to explore phytoplankton bloom timing, peak and magnitude at a basin scale. Landsat TM images from 1984-2013 are used to detect the phytoplankton dynamics, and the structural equation model was carried out to compare the effects of climate change and nutrient concentration on phytoplankton dynamics in lake Dianchi. The results illustrated that the minimum temperature was the probable driving factor to affect phytoplankton dynamics, which was significantly correlated with the spring bloom and the seasonal growth patterns of phytoplankton. Furthermore, climate change may result in more impacts on the phytoplankton dynamics than the nutrient concentration.

PRESENTATION TYPE: ORAL

ASSEMBLAGE OF PHYTOPLANKTON STRUCTURE IN THE THREE GORGES RESERVOIR: EVIDENCE OF HYDRODYNAMIC CHANGING

Zhengyu Hu
Institute of Hydrobiology, University of Chinese Academy of Sciences, China
Binliang Wang
Institute of Hydrobiology, University of Chinese Academy of Sciences, China
Xi Wang
Institute of Hydrobiology, University of Chinese Academy of Sciences, China
Yonghong Bi
Institute of Hydrobiology, University of Chinese Academy of Sciences, China

KEYWORDS: PHYTOPLANKTON, SEASONAL SUCCESSION, RESERVOIR

Impoundment of Three Gorges Reservoir (TGR) drastically reduced the velocity of water, and great changes happened in the hydraulic conditions of the mainstream and influents. Spatio-temporal differences in the community structure of phytoplankton were determined from spring to winter in this survey. In main channel, the number of taxa was 26, 22, 32 and 32 in four seasons, respectively. In five tributaries, 35, 33, 31 and 41 genera were separately observed in four seasons. Diversity index and evenness were in the same degree according to the evaluation standard. In spring, summer and autumn, diatom and cyanobacteria blooms frequently happened in different tributaries, of which the dominant species was Raphidiopsis curvata, Aphanizomenon flos-aquae, Cyclotella sp. and Coelastrum sp. respectively. Totally vertical mixing in the main channel leaded to the homogeneous distribution of biomass, but alternatively the tardy velocity accompanied by high temperature resulted in the evident stratification in biomass of phytoplankton in tributaries. This phenomenon was also further demonstrated by Morisita's index (Iδ). Throughout the cluster analysis, different groups were constructed between mainstream and tributaries, which further suggested the discrepancy in phytoplankton community structure and biomass. Overall, seasonal environmental factors (temperature, light and et al.) and hydraulic changes (advective velocity, thermal stratification and et al.) from the anthropogenic managements in reservoirs gave remarkable impacts on the assemblage of phytoplankton.

PRESENTATION TYPE: POSTER

SPATIOTEMPORAL DYNAMICS OF PHYTOPLANKTON COMMUNITY AND ITS RELATIONSHIP WITH ENVIRONMENTAL VARIABLES IN CHILIKA LAKE, INDIA

Suchismita Srichandan
Wetland Research and Training Centre, Chilika Development Authority, Barkul, Balugaon, Khurda, Odisha, India
Punyasloke Bhadury
Department of Biological Sciences, Indian Institute of Science Education and Research-Kolkata, Mohanpur Campus, Mohanpur, India
Saroj K. Barik
Wetland Research and Training Centre, Chilika Development Authority, Barkul, Balugaon, Khurda, Odisha, India
Pradipta R. Muduli
Wetland Research and Training Centre, Chilika Development Authority, Barkul, Balugaon, Khurda, Odisha, India
Ajit K. Pattnaik
Wetland Research and Training Centre, Chilika Development Authority, Barkul, Balugaon, Khurda, Odisha, India
Gurdeep Rastogi
Wetland Research and Training Centre, Chilika Development Authority, Barkul, Balugaon, Khurda, Odisha, India

KEYWORDS: PHYTOPLANKTON, , CHILIKA, , ESTUARY

The Chilika Lake is a brackish shallow estuary and a designated Ramsar site in the East coast of India. We investigated the spatial and temporal dynamics of phytoplankton communities through monthly campaign between July 2011-June 2012 in relation to physical (temperature, salinity, pH, dissolved oxygen) and chemical (nutrients) variables of water column. Chilika Lake due to its unique salinity gradient covering freshwater, brackish, and marine conditions supported a high diversity of Phytoplankton. A total of 259 species of phytoplankton, mostly dominated by diatoms (138 species) followed by dinoflagellates (38 species), green algae (32 species), cyanobacteria (29 species), euglenoids (18 species), and silicoflagellates (4 species) were recorded during study period. Irrespective of the sampling season, diatoms were the most dominant member in phytoplankton communities. Different ecological sectors of the lagoon (except the northern sector) were dominated by diatoms while the northern sector due it its freshwater regime supported large population of euglenoids. Phytoplankton density showed a marked variation ranging from 12 cells/L in Northern Sector to 43512 cells/L in Central Sector. The five most abundant taxa encountered in the lagoon during survey period were Pleurosigma normanii (9.5-75.7%), Dictyocha sp.(14-56.6%),Trachelomonas sp.(29.2-56.7%), Gymnodinium sp. (33.95%), and Eudorina sp. (29.68%). We observed a strong positive correlation between phytoplankton density and salinity during summer season (p

PRESENTATION TYPE: ORAL

TEMPORAL CHANGES ON THE PHYTOPLANKTON DIVERSITY AND ITS IMPLICATION IN FISHERIES MANAGEMENT OF PHEWA LAKE, POKHARA VALLEY, NEPAL

Md Akbal Husen
Nepal Agricultural Research Council, Nepal

KEYWORDS: PHEWA LAKE, PHYTOPLANKTON, MICROCYSTIS AERUGINOSA

Increase in eutrophication of Phewa Lake has been experienced due to increase in intensive agriculture and urbanisation in its watershed. Study on the changes in phytoplankton community is one of the key indicators for understanding the rate of eutrophication. Time series data on phytoplankton community have been collected from year 1993 to 2010 to know the shifts in diversity, quality and quantity of phytoplankton from phyla to species level. There was decreasing trends of phyla and species of phytoplankton where as the density (cells/mL) was in increasing trends in Phewa lake. The phyla Cyanophyceae was increased where as Chlorophyceae, Bacillariophyceae and Dinophyceae were decreased in total phytoplanktonic organism of water of Phewa Lake in the year 2010 as compared to the year 1993. The annual mean density of phytoplankton was increased by more than two times in the year 2010 as compared to the year 1993. This indicated that shifted in the diversity, quality and quantity of phytoplankton phyla to species level due to cultural eutrophication in this Lake. Annual mean density of Microcystis aeruginosa was increased significantly in water of Phewa Lake in the year 2010 as compared to the year 1993 which indicated eutrophication impacts in this lake. The possible impact of these changes in phytoplankton community on fisheries of Phewa Lake and possible measures to combat eutrophication in this magnificent lake has been discussed.

PRESENTATION TYPE: ORAL

MS01-07
Euttophication problems

NUTRIENT LEVELS ASSOCIATED WITH ECOLOGICAL THRESHOLDS OF IMPAIRMENT IN RESERVOIRS OF PUERTO RICO

Gustavo Martinez
University of Puerto Rico, Puerto Rico

KEYWORDS: TROPICAL RESERVOIRS, NUTRIENT CRITERIA, EUTROPHUCATION

Six reservoirs of Puerto Rico of varying trophic status were monitored during a three year period to establish relationships between nutrients (N and P) and different ecological thresholds of impairment. The objective was to develop numeric nutrient criteria linked to a biological response variable. The conceptual basis was initially construct on the USEPA trophic status assessment framework that uses 30 µg/L for Chl a to define the boundary between eutrophic – hypereutrophic conditions. A least squares method of change-point analysis was used to determine total nitrogen and total phosphorus concentrations associated with our impairment threshold (i.e., 27 µg/L Chl-a). Results were: 0.032 mg/L for TP and 0.53 mg/L for TN. Hypolimnion anoxia is a naturally occurring phenomenon in tropical reservoirs and cannot be used to establish impairment. However, differences in the dissolved oxygen profiles of the different reservoirs were used to strengthen the criteria. Plots of the oxycline depth vs. either total phosphorus or chlorophyll resulted in two clearly distinguishable populations that could be used to define impairment. Other meaningful relationships were those between Secchi depth and total phosphorus or chlorophyll, and between the anoxic (

PRESENTATION TYPE: POSTER

ADAPTIVE MANAGEMENT OF OVERGROWN SUBMERGED MACROPHYTES IN THE SOUTH BASIN OF LAKE BIWA

Eiso Inoue
Lake Biwa Environmental Research Institute, Shiga Prefectural Government, Japan
Takamaru Nagata
Lake Biwa Environmental Research Institute, Shiga Prefectural Government, Japan
Kanako Ishikawa
Lake Biwa Environmental Research Institute, Shiga Prefectural Government, Japan
Hiroki Haga
Lake Biwa Museum, Shiga Prefectural Government, Japan
Machiko Nishino
Biwako Seikei Sport College, Japan

KEYWORDS: LAKE BIWA, SUBMERGED MACROPHYTES, ADAPTIVE MANAGEMENT OF ECOSYSTEMS

Lake Biwa, the largest lake in Japan, is classified into two basins: the large (618 km2) and deep (mean 43 m) north basin, and the small (52 km2) and shallow (mean 4 m) south basin. In the south basin, bivalves, especially an endemic freshwater clam, were abundant before the 1960s, but the catch decreased rapidly in recent decades. A possible reason is deterioration of the bottom habitat caused by an explosive increase of submerged macrophytes after a severe drought in 1994. Because the overgrown macrophytes also cause nuisances in navigation and fishery, Shiga Prefectural Government has been harvesting submerged macrophytes adaptively following the long-term plan called “Mother Lake 21 Plan” to recover the ecosystem and solve such problems. The harvested macrophytes are used for compost as a series of the social works.Our recent monitoring revealed that submerged macrophytes were overgrown in summer 2011, but rapidly decreased in 2012 due to turbid water mainly caused by massive occurrence of phytoplankton. After the suspension of harvesting in summer 2013, macrophytes increased to the amount of 70% in summer 2011, but the dominant species changed.The monitoring of submerged macrophytes provides fundamental information for the management plan, but the methods to maintain moderate growth are not established due to scientific uncertainties in the prediction. However, if harvesting is needed, we found that the mean height of macrophyte communities decreased in winter by one-third, and harvesting efforts are needed in summer.The amounts of submerged macrophytes showed a significant negative correlation with the densities of total benthic macroinvertebrates in summer, which suggests that macrophyte harvesting is an effective method to improve the bottom habitat. However, aquatic oligochaetes were dominant among the benthic macroinvertebrates and bibalves were rare, which implies that the bottom substrate should also be improved to recover the ecosystem and production in the south basin.

PRESENTATION TYPE: ORAL

A PROPOSAL TO MAINTAIN THE LAKE BIWA CONDITIONS HEALTHY

Akihiko Oyama
Shiga Prefecture, Japan

KEYWORDS: LAKE BIWA, FISHERIES PRODUCTS, OLIGOTROPHICATION

From ancient times, Lake Biwa has brought bountiful blessings to the people living around it. One of them is fisheries' products. In Lake Biwa, the amount of fish catch had increased from about 2,000 tons in 1954 to over 3,000 tons in 1969 peaking at 3,702 tons in 1983, yet it has decreased to 1,405 tons in 2009. The amount of total phosphorus (TP) load to Lake Biwa has drastically decreased since 1980; 1.2 tons/day in 1985 to 0.6 tons/day in 2010. Along with the decrease of TP loading, the number of regions where red tides were found in Lake Biwa has decreased from 21 regions in 1985 to 5 regions in 2009. Although the reduction measure of TP, which is essential for living things, successfully restricted the occurrence of red tides, it might have decreased the biomass of fish. In the Seto Inland Sea, a typical enclosed coastal sea in Japan, a similar situation was observed and it is reported that “oligotrophication” is the major cause of the decrease in the fish catch. In Lake Biwa, it is concerned that the effort of reduction measure of total nitrogen (TN) and TP will be continued. We propose that wealthiness and healthiness should be measured by an index that reflects the total ecosystem including living things not by the water quality represented by the TN and TP. It can be said that coexistence of humans and nature where we can access fishery products may indicate wealthy and healthy conditions. Based on this concept – ecosystem-based management -, the environmental standards for enclosed coastal seas in Japan were partially revised. We must discuss what to do in order to make sure that Lake Biwa continues to bring bountiful blessings to people.

PRESENTATION TYPE: ORAL

SEDIMENTARY PHOSPHORUS RELEASE IN A SHALLOW, COASTAL LAKE, SOUTH ISLAND, NEW ZEALAND

Sean Waters
University of Canterbury, New Zealand
Jenny Webster-Brown
University of Canterbury, New Zealand
Ian Hawes
University of Canterbury, New Zealand

KEYWORDS: CYANOBACTERIA, SALINITY, MACROPHYTES

Te Roto o Wairewa/Lake Forsyth is a small, shallow, coastal lake on the east coast of the South Island of New Zealand. The lake has no natural outlet but is intermittently opened to the sea to control flooding. Blooms of nitrogen-fixing cyanobacteria occur regularly in summer, and it is suspected that dissolved phosphorous (P) availability may be a key factor in bloom development. External loads of P, delivered mainly in particulate form during flood events in the lake catchment, cannot explain the observed short-term fluctuations in dissolved P concentrations in the lake. However, the release of P sequestered in lake sediments may both explain these fluctuations and, under the right conditions, trigger and sustain rapid increases in primary productivity leading to bloom formation. An understanding of the mechanisms that release dissolved P into the water column, and the factors that favour such mechanisms, is therefore critical to the formulation of good management responses to eutrophication of this lake. Sequential extraction of lake sediments, indicates that there is a large reservoir of exchangeable and oxide-adsorbed P available for release into the water column. The analysis of sediment porewater, confirms the mobility of P in the upper sediment profile. Release experiments, combined with in-lake monitoring data, have quantified the effect of salinity changes associated with lake openings, high pH associated with increasing photosynthesis, and low dissolved oxygen associated with changes in macrophyte density, on sedimentary P release. A combination of these factors may be important in triggering and perpetuating bloom formation

PRESENTATION TYPE: ORAL

SOUTH AFRICA'S EUTROPHICATION NEMESIS: THE MILLSTONE OF THE VERY WICKED HARTBEESPOORT DAM

Bill Harding
International Environmental Management Services Ltd
Rob Hart
University of KwaZulu-Natal, South Africa
Jeffery A. Thornton
International Environmental Management Services Ltd

KEYWORDS: WICKED PROBLEMS, EUTROPHICATION, SOUTH AFRICA, HARTBEESPOORT DAM, RESERVOIR MANAGEMENT

South Africa's Hartbeespoort Dam, a reservoir located north of the economic centre of Johannesburg, was a focus of concentrated limnological science during the 1970s and 80s. Between then and now it has progressed from being a notable and famous locus for both eutrophication and cyanobacterial research, to becoming notorious for ignoring reservoir management best practice and falling prey to scientifically invalid solutions, as well as 'hobbyist' approaches to management, all the while allowing conditions in the impoundment to worsen. The reservoir receives the bulk of its nutrient loading as wastewater effluents from, inter alia, the city of Johannesburg, along with polluted urban runoff and other contributions. Such inputs continue to increase and, despite relatively high levels of nutrient removal at the largest sewage treatment works, vastly exceed the reservoir's assimilative capacity. This obvious locus of management attention notwithstanding, efforts to improve water quality have recently focused on 'in-lake' solutions - including top-down biomanipulation - despite scientific evidence disproving its validity for South African reservoirs. Substantiated criticism of these remediation efforts has achieved little, apart from attempts to discredit the source of the critique, solicit "sweetheart peer review" and make unsubstantiated claims of 'internationally recognized' success. The nett outcome is that little, if anything, has been achieved. Despite several years of attentive focus/publicity and major financial expenditure, not a single scientific paper has emerged, despite the achievements claimed. Excessive financial expenditure and the lack of progress to-date have seriously compromised the allocation of funds for relevant reservoir management interventions. This presentation analyses Hartbeespoort Dam as a case study of eutrophication as a 'Wicked Problem', highlighting where this phenomenon has, and continues to, confound attempts at successful amelioration.

PRESENTATION TYPE: ORAL

NITROGEN DYNAMICS IN A MEROMICTIC SUBALPINE LAKE: FROM WATERSHED TO IN LAKE PROCESSES

Daniele Nizzoli
University of Parma, Department of Life Sciences, Italy
Marco Bartoli
University of Parma, Department of Life Sciences, Italy
Roberta Azzoni
University of Parma, Department of Life Sciences, Italy
Giuseppe Castaldellli
University of Ferrara, Department of Life Sciences and Biotechnology, Italy
Daniele Longhi
University of Parma, Department of Life Sciences, Italy
Pierluigi Viaroli
University of Parma, Department of Life Sciences, Italy

KEYWORDS: MEROMICTIC LAKES, NITROGEN CYCLE, DENITRIFICATION

Inputs of anthropogenic reactive nitrogen (Nr) to watersheds in excess of their processing and storage capacity, results in Nr export causing a cascade of detrimental effects in receiving aquatic ecosystems. Mass balance studies have demonstrated that lakes and reservoirs are landscape components that both process and sequester Nr in the terrestrial to marine aquatic continuum. However, little is known about the relative importance of different Nr retention/elimination mechanisms or factors that regulate these mechanisms, particularly in deep meromictic lakes. Prolonged stratification, persistent anoxia and the establishment of reducing conditions may profoundly influence the fate of Nr loads in these lakes. In this study, we analysed the spatial and temporal variability of microbial N-transformations in a sub-alpine meromictic lake (Lake Idro, Italy), in order to elucidate the role of denitrification as a N-sink for net anthropogenic nitrogen inputs (NANI) to the watershed. Lake Idro is highly productive lake that undergoes stable, and persistent thermal and chemical stratification, resulting in the accumulation of reducing compounds and dissolved nutrients in the monimolimnion (~50% of lake volume). Denitrification dominated microbial N-transformations in the oxic to anoxic transition zones of the epilimnion. In contrast, the monimolimnion was a source of regenerated ammonium and had a low capacity to buffer the incoming nitrogen load. NANI was relatively low, and dominated by atmospheric deposition and feed and food N-imports. Overall, the watershed had a relatively low capacity to retain/eliminate Nr inputs and annual Nr export accounted for close to 50% of the NANI.

PRESENTATION TYPE: ORAL

IMPROVEMENT OF HYPOXIC ENVIRONMENT BY A SUPPLY OF HIGH-DISSOLVED-OXYGEN WATER INTO A BOTTOM LAYER AT A RIVER MOUTH OF A SHALLOW EUTROPHIC LAKE

Atsushi Hayakawa
Department of Biological Environment, Faculty of Bioresource Science, Akita Prefectural University, Japan
Noboru Katano
Department of Biological Environment, Faculty of Bioresource Science, Akita Prefectural University, Japan
Ryoko Tsushima
Department of Biological Environment, Faculty of Bioresource Science, Akita Prefectural University, Japan
Hiroaki Sonobe
Department of Biological Environment, Faculty of Bioresource Science, Akita Prefectural University, Japan
Yuichi Ishikawa
Department of Biological Environment, Faculty of Bioresource Science, Akita Prefectural University, Japan
Shin Hidaka
Department of Biological Environment, Faculty of Bioresource Science, Akita Prefectural University, Japan

KEYWORDS: HIGH-DISSOLVED-OXYGEN WATER, PHOSPHORUS RELEASE, BLUE-GREEN ALGAE

Hypoxic bottom water in lakes and rivers poses a phosphorus release from sediments, which can cause aquatic-ecosystem degradation such as algal bloom. To supply high-dissolved-oxygen water into a bottom layer may improve such degraded conditions. Lake Hachiro, Akita prefecture, Japan is a shallow eutrophic lake and its water quality improvement is urgent issue. The objectives of this study was to evaluate the effect of a supply of high-dissolved-oxygen water on the qualities of river water and riverbed sediments at the river mouth of Lake Hachiro. River water was sampled from the surface and bottom both at the river mouths of the experimental river in which the high-dissolved-oxygen water supply system was installed and the control river that has similar water quality as the experimental one. Riverbed sediments were collected and the sediment incubation was conducted to evaluate the effect of temperature and oxic or hypoxic conditions on nutrients dynamics in the water. The supply of high-dissolved-oxygen water increased DO in the bottom water in the experimental river, while in the control river, DO concentration in the bottom water decreased while that in surface water became supersaturated by algal photosynthesis. In both of the incubation and the field experiments, high concentrations of PO4 and Fe were observed in a hypoxic with over 25°C condition. This study suggested that the supply of high-dissolved-oxygen water improved hypoxic environment in the bottom water and controlled an iron-related phosphate release from the riverbed sediments, which would be expected to decrease a bloom of blue-green algae.

PRESENTATION TYPE: POSTER

PERIL OF EUTROPHICATION AND SPATIO-TEMPORAL DYNAMICS OF LAKE KALAR KAHAR , POTOHAR PLEATUE, SALT RANGE, PAKISTAN

Khalida Khan
University of the Punjab, Lahore, Pakistan
Rabia Faridi
University of the Punjab, CEMB, Lahore, Pakistan
Mohammad Ikram
Center for Integrated Mountain Research (CIMR), University of the Punjab, Lahore, Pakistan
Mohammad Naeem
Pakistan Council of Scientific and Industrial Research (PCSIR), Lahore, Punjab-Pakistan

KEYWORDS: EUTROPHICATION, SPATIO-TEMPORAL ANALYSIS , WATER CONTAMINATION, DEGRADATION OF LAKE KALAR KAHAR

Lake Kallar Kahar with an altitude of about 1500□ above msl is located in the southern hilly area of Potohar Plateau in the Salt Range. It is a shallow lake, thus natural vegetation can be seen in the middle as well as all around the lake. Because of the abode of a number of migratory birds, fishing and boating activity lake has become a prominent tourist spot and a distinctive wetland. Though, lake is facing environmental degradation due to the rise of agricultural practices to supply food for rapidly growing population, un planned tourism and hunting practices are some of the probable pressures towards conservation. Identification of drivers liable for deterioration in water quality, biodiversity and increased anthropogenic pressures in lake conservation perspective is highlighted. Various water samples were gathered from the lake and recharging springs from April 2008 to July 20I3 and examined according to the World Health Organization guidelines. Study is focused on the spatio□temporal dynamics of eutrophication of the lake water quality, biodiversity as well as the potential sources of the diverse turbidity in Lake Kallar Kahar. The eutrophication of the lake is realized to be higher than stated in prior studies, signifying an increasing deterioration of quality of the lake water both physical and biological because of the incoming untreated sewage water and from the food court situated in the south and surface water runoff produced from inhabited area in the north and western periphery of the lake. Cumulative tendency of the contamination, the chemical quality of the lake water is quite alarming, it differs significantly over the years. Likewise, the turbidity is subjugated by suspended sediment and dissolved coloured material in the northern part of the lake. Pollution in the lake water is a big menace for the migratory birds and reduced storage capacity due to sedimentation. The outcomes will provide good basis for further investigation of the current loading magnitude of both nutrients and sediments, in order to facilitate sustainable management to ensure community integrity and functions of the lake ecosystem.

PRESENTATION TYPE: ORAL

ECOLOGICAL INVESTIGATION OF THE MACROPHYTES OF BANAS RIVER CORRIDOR, BALARAM SANCTUARY, N. GUJARAT

Yogesh B. Dabgar
Hemchadracharya North Gujarat University, Patan, Gujarat, India

KEYWORDS: MACROPHYTES, BANAS RIVER, PHYSICO-CHEMICAL CHARACTER

Macrophytes are plants whose seeds germinate in either the water phase or the substrate of a body of water which must spend part of their life cycle in water. This is a very broad term to include the submerged, emergent, free floating and free floating leaved hydrophytes and semi-aquatic plants. They play role as physical filters, nutrient sinks and stabilizing agents. They provide valuable habitat for aquatic fauna, which include provisions of shelter, egg laying sites, food source for herbivores etc. They play an important role in maintaining the riverine ecosystem. Thus understanding about the occurrence and abundance of aquatic and semi-aquatic macrophytes in riverine vegetation, which would help to gain more knowledge on tropical aquatic system. Applying this concept of macrophytes as many as 78 species of macrophytes could be identified from Banas river corridor. Of the 78 species, 2 species were pteridophytes, one species of algae and the remaining 75 species were angiosperms. Cyperaceae is the most dominant family followed by Asteraceae and Polygonaceae. Four sampling sites viz. (i) Balaram temple site (ii) Dharmata temple site (iii) site behind the Balaram palace and (iv) Hathidra village site were selected for the study of ecological investigation. Water and soil samples at monthly interval collected from each site and analysed for temperature, pH, total solids, dissolved oxygen, Chloride and elemental composition such as N, P and K. From amongst the studied sites Dharmata temple and Hathidra village sites were found to be more polluted than the others. Balaram temple site was treated as reference site while site behind the Balaram palace was confluence of Banas river and the polluted sites were having more accumulation of nutrients (N and P). Phytoplankton population were maximum at the unpolluted site while the macrophytic vegetation were abundantly found at the polluted site.

PRESENTATION TYPE: POSTER

WHY CAN'T WE SOLVE EUTROPHICATION?

Jeffrey Thornton
International Environmental Management Services Ltd
Thomas M Slawski
Southeastern Fox River Partnership, USA
Hebin Lin
International Lake Environment Committee Foundation

KEYWORDS: EUTROPHICATION, NUTRIENT ENRICHMENT, WATER QUALITY

This presentation presents the many aspects of nutrient enrichment of lakes and reservoirs. In particular, the presentation examines the question of whether nutrient enrichment is a problem; whether it can be "solved"; and whether it is a concern that human communities need to be concerned about. Using case studies from around the world, the paper examines the characteristics of a "wicked" problem, or a problem wherein the solution of one symptom leads to the revelation of another symptom. This presentation introduces the concept of the "wicked" problem ad shows the connection between such problems and the problem of nutrient enrichment. Through this introductory paper, the subsequent contributions to this session will be placed in context, and the scene will be set for an open discussion which will conclude this special session. It was not long ago that eutrophication was declared to be "yesterday's news", "solved", a "non-problem". However, as the world faces an ever changing climate and as "new" elements of the consequences of the presence of excessive nutrients in lakes and reservoirs manifest themselves, this paper suggests that the problem of eutrophication, far from being resolved, remains a major threat to the integrity of the world's feshwater ecosystem.

PRESENTATION TYPE: ORAL

FEATURES OF THE EUTROPHICATION OF LARGEST FRESHWATER LAKES IN THE WORLD

Anna Izmailova
Institute of Limnology, Russian Academy of Sciences (RAS), Russia
Rumyantsev Vladislav
Institute of Limnology, Russian Academy of Sciences (RAS), Russia

KEYWORDS: EUTROPHICATION, WATER QUALITY, LAKES WATER

At present the majority of the world's lakes are affected by anthropogenic eutrophication. Under natural conditions about 96% of waters contained in 57 of the 93 world's largest freshwater lakes (with area >1000 km2) were oligotrophic. Due to human impact, by the beginning of the 21st century, only 41 lakes retained their oligotrophic status throughout their water area and 13 more lakes retained it in the deep water zone. The proportion of high trophic fresh waters in the largest lakes reached 3.2%. Dynamics of changes in the trophic level of largest lakes for 1950-2010 is contained in the report. The most rapid anthropogenic eutrophication processes have taken place in shallow water bodies in both the tropical and temperate latitudinal zones. In tropical lakes they are intensified by consistently high temperatures, which accelerate biological processes. Eutrophication processes in deep lakes containing huge masses of water are mostly local and affect the shallow zone. Since the bulk of fresh water is concentrated in the deepest lakes (about 70% of all fresh lake water is concentrated in the 14 largest lakes), the total amount of oligotrophic waters remains high. For 60 years the volume of oligotrophic waters in the largest lakes decreased by 3.5%. It has increased over the past decade in comparison with the 1960s–1980s due to the improvement of the state of the American Great Lakes and the largest lakes in Sweden. The largest lakes are the most important reserve of surface fresh waters, since their resistance to pollution is much higher than that of small ones. It's necessary the particular attention to the maintenance of their ecological status.

PRESENTATION TYPE: ORAL

BIOMANIPULATION AS A MANAGEMENT TOOL FOR THE WICKED EUTROPHICATION PROBLEM IN SOUTH AFRICAN RESERVOIRS – A SYNTHETIC CRITIQUE

Rob Hart
School of Life Sciences, University of KwaZulu-Natal, South Africa

KEYWORDS: BIOMANIPULATION, WARM WATER RESERVOIRS, FOODWEB STRUCTURE

With increasing urbanization and development grossly overloading structurally collapsing wastewater treatment facilities, eutrophication is an uncontrollably escalating problem in river reservoirs, a primary potable water source for South Africa. With 'prevention' of this problem becoming increasingly intractable, interest in 'curative' in-lake options – notably biomanipulation – grows. Drawing on experience in north temperate natural lakes, the targeted removal of 'coarse' fish is touted as an effective mitigation tool in affected reservoirs, despite obvious intrinsic constraints. Ecological evidence from local reservoirs is synthesized to show that both 'top-down' and 'bottom-up' impacts of fish are marginal, and render biomanipulation ineffective as an ameliorative tool regionally, with wider geographical relevance. Predator-prey couplings that underpin 'top-down' biomanipulation are inoperative. Firstly, direct grazing of problem planktonic autotrophs by zooplankton is slight, with problem bloom-forming taxa (predominantly cyanophytes – Microcystis, commonly with Ceratium) being physically too large for zooplankton ingestion, apart from their nutrition inferiority (if not toxicity). Secondly, predation on zooplankton by fish is negligible, as evidenced by: a) sustained high zooplankton biomass levels, and b) its common domination by large-bodied taxa; c) high zooplankton-phytoplankton biomass ratios; d) fish dietary records; e) direct stable isotope analysis. In terms of 'bottom-up' biomanipulation, fish impacts are equally minor. Nutrient pools in fish biomass, and recycled internally through excretion are both slight relative to persistently high external phosphorus loading rates. Internal nutrient loading by fish bioturbation is constrained spatially and/or temporally by sediment inaccessibility associated with hypoxic/anoxic conditions resulting from morphometric and bathymetric profiles, and seasonal stratification/mixing regimes of affected reservoirs.

PRESENTATION TYPE: ORAL

AQUATIC VEGETATION OF LAKE PIEDILUCO

Fedra Charavgis
Regional Environmental Protection Agency (ARPA Umbria), Italy
Elisabetta Ciccarelli
Regional Environmental Protection Agency (ARPA Umbria), Italy
Tisza Lanconi
Regional Environmental Protection Agency (ARPA Umbria), Italy
Barbara Todini
Regional Environmental Protection Agency (ARPA Umbria), Italy

KEYWORDS: MACROPHYTE, MEDITERRANEAN LAKES, SHALLOW LAKES

Piediluco is a natural lake located in Central Italy, with a maximum depth of 19,20 m and a surface area of 1.52 sq km. Local Environmental Protection Agency carried out, in June-July 2010, the macrophytes monitoring activities, in order to validate the applicability of the national sampling method (APAT, 2007) in the Mediterranean calcareous shallow lakes and to collect data for ecological status evaluation according to WFD 2000/60/EC. Macrophytes survey was performed in 5 sites, selected on the basis of aquatic vegetation distribution, geological features, variations in shore morphology within two water bodies. The first, Piediluco 1, is impacted by hydropower regulation and shows a frequent water shuffle, short renewal times and lack of stratification. The second, Piediluco 2, is an eutrophic water body, with a stable stratification and anoxic sediments. Samplings were carried out over 21 representative transects and the frequency of Hydrophytes, Pteridophytes, Bryophytes and Macroalgae was recorded. The 17 taxa detected don't have the same frequency and distribution in the two water bodies. Piediluco 1 is characterized by a greater abundance, depth of growth and biodiversity. Analysis of aquatic vegetation data showed the dominance and widespread availability of rooted hydrophytes with floating leaves (Nuphar luteum), the presence of filamentous algae (Spirogyra, Cladophora, Vaucheria) and of bryophyte Fontinalis antipyretica. Submerged hydrophytes don't represent a significant macrophyte share and various species widespread in the past (Potamogeton lucens, P. natans, P. perfoliatus, Myriophyllum alterniflorum, M. spicatum) were not observed anymore. Elodea canadensis was the only exotic species found.

PRESENTATION TYPE: POSTER

ENVIRONMENTAL CONDITION AND EUTROPHICATION STATUS OF RAWAPENING LAKE OF CENTRAL JAVA, INDONESIA

Sulastri
Research Center for Limnology-LIPI, Cibinong, Indonesia
Cynthia Henny
Research Center for Limnology-LIPI, Cibinong, Indonesia
Unggul
Research Center for Limnology-LIPI, Cibinong, Indonesia

KEYWORDS: RAWAPENING LAKE, EUTROPHICATION, WATER QUALITY

Rawapening is one of 15 Indonesian lakes identified as National Priority lakes. Naturally Rawapening Lake is a Tectono – Volcanic type of lake with surface area of 1,650 – 2,770 ha. Water inflows to the lake are from the springs on the sides of the mountains and from eight tributaries. The problem of Rawapening Lake is eutrophication indicated by invasive marophyte coverage of water hyacinth in the lake surface. The study was aimed to observe the current environmental condition and eutrophication status in Rawapening Lake. Sediment load, water quality, and nutrient concentration were measured in the tributaries of lake inflow, the lake water and the lake outflow of Tuntang River. The tributaries of lake inflow which receives waste waters from the human settlements contributes high sediment load to the lake (3.7 – 5.3million kg.year-1). Total sediment load into Rawapening Lake was around 10.42 million kg.year-1, while sediment load exit from the lake was 3.16 million kg.year-1. Total nitrogen (TN), nitrate, total phosphor (TP) and phosphate in the tributaries of lake inflow ranged from 1.003 to 3.509 mg.L-1; 0.755 to 3.177 mg.L-1; 0.136 from 0.220 mg.L-1 and 0.011 to 0.101 mg.L-1respectively, while in the lake outflow was 0.456; 0.375 mg-L; 0.082 mgL and 0.011 mg.L-1 respectively. In the lake waters DO fluctuated spatially and temporally, pH ranged from 6.95 to 8.5, water temperature was around 25.4-29.1oC and secchi depth was 40-90 cm. Average of TN, nitrate, TP, phosphate and chlorophyll-a ranged from 0.640 to 1.405 mg.L-1; 0.301 to 0.560 mg.L-1; 0.037 to 0.125 mg.L-1; 0.003 to 0.055 mg.L-1 and 7.445 to 29.632 2µg.L-1 respectively, and apparent massive water hyacinth coverage in the surface water indicates that Rawa Pening Lake in the eutrophic condition.

PRESENTATION TYPE: ORAL

N DYNAMICS IN AN HEAVY IMPACTED WATERSHED (OGLIO RIVER, NORTHERN ITALY): WHAT IS THE FATE OF EXCESS N?

E. Racchetti
Department of Life Sciences, University of Parma, Parma, Italy
E. Soana
Department of Life Sciences, University of Parma, Parma, Italy
C.A. Delconte
Institute of Geosciences and Earth Resources (IGG), CNR, U.O.S. Pavia, Pavia, Italy
E. Sacchi
Department of Earth and Environmental Sciences, University of Pavia, Pavia, Italy
A. Laini
Department of Life Sciences, University of Parma, Parma, Italy
D. Longhi
Department of Life Sciences, University of Parma, Parma, Italy
M. Bartoli
Department of Life Sciences, University of Parma, Parma, Italy
P. Viaroli
Department of Life Sciences, University of Parma, Parma, Italy

KEYWORDS: N SURPLUS, DENITRIFICATION, RIVER-GROUNDWATER INTERACTIONS

The Oglio River basin (3800 km2, Northern Italy) is densely inhabited and heavily exploited for animal farming, agriculture and water use. Human pressures menace the river, the secondary drainage system and the groundwater quality. Since 2007 different theoretical, monitoring and experimental activities were started in order to study N paths in this area. Overall aim was to analyze quantitatively the main N sources and sinks, evaluate the risk of water contamination and the potential for recovery, disseminate the results and interact with stakeholders in order to put in action more sustainable practices. N budget suggest uncoupled N sources (mainly livestock manure and synthetic fertilizers) and sinks (mainly crop uptake) resulting in a large N surplus and water contamination risk. Annual N export from the basin is a relatively small fraction of N surplus (~34%), meaning that relevant temporary or permanent N sinks are not included in the budget. N removal via denitrification in the riverbed, riparian areas (including those of the irrigation network) and riverine wetlands was evaluated experimentally (isotope pairing technique and open channel methods) and via combination of stable isotopes analysis and mass budgets. Our estimates suggest that denitrification removes at most half of the N surplus. Groundwater analyses reveal dramatic N accumulation in the central sectors of the watershed, where soils are more permeable, and support the hypothesis that aquifer can storage large amount of excess N. At present we are investigating river-groundwater interactions to evaluate how N in the aquifer can be recycled to the surface.

PRESENTATION TYPE: ORAL

COMBINED EFFECTS OF EUTROPHICATION AND ALTERED HYDROLOGY ON RIVER METABOLISM

Monica Pinardi
University of Parma, Italy; National Research Council, Institute for Electromagnetic Sensing of the Environment (CNR-IREA), Italy
Mariano Bresciani
National Research Council, Institute for Electromagnetic Sensing of the Environment (CNR-IREA), Italy
Daniele Longhi
University of Parma, Italy
Rossano Bolpagni
University of Parma, Italy
Claudia Giardino
National Research Council, Institute for Electromagnetic Sensing of the Environment (CNR-IREA), Italy
Pierluigi Viaroli
University of Parma, Italy
Marco Bartoli
University of Parma, Italy

KEYWORDS: RIVER METABOLISM, NUTRIENT MASS BALANCES, PRIMARY PRODUCERS

Human pressures impact the water quality (e.g. eutrophication) and flow (e.g. river damming) of rivers and their biological communities composition and activity. The combined effect of flow reduction and eutrophication has the potential to alter the river metabolism, turning a net heterotrophic system into an highly productive, autotrophic one. The Mincio River, including the Mantua fluvial lakes (northern Italy), offers a unique opportunity to analyze the effects of human pressures on communities and processes. This system lays within a watershed heavily exploited for agriculture and is highly modified to water abstraction and dams. We present results from a 7 years research activity including nutrient mass budgets, seasonal monitoring of water quality and flow, detailed evaluation of whole reach metabolism, analysis of sedimentary processes and of pelagic and benthic primary production by remote sensing. Three different reaches were analyzed in detail: a free flowing section within natural banks, hosting large meadows of submersed macrophytes, a hypetrophic fluvial lake dominated by phytoplankton and floating-leaved macrophytes and a downstream, channelized reach dominated by phytoplankton. Our results suggest a large N surplus at the watershed level, resulting in a progressive N-enrichment from upstream to downstream. Nutrient availability combined with water stagnation determines a steep shift in water quality parameters, with phytoplankton blooms, decreased transparency and disappearance of submerged phanerogams characterizing downstream reaches. Such shift is coupled to a net transition from net heterotrophy in the free flowing reach to net autotrophy in the channelized reach and the fluvial lake.

PRESENTATION TYPE: ORAL

MODELLING THE RESPONSE OF A DEEP INLAND LAKE TO NUTRIENT INPUTS

Meric Albay
Istanbul University, Fisheries Faculty, Department of Freshwater Biology, Turkey
Ali Erturk
Istanbul Technical University, Department of Environmental Engineering, Turkey
Reyhan Akcaalan
Istanbul University, Fisheries Faculty, Department of Freshwater Biology, Turkey
Latife Köker
Istanbul University, Fisheries Faculty, Department of Freshwater Biology, Turkey
Cenk Gurevin
Istanbul University, Fisheries Faculty, Department of Freshwater Biology, Turkey

KEYWORDS: EUTROPHICATION, ECOLOGICAL MODELLING, NUTRIENT LOADS

Aquatic ecosystems have different biogeochemical and trophic network structure; however they also have common components that behave similarly. These components can be represented using a nutrient dynamics or an NPZD (Nutrient Phytoplankton Zooplankton Detritus) model, which includes primary producers (phytoplankton groups) and consumers on the lower levels of the trophic network. Such models are advantageous since they can spatially and temporally interpolate single measurements; allow testing of several hypotheses and investigating the outcomes of different scenarios such as pollution or climate change in a predictive fashion. Sapanca Lake is a relatively less polluted inland water body, with a surface area of 46.9 km2, an averaged depth of 36 meters, a maximum depth of 53 m and a watershed area of approximately 300 km2. The lake has been pristine for most of the 20th century, however in the last decades intensifying land use, increasing pollution in the streams draining to the lake and excess water withdrawals affected the lakes water quality and ecology adversely so that symptoms of eutrophication became noticeable. We developed a dynamic NPZD model to evaluate the trophic status of the lake and simulate its response to increase nutrient loads under different scenarios such as different water withdrawals. The model was calibrated and validated with monthly monitoring data collected for two years. Our analysis indicated that the lake is shifting from oligotrophic to mesotrophic state and eutrophication is expected to proceed by the anthropogenic influences. More details including the theoretical construct of the NPZD model, the scenarios and the results will be presented in the conference.

PRESENTATION TYPE: POSTER

STATUS OF AQUATIC MACROPHYTES OF 'THOL LAKE WILDLIFE SANCTUARY', NORTH GUJARAT IN RELEVANCE OF SEASONAL CHANGES AND WATER LEVEL FLUCTUATION

Shaileshkumar N. Jaiswal
Hemchandracharya North Gujarat University, Patan, India

KEYWORDS: AQUATIC MACROPHYTES, THOL WILD LIFE SANCTUARY, SEASONAL CHANGES

Being one of the three sanctuaries and only protected wetland of North Gujarat region, Thol Lake Wildlife Sanctuary popularly known as Thol Bird Sanctuary (TBS) was studied for the aquatic macrophytes and their status in relevance of seasonal changes and water level fluctuation because of irrigation. Present paper discusses mainly about the impact of changes in season especially pre & post monsoon and water pulling through ducts and water pumps for the purpose of irrigation. Discrepancy was observed amongst the numbers of species of higher aquatic plant species, their density and flourishing approach depending upon water availability in the lake due to two major reasons mentioned above, one is natural (season change) and the other is manmade (irrigation). Additionally in the ditches surrounding the lake with low water depth (not suitable for irrigation purpose) where only the seasonal changes affected without any human interference, such variations of the higher aquatic plants were found to be narrow in comparison of that of the lake concluding yet again that natural changes in the surroundings are effortlessly exactable by living things rather than the same mixed with changes created through human interference.

PRESENTATION TYPE: POSTER

MS01-08
Harmful algal blooms (HABs)

MAIN GAPS AND CHALLENGES TO TOXIC CYANOBACTERIA ISSUES IN LATIN AMERICA

Sandra Azevedo
Carlos Chagas Filho Institute of Biophysics, Federal University of Rio de Janeiro, Brazil

KEYWORDS: CIANOTOXINS, CYANOBACTERIA, LATIN AMERICA

In Latin America as elsewhere the observation of occurrence of toxic cyanobacterial blooms began in the first half of the 20th century. However, the advancement of knowledge about the physiological processes, biochemical and molecular effects from exposure to these toxins occurred more slowly and late that the understanding of the environmental factors that determines the dominance of cyanobacteria. Moreover, understanding the effects of these toxins in the aquatic environment is still far from being achieved. We have had a major breakthrough in studies of management and treatment of water for public supply, in environmental aspects relate with cyanobacteria growth and dominance and in toxicology of some cyanotoxins. But still little advance in cellular and molecular studies that allow us to understand the mechanisms controlling the synthesis of cyanotoxins and their effects on aquatic community. In natural blooms, toxic and non-toxic strains co-exist - and the toxic ones have varying toxin contents. Consequently, cyanotoxin dynamics is driven chiefly by the dynamics of toxin producing clones. In the last few years, marked advances in methodology allowed the elucidation of sub-specific or clonal dynamics in natural waters. However, the driving forces behind clonal dynamics are still poorly understood. Besides, the role of cyanotoxins is still an open question and the evolution of toxicity among species and strains is practically unknown - very distant taxa may produce identical toxins while very closely related differ in this capacity. In this presentation, these aspects will be shortly reviewed and important gaps of knowledge will be highlighted

PRESENTATION TYPE: ORAL

TOXIN DYNAMICS INSIDE THE RESIDENT CYANOBACTERIAL COMMUNITY OF LAKE GARDA (ITALY)

Leonardo Cerasino

Research and Innovation Centre, Fondazione Edmund Mach, Istituto Agrario di S. Michele all'Adige, Italy

Shiva Shams

Research and Innovation Centre, Fondazione Edmund Mach, Istituto Agrario di S. Michele all'Adige, Italy; Human and Environmental Toxicology Group, Department of Biology, University of Konstanz, German

Adriano Boscaini

Research and Innovation Centre, Fondazione Edmund Mach, Istituto Agrario di S. Michele all'Adige, Italy

Nico Salmaso

Research and Innovation Centre, Fondazione Edmund Mach, Istituto Agrario di S. Michele all'Adige, Italy

KEYWORDS: LAKE GARDA, CYANOBACTERIA, MICROCYSTINS

Cyanobacteria have the ability to produce an extraordinary variety of secondary metabolites, some of which are toxic for humans. Massive developments (blooms) of these microorganisms represent a major concern in many natural and artificial water bodies, because of the high levels of toxins which can be potentially released in the water and eventually uptaken by humans (mainly by ingestion). Microcystins, potent hepatotoxins, represent the most frequent toxins produced by cyanobacteria. They show a big variability in chemical structure and, in fact, more than 90 variants have been reported. The chemical diversity has an impact on the toxicity, which differs substantially from variant to variant. The factors triggering the toxin production in cyanobacteria as well as the reasons of the wide chemical variability are still matter of debate. In order to elucidate the dynamics of toxin production inside a population of cyanobacteria, we have investigated the temporal and spatial variability of the microcystin diversity in the resident cyanobacterial community of Lake Garda. The lake, which represents the biggest water basin in Italy, was sampled on a monthly basis from 2009 till 2013. Toxin analysis, based on LC-MS/MS technique, was performed on phytoplankton samples taken at discrete depths in the trophogenic layer. The investigation showed a seasonal pattern of toxin production (with typical late summer-early autumn peaks) and a relatively constant toxin diversity (with five variants accounting for almost the totality of the microcystin content) with one variant ([D-Asp3]MC-RR) always dominating over the others.

PRESENTATION TYPE: ORAL

WHY BUBBLE PLUMES SUPPRESS MICROCYSTIS SCUM LAYERS IN LAKES?

Rob Uittenbogaard
Deltares, Delft, Netherland

KEYWORDS: SCUM FORMATION, BUBBLE PLUME, MICROCYSTIS

Increasingly the cyanobacterium Microcystis aeruginosa becomes a nuisance in recreational lakes by blooming and forming scum layers at the water surface or even worse occasionally becoming toxic and obstructing the function of drinking-water reservoirs. Although some dislike their energy consumption, bubble plumes in deep lakes or deep reservoirs are generally accepted as a faithful methodology for suppressing scums. Despite these favourable applications, the physical-biological mechanism has not been well explored. Actually, there exist seemingly contradictory applications of bubble plumes such as Dissolved or Dispersed Air Flotation (DAF) intended to bring algae to the water surface rather than removing their scum from the surface. My presentation addresses various mechanisms that may explain the suppression or removal of scums. The basic tool for this study is my one-dimensional vertical (1DV) model for thermocline formation and vertical mixing in wind-forced lakes, using the k-□ turbulence model including buoyancy damping. This 1DV model is directly coupled to a detailed model for the diurnal vertical mobility of microcystis based on the Fokker-Planck equation (Aparicio-Medrano et al., 2013). This concept includes the rate of change of cell-tissue density as function of photosynthesis and respiration as determined experimentally (Visser et al., 1995). The vertical velocity of microcystis colonies is determined by the computation of the cell-tissue density and for given gas vesicle concentration and volume colony size. Finally, these models are implicitly coupled to an integral model for the entrainment by bubble plumes in thermally-stratified water. Using this set of tools I can show that bubble plumes actually create a better light climate for the growth of microcystis in deep lakes, as has been observed by (Visser et al., 1996). Consequently, when bubble plumes are switch off, stronger scum formation may appear, this too is experienced in cases of malfunctioning air compressors. As bubble plumes are effective mixers, flotation may be counteracted by homogenous mixing. Further, the breakdown of the colony size by fine-scale shearing in bubble plumes strongly reduces their vertical mobility. The downdraught of microcystis in the recirculation by bubble plumes is used as explanation, however by mass continuity the colonies return to the water surface. Or small bubbles may adhere to the colonies such as in DAF although fine-scale turbulence may detach the bubbles. Finally, in oxygen-supersaturated water ongoing photosynthesis invokes oxygen bubbles in the mucus and thus buoyancy whereas bubble plumes reduce the supersaturation and thus cancel bubble growth. All these contradictory mechanisms will be addressed in this presentation.

PRESENTATION TYPE: ORAL

MICROCYSTINS BIOACCUMULATION IN FRESHWATER MUSSELS (UNIO ELONGATULUS) MEASURED BY MATRIX-ASSISTED LASER DESORPTION IONIZATION-TIME OF FLIGHT MASS SPECTROMETRY

Rosaria Lauceri
National Research Council – Institute of Ecosystem Study (CNR-ISE), Verbania-Pallanza, Italy
Andrea Lami
National Research Council – Institute of Ecosystem Study (CNR-ISE), Verbania-Pallanza, Italy
Valentin Pflueger
Mabritech SA, Riehen, Switzerland
Mauro Tonolla
SUPSI, Bellinzona, Switzerland
Francesca Caviglia
Agenzia Regionale per la Protezione Ambientale, Dip. Prov., Omegna, Italy
Nicoletta Riccardi
National Research Council – Institute of Ecosystem Study (CNR-ISE), Verbania-Pallanza, Italy

KEYWORDS: SENTINEL ORGANISMS, FRESHWATER MUSSELS, MALDI TOF MS

Microcystins, potent toxins produced by some species of cyanobacteria, are a growing problem worldwide posing a serious threat to human health and aquatic biota. The hepatotoxin microcystins (MCs), can enter the aquatic food web through accumulation in various organisms including zooplankton, macroinvertebrates and vertebrates. Freshwater bivalves are filter-feeders and have the potential to bioaccumulate a range of organic and inorganic pollutants found in freshwaters. Because of their capacity to concentrate various toxic and non-toxic trace elements, freshwater bivalves have been exploited as “sentinel organisms” to enhance toxicant detection. The present study aimed at developing in situ early warning system based on bivalves as MCs accumulators (biosentinels). To this aim the application of quick, cheap and easy analytical tools is required. Therefore, we explored the efficiency of MALDI TOF MS, in comparison with traditional methods (HPLC; ELISA immunoassay), for detecting toxins in the bivalve tissues. We studied microcystin–LR (MC–LR) assimilation in Unio elongatulus when exposed to Microcystis aeruginosa. Mussels’ tissues were analyzed after short term grazing experiments at high toxic algae concentrations and during long term grazing experiments at low toxic algae concentrations to study the feeding rate and the accumulation capacity of the mussels. The results confirm the utility of MALDI-TOF MS as a quantitative screening method for microcystins, and the potential for its use as a stand-alone technique.

PRESENTATION TYPE: ORAL

TOXIC CYANOBACTERIA IN LAKE GARDA: A MOLECULAR ASSESSMENT ON CYANOTOXIN PRODUCING GENOTYPES

Camilla Capelli

Research and Innovation Centre, Fondazione Edmund Mach, Italy; Department of Biology, Università di Firenze, Italy

Shiva Shams

Research and Innovation Centre, Fondazione Edmund Mach, Italy; Human and Environmental Toxicology Group, Department of Biology, University of Konstanz, Germany

Leonardo Cerasino

Research and Innovation Centre, Fondazione Edmund Mach, Italy

Duccio Cavalieri

Research and Innovation Centre, Fondazione Edmund Mach, Italy

NIco Salmaso

Research and Innovation Centre, Fondazione Edmund Mach, Italy

KEYWORDS: CYANOBACTERIA, CYANOTOXINS, TOXIC GENOTYPES

Harmful cyanobacteria blooms are increasing worldwide. The health hazard for humans and animals is due to the ability of these organisms to produce a wide range of toxins, including hepatotoxins (e.g., microcystins, MCs), and neurotoxins (e.g., anatoxin-a, ATX). The gene clusters encoding the synthesis of the broad group of MCs have been analyzed in detail 15 years ago, while the genes responsible of the synthesis of ATX were discovered only recently. The dominant cyanobacterium in Lake Garda is Planktothrix rubescens, a filamentous species which synthesizes different MCs congeners. In the last two decades a new species forming huge blooms appeared, Dolichospermum lemmermannii, which can produce both MCs and ATX. Nevertheless, metabolomic data and phytoplankton biomass quantification, showed that most of the time the abundance of D. lemmermannii was not sufficient to explain the high concentrations of ATX, raising important questions about the correct identification of ATX-producers in Lake Garda. In this contribution we will report the first results obtained from a wide survey carried out in Lake Garda with the aim to characterize the cyanobacterial genotypes carrying the MCs and ATX encoding genes. The analyses are based on taxonomical, genetic (PCR and Real-Time PCR, qPCR) and metabolomic determinations carried out on both environmental samples and numerous isolated strain cultures. The information will contribute to better define specific lake-tailored risk-assessment models aimed at minimizing the health risks connected with the presence of toxic cyanobacteria in bathing waters and in waters used as drinking water supply.

PRESENTATION TYPE: POSTER

EUTROPHICATION OF A DEEP LAKE WITH SPECIAL EMPHASIS OF CYANOBACTERIA BLOOMS: IZNIK LAKE, TURKEY

Reyhan Akcaalan
Istanbul University, Fisheries Faculty, Department of Freshwater Biology, Turkey
Ayca Oguz
Istanbul University, Fisheries Faculty, Department of Freshwater Biology, Turkey
Latife Koker
Istanbul University, Fisheries Faculty, Department of Freshwater Biology, Turkey
Zeynep Dorak
Istanbul University, Fisheries Faculty, Department of Freshwater Biology, Turkey
Cenk Gurevin
Istanbul University, Fisheries Faculty, Department of Freshwater Biology, Turkey
Ozcan Gaygusuz
Istanbul University, Fisheries Faculty, Department of Freshwater Biology, Turkey
Meric Albay
Istanbul University, Fisheries Faculty, Department of Freshwater Biology, Turkey

KEYWORDS: CYANOBACTERIA BLOOM, POLLUTION LOAD, WATER QUALITY

Iznik lake is a fifth largest natural lake in Turkey with a 80 m depth and 308 km2 surface area. It has a tectonic origin and a highly alkaline character with a mean pH of 9.1. The transparency is generally over 3 m. Lake is under the pressure of polluted run-off originating from surrounding agricultural land and also residential areas. According to Trophic State Index (TSI) lake is a meso-eutrophic status, however is very close to eutrophic conditions. There are cyanobacterial blooms in the lake starting from May continued throughout summer months. Nitrogen fixing cyanobacteria is generally dominant in the lake. Anabaena species form blooms in spring and water stratification in summer months allows Planktothrix rubescens to establish a population in the metalimnion of the lake. However, some other Nostocalen species, such as Aphanizomenon, Cylindrospermopsis and even Nodularia spumigena reach high numbers in the upper parts of water column in late summer and fall. Microcystin variants and cylindrospermopsin was detected in lake waters when cyanobacteria blooms occurred. Lake is used for irrigation and recreational activities and cyanotoxins produced by these species pose a severe health hazards to human and also effects the functioning of the ecosystem. Therefore, an eutrophication control system need to be launched in the watershed. The relationship between environmental conditions and cyanobacterial blooms is also discussed.

PRESENTATION TYPE: ORAL

CYANOBACTERIA DETECTION IN THE LAKE VICO USING COMPACT AND ADVANCED LASER SPECTROMETER (CASPER) PROTOTYPE

Maria Sighicelli
Technical Unit Sustainable Development and Innovation of Agro-industry system (UTAGRI-ECO) ENEA, Roma, Italy
Valentina Iannilli
Technical Unit Sustainable Development and Innovation of Agro-industry system (UTAGRI-ECO) ENEA, Roma, Italy
Riccardo Ceccarelli
Technical Unit Sustainable Development and Innovation of Agro-industry system (UTAGRI-ECO) ENEA, Roma, Italy
Patrizia Menegoni
Technical Unit Sustainable Development and Innovation of Agro-industry system (UTAGRI-ECO) ENEA, Roma, Italy
Massimiliano Guarneri
Technical Unit Development of Applications of Radiations-Diagnostics and Metrology Laboratory (UTAPRAD-DIM), ENEA, Frascati, Italy
Ivano Menicucci
Technical Unit Development of Applications of Radiations-Diagnostics and Metrology Laboratory (UTAPRAD-DIM), ENEA, Frascati, Italy
Luca Fiorani
Technical Unit Development of Applications of Radiations-Diagnostics and Metrology Laboratory (UTAPRAD-DIM), ENEA, Frascati, Italy
Antonio Palucci
Technical Unit Development of Applications of Radiations-Diagnostics and Metrology Laboratory (UTAPRAD-DIM), ENEA, Frascati, Italy

KEYWORDS: LASER INDUCED FLUORESCENCE, SPECTRAL DECONVOLUTION, ALGAL BLOOMS

Phytoplankton is an important bio-indicator of general ecologic status of water bodies. Cyanobacteria are common members of the plankton and under favourable environmental conditions can quickly multiply and form blooms. Potentially toxic cyanobacteria are particularly abundant in eutrophic and thermally stable lakes. The increase in the trophic status of Lake Vico is followed by a significant growth of Planktothrix rubescens.Evaluation of in vivo fluorescence chlorophyll is widely accepted as a proxy of phytoplankton biomass. The Compact and Advanced laser SPEctrometeR (CASPER, patented by ENEA) is a portable fluorescence spectral system for the real-time assessment of sensitive aquatic components, like chromophoric dissolved organic matter, proteins-like components, algal pigments. The CASPER instrument prototype is based on double filtration (30 and 0,22 µm) and lasers excitation (266 and 405 nm) system in order to detect both dissolved and particulate components of waters. The quantification of photosynthetic pigments, including accessory phycobiliproteins, determines the contribution of each taxonomic groups.The CASPER instrument is equipped with an ad-hoc software for spectral analysis: in order to contribute to the marker pigments and phytoplankton groups identification a spectral deconvolution procedure based on laboratory and field measurements was developed. In this work freshwater samples from different depths (surface, -15,-30 m) have been collected and analyzed from December 2012 through March 2013. The present results demonstrate the CASPER capability to provide an early warning system for harmful algal blooms detection and eutrophic status of water bodies assessment.

PRESENTATION TYPE: POSTER

PRESENCE OF MICROCYSTIN IN WATERS OF SOME LAKES OF PIEDMONT

Claudio Foglini
Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, Italy
Paola Arsieni
Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, Italy
Gabriella Fornaro
Regional Agency for the Protection of the Environment of Piedmont (ARPA), Italy
Antonia Concetta Elia
Department of Cellular and Environmental Biology, Università degli Studi di Perugia, Italy
Tommaso Scanzio
Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, Italy
Erika Burioli
Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, Italy
Marzia Righetti
Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, Italy
Marino Prearo
Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, Italy

KEYWORDS: WATER LAKES , MICROCYSTIN, PIEDMONT

Among toxins produced by Cyanobacteria, microcystin is the most frequent and toxic. Its threshold value, indicated by the WHO for drinking water, is 1 µg/L. In Italy, many lakes in different regions are affected by cyanobacterial blooms and the more widespread genera are Microcystis, Anabaena and Planktothrix, all microcystins producers. People can be exposed to toxins through the ingestion of contaminated drinking water, bathing, inhalation of aerosols during recreational activities in the algal bloom area or with the intake of foods processed with contaminated water. The exposure to toxins may affect fishes living in the basin as well as animals who drink water contaminated with microcystins. During the summer 2013, 38 samples of water from 12 small morainic lakes in the upper Turin province were analyzed. The samples were processed using the commercial kit test Mycrocystest (Zeu-Inmunotech S.L.) that is based on the inhibition of phosphatase activity by the microcystins. 26 water samples were below quantifiable limit of commercial kit (0.25 µg/L); for the remaining 12 positive samples, only 2 presented very high levels of microcystin (13 µg/L each), while the remaining 10 showed a contamination level between 0.25 µg/L and 2.25 µg/L (mean 1.16 µg/L, SD 0.88). This preliminary study showed that the microcystins, especially in summertime, may be present in lakes not included in the national monitoring program and these results highlight a potential hazard to keep under control.

PRESENTATION TYPE: POSTER

THE DETERMINATION OF PROTEIN BINDING MICROCYSTIN IN ENVIRONMENTAL SAMPLES

Latife Köker
Istanbul University, Faculty of Fisheries, Turkey
Elke Dittmann
University of Potsdam, Institute of Biochemistry and Biology, Department of Microbiology, Germany
Reyhan Akçaalan
Istanbul University, Fisheries Faculty, Department of Freshwater Biology, Turkey
Meriç Albay
Istanbul University, Fisheries Faculty, Department of Freshwater Biology, Turkey

KEYWORDS: MICROCYSTIS, MICROCYSTIN, KüçüKçEKMECE LAGOON

Kücükcekmece Lagoon located in Istanbul metropolitan area is B-class wetland area. Due to rapid industrialization and population growth, a significant deterioration in water quality has been observed, and almost every year between June to October toxic algal blooms mostly resulted from Microcystis species have been reported. Environmental factors play an important role in the production of microcystins . Particularly, high water temperatures and calm weather stimulate the bloom of Microcystis and consequently the production of microcystins. It was found that microcystin binds to a number of proteins in vivo and under high light and oxidative stress conditions the binding strongly enhanced. In Küçükçekmece Lagoon, samples were collected at the surface, 1m and then at 5m intervals between surface and a depth of 18m at regular monthly intervals from March 2012 to March 2013 in the growth period of Microcystis. Samples were analyzed on a Perkin Elmer HPLC system with photodiode array detection (PDA) to detect cell-bound microcystin. However, the western-blotting was used for the detection of microcystin in protein fractions According to our results, both cell bound microcystin concentration and protein-binding microcystin showed an increase simultaneously. As a result, lack of cell-bound microcystin could be related to an increase in microcystin binding to proteins.

PRESENTATION TYPE: ORAL

MECHANISTIC STUDY ON THE DEGRADATION OF TOXIGENIC CYANOBACTERIA BY BIO-FENCE TYPE REACTOR

Liu Chunyan
Graduate School of Engineering, Nagasaki University, Japan
Yang Gu
Graduate School of Engineering, Nagasaki University, Japan
Norio Iwami
Faculty of Science and Engineering, Meisei University, Japan
Kazuya Shimizu
Department of Life Science, Toyo University, Japan
Redel Gutierrez
College of Arts and Sciences, Central Luzon State University, Philippines
Niwooti Whangchai
Faculty of Fisheries Technology and Aquatic Resources, Maejo University, Thailand
Xueying Bi
Graduate School of Engineering, Nagasaki University, Japan
Dong Xia
Graduate School of Engineering, Nagasaki University, Japan
Tomoaki Itayama
Graduate School of Engineering, Nagasaki University, Japan

KEYWORDS: CYANOBACTERIA, MICROCYSTIN, BIOREACTOR

Toxic cyanobacterial bloom has been occurring in eutrophicated water bodies, which have become concerned as to the cyanotoxin microcystin. Bioreactor systems using several bio-carriers have been studied as low cost water treatment systems, however, little is known the removal mechanisms including adsorption and biodegradation. In this study, microcystin removal in charcoal granules were discriminated and assessed by a bench scale model reactor and pilot scale reactor. The results demonstrated that the charcoal had an effective removal of microcystin with the Chlorophyll a removal of 80~90%, as well as microcystin removal when the HRT was 6~8hour. The removal is related to HRT, and when shortening the HRT, the removal decreased. Moreover, the observation of plenty of microorganisms such as Rotifers (Philodina sp.) and Protozoa (Voticella Sp.) under microscope suggested that the biodegradation of microcystin could occur within charcoal carriers. Corresponding to the quantification of the total bacteria, the total cyanobacteria, mlrA gene (microcystin degradation enzymatic gene) using real time PCR of DNA sample extracted from charcoal at the end of experiment, it suggested that the charcoal carriers not only adsorb microcystin but also simultaneously played a role on a habitat for microorganisms in which MC degrading bacteria might exist and work.

PRESENTATION TYPE: ORAL

AQUACULTURE FISH PONDS AS EXPERIMENTAL PONDS FOR STUDY ON TOXIGENIC CYANOBACTERIA IN THAILAND

Tomoaki Itayama
Nagasaki University, Japan
Kazuya Shimizu
Department of Life Science, Toyo University, Japan
Redel Gutierrez
College of Arts and Sciences, Central Luzon State University, Philippines
Ruenkeaw Praphrute
Faculty of Fisheries Technology and Aquatic Resources, Maejo University, Thailand
Dong Xia
Graduate School of Engineering, Nagasaki University, Japan
Khomasan Ruangdet
Faculty of Science, Chaingmai University, Thailand
Norio Iwami
Faculty of Science and Engineering, Meisei University, Japan
Yang Gu
Graduate School of Engineering, Nagasaki University, Japan
Wang Pengfei
Graduate School of Engineering, Nagasaki University, Japan
Norio Sugiura
Malaysia-Japan International Institute of Technology, Malaysia

KEYWORDS: AQUACULTURE POND, TOXYGENIC CYANOBACTERIA, MCY GENE

Aquaculture ponds of catfish and tilapia in Thailand were surveyed to obtain the basic information of occurrence of harmful cyanobacteria and cyanotoxins. This study was meaningful from the two faces. One was, of course, from a viewpoint of the evaluation of the risk of cyanotoxins in aquaculture. The other was as an ecological study of toxigenic cyanobacteria because we surveyed various sorts of aquaculture ponds that were operated under various environmental conditions. In this study, we especially analyzed the relation between the proliferation of toxigenic cyanobacteria and environmental conditions such as nutrients, temperature and kinds of cultured fish in aquaculture ponds. As a result, we found the following characters. The cultured fish type (tilapia or catfish) determined the cyanobacterial community structure. The ratio of copy number of mcyD gene in total Microcystis was related to N/P ratio (T-N/T-P). The detection probability of mcyD in aquaculture ponds was explained by using a logistic regression with mainly T-P. Furthermore we noticed the difference of altitude of aquaculture ponds that reflected the average temperature to investigate the temperature effect for proliferation of cyanobacteria related with global warming problem.

PRESENTATION TYPE: ORAL

MS02-01
Chemical and physical processes

OCCURRENCE AND LEVELS OF INORGANIC IONS IN LAGUNA LAKE (PHILIPPINES) AND ITS TRIBUTARY RIVERS

Maria Pythias Espino
University of the Philippines, Quezon City, Philippines

KEYWORDS: INORGANIC IONS , WATER QUALITY CRITERIA, PHILIPPINE

The concentrations of bromide, chloride, fluoride, nitrate, nitrite, sulphate, phosphate, sodium, potassium, magnesium and calcium ions in Laguna Lake and its tributaries were determined. Fishing is an important livelihood for the people in the lake area. High concentrations of ions including phosphate cause eutrophication of the lake, endangering this industry. Laguna Lake is also considered a raw water source for drinking water production. Hence, lake water quality assessment should include contamination of key ions. The analysis of ions in water was done using ion chromatography-conductivity detection. Most of the ions were in relatively high concentrations in waters near urban and agricultural areas surrounding the lake. Although nitrate, phosphate and chloride concentrations in the lake did not exceed the Class C water quality criteria stipulated in the Philippine Department of Environment and Natural Resources Administrative Order No. 34, high concentrations of the ions in the tributary rivers pose a threat to the lake. The mean phosphate concentration in the rivers, for example, is nine times higher than in the lake. The mean nitrate concentration in the rivers is 204 times higher than in the lake.These river waters that flow to the lake may cause fish kills. Time trends data show high concentrations of ions during dry season than in rainy season. Spatial trends data suggest random inputs from domestic discharges, industrial effluents and agricultural runoffs. The ions contamination is more evident in the densely populated western side of the lake than in the sparsely populated eastern side.

PRESENTATION TYPE: ORAL

DIURNAL VARIATION OF CO2 FLUXES IN THE AIR-WATER SYSTEM ON THE LAKE BAIKAL IN DIFFERENT SEASONS.

Mikhail Panchenko
V.E. Zuev Institute of Atmospheric Optics, Russia
Valentina Domysheva
Limnological Institute of Siberian Branch of Russian Academy of Sciences, Irkutsk, Russia
Dmitry Pestunov
V.E. Zuev Institute of Atmospheric Optics of Siberian Branch of Russian Academy of Sciences, Russia
Mariya Sakirko
Limnological Institute of Siberian Branch of Russian Academy of Sciences , Russia

KEYWORDS: CO2 FLUXES , LAKE BAIKAL , DIURNAL VARIATION

Lake Baikal is one of the most unique natural environments in Siberia. The paper presents the results of a study of the gas exchange of CO2 between the atmosphere and the water, which are obtained in the littoral of Baikal during 2002-2013 years. The carbon dioxide concentrations were measured around the clock in atmosphere, the floating chamberand 2 equilibrators, using one gas analyzer. Chemical analysis of the water samples collected every three hours at the chamber locations was carried out in the on-land laboratory. We measured pH, content of dissolved oxygen, bicarbonate, nitrate and phosphate. Changes in the concentration of CO2 in water and carbon dioxide fluxes, resulting from the process of photosynthesis plankton are most manifest in the diurnal cycle. Carbon dioxide emission was observed from the water surface into the atmosphere at night. At sunrise, this flux decreased and changed direction, and its maximal flux to the water surface was recorded at 3-4 p.m. Even in December (before freezing), when the flux was directed into the atmosphere during the day, its value decreased before sunset. This work was supported by a grant from the RFBR (Project 14-05-00277a), Program of the Department of Earth Sciences of RAS№11.

PRESENTATION TYPE: POSTER

CHEMICAL COMPOSITION OF THE WATER OF LAKE BAIKAL IN THE MODERN PERIOD

Valentina Domysheva
Limnological Institute, Siberian Branch of the Russian Academy of Sciences
Sakirko M
Limnological Institute, Siberian Branch of the Russian Academy of Sciences
Onischuk N.
Limnological Institute, Siberian Branch of the Russian Academy of Sciences

KEYWORDS: NUTRIENTS , DISSOLVED OXYGEN , LAKE BAIKAL

To assess the water quality of Lake Baikal in the observed climate change and the active development of the coastal tourism monitoring studies of the chemical composition of water held from 1993. Long-term observations have shown that the concentration of nutrients increases with depth and does not exceed 1.9 mg Si/l for silicon, 0.14 mg N/l for nitrates and 20 µg P/l for phosphates. Seasonal variations of the content of biogenic elements occur mainly in the upper 300 m layer. The unique mechanism of renewal of deep water in spring and autumn leads to the decrease of their concentrations in the 100-m near-bottom layer. The content of dissolved oxygen is 9-14 mg/l, the value of oxygen saturation of the water of near-bottom layer does not decrease lower than 70%. The concentration of nutrients in the deep water of the pelagic zone of the lake, which is not undergone seasonal variations, is practically constant during the last 60 years. The concentrations of Na+, Ca2+, Mg2+, K+, HCO3–, SO42–, Cl- in the water of Lake Baikal are stable. The constancy of the content is caused by insignificance of the annual water sink of the tributaries in comparison with the volume of the water mass of the lake, as well as intensive water exchange in the lake. The increase of nutrients has observed in the littoral zone in places where tourism is developing. This work was supported by a grant from the RFBR (Project 14-05-00277a), Program of the Department of Earth Sciences of RAS№11.

PRESENTATION TYPE: POSTER

EVIDENCE OF HIGH POLLUTED SEDIMENT STORAGE AFTER MAJOR FLOOD EVENTS IN A FLOOD-CONTROL RESERVOIR (FRANCE)

Elie Dhivert
Laboratoire GéHCO, France
Cécile Grosbois
Université François Rabelais de Tours, France
Marc Desmet
Université François Rabelais de Tours, France
Alexandra Coynel
Université de Bordeaux, France.
Irène Lefèvre
Laboratoire des Sciences du Climat et de l'Environnement, France

KEYWORDS: FLOOD EVENT, POLLUTED SEDIMENTS, SEDIMENT-LADEN UNDERFLOWS

The Villerest flood-control reservoir (36 km long, maximum 50 deep and 128 Mm3) was built in the Upper Loire River Basin (France) during the early 1980's downstream a various topographical and geological basin (6516 km²) and draining an important industrial and coal mining area. This reservoir, functioning like a lake, constitutes an important trap of sediments and associated pollutants since its operation in 1984. A 154 cm long core was sampled in 2010, in the deepest zone of the reservoir and shows the influence of high discharge events in terms of sediment accumulation rate and pollution storage. During dam operation, lacustrine aggradation rate is not linear because of three turbiditic-like layers. These 3 sedimentary layers result from sediment-laden underflows during 1996, 2003 and 2008 major floods and contribute to 43% of the 151 kg/m-² accumulated sediments since 1984. Over the 1984-2010 period, sediments show a general but light decontamination. However, some contaminant solid sources appear to be only solicited or severely amplified during these major floods with the highest enrichment factors of the study period (> 20 for Hg and >10 for Cd and Bi). During interflood periods, these contamination levels are never reached. In addition during these flood events, sedimentological and detrital signals influence contaminant signals by a variable dilution effect (maximum during the increasing discharge stage).

PRESENTATION TYPE: ORAL

COMPARATIVE STUDY OF PHYSICO-CHEMICAL CHARCTERISTICS OF SEDIMENTS IN AMLI AND MAKARBA LAKE OF AHMEDABAD, GUJARAT, INDIA

Manisha Desai
mnd909@yahoo.co.in

KEYWORDS: AUDA, LAKE, AMLI LAKE, MAKARBA LAKE, GEOCHEMISTRY PHYSICO-CHEMICAL

The focus of the study was on the seasonal variation of sediment geochemistry and some physical properties of Amli and Mkarba lakes of Ahmadabad –Gujarat, west coast of India, for period of two years during 2010 - 2011. The lake is loaded mainly by the rain water and municipal sewages of Ahmedabad city. The minimum and maximum values of pH varied from 6.2 to 7.7 respectively .variation in EC was 1.2 to 2.96 moh. Concentrations of nutrients viz. Total Nitrogen (1.0 to 4.0 ppm), Total phosphorus ranged between 0.44 to 23.1 µg/g, Total Organic Carbon varied from 0.32 % to 11.1 % and total organic Matter varied from 1.18% to 5.29% respectively in all two lakes. Results show that geochemical composition of sediment varies strongly within the summer-monsoon period. The elements migrated within the sediment layer and considerable amounts of element exchange across the sediment/water was observed.

PRESENTATION TYPE: ORAL

LOW-MOLECULAR ORGANIC COMPOUNDS IN FRESH WATERS OF THE LENINGRAD REGION

Alexandra Rizhinashvili
St.Petersburg State University, Russia

KEYWORDS: FRESH WATERS, DISSOLVED ORGANIC MATTER (DOM) IN WATER, LOW-MOLECULAR ORGANIC COMPOUNDS

The aim of our study is to define the quantitative and qualitative composition of the low-molecular organic compounds in water samples collected from lakes and rivers of the Leningrad Region (mainly, the Karelian Isthmus area, north-western European part of Russia), in order to evaluate the trophic conditions in these ecosystems. The molecular composition of dissolved organic compounds in water samples collected from four lakes and three rivers was analyzed by gas chromatography-mass spectrometry (GC-MS) method. Above 30 substances were identified in the water bodies under study. These refer to the following classes: polyatomic alcohols, carboxylic acids (lactic, acetic, malic, citric, succinic, oxalic, ribonic, gluconic, and ketogluconic), monosaccharides (arabinose, ribose, xylose, galactose, glucose, mannose, fructose, etc.), some disaccharides, and monosaccharide derivatives.As demonstrated, carbohydrates dominate (by concentration) the chemical composition of these waters. This fact confirms the predominantly autochthonous origin of the dissolved organic matter in the water bodies. The trend of an increasedpentoses to hexoses ratio (i.e., the relative contribution of pentoses), against the decrease in total carbohydrates concentration, was identified. This regular pattern is discussed with view of its possible application to evaluating production and destruction processes in the water bodies. Such estimations may be taken as a background for evaluating the level of ecosystem vulnerability to human impacts. It is important, that our results are needed for elaboration of the natural water quality criteria and programs of the water resources management.The data obtained supplement significantly our knowledge of aquatic ecosystems functioning from the point of view their abiotic component.

PRESENTATION TYPE: ORAL

GEOCHEMICAL AND ISOTOPIC EVOLUTION OF LAKE TRASIMENO (ITALY)

Francesco Frondini
Università di Perugia, Italy
Nicola Morgantini
ARPA-Umbria, Italy
Carlo Cardellini
Università degli Studi di Perugia, Italy
Giovanni Chiodini
INGV-OV Napoli, Italy
Stefano Caliro
INGV-OV Napoli, Italy
Marco Donnini
IRPI-CNR Perugia, Italy

KEYWORDS: LAKE TRASIMENO, ISOTOPES, SALINITY

Lake Trasimeno is a closed lake, its average depth is about 4 m and its level is strictly related to the precipitation regime. The main inflows are precipitation over the lake and surface runoff, the main outflow is evaporation. The history of Lake Trasimeno is strictly related to the changes of the climatic conditions and is characterised by strong variations of the lake level. Along with the quantitative variations, also some changes in the quality of lake water occurred. The salinity increase is the most evident change in the water quality during the last decades. Here we present a set of monthly chemical and isotopic data, collected from 2006 to 2014, integrated with previous data relative to the period 1968-2010, in order to assess (i) the main geochemical processes, (ii) the relations of seasonal water level changes with the chemical and isotopic composition and (iii) the presence of long term geochemical trends. Data analysis permit to separate short term trends, strictly related to the seasonal and yearly variations of precipitation, from long term trends that are characterised by a progressive increase of dissolved load and Cl content and a progressive change of the isotopic composition of lake water.

PRESENTATION TYPE: POSTER

EVALUATION OF THE WATER RENEWAL TIME OF NATURAL STRATIFIED LAKES BY DIMENSIONLESS CHARTS

Marco Pilotti

Università degli Studi di Brescia, Department of Civil Engineering, Architecture, Land, Environment and Mathematics, Italy

Giulia Valerio

Università degli Studi di Brescia, Department of Civil Engineering, Architecture, Land, Environment and Mathematics, Italy

KEYWORDS: WATER RENEWAL TIME, STRATIFIED LAKES, INTERFLOW

The water renewal time of a lake is an important integrative indicator of the renewal capacity of a water body. In spite of its wide use in limnology, it is typically calculated as the ratio between the volume of the whole basin and the long-term time average discharge of water passing through the lake, completely neglecting the most relevant hydrodynamic features of the lake. Accordingly, this ratio has a clear meaning only in strongly idealized situations, while it cannot represent the actual renewal capacity of stratified lakes, especially if they do not completely mix on a regular annual basis. This work presents the evolution of a simple model, recently proposed in the literature, to evaluate the water renewal time, intended as the time after which 37% of the original water mass is still present in a natural stratified lakes. The proposed model is based on a mass balance of the water initially present within the lake. This balance provides the age distribution of water within stratified natural lakes taking into account fundamental aspects of its mass exchange and thermal evolution. Although the model can be directly used for a particular lake, we show that its results can be made dimensionless. By working out the dimensional results for a wide set of simulations, a dimensionless graph can be obtained by which a first order approximation to the residence time of water in a lake can be obtained in a straightforward fashion. The obtained results are used to discuss the renewal capacity of some deep Italian prealpine lakes.

PRESENTATION TYPE: ORAL

PHYSICO-CHEMICAL BASELINE DATA FOR AN INTEGRATED MANAGEMENT OF LAKES ECOSYSTEM IN CAMEROON (WEST AFRICA)

Issa Issa
Institute for Geological and Mining Research, Cameroon
Sighomnou Daniel
Basic Systems in Hydrology Division, WMO, Geneva, Switzerland
Chako Tchamabé Boris
okai University, Laboratory of Volcanology and Geochemistry, Japan
Sigha Nkamdjou
Congo-HYCOS/FFEM program (CICOS) Kinshasa, Democratic Republic of Congo
Ohba Takeshi
Tokai University, Laboratory of Volcanology and Geochemistry, Japan

KEYWORDS: CAMEROON, EPILIMNIA, PHYSICO-CHEMISTRY

Lakes are peculiar environments having complex and fragile ecosystems. In spite of that fragility, the lacustrine systems have been preserved for centuries. Lately however, holding to the aesthetic (e.g., sightseeing), recreational (e.g., pleasance) and economic (e.g., domestic, industrial…) benefits associated with lakes, human beings have progressively, but increasingly and extensively intruded their environments. Given the growing development of lakes-oriented activities and their possible damageable impacts, it has become necessary to protect and preserve the lacustrine ecosystems. This implies a sound understanding of their hydrology, biology, physics and chemistry…, in brief, their dynamic. Cameroon hosts > 44 artificial and natural lakes. The largest artificial lake is the Lom Pangar dam (under construction) which occupies 540 km2. Excluding Lake Chad, the Barombi Mbo is the largest natural lake (4.5 km2). Generally, those lakes serve for multiple purposes. Unfortunately, basic information permitting to assess the impact of anthropogenic activities on them is scarce or completely lacking. Accordingly, this study reports the physico-chemistry of 17 natural lakes to serve as base line for future evaluation of their status. The physical parameters suggest that, almost all the lakes feature stratified water columns exhibiting several layers, the structure of which varied daily and/or seasonally. The epilimnia were significantly O2-enriched whereas the hypolimnetic waters were generally anoxic. Anions were overwhelmingly dominated by HCO3- implying acidity for water-rock interaction is provided solely by CO2(aq). Cations suggest that the lake waters could be associated with a specific type of lithology. Overall, ca 80 % of the investigated waters were of Fe-Mg-HCO3- type.

PRESENTATION TYPE: ORAL

INDICATORS OF A LAKE OVERTURN IN TAAL LAKE, PHILIPPINES

Macrina Zafaralla
Institute of Biological Sciences College of Arts and Sciences University of the Philippines, Los Banos, Philippines
John Michael Aguilar
Institute of Biological Sciences CAS UP Los Banos, Philippines
Yves C. Lagasca
Institute of Biological Sciences CAS UP Los Banos, Philippines
Marieanne Itoy
Institute of Biological Sciences CAS UP Los Banos, Philippines

KEYWORDS: LAKE OVERTURN, , TAAL LAKE,, SULFUR UPWELLING

A limnological study was done in the northern basin of Taal Lake from May 2012 to February 2013. The aim was to determine the physico-chemical characteristics of the lake water before, during and after occurrence of a lake overturn, and observe its effect on fish in floating fish cages. Data were collected from permanent and ad hoc sampling stations were the data sources for water quality (WQ) inside and outside of fish cages that had and had not a history of fish kill occurrence. Pre-lake overturn data of December 19, 2012 - January 8, 2013 in fish kill and non-fish kill areas of barangay Sampaloc gave the following ranges of values of WQ parameters: water temperature (WT), 25.7 - 27.3oC; dissolved oxygen (DO), 3.35 – 9.7 mg/L, and ammonia (NH3) 0 – 0.64 mg/L. Cool, strong velocity winds (3 – 4 mps) with 7-day duration on January 14 – 20) led to establishment of a cool (5–0.12 mg/L; SRP, 0.5 – 0.6 mg/L; S2-, 0.5–0.7 mg/L; and SO4=, 51.3–75.1 mg/L. On February 1, waters in the NE lake region had fishes inside cages manifesting hyperventilation at the surface (gataw) in waters with DO, 0.1 – 0.9 mg/L; NH3, 0.005 – 0.001 mg/L; NO2, zero; sulfide, increasing with depth at 0 – 0.5 mg/L; SO4= , increasing with depth at 81.3 – 99.3 mg/L; and SRP, 0.8 – 0.9 mg/L. The dark green and blue-green colored zones in the NE lake quadrant were manifestations of an ongoing lake overturn with sulfur upwelling. Non-colored waters where gataw fishes were observed were probably affected by the lake overturn and sulfur upwelling. The return of normal lake conditions are described in the paper.

PRESENTATION TYPE: ORAL

PHYSICAL-CHEMICAL PROFILES BY HANDMADE SENSORS IN THE MEROMICTIC LAKE IDRO

Edoardo Guerrini
Università degli Studi di Milano, Italy
Maria Leonor Carvalho
RES - ricerca sul Sistema Energetico SpA, Italy
Stefano Pierpaolo Trasatti
Università degli Studi di Milano, Italy
Gildo Storni
RES - ricerca sul Sistema Energetico SpA, Italy
Alessandro Bertini
Eridio Sub Association, Italy
Pierangela Cristiani
RSE - Ricerca Sul Sistema Energetico SpA , Italy

KEYWORDS: REDOX POTENTIAL, SULPHYDES, MEROMICTIC STRATIFICTION

The physico-chemical parameters of water of the meromictic subalpine lake Idro (in the north of Italy) were investigated by handmade sensors. Monitoring campaigns were devoted to ascertain the profile of some chemical parameters of the lacustrine water at different depths to detect the chemical variations during seasons. A chain of copper alloy (CuNi 70/30) was immersed at different depths in the water down to the bottom of the lake, in a point where the lake depth is the maximum (120 m). Temperature, pH, oxygen concentration and conductivity were measured with a commercial multi-parameters probe. A combined sensor for redox potential and sulphide concentration, handmade, was utilized. The profiles achieved from the multiparametric probe and the handmade sensors were in a good agreement, underliying variatiosn in the mixolimnio. From the measurement done in May 2013, temperature shows a thermocline starting right after 6-8 m deep (20°C), and finishing at around 30 m (6°C). The temperature remained fixed at 6 °C down to the bottom of the lake after the thermocline. The redox potential and the sulphide sensors showed a similar but opposite sigmoidal behavior, underlying a sudden inflexion around 50 m. The sulphide sensor started with very low concentrations (high potential) near the surface, and very high concentrations under the redox transition at a depth of 49 m. Oxygen concentration shows the total depletion of O2 just before the redox transition, around 43 m. The open circuit potential of copper alloys, measured versus the same Ag/AgCl reference electrode used for the sulphide measurements, varied as a function of the oxygen concentration in the different water layers and stabilized in time in each layer (from +200 mV down to -600 mV vs. Ag/AgCl). The results indicated that, in different ways, handmade sensors can be cost effective tools, able to give insight into the redox conditions of water. Acknowledgments: Financial support by FSE-Lombardia, project number 17157, is gratefully acknowledged.

PRESENTATION TYPE: POSTER

ALUMINUM CONCENTRATION AND SPECIATION IN ABIOTIC ENVIRONMENT OF FIVE TEMPERATE LAKES WITH LOW BUFFERING CAPACITY

Michał Łopata

Department of Water Protection Engineering, Faculty of Environmental Sciences, University of Warmia and Mazury, Poland

Grzegorz Wiśniewski

Department of Water Protection Engineering, Faculty of Environmental Sciences, University of Warmia and Mazury, Poland

Renata Brzozowska

Department of Water Protection Engineering, Faculty of Environmental Sciences, University of Warmia and Mazury, Poland

Jolanta Grochowska

Department of Water Protection Engineering, Faculty of Environmental Sciences, University of Warmia and Mazury, Poland

KEYWORDS: ALUMINUM, POLLUTION, IN-LAKE GRADIENTS

This study highlights the contamination of lake water and recent bottom sediments by aluminum in the absence of atmospheric pollution. Field examinations were conducted in five small (5-30 ha) lakes affected with moderate anthropopressure, characterized by a low alkalinity (0.5-2.5 mval/dm3) and varying reaction (5.7-8.5 pH), localized in the Masurian Lake District (Poland). Water samples were taken from each lake surface, bottom and near-bottom layers and interstitial water of 20-cm sediments cores divided into 5cm thickness sections. Total aluminum was determined spectrophotometrically after mineralization using the eriochrome cyanine R. Dissolved Al was measured after the filtering the samples with 0.45 µm cellulose nitrate filters. In water, the concentration in total aluminum ranged from 0.007 to 0.350 mg/L and increased with a decrease in water alkalinity and an increase in organic matter. Dissolved aluminum content (0.005 – 0.049 mg/L) was clearly correlated with water reaction (r=-0.78, n=40). In slightly acidic lakes, rich in humic substances, dissolved Al in pore water was always lower than in he water column (up to 0.036 mg/L). This would indicate the stabilizing role of sediments in the formation of Al circuit in the soft-water lakes with dystrophy features. Despite high content of total aluminium at low pH (close to or lower than 6), the small concentrations of soluble Al forms recorded in the water of examined ecosystems (

PRESENTATION TYPE: POSTER

THE REGULATING ROLE OF DIFFERENT LAKE COMPARTMENTS AND BIOGEOCHEMICAL PROCESSES ON BENTHIC P ACCUMULATION AND RECYCLING IN A MEROMICTIC SUBALPINE LAKE (LAKE IDRO, ITALY)

Roberta Azzoni
University of Parma, Department of Life Sciences, Italy
Gianmarco Giordani
University of Parma, Department of Life Sciences, Italy
Daniele Longhi
University of Parma, Department of Life Sciences, Italy
Daniele Nizzoli
University of Parma, Department of Life Sciences, Italy
Pierluigi Viaroli
University of Parma, Department of Life Sciences, Italy

KEYWORDS: INTERNAL PHOSPHOROUS LOAD, MEROMICTIC LAKE, PHOPHORUS BIOGEOCHEMISTRY

Phosphorus is considered a limiting nutrient for primary production in lakes. Investigations on anthropogenic phosphorus input to watersheds are therefore a key issue for water quality maintenance. Nevertheless, in lake P recycling can be an additional P source that magnify the impact of external loads. Despite its importance the internal P load is often difficult to quantify because it is regulated by a large array of biogeochemical mechanisms, mainly occurring in the sediments. In fact, phosphorus can be released, temporarily retained or permanently accumulated on particles depending on their composition and water and sediment conditions (mainly redox state, pH, iron and sulfides concentrations). The aim of this study was to quantify the internal P load in a sub-alpine meromictic lake (Lake Idro, Italy) and to elucidate the regulating role of different lake compartments and biogeochemical processes. We analysed seasonally (winter and summer) the sedimentary P pools and fluxes across the water sediment interface in four sites along a depth gradient. Littoral sediments were a good P sink, while the profound benthic system constantly releases P to the water compartment. Consequently, the monimolimnion was a significant reserve of inorganic reactive P, mostly derived from bacterial mineralization in the sediment. Here, the permanent reducing conditions exhausted the iron P-binding capacity and most of the P was bound to Ca. These results are compared with the external loading estimated through a mass balance approach (NAPI) to define some possible management options addressed to lake recovery.

PRESENTATION TYPE: POSTER

PHAILIN INDUCED PRECIPITATION IMPACT ON NUTRIENTS AND SALINITY DYNAMICS OF A TROPICAL COASTAL LAGOON CHILIKA, INDIA

Pradipta Muduli
Chilika Development Authority, India
Saroja Kumar Barik
Chilika Development Authority, India
Debasis Mohapatra
Chilika Development Authority, India
R.N. Samal
Chilika Development Authority, India
Madhusmita Tripathy
Chilika Development Authority, India
Gurdeep Rastogi
Chilika Development Authority, India
Krupasindhu Bhatta
Chilika Development Authority, India
Ajit K. Pattnaik
Chilika Development Authority, India

KEYWORDS: RIVER DISCHARGE, NUTRIENT FLUX, SHALLOW BRACKISH LAGOON

The Asia's largest lagoon; Chilika was studied after the severe cyclonic storm "Phailin" (October 2013) followed by intense flood. Post-Phailin data was compared with the data set collected before the cyclone. Physicochemical parameters, nutrients (NO3+NO2, PO4, SiO2) (September and October of 2012 and 2013) and salinity data (March 1999-December 2013) was analyzed to understand the impact of "Phailin" in the hydrology of the ecosystem. There was a very significant change (ANOVA, p0.05) observed in the salinity regime as well as in the nutrients parameters afer the Cyclonic storm, compared to the previous month. The average salinity of the lagoon after the intense flood was recorded to be the lowest as compared to past 15 years. The salinity of southern, central sectors and outer channel decreased by 28.7%, 29.8% and 19.1% respectively, whereas in the northern sector it remained fairly same compared to the month just before the Phailin. There was an overall increase in silicate concentration in the lagoon as the silicate influx from river increased by ~3.8 times during October 2013 (132.40×106 mol d-1) than September 2013 (34.90×106 mol d-1). Decline in NO3+NO2 andphosphate concentration was also observed throughout the lagoon in comparison to the previous month which could be attributed to the dilution effect (River water with lower nutrient concentration) as well as adsorption to sediment in lower saline condition in case of Phosphate. Environmental changes in form of diversity & distribution of sea grass, macrophytes and benthic community on spatial scale was also observed.

PRESENTATION TYPE: ORAL

GEOCHEMISTRY OF SEDIMENTS FROM "PIETRA DEL PERTUSILLO" LAKE: PRELIMINARY RESULTS

Elisabetta Fortunato
Università degli Studi della Basilicata, Italy
Mario Bentivenga
Università degli Studi della Basilicata, Italy
Michele Paternoster
Università degli Studi della Basilicata, Italy
Giacomo Prosser
Università degli Studi della Basilicata, Italy
rosa sinisi
Università degli Studi di Sassari, Italy

KEYWORDS: LACUSTRINE SEDIMENTS, CHEMICAL AND MINERALOGICAL ANALYSES, PERTUSILLO RESERVOIR

This study is part of a multidisciplinary (sedimentological, mineralogical and geochemical) PhD research regarding the lacustrine sediments from Pertusillo reservoir, a manmade lake laying in high Agri Valley (Basilicata, Italy). Several human activities are in Pertusillo watershed including waste water treatment plants, landfills, farms, oil and reinjection wells, a first treatment oil plant, plastics and other industries. So, this reservoir is a natural laboratory for assessing the sediment pollution from human activities. We sampled: Meso-Cenozoic rocks, outcropping on the left and right sides of the high Agri Valley; Quaternary fluvial-lacustrine deposits, outcropping in the surrounding area of the reservoir; stream sediments of the main Pertusillo affluents. Quaternary and stream sediments were separated by wet sieving in order to collect only the particles with size smaller than 75 μm (sieve 200 ASTM). This sample fraction was first dried and then milled in a ring agate mill to obtain a very fine powder suitable for the chemical and mineralogical analyses. Mineralogy was analysed from randomly oriented powders recorded at 2°–70° 2θ (step size: 0.02° 2θ) using a Philips X'Pert PW3040 diffractometer (Cu-Kα radiation, 40 kV, 30mA). Chemistry (major, minor, trace, and RE elements) was obtained on powdered samples analysed by ICP/MS technique after a four acids digestion and lithium metaborate/tetraborate fusion to facilitate the destruction of possible resistate minerals. Chemical and mineralogical data are being processed and they will be available soon. In addition, the collection of core sediments from Pertusillo reservoir was planned and it will take place next months.

PRESENTATION TYPE: ORAL

BIOGEOCHEMICAL PROXIES INDICATING ENVIRONMENTAL CHANGES OF CRENOGENIC MEROMICTIC LAKE KIVU (EAST AFRICA) SINCE THE HOLOCENE

Fabrice A. Muvundja
Institut Superieur Pedagogique de Bukavu, R.P of the Congo
Cedric Morana
Division of Soil and water management, Katholieke Universiteit Leuven (KULeuven), Department of Earth and Environmental Sciences, Belgium
Carsten Schubert
Eawag, Surface Waters - Research and Management, Swiss Federal Institute of Aquatic Science and Technology, Switzerland
Claas Gerhard Steigüber
Protistology and Aquatic Ecology, Department of Biology, Ghent University, Ghent, Belgium
Elie Verleyen
Protistology and Aquatic Ecology, Department of Biology, Ghent University, Ghent, Belgium
KellyAnn Ross
Eawag, Surface Waters - Research and Management, Swiss Federal Institute of Aquatic Science and Technology, Switzerland
Flavio Anselmetti
Institute of Geological Sciences and Oeschger Centre of Climate Change Research, University of Bern, Bern, Switzerland
François Darchambeau
Chemical Oceanography Unit , University of Liège, Liège, Belgium
Steven Bouillon
Division of Soil and water management, Katholieke Universiteit Leuven (KULeuven), Department of Earth and Environmental Sciences, Belgium
Jean-Pierre Descy
Laboratory of Freshwater Ecology, URBE, Department of Biology, University of Namur, Belgium

KEYWORDS: LAKE KIVU, PARTICULATE ORGANIC MATTER, ENVIRONMENTAL CHANGES

Situated in the Western branch of the East-African rift zone, Lake Kivu is a large meromictic lake lying in a tecto-volcanic active region between Rwanda and the Democratic Republic of the Congo. The limnology of the lake is significantly influenced by the activity of subaquatic springs bringing salts, dissolved gases and heat into its deep waters. Previous studies have revealed a ~1000 yrs old geological event related to volcanism that modified the lake's permanent stratification. Our study aims to report the dynamics of the limnology and biogeochemistry of the lake since then, using sedimentary records of stable isotope tools as well as pigment and lipid biomarker proxies. Results indicate that the lake has undergone a constant strengthening of the thermohaline stratification since the mixing event due to: (1) continuously increasing inputs of saline hydrothermal springs; (2) decreasing surface salinity by increased surface runoffs; and (3) more recent warming of the near-surface water by climate change. Higher degradation of organic matter during the diagenesis of the sedimentary material has been observed in young sediments. The carbonate geochemistry indicates alternating periods of carbonate preservation in the sediments and periods of redissolution.

PRESENTATION TYPE: POSTER

DETERMINATION OF NUTRIENTS FROM SEDIMENT PORE WATER IN KüçüKçEKMECE LAKE (ISTANBUL)

Cenk Gürevin
Istanbul University, Fisheries Faculty, Turkey
Meriç Albay
Istanbul University, Fisheries Faculty, Turkey

KEYWORDS: KüçüKçEKMECE LAKE, SEDIMENT, PORE WATER

Nutrients in sediment pore water from Küçükçekmece Lake were investigated in this study. Sediment samples were collected at four stations with a Kajak core on a monthly basis from October 2006 to February 2008. Average Total Nitrogen (TN) and Total Phosphorus (TP) contents of the pore water were measured as 215 mg l-1 and 5.4 mg l-1 in the deep station, respectively. On the other hand, average concentrations of these nutrients were 62 mg l-1 and 1.62 mg l-1 in the shallow stations, respectively. Deep station has anoxic condition and higher values were measured in this station comparing to shallow ones. Statistical differences were observed between the deep and shallow stations for the nutrients, however no differences were recorded in the physical parameters (ρ

PRESENTATION TYPE: POSTER

MS02-02S

Special Session - Hydrology issues in water storage systems

ON THE ROLE OF HYDROLOGICAL BALANCING IN LAKE BASIN MANAGEMENT

Chiara Biscarini
UNESCO Chair Water Resources Management and Culture, University For Foreigners Perugia, Perugia, Italy
Valeria Montesarchio
Niccolò Cusano University, Rome, Italy
Piergiorgio Manciola
Dep. of Civil and Environmental Engineering, University of Perugia, Perugia, Italy
Silvia Di Francesco
Niccolò Cusano University, Rome, Italy

KEYWORDS: HYDROLOGICAL BALANCE, BASIN MANAGEMENT, EXTREME EVENTS

Management of water resources in complex environmental systems including lakes or reservoir, requires advanced hydrological modelling to forecast main state parameters (levels, volumes, temperature, pollution level, …) and impacts of human activities on the natural context. In this work an opensource computational model is applied and tested to a typical Italian lake environment, the Bolsena lake, where surface flows, deep flows, direct losses from the lake surface, the lake regulation volume, and anthropic uses (drawing from and discharging into the lake) are jointly involved . Bolsena Lake, located in northern Lazio, the largest volcanic lake in Europe, is a source of both environmental and economic wealth for the neighboring area, drawing tourists and providing drinking and irrigation water. Recently the system's hydraulic state has undergone moments of unbalance, due to the alternation of drought and flood periods starting in the early 1990s which have led to not negligible consequences from hydrological (decreased flow of some springs in the hydrogeological basin and toward the outlet, inundation of facing villages) and societal point of views. The complexity of the hydrogeological and anthropic system and the current technical/scientific relevance of the latest water emergencies occurring at the lake, put in evidence the need of a solid plan to manage all different extreme scenarios that can affect the lake basin. Therefore an instrument of basin/lake and lake/river management and simulation is necessary for mitigating the extreme values of the levels and flows and for controlling lake water quality.

PRESENTATION TYPE: POSTER

GRAPHICAL FLOW DURATION CURVES REGIONALIZATION METHOD BASED ON INSTANTANEOUS MEASURES

Maura Rianna
Sapienza Università di Roma, Rome, Italy
Elena Ridolfi
H2CU - Sapienza Università di Roma, Rome, Italy
Lucio Ubertini
H2CU - Sapienza Universita' di Roma, Rome, Italy

KEYWORDS: FLOW DURATION CURVES, HYDROPOWER, RESERVOIR

Flow duration curves estimation is fundamental to design a hydropower stations. These curves represent all flows occurred in a specific period, ranked from the lowest to the highest. They permit to design hydroelectric systems coping with extreme flows, operating efficiently in the medium range of flows while over Q70 values (i.e. 'low flows') operating at a low power output. In ungauged basins flow duration curves evaluation remains an open issue, specifically for small basins where calibration data are sparse and refer to large catchments scales. In this work, a graphical regionalization approach based on the flood index method of flow duration curves is proposed. It combines a regional dimensionless flow duration curve with a direct method to estimate the flood index. To compute the flood index, instantaneous flow measurements at a specific site are synthetically generated and then, their mean value is estimated. An optimization study to define the minimum number of instantaneous measures, necessary to obtain a good agreement between observed and simulated curves, is developed. A jack knife procedure is used to simulate the ungauged basins case. In the proposed paper, the methodology is tested on a homogeneous region located in central Italy.

PRESENTATION TYPE: ORAL

WHAT FUTURE FOR LAZIO'S LAKES OF ALBAN HILLS? THE SITUATION OF THE ALBANO'S LAKE

Dario Orlando
Sapienza" University of Rome, Rome, Italy
Michele Giglioni
Sapienza" University of Rome, Rome, Italy
Francesco Napolitano
Sapienza" University of Rome, Rome, Italy

KEYWORDS: HYDROLOGICAL BALANCE , ALBANO HILLS

Lazio is one of the 20 administrative regions of Italy, situated in the central peninsular section of the country. In this region there are several situations of water crisis, and the most compromised situations are well known and include for example the aquifers of the volcanic districts and the coastal aquifers; among the most complex andcompromised situations there are the Alban Hills, a volcanic complex situated in the southeast of Rome.Factor as water withdrawals, less rainfall, changing in land uses, have altered the balance of the hydrological systems of this area, with troubling effects on the quantity and quality of water resources. It is well known that in this area the high as indiscriminate use of water resources over the last twenty years have brought lowering of piezometric surface, continuous lakes level lowering, the drying up of many wells and springs, an overall net decrease in the river flow originated from the volcanic area slopes. These events, together with the evidence of the depletion of aquifers, make urgent coordinated action and specific studies for the quantification and management of water withdrawals.In this memory we present the particular situation of the Albano's lake, investigating the hydrological balance of the site through the years, trying to focus on the balance factors that have brought the hydrological crisis in order to individuate possible future actions to mitigate the water crisis problem.

PRESENTATION TYPE: ORAL

THE INFLUENCE OF ANTHROPIZATION OVER FLOW IN A MIDDLE ITALIAN BASIN. DIFFERENT SCENARIOS.

Michele Giglioni

Department of Civil, Constructional and Environmental Engineering, "Sapienza" University of Rome, Rome, Italy

Sandra Spina

Department of Civil, Constructional and Environmental Engineering, "Sapienza" University of Rome, Rome, Italy

Fabio Russo

Department of Civil, Constructional and Environmental Engineering, Sapienza" University of Rome, Rome, Italy

KEYWORDS: ANTHROPIZATION, URBANIZATION, WATER RECHARGE

The modifications generated by human buildings over natural environment produce changes over hydrological answers of the same basins. In the last decades urbanization changed largely land use, generating big impermeable areas that impacts over water flow and aquifer recharge. Different distributions of buildings, streets, and industrial areas will also generate different answers of the hydraulic system. Using a digital elevation model (DEM) for the area and different Curve Number matrix it is possible to create various set of data, starting from several location of building over the basin, to different distribution of urban fabric , high density or scattered. Another parameter that has been changed is the soil geology in order to extend the results of the study to different areas. The goal of the study is to improve the knowledge of the hydraulic changes occurred over years of uncontrolled urbanization, the impact that this change have on natural environment and the strategy that should be used in the future for a better management of water asset in order to prevent extreme events, as stream-flow or long dry period.

PRESENTATION TYPE: ORAL

WATER STORAGE SYSTEMS IN INNOVATIVE SMALL SCALE HYDRO-POWER INSTALLATIONS

Lorenzo Micheli
Sapienza" University of Rome, Rome, Italy
Francesco Napolitano
Sapienza" University of Rome, Rome, Italy

KEYWORDS: RESERVOIR, HYDRO-POWER, WATER-MANAGEMENT

Recently hydro-power has been re-evaluated as being a precious "green" technology with development prospective for the future. Hydro-power generation has been analyzed focusing on the aspects concerning with water resource management and energy production, giving particular attention to the water storage system design techniques. The present study goes into small scale hydro-power generation (micro and pico) investigating around technical solutions, case studies and opportunities of development for this particular typology of installations. Run of rivers plants do not require a proper water impound, but just a weir to realize the intake structure to collect the water and divert it into canals or penstocks. In the case of impoundment plants it is necessary to design a proper water storage systems able to accomplish the energy production requirements together with the river basin needs and the river environmental standards. Water volumes stored in reservoirs are bigger compared with weirs' capabilities, despite an higher realization cost. Realization of small hydroelectric installations is also an innovative solution to retrieve ancient constructions like mills, dyeing plant, and other structures of the primordial industry located along rivers. A sample case has been taken into account in the northern side of Casentino Valley (Stia(AR)-Italy). Along Arno river path it has been identified a section where historically there was a water mill for wheat floor production. Three different plant configurations have been identified to utilize Arno water to produce electrical energy. In all cases a weir realization was preferred at a reservoir one, representing a better technical/economical solution.

PRESENTATION TYPE: ORAL

USE OF INTEGRATED MODELING TO ASSESS HYDROGEOLOGICAL CONTROLS ON GROUNDWATER – LAKE INTERACTIONS IN BURABAY NATIONAL NATURE PARK, KAZAKHSTAN

Gani Nessipbekov
Nazarbayev University Research and Innovation system, Astana, Kazakhstan
Marzhan Kabiyeva
Nazarbayev University Research and Innovation System, Astana, Kazakhstan
Vadim Yapiyev
nazarbayev University Research and Innovation System, Astana, Kazakhstan

KEYWORDS: INTEGRATED MODELLING, LAKE GROUNDWATER INTERACTIONS, HYDROGEOLOGICAL CONTROL

Lakes in National Nature Park Burabay play a key role in providing a habitat for a wide range of aquatic flora and fauna.Groundwater and lake models were integrated using model integration standards and simulated for Lake Shuchie in Burabay National Nature Park. Simulated groundwater fluxes were checked against net groundwater flow derived from a detailed lake hydrologic budget with short-term lake evaporation computed by the energy budget method. Discrepancies between modeled and budget-derived net groundwater flows were studied.The need to understand the hydrogeological controls responsible for groundwater – lake interactions, both from the lake to the aquifers and also across the aquifers themselves is vital so as to provide the basis for exploitation of water resources.

PRESENTATION TYPE: POSTER

WATER QUALITY ASSESSMENT BY TELEMETRY IN A LAKE ENVIRONMENT: COLLECTING, MODELING AND REPRESENTING DATA

Silvia Di Francesco
Niccolò Cusano University, Rome, Italy
Laura Tribioli
Niccolò Cusano University, Rome, Italy
Valeria Montesarchio
Niccolò Cusano University, Rome, Italy

KEYWORDS: LAKE ENVIRONMENT, AQUATIC ROBOTIC VEHICLE, POLLUTANT

Under the background of climate change and human activities, there has been an increase both in the frequency of extreme hydrological events and the range of their impacts. The hydrological extreme events can affect heavily the quality of water systems, leading to a critical condition, as shown in studies on laws of generation, transfer, transformation and degradation of pollutants. In this context, developing a model to couple hydrological inputs (such as heavy rains) with flow simulation and pollutant concentrations routing will aid the development of mitigation strategies. The aim of this work is to identify contaminants in vulnerable surface water systems like lakes and reservoir, their evolution and assess management measure to mitigate their effects. The undergoing research is based on three activities: experimental water pollution data acquisition, mathematical modeling of their evolution and dispersion, and citizenship collaboration involvement. For the dynamic acquisition of water surface data, a prototype ARV (Aquatic Robotic Vehicle) is being designed in order to sample the water surface quality parameters and to detect the presence of freshwater contaminants. To identify the changing conditions for the flow dispersion model, a preliminary hydrological study of runoff is performed. The fluid dynamic simulation is performed through the use of the so called “Lattice Boltzmann Method” LBM, an alternative numerical fluid dynamics scheme based on Boltzmann’s kinetic equation. The active participation of citizens in measurement collections and dissemination of results is essential to the project. All obtained results will be shown in a web-based GIS environment.

PRESENTATION TYPE: ORAL

A SCIENTIFIC METHOD OF DETERMINING MINIMUM ALLOWABLE VALUES OF WATER USE EFFICIENCY IN SUITABLE WATER MANAGEMENT

Shengle Cao
Shandong University, Shandong, China
Jincun Zhang
Shandong University, Shandong, China

KEYWORDS: WATER USE EFFICIENCY, WATER RESOURCES MANAGEMENT , THREE RED LINES

Water use efficiency is one of the control indexes of the most strict water resources management system of China. The method of determining minimum allowable values of water use efficiency is subjective and lack of science in the management practice. Facing the perspective of sustainable development, a scientific method for determining the index of water use efficiency is put forward based on the coordinated development, which was the coordinated allocation of water supply for production, life and ecology; which would be of guarantee for the coordinated development of agriculture, industry and service, and keep the balance of water supply and water demand. According to the water resources allocation scheme and water use efficiency in history of the developed countries, in view of the economy development program of China, a reasonable yearly changing process of water efficiency index are put forward with a coordination degree model.

PRESENTATION TYPE: ORAL

HYDRO-CLIMATIC AND LAND USE SENSITIVITIES OF STORMWATER IN COMPLEX COASTAL-URBAN ENVIRONMENTS: A CASE STUDY FOR THE MIAMI RIVER BASIN OF FLORIDA, U.S.A.

Abdul-Aziz Omar

Florida International University , Miami, U.S.A.

Al-Amin Shams

Ecological and Water Resources Engineering Lab (EWREL), Department of Civil & Environmental Engineering, Miami, U.S.A.

KEYWORDS: HYDRO-CLIMATIC VARIATIONS, BASIN OF FLORIDA, SWMM MODEL

We investigated the stormwater runoff and quality responses to the hydro-climatic variations and land use/cover changes in complex coastal-urban environments considering the Miami River Basin of Florida as a case study. Reference stormwater sensitivities were quantified by building a dynamic rainfall-runoff model with the well-known urban hydrology model, SWMM. Remarkably different, high seasonal sensitivities of runoff to rainfall were found for the complex coastal-urban Basin; stronger rainfall-runoff responses were noted in the drier, early winter months. Variations in the hydrologic and land cover parameters showed moderate sensitivities in Basin runoff and pollutant loads; imperviousness and roughness led to much stronger responses than that of slope. Land use conversions (e.g., open lands to residential to commercial/industrial areas) resulted in relatively small changes in the stormwater budget and quality likely due to the highly urbanized, developed nature of the Basin. Simultaneous hydro-climatic or climate-land use perturbations led to non-linear changes in potential runoff and pollutants. The research findings can guide the management of stormwater quantity and quality in complex urban basins around the world under a changing regime of climate, land use/cover, and hydrology.

PRESENTATION TYPE: ORAL

SIMULATION OF INFILTRATION AND SURFACE RUNOFF BY A CONCEPTUAL MODEL

Alessia Flammini
Department of Civil and Environmental Engineering, University of Perugia, Perugia, Italy
Renato Morbidelli
Department of Civil and Environmental Engineering, University of Perugia, Perugia, Italy
Carla Saltalippi
Department of Civil and Environmental Engineering, University of Perugia, Perugia, Italy
Corrado Corradini
Department of Civil and Environmental Engineering, University of Perugia, Perugia, Italy

KEYWORDS: RUNOFF, CONCEPTUAL APPROACH, CENTRAL ITALY

The prediction of soil moisture content, θ, as a function of depth, z, and time, t, is of fundamental importance for applications in many hydrological processes. The main objective of this paper is to provide an approach to solve this problem at a local scale in soils with vegetation. The matching of soil moisture vertical profiles observed under natural conditions in grassy plots and their simulations by a conceptual model is presented. Experimental measurements were performed in a plot located in Central Italy, complete with hydrometeorological sensors specifically set up and equipped with a time domain reflectometry system providing the water content, θe(z, t). A conceptual model framework earlier proposed for two-layered soil vertical profiles was modified and adopted for simulations. The changes concern the incorporation of evapotranspiration, the reduction of the original model for applications also to homogeneous soil vertical profiles, and a correction for the differences existing between assumed and observed initial moisture contents. In the model calibration, it was found that the effects of vegetation could be represented adequately by a fictitious soil vertical profile with a more permeable upper layer of saturated hydraulic conductivity, Ks, independent of time. Then, for the validation events, the model simulations in the stages of both infiltration and redistribution/evapotranspiration reproduced appropriately θe(z, t). Similar results were obtained by applying the modified two-layered model for simulations of experimental data observed in three other plots located in Northern Italy and Germany. For all four vegetated sites, validation of the two-layer profile better matched the experimental data than the assumption of a homogeneous profile. Thus, the conceptual approach based on a two-layered scheme for representing θ(z, t) in soils with vegetation appears to be appropriate for many hydrological applications.

PRESENTATION TYPE: ORAL

MS02-03S

Special Session - Challenging Global and Local Changes in Coastal Lagoons and their Watersheds

WONDERFUL LAGOONS – CHARACTERISTICS AND VARIATIONS

Masumi Yamamuro
Graduate School of Frontier Sciences, The University of Tokyo, Japan

KEYWORDS: SALINITY GRADIENTS, STRATIFICATION OF SALINITY, BIODIVERSITY

Lagoons are a wondrous place not only for human beings but also for many animals. Lagoons provide a habitat for a variety of migratory birds, and many marine and freshwater fish utilize the food resources found in lagoons. Lagoons are situated downstream, so nutrients supplied from the land support vigorous primary production, allowing animals to thrive. The salinity of lagoon water varies from freshwater to seawater. Organisms regulate the osmotic pressure according to the salinity, which restricts the number of species in a brackish environment. Flora and fauna change drastically in lagoons when salinity changes. Humans also contribute to changes in the salinity of lagoons, both intentionally and unintentionally. This changes the interaction between lagoons and people. The stratification of salinity is also severely affected by the change in salinity. Extremely anoxic conditions are observed at well-stratified lagoons where anaerobic bacteria exhibit a variety of metabolisms. One type of anaerobic bacteria produces hydrogen sulfide in the water. Mixing of the bottom water with toxic hydrogen sulfide sometimes induces mass mortality in the shallow part of the lagoons. Whether the lagoon water vertically mix or not can be roughly estimated using a few factors, and this is necessary to understand the basic physical properties of lagoons for sustainable use by people. Although so many aspects of lagoons are vulnerable, several endangered species are found only in certain lagoons, demonstrating the wonder that exists in lagoons.

PRESENTATION TYPE: ORAL

ENVIRONMENTAL SUSTAINABILITY IN THE VENICE LAGOON MANAGEMENT

Maurizio Ferla

National Institute for Environmental Protection and Research, Italy

KEYWORDS: LAGOON OF VENICE , ECOSYSTEM, WFD

The complexity of safeguarding the Venice Lagoon is due to the particular northern Adriatic coastline context which is streghtened by numerous estuaries and some other important lagoons more or less opened to the tide. During the centuries, transformation processes have taken place, intensified by particular meteoteorological, marine and geological conditions which have deeply changed this particular transitional environment in its hydrodynamic and morphological features. The Venice Lagoon represents the most significant wetland area in the Mediterranean Sea. Since the fall of the Republic of Venice (1797) many important interventions have been carried out, such as the works to prevent from Piave and Brenta rivers silting up, which emptied out the lagoon, and the so-called MURAZZI, a massive Istrian stone sea walls along the littoral. Furthermore, this paper illustrates the main important features connected with the safeguarding of the Venice Lagoon and how it has been managed since the fall of the Serenissima Venice Republic to the present day. Overall, it focuses on the special protection provided by specific laws issued by Italian Government after the dramatic flood occurred in 1966, analyzing the efficacy of ongoing interventions on mitigation of high tides, arrest and reversion of environmental deterioration, reclamation of the lagoon bed in polluted area, coastal reinforcement made possible by important Italian financial resources. This memo also aims to describe some relevant environmental emergencies related to the morphological features of the lagoon (deterioration of sediments, water quality, etc.) which show a decline of the features typical of an environment in transition towards a marine environment. The Directive 2007/60/CE on the assessment and management of flood risks which also requires river basin management plans to be developed for each river basin district its coastal areas, is the updated framework to effectively safeguard the Venice Lagoon according to a systematic and coherent approach with the North-eastern territorial context. In short, an urgent reform of the special law is needed, as well as a reorganization of the institutional subjects connected with the interventions to safeguard the Venice Lagoon.

PRESENTATION TYPE: ORAL

PRESSURES, IMPACTS AND RESPONSES IN MEDITERRANEAN COASTAL LAGOONS: FROM LOCAL TO GLOBAL CHALLENGES

Pierluigi Viaroli
Department of Life Sciences, University of Parma, Italy
Roberta Azzoni
Department of Life Sciences, University of Parma, Italy
Marco Bartoli
Department of Life Sciences, University of Parma, Italy
Gianmarco Giordani
Department of Life Sciences, University of Parma, Italy
Mariachiara Naldi
Department of Life Sciences, University of Parma, Italy
Daniele Nizzoli
Department of Life Sciences, University of Parma, Italy

KEYWORDS: EUTROPHICATION, SHELLFISH FARMING, INTEGRATED MANAGEMENT

Coastal lagoons in the northern Mediterranean arc are exploited for shellfish farming and tourism, which are the backbone of the local economy and social system. Many sectorial studies provided a robust scientific background, e.g. on ecology and farming issues. Less is known on interactions between stressors acting at both local and wider/global scales. These lagoons are exposed to pressures from watersheds and seaside which can greatly amplify internal stressors. Macroalgal and harmful algal blooms, faecal bacterial contamination and frequent anoxic outbreaks are among the most important threats, which have adverse effects on the ecosystem functioning and, in cascade, on shellfish production. Moreover, climate change can amplify such impacts: e.g. in dry regions, sudden flash floods from streams are assumed to deliver great amounts of nutrients and faecal bacteria which accumulates during the dry season. Often, the shellfish farming itself impacts on ecosystem functioning. Different shellfish species can have diverse impacts on water and ecosystem quality due to different management. The common feature of all species is the quick recycling of ammonium, mineral phosphates and silica from particulate organic matter, often shifting N:P:Si stoichiometry which can influence interactions between phytoplankton and macroalgal species, inducing negative feedback loops for farming. In contrast with the failure of the sectorial approach, the integrated management of lagoons, their watersheds and the adjacent coastal zones are key issue for preserving the aquatic ecosystems and their resilience capacity.

PRESENTATION TYPE: ORAL

PARTICIPATION OF DIATOMS AND FORAMINIFERS AT RADIOACTIVE POLLUTED PADDIES ASSOCIATED WITH TSUNAMI DAMAGE IN THE FUKUSHIMA SEACOAST, JAPAN

Kazue Tazaki
Kahokugata Lake Institute, Japan
Hisashi Takahashi
Kahokugata Lake Institute, Japan
Nanae Takahashi
Kahokugata Lake Institute, Japan
Yasuhiro Shimojima
Kaihatsu Gijutsu Consultant Co., Ltd., Japan
Naoki Nemoto
Graduate School of Science and Technology, Hirosaki University, Hirosaki , Japan

KEYWORDS: RADIOACTIVE POLLUTION, TSUNAMI, FUKUSHIMA, PADDY SOILS, SEACOAST, SEM-EDX, ED-XRF, GE SEMICONDUCTOR DETECTOR, FORAMINIFERA, DIATOMACEOUS EARTH, NOTO PENINSULA, CLAYS, RADIO NUCLIDES.

Coastal areas in Minami-Soma City, Fukushima, Japan, were seriously damaged by the radioactive contamination from Fukushima Daiichi Nuclear Power Plant (FDNPP) accident caused multiple pollutions by the Tsunami and radionuclide exposure, after The Great East Japan Earthquake, Japan, on 11th -12th March, 2011. FDNPP leaked 17 kinds of radio nuclides, such as 134Cs (1.8x1016Bq; half-life time 2.1y), 137Cs (1.5x1016Bq; half-life time 30.0y), 90Sr (1.4x1014Bq; half-life time 29.1y), and 95Zr (1.7x1013Bq; half-life time 64.0d) to the atmosphere, river basin, paddies, and seawater in Japan. The paddy soils in Fukushima Prefecture have heavily been contaminated by radio nuclides, especially by Cs (134Cs, 137Cs) and Sr (89Sr, 90Sr), even though more than 25-30km north of the FDNPP. Hundreds of diatom with diverse size and shape associated with foraminifer were found in paddies near Karasu-zaki fishing port in Fukushima, Japan, which are considered to have been originally formed in the area under a freshwater environment, after Tsunami. Based on observation with optical and electron microscopy and analysis by X-ray diffraction pattern, X-ray fluorescence, and Ge semiconductor detector, both inorganic factor and microorganisms are suggested to have contributed to remediation of the environments. A field simulation experiment at radioactive polluted soils with fresh water in Baba, Minami Soma, Fukushima, shows participation of diatomaceous earth, supporting the suggestion. The diatomaceous earth collected from Noto Peninsula, Ishikawa Prefecture.Energy dispersive X-ray fluorescence analysis (ED-XRF) and Ge semiconductor detector found not only major elements but also radio nuclides, such as 134Ce, 137Cs, 89Sr, and 90Sr, in the paddy field in Baba. After one year examination, quantitative analyses using scanning electron microscopy equipped with energy dispersive X-ray analyzer (SEM-EDX), diatoms and clay minerals (mainly montmorillonite) clearly indicated concentration of radionuclide, such as I, Cs, Ba, Nd, Th, U, Np, and Pu, suggesting absorption of both radionuclide and stable isotope elements. The leak of radioactivity of 137Cs, part of 90Sr, and the traces of some other radionuclide are originated from FDNPP accident. It is a possibility that the interaction between diatomaceous earth and radionuclide could be effective as the shield for low-level radioactive coastal area and marshes.

PRESENTATION TYPE: ORAL

THE REALIZATION OF A HEALTHY HYDROLOGICAL CYCLES BY POSITIVE RELATIONSHIP OF PEOPLE, LAGOON AND DUNE IN KAHOKUGATA DISTRICT

Hisashi Takahashi
Kahokugata Lake Institute, Japan
Masao Nagasaka
Kanazawa Seiryo University, Kanazawa, Japan
Kazue Tazaki
Kahokugata Lake Institute, Japan
Nanae Takahahshi
Kahokugata Lake Institute, Japan

KEYWORDS: HEALTHY HYDROLOGICAL CYCLES, ALIEN PLANTS, COOPERATION OF LAKE ANDDUNE

Lake Kahokugata is a shallow lagoon located in central Japan. Land reclamation was carried out at two-thirds of the lake, and a tide gate was constructed in 1980s. Shore protection works were carried out at the same time. Natural vegetation was lost, the lake had eutrophicated it. Fishery and other occupation associated with the lake disappeared at the same time. Because management disappeared, alien plants increased in the lakefront. Particularly gramineous Paspalum distichum var. indutum became the problem such as the confinement of the waterway. We began new collaboration work to revivify a lake in the Kahokugata area where collaboration work had been lost.We began activity to take gramineous plants by hands. It was effective than it was eliminated by machine. Furthermore, we began a trial using the gramineous plants which we harvested. “Suzume yasai” which mean sparrow vegetables has been cultivated to promote removal activities of alien plants in Lake Kahokugata. We can get the action of sparrow vegetables from another effect at the same time. We can create a healthy water cycle and regional cyclical change of matter by using the plant which we had taken from the eutrophic lake for a oligotrophic dune in the neighbor. By the cooperation of the lake and the dune, a powerful sand filter device is created. The collaboration of people is necessary for the device.

PRESENTATION TYPE: POSTER

SPATIAL AND SEASONAL VARIABILITY OF TURBIDITY IN LAKE KAHOKUGATA, A SHALLOW EUTROPHIC LAGOON IN JAPAN

Masao Nagasaka

Kanazawa Seiryo University , Kanazawa, Japan

Morihiro Takano

Ishikawa National College of Technology, Ishikawa, Japan

KEYWORDS: LAGOON , TURBIDITY, BRAKISH WATER

Lake Kahokugata is a shallow eutrophic lagoon located in central Japan. Land reclamation was carried out at the lagoon, and a tide gate was constructed in 1980s. Since then, the lake has switched from a clear water state to a turbid water state. Physical and chemical properties of the lake water were surveyed in 2013. The purpose of this survey is to analyze the spatial and seasonal variability of turbidity in the lake. The decreasing sedimentation rate is one of the major factors influencing turbidity in the present lake.

PRESENTATION TYPE: ORAL

NEW PURPOSE OF THE USE OF THE WATERSIDE VEGETATION RESOURCES WHICH ADOPTED A FACTOR OF THE PLAY

Nanae Takahashil
Kahokugata Lake Institute
Hisashi Takahashi
Kahokugata Lake Institute, Japan
Takako Banjyo
Kahokugata Lake Institute, Japan
Kazue Tazaki
Kahokugata Lake Institute, Japan

KEYWORDS: LAKE KAHOKUGATA, REED SHIP, MAINTENANCE OF THE REED BED

In wetlands including Lake Kahokugata, emergent plants such as the reed of the waterside have be en used as resources traditionally. The reed has been used to roof materials and building materials or such as snow fences. However, it is not used by these uses at present. Therefore the maintena nce of the reed bed is not carried out, and disappearance or decline of emergent plants which is im portant waterside plant communities are seen. We reconfirmed these plants as a useful resource b y adopting a factor of the play as new usage of the plants of the waterside. Furthermore, I carried o ut a trial to promote that a citizen worked on the maintenance by using the plant of the waterside. In 2013, we tried the making of reed ship for practical use of reeds. Using the reeds in the area appro ximately 200 square meters, we carried out an event to cooperate with many people, and to make one ship. For the people who have little experience of group work in nature, as for having made on e reed ship together, it was with good opportunity. In addition, there was a big effect as a outdoor o n-site training of children. If the making of reed ship will be established as a play of the Lake Kahok ugata from now on, we can expect that the maintenance of the reed bed which is decreasing in the lakefront advances. It leads to maintenance of wildlife inhabiting reed bed.

PRESENTATION TYPE: POSTER

ECOSYSTEM PROPERTY DETERMINANTS OF BIODIVERSITY ORGANISATION IN LAGOONS

Alberto Basset

Department of Biological and Environmental Sciences and Technologies, University of the Salento, Lecce, Italy

KEYWORDS: ECOSYSTEM PROPERTIES, SPECIES DIVERSITY, SPATIAL SCALES

Patterns of biodiversity in transitional waters have been addressed considering physical gradients, spatial patchiness, energy constraints and, clearly, anthropogenic-based perturbations. Lagoons particularly tend to be characterised by low local diversity, with few dominant species; the harshness of the physical environment has been considered a main determinant of these observations. On the other hand, by enlarging the scale of observation, both with and between ecosystems up to the eco-regional scale a role of lagoons as biodiversity hotspot is commonly claimed, supported both by the evidences of high b and g diversity and by the observations of island or nursery role of lagoons for many flagship or keystone species. Conceptual links between biodiversity patterns in lagoons and ecosystem properties have been recently proposed but not yet fully explored. Here, I am addressing the actual relevance of key ecosystem properties, as capacity, resilience and parsimony, on biodiversity patterns and organisation. Data are from data resources (i.e., Transitional Water Platform and Phytoplankton Data Platform) from LifeWatch-ITA covering mainly macro-invertebrate and phytoplankton guilds from different eco-regional areas. Capacity and resilience play key roles in determining biodiversity organisation in lagoon ecosystem, while they differ in the characteristic scale of influence. A hierarchical organisation of ecosystem properties seems to be generalizable to guilds differentially using lagoon ecosystems.

PRESENTATION TYPE: ORAL

THE DIACHRONIC EVOLUTION OF THE WESTERN GREECE'S LAGOONS

Ioannis Kalavrouziotis
Helelnic Open University, Greece

Prodromos Koukoulakis
Soil Science Institute, NAGREF, Greece

John N. Hatzopoulos
University of Aegean, Department of the Environment, Greece

Michalis Gazis
Hellenic Ministry of Culture and Sport, 6th Ephorate of Prehistoric and Classical Antiquities, Greece

KEYWORDS: DIACHRONIC EVOLUTION, ARCHEOLOGICAL STUDY, GREECE'S LAGOONS

The lagoons of Araxos, Kotyhiou, and Messolonghion- Aitolikon are located in Western Greece. Among them, the Messolonghion - Aitolikon lagoons are the greatest in the Mediterranean region. Today, these two lagoons have been proclaimed as environmentally protected parks of the Sothern edge of Sterea Ellada, where Patraikos gulf meets the Ionian sea. These lagoons in relation to the number of population and kind of bird species, are considered the richest wetlands of Europe. The lagoon of Araxos, the lake Prókopos and the marsh of Lamias in Achaia, and a bit Southern, the lagoon of Kotychi in the Prefecture of Elias, constitute a chain of wetlands in Western Peloponnese. In the area of Messolongion, the lagoons, and the terrestrial river regions, are respectively included in the Northern part of the Etoloakarnanian prefecture, as well as the island complex of the Echinades of the kefallinias Prefecture, which are distinguished and well known for their biological,, ecological, aesthetic, scientific, geomorphologic and environmental value. It has been concluded that there is a strong relation between the environmental factors and the archeological findings related to the selection of the site and the establishment of new town, in antiquity. The present study allows us today to have an in depth understanding of the environmental problems of the region of Western Greece, and also gives the possibility to face them with greater caution, and responsibility. At the same time it shows off the significance of the "wet factor" in the economic development of robust towns and societies, in general.

PRESENTATION TYPE: ORAL

MS03-01
Climate change trends and adaptation

OBSERVED SNOWFALL AND RIVER DISCHARGE TREND AND LOW-FREQUENCY VARIABILITY OVER ALPS

Matteo Zampieri
CMCC - Bologna, Italy
Enrico Scoccimarro
CMCC - Bologna, Italy
Silvio Gualdi
CMCC - Bologna, Italy

KEYWORDS: SNOWFALL, RIVER DISCHARGE, RUNOFF

We present a twofold analysis of long-term trend and variability of different factors affecting the hydrologicalcycle over the Alps in spring. The study is based on datasets derived from observations for the last 150 years. Inone case we focus on snowfall flux, which we found shifting between two different regimes in concert with theAtlantic Multidecadal Oscillation. This teleconnection is explained by a mixture of changes in circulation and bylocal climatic feedbacks. Moreover, we analyzed the timing of the river discharge peaks relative to the main Alpinerivers, finding similar features of low frequency variability, and a common anticipation tendency of more than twoweeks per century, probably explained by a change of seasonality of total precipitation.

PRESENTATION TYPE: ORAL

IMPACTS OF CLIMATE CHANGE ON LAKES IN JAPAN - PREDICTION OF IMPACTS ON LAKE BIWA-

Hironori Ogata
Ministry of the Environment, Tokyo, Japan
Masanobu Miszaki
Pacific Consultants Co., Tokyo, Japan
Takashi Yuasa
Pacific Consultants Co., Tokyo, Japan
Hiroshi Uehara
Pacific Consultants Co., Tokyo, Japan
Mutsumi Kasai
Pacific Consultants Co., Osaka, Japan

KEYWORDS: CLIMATE CHANGE, VERTICAL MIXING, DO CONCENTRATION

Using the output (temperature, solar radiation and rainfall) of the MRI-AGCM3.2S climate model made by Japan Meteorological Research Institute as the calculation condition, future changes in water temperature, vertical mixing and water quality was predicted, and the impact to the ecosystem of Lake Biwa and it's watershed was assessed. The result showed that, due to insufficient drop in surface-intermediate water temperature in the winter, vertical mixing stops for three years within ten years of near future climate condition, causing DO level in the bottom layer to decrease and deplete. Consequently, total phosphorus especially the concentration of phosphoric acid would increase in the bottom layer. The impact of decreasing DO level in the bottom layer to Isaza (Gymnogobius isaza) was assessed at median lethal concentration (LC50). It is predicted that, at 90m depth, the DO concentration may be less than LC50 throughout a year for a certain year. Based on the findings of this study, further assessment of climate change impacts on Lake Biwa will be conducted. In addition, assessment of climate change impacts on Lake Hachiro, Lake Ikeda and other lakes in Japan will be conducted using a similar method. After these assessments, a summary of impacts of climate change on lakes in Japan will be compiled using these results.

PRESENTATION TYPE: ORAL

TRENDS OF BREAKUP DATES IN FINNISH LAKES IN 1964-2013

Esko Kuusisto
Finnish Environment Institute, Helsinki, Finland

KEYWORDS: ICE BREAKUP, TREND, CLIMATE CHANGE

Trends of breakup dates in Finnish lakes in 1964-2013 Esko Kuusisto Finnish Environment Institute (SYKE) Helsinki, Finland In about half of the lakes, the shift towards an earlier breakup has been 10–12 days during the fifty year period. In one quarter, it has been 7–9 days, in one quarter 13–15 days. In southern and western parts of the country and in the former Oulu province the trends have been slightly stronger than elsewhere in the country. Significant trends can be detected also in most of the breakup data series, which are longer than one hundred years. However, these trends are considerably milder than those calculated from the last fifty years.

PRESENTATION TYPE: ORAL

THE RECENT WARMING OF LAKE ZURICH: CONTRIBUTIONS OF DIFFERENT DRIVERS

Martin Schmid
Eawag, Dübendorf, Switzerland

KEYWORDS: CLIMATE CHANGE, LAKE ZURICH, LAKE MODELLING

The surface waters of Lake Zurich (Switzerland) have been warming by almost 0.5 °C per decade during the years 1981 to 2012. Similar trends have been observed in other Central European lakes. The observed warming is strongest in spring and exceeds the trend in air temperature. Simulations of temperature and stratification with the one-dimensional lake model Simstrat show that the warming of Lake Zurich can be fully explained by the observed meteorological changes. The model is driven by homogenized time series of air temperature, solar radiation, vapor pressure, wind and cloudiness supplied by MeteoSwiss. The contributions of different drivers to the warming trend are estimated by model runs where the trends for individual forcing variables were removed. The results imply that the contributions of the individual drivers in the recent past differ from those expected in future scenarios derived from global climate models. Consequently, the effects of future climate warming on stratification and mixing processes in Central European lakes may be qualitatively different from those observed in the recent past.

PRESENTATION TYPE: ORAL

MANAGEMENT OF A TROPICAL FRESHWATER LAKE UNDER A CHANGING CLIMATE AND ENVIRONMENT

Shadananan Nair Krishnapillai
Nansen Environmental Research Centre, Kerala, India

KEYWORDS: CLIMATE CHNAGE, TROPICAL LAKE, ADAPTATION

Lakes are under threat from the impact of environmental degradation and changing climate, especially in developing countries like India with fast rising population and with several social, economic and political hurdles in manangement and in implementing adaptation measures. The Sasthamkotta Lake, a designated Ramsar site in the south-western Indian State of Kerala is a designated wetland and the only freshwater lake in Kerala. This spring-fed lake is the source of drinking water for half a million people and residence of nearly 27 freshwater fish species. However, the input of chemicals, fertilizers and pesticides from the agricultural lands carried through flowing water from even far inland, and the detergents and untreated domestic effluents from nearby urban areas contaminate the lake's relatively pure water, threatening the life of millions depending on it. Needs in domestic and agricultural sector associated with increasing population and the extremes in local climate as part of global anomalies worsen the situation. Increasig rainfall intensity causes large-sclae erosion in the upper hills and the sediment load carried by rivers threatens the existence of the lake. Increasing rianfall seasoanality reduces the summer runoff, affecting quality and quantity of water. Area of the lake is shrinnking fast because of encroachment, violating exisitng rules. Possible rise in sea level may contaminate the lake by the end of the century if adaptation measures are not resorted to, as the land between the lake and the Arabian Sea is less than a metre from the high tide line. New development projects such as the national river linking project is likely to reduce freeshwater input into the lake. Rules and regulations for the protection of lake become farce bcause of various social and political reasons. In this paper, a comprehensive study of the factors leading to the degradation of the lake, an assessment of the impact of chaging climate and a review of current policies, regulations and management practices have been carried out. Changes in runoff and water availability in the area under a predicted change in climate have been assessed using hydrological model. Results warn a decreasing availability of reliable water, both due to anthropogenic and climate change impacts. Guidelines for the better adaptation and mitigtion strategies have been provided.

PRESENTATION TYPE: ORAL

INTERANNUAL VARIABILITY OF LAKE LADOGA ICE COVER AND RELATIONSHIP TO ATMOSPHERIC TELECONNECTION INDEXES

Mikhail Naumenko
Limnology Institute of Russian Academy of Sciences, St.-Petersburg, Russia
Sergey Karetnikov
Limnology Institute of Russian Academy of Sciences, St.-Petersburg, Russia
Vadim Guzivaty
Limnology Institute of Russian Academy of Sciences, St.-Petersburg, Russia

KEYWORDS: ICE COVER, CLIMATE CHANGE, LAKE LADOGA

The largest lake in Europe - Lake Ladoga (S = 17670 sq.km., V = 848 cu.km) is situated at 60° N latitude. Winter conditions play an important role for the lake and serve as climate change indicator. The ice cover lasts for 171 ± 3 days on average from the early November until the mid-May. A digital Lake Ladoga ice cover data set was created to construct time series of a grid 5-day ice concentration and used this grid for investigation of the seasonal progression of the spatial distribution patterns of ice cover from 1943 to 2014. More than 1,300 surveys of the lake's ice cover were collected by using aircraft surveys and satellite images for winters of different types of severity. It have been shown that Lake Ladoga ice cover decreased significantly from eighties of last century. Since ice phenology records show considerable year-to-year variation we have used six teleconnection indices (NAO, AO, SCAND, EA-WR, POL) for the period from October to May for estimation of different types of Lake Ladoga's ice conditions. We selected representative parameters for further detection of climate change. We have developed multi-regression models to estimate the Relative Ice Cover Index (RICI) for whole winter condition and other ice characteristics as dates of first and last ice and maximum of accumulated freezing degree days (AFDDs).

PRESENTATION TYPE: ORAL

THE PROBLEM OF EXTERNAL PRESSURES FOR WATER AND ECOSYSTEMS RESTORATION OF WETLANDS-LACUSTRINE HMWB IN TIBER RIVER NETWORK (ITALY)

Angiolo Martinelli
ARPA Lazio, Rieti, Italy
Antonella Carosi
Provincia di Terni, Terni, Italy
Fedra Charavgis
ARPA Umbria, Perugia, Italy
Alessandra Cingolani
ARPA Umbria, Perugia, Italy
Susanna D'Antoni
ISPRA, Rome, Italy
Donatella Franchi
ARPA Lazio, Rieti, Italy
Maria Paola La Pegna
Provincia di Terni, Terni Italy
Malgorzata Owczarek
ARPA Lazio, Rieti, Italy
Alessandra Santucci
ARPA Umbria, Perugia, Italy
Gianluca Scialanga
Nazzano Tevere Farfa Reserve, Italy

KEYWORDS: ARTIFICIAL LAKES, WETLANDS RESTORATION, IMPACTS

Four on stream dams and related hydro power plants are located in the central part of the Tiber River and its principal tributary the Nera River, involving large hydrographic basins. Lentic water bodies developed upstream, covering the whole river flood channel and peripheral lagoons or marshes, are considered as Heavily Modified Water Bodies according to EU Water Framework Directive (DIR 2000/60CE) and are established as protected areas (Special Areas of Conservation, 92/43/CEE Directive; Special Protection Areas for Birds, 2009/147/CE Directive; Ramsar Sites). They are subject to high variable artificial discharge rates, and to insignificant residence times along river channels. “Alviano lagoon”, WWF Oasis also, is just below Corbara Lake, a great reservoir. “Recentino and S. Liberato lakes” play end role of the complex Nera hydro-power system, and are exposed to impacts from steel and chemical industrial sites. “Nazzano Natural Reserve”, after the confluence of Nera River, has a long lentic watercourse trait, fixed water level, and an important macrophytes marsh area at the Farfa River inlet, the latter providing, in theory, clear spring water. Monitoring data evidenced that biodiversity and ecological status of these environments are often critically endangered: turbidity, chemicals, sediment accumulation and pollution, hydraulic regulation, dredging and deslime works, floods and drought, can suddenly deteriorate the fragile artificial equilibrium. New perspectives for an ecological sustainable management and the creation of riverine wetlands are suggested, starting from a wider river restoration approach (like River and Lake Contract, public participation) which involves whole fluvial corridor, ecologic network, quarry degraded areas, sediment management, hydrological dynamics and water use.

PRESENTATION TYPE: ORAL

EFFECT OF CLIMATE CHANGE ON INTEGRATED SUSTAINABLE ENVIRONMENTAL MANAGEMENT OF FAMOUS FRESH WATER LAKE

Chittaranjan Das
KIIT University, Odisha, India
Sharmistha Mohanty
KIIT University, Odisha, India

KEYWORDS: FRESH WATER,LAKE,FISHERY,POTENTIAL, BIODIVERSITY,CLIMATE,CHANGE,ODISA,INDIA, SOCIO ECONOMIC

Lake Ansupa,the bigest fresh water lake in the state of Odisa, India is HIGHLY PRODUCTIVE ECOSYSTEM.iT has uniquie Biodersity chracter.It harbours 21 types of fishes,about 15 types of both floating & submerged type of aquatic vegetATION. .tHE MAIN RESOURCE IS FISHERY.ABOUT 2.5 LAKH PEOPLE LIVE ARROUND THE FRESH WATER LAKE.they depend on fishery resources for their livilyhood.This lake is suffering from various env. degradations like siltation,weed infestation & water quality degradation.These have adversely affected the day to living of the people living near the periphery of the lake. the integrated sustainable env. management plan which was initiated has been very recently completely shattered by drastic climate change.The Sudden rise in temperature about 42 degrees celcius has evaporated most of the water. The water level has come down drrastically.The Under ground aqifers are drying up.The water tablw has gone down. As a result the fishery potential has considerably decreased.,Adversely affecting the day to day living of the people.The sudden storm & Heavy unusual flood has devastated the ecology of the system.The SocioEconomic study through Rapid Rural AppraisalRRA & Through PRA(Participatory Rural Appraisal techniqes revealed that their SocioEconomic conditions have drastically changed due to sudden climatic change in this tropical area.All these physical chemical factors have been studied in detail with detailed socioeconomic studies.The results have been coorelated with the drastic changes in climatic conditions of this famous fresh water wetland.

PRESENTATION TYPE: ORAL

THE EFFECTS OF ATATURK DAM LAKE AND IRRIGATIONS INCLUDED SOUTHEAST ANATOLIA PROJECT (GAP) TO CLIMATIC PARAMETERS OF SANLIURFA PROVINCE

Remziye Yildiz Gülağaci
General Directorate of State Hydraulic Works GAP 15th Regional Directorate, Şanlıurfa, Turkey
Hüseyin Sefa Hizli
General Directorate of State Hydraulic Works GAP 15th Regional Directorate, Şanlıurfa, Turkey
Feride Dere
General Directorate of State Hydraulic Works GAP 15th Regional Directorate, Şanlıurfa, Turkey

KEYWORDS: ATATüRK DAM LAKE , CLIMATE CHANGE, NONPARAMETRIC TESTS

In this study , Atatürk Dam Lake and its irrigations have been opened to operation effects of meteorological variables that obtained from the meteorological stations of Şanlıurfa, Siverek, Hilvan, Akçakale, Bozova and Ceylanpınar that belong to the General Directorate of Meteorology until 2010 data was investigated by statistical methods. For many years, the monthly mean temperature, monthly maximum temperature, monthly minimum temperature, monthly mean relative humidity and monthly total precipitation observations are used. Kendall Rank Correlation test was analyzed with the observations change over time and showed some tendency to increase or decrease in the seasons of observations. Then, before-after observations of dam and, before-after observations of irrigation results analyzed by Mann-Whitney test change were obtained.

PRESENTATION TYPE: POSTER

A DECADE OF RAINSTORMS: NATURAL AND SOCIAL RESPONSE AT THE LAKE ATITLáN BASIN

Juan Skinner-Alvarado
Lake Atitlán Basin Authority - PROLAGO, Guatemala

KEYWORDS: CLIMATE CHANGE, ADAPTATION, MAYA

The Lake Atitlán Basin, in the volcanic mountains of Guatemala, has suffered from extreme climatic events in the past decade. The first disastrous rainstorm named Mitch occurred in the year 1998, Stan in 2005, Agatha and Alex in 2010, and storm E12 during 2011. These natural disasters triggered several social responses in this multicultural landscape. These events were later exacerbated by the lake response with cyanobacteria blooms. This paper examines the changes in the lake and the response by different groups of lake stakeholders to the consequences of climate change. To be able to explain the complexity of the responses to extreme climate events, a multidisciplinary review is obligatory. This includes: analysis of climate records, history of anthropogenic disturbance, lake ecology and water quality changes, and crisis response as research, policy, planning, and actions by different groups of stakeholders. Presently, more than 95% of the population at the Lake Atitlán Basin belongs to indigenous Mayan ethnic groups. Paleolimnology research in lakes of the Mesoamerican region conclude that the downfall of the Maya Classic period (1800-1100 BP) was due to severe droughts, which implies that the survivors of these catastrophic climate changes have incorporated adaptations in their cultural evolution and traditional way of life, favoring sustainability of resources and environmental services. A minority of non-indigenous lake stakeholders tends to sidetrack from issues of sustainability and adaptations to climate change.

PRESENTATION TYPE: ORAL

ECOSYSTEM IMPACT LINKED WITH ECO-WATER ALLOCATION AND SUSTAINABLE WATER MANAGEMENT: CASE STUDY OF BOSTEN LAKE, TARIM RIVER IN CHINA

Jun Xia
Research Institute of Water Security(RIWS), Wuhan University, Wuhan, China

KEYWORDS: ECO-WATER, BALANCING MULTIPLE USE OF WATER , BOSTEN LAKE

Bosten Lake in Tarim River that is located to West of China is the biggest inland river lake in China with water area of 1210.5 km2 that plays a key role for sustainable development of whole Tarim River Basin. However, water resources management and water allocation face big challenges due to contradictions and conflict amount upstream, lake and downstream to changing environment, in which eco-water use becomes a key issue on balancing multiple use of water in inland river basin. This paper developed a sustainable water management approach applied to Bosten Lake and Tarim River Basin based on three main principles, i.e., sustainability, carrying capacity and benefit. A basin water system model is developed to quantify interaction amount water quantity, water quality and ecosystem sustainability. Case study of sustainable water management in Bosten lake and Tarim River are given as explanation on solution for balancing multiple water uses and ecosystem sustainability with significan social and ecosystem benifits in whole basin in practice.

PRESENTATION TYPE: ORAL

NUMERICAL SIMULATIONS OF THE VICO LAKE BASIN WATER BUDGET UNDER DIFFERENT CLIMATE SCENARIOS

Francesca Lotti
Università della Tuscia, Italy
Antonella Baiocchi
Università della Tuscia, Viterbo, Italy
Vincenzo Piscopo
Università della Tuscia, Viterbo, Italy

KEYWORDS: VICO LAKE, VOLCANIC AQUIFER, WATER BUDGET

The Cimino-Vico hydrogeological system is characterized by a continuous basal aquifer and perched aquifers of limited extension (Capelli et al. 2005; Baiocchi et al. 2006). Groundwater flows in volcanic and pyroclastic formations, whose substrate is formed by the Plio-Pleistocene and Meso-Cenozoic sedimentary formations. The recharge area of the basal aquifer lies between the Cimini Mountains and Vico Lake. The lake represents an outcrop of the basal aquifer being fed in the northern sector and feeding the aquifer in other directions (Fig. 1). Field investigations confirmed the presence of perched aquifers in the northern and eastern external sides of the caldera, due to the extreme heterogeneity of the pyroclastic deposits of Vico volcano (Sollevanti 1983). Concerning the portion of aquifer involving the lava domes, it turned to be a dome-impounded groundwater (Baiocchi et al. 2014). Numerical model A numerical model was implemented in MODFLOW-2000 (Harbaugh et al., 2000) and covered an area of 213 km2. The discretization was performed by a grid of 21,280 cells (100x100 m) for a single layer. The upper limit was defined by a DEM with the detail of 10 m, the lower one was inferred from hydrostratigraphic logs and results of conceptual model. The initial hydraulic heads were assigned according to the reconstructed potentiometric map. The E, W and S limits of the model are head-dependent flow boundaries (GHB), function of the reconstructed potentiometric field (Fig. 2 and 1). The lake is simulated with the LAK3 package (Merritt and Konikow 2000) with direct recharge on the surface of the lake (1.47 × 10-8 m/s) and runoff within the caldera (5.3 × 10-9 m/s) estimated through the budget. Aqueduct withdrawals were assigned according to official data (7.74 × 10-9 m/s). The average annual recharge was assigned according to one out of four budget scenarios calculated in GIS environment. The automatic calibration (using PEST 12.3; Doherty 2012) was carried out according to two different approaches: the first one considered values and geometry of the zones of hydraulic conductivity (ZC); the second applied the method of pilot points (PP) (Certes and De Marsily,1991). More than 100 observation points allowed to reach a good agreement between the measured and calculated heads, as well as between the water budget analytically estimated and the one calculated by the numerical model. The two calculated potentiometric surfaces are consistent with measured data and volumes of the budget are comparable, especially in PP calibration. Conclusions A detailed hydrogeological scheme of the Vico basin was defined through new investigations. New elements acquired can be summarized as follows: - Possible presence of contaminant in groundwater could only reach the lake from the northern sector; in other areas, flows are oriented from the lake towards the aquifer. - The modeling provided estimates of water loss from the lake towards groundwater, previously estimated only indirectly from the water budget. - The hydrogeological scheme is characterized by the interaction of different components: a basal continuous aquifer connected to the lake surface, a deep aquifer with upflows towards the basal volcanic aquifer and the lake, perched aquifers s.s. in the Vico volcanic deposits, and dome-impounded groundwater at the edge of the Cimini domes. References Baiocchi A, Dragoni W, Lotti F, Luzzi G, Piscopo V (2006) Outline of the hydrogeology of the Cimino and Vico volcanic area and of the interaction between groundwater and Lake Vico (Lazio Region, Central Italy). Boll. Soc. Geol. It., 125, 187-202. Baiocchi A, Barbieri M, BattistelM, Lavinia M.P. Delfanti LMP, Lotti F, Madonna S, Piscopo V. (2014) The role of perched aquifers and dome-impounded groundwater in drinking water supply in the Cimino-Vico volcanoes (central Italy). Present Abstract Volume. Capelli L, Mazza R, Gazzetti C (2005) Strumenti e strategie per la tutela e l'uso compatibile della risorsa idrica nel Lazio. Gli acquiferi vulcanici. Quaderni di tecniche di protezione ambientale. Protezione

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PRESENTATION TYPE: ORAL

ANALYSIS OF THE CLIMATE CHANGE EFFECTS ON THE BRACCIANO LAKE (ITALY) USING NUMERICAL MODEL APPLICATION

Sara Taviani
Università degli Studi Roma Tre, Rome, Italy
Hans Jørgen Henriksen
Geological Survey of Denmark and Greenland, GEUS, Copenhagen, Denmark
Roberto Mazza
Università degli Studi Roma Tre, Rome, Italy

KEYWORDS: NUMERICAL GROUNDWATER MODEL, LAKE BRACCIANO, HYDRO-METEOROLOGICAL TIME SERIES

Bracciano volcanic caldera lake (Italy) is part of the Sabatini Hydrogeological Unit. Studies indicate that the lake is in direct contact with the main aquifer. The area is exposed to continuous stresses from several public and private pumping wells tapping the groundwater aquifer. Over the last thirty years the withdrawals from the aquifer have increased. Another stress on the system is climate change leading to changes in precipitation and temperature conditions, which in turn affect aquifer recharge and the lake water budget. The effects of global warming are increasingly evident (IPCC 2014), and are expected to lead to an increase in the use of groundwater. A numerical groundwater flow model on the Bracciano lake and its hydrogeological basin was constructed using the finite-difference code MODFLOW2000. The model was implemented for steady state, at first and it was calibrated. After that it was implemented for transient (monthly time steps over six years) conditions. A spatial interpolation of weather station information including rain and temperature (data over last 50 years), were considered as input values for the modelling of groundwater and lake water balance. The Bracciano model was applied to simulate possible climate change and water-use scenarios to better understand the behavior of an example volcanic lake under multiple stresses. The Bracciano model simulation results helps understanding the climate change effects on groundwater and lake water balance. It could also be a useful tool for analysing climate change adaptation strategies for water supply and groundwater and lake dependent ecosystems.

PRESENTATION TYPE: ORAL

CLIMATIC VARIATIONS AND MANMADE OUTLET CANALS OF LAKE TRASIMENO (UMBRIA, ITALY)

Walter Dragoni
University of Perugia, Italy
Paolo Boila
Consultant Geologist, Italy

KEYWORDS: LAKETTRASIMENO, OULET CANALS, CLIMATIC VARIATIONS

Lake Trasimeno (Central Italy) has no natural outlets, so its level fluctuates considerably and is strictly linked to climate. During the Warm Medieval Period the water was low, but it rose during the Little Ice Age, when large agricultural areas were flooded. In order to control the high water, during the 15th century an outlet tunnel was built and the draining basin was reduced. These works were unsuccessful and, at the end of the 19th century, an efficient outlet tunnel was constructed. At present the climate in central Italy is changing again, with decreasing rainfall and increasing temperature. This trend and the new outlet have led to a substantial lowering of the average water level, which creates serious problems for ecosystems and economy. In 1962, the streams diverted in 1480 were linked again to the lake in order to stabilise its water levels. The existence of a Roman outlet is inferred because all the lakes in Central Italy have been artificially managed in Etruscan-Roman periods and at least one Roman literary source mentions it; some Roman remnants were found during the excavation of the 19th century outlet canal. The location of the Roman outlet is believed to be on the Lake's eastern shore. Our geophysical investigations, however, indicate that this is an unlikely location. Probably the "Roman" outlet, if existed, was located on the western shore, draining towards the Chiana Valley. (Project funded in part by Provincia of Perugia and by Fondazione Cassa di Risparmio di Perugia, project 2010.011.0442).

PRESENTATION TYPE: ORAL

INFLUENCE OF CLIMATE CHANGE AND ANTHROPIC PRESSURE ON LAKES: ANALYSIS OF BRACCIANO AND BOLSENA LAKE SYSTEMS (CENTRAL ITALY)

Lucio Di Matteo
Department of Physics and Geology - University of Perugia, Italy
Walter Dragoni
Department of Physics and Geology - University of Perugia, Italy
Daniela Valigi
Department of Physics and Geology - University of Perugia, Italy
Massimo Melillo
CNR-IRPI Perugia, Italy

KEYWORDS: BOLSENA AND BRACCIANO LAKES, WATER MANAGEMENT, HYDROGEOLOGICAL MODELLING

A hydrogeological investigation was carried out on Bracciano and Bolsena lake systems (Central Italy). Both lakes are fed by a complex groundwater circulation hosted in volcanic deposits belonging to the Vulsino and Sabatino volcanic districts. The increasing of withdrawals from lakes and aquifers coupled with the reduction in rainfall produced by the climatic change have deeply influenced the environmental state of lakes. The water levels of Bolsena lake was simulated by means the LAGO model taking into account some climatic scenarios for the next decades. The model indicates that for a rainfall decrease up to the 10%, the minimum vital flow to the outlet could be supplied applying a sensible reduction of withdrawals. For a rainfall decrease higher than 10% and with no withdrawals the lake could become a closed lake as occurred around 1000 B.C. when the level of the lake was about 5 m lower than today. Regarding the Bracciano lake - due to the withdrawals for drinking from 1960s (0.8 m3/s) - the discharge of the lake outlet, became nil in the last decade. Although the water levels have reached in march 2014 values close to those of 60s, this situation is probably due to a very rare event, while most of scenarios of the IPCC suggests a decreasing of average rainfall, corresponding to water shortage. Besides the impact of climate change, there are plans to increase the water supply from the lake and the aquifer: in this context new rational management plans have to be developed.

PRESENTATION TYPE: POSTER

IMPACT OF CLIMATIC VARIATIONS ON WATER BUDGET OF LAKE TRASIMENO (CENTRAL ITALY)

Walter Dragoni
University of Perugia, Dept. of Physics and Geology, Perugia, Italy
Massimo Melillo
CNR-IRPI, Perugia, Italy

KEYWORDS: LAKE TRASIMENO, CLIMATIC CHANGE, MODEL

Lake Trasimeno, Italy, extends over approximately 124 km2 with a maximum depth of approximately 5.5 m. Lake Trasimeno has no natural effluents and the volume of water stored is strictly linked to rainfall. Until the end of the 19th century the main problem of the Lake was due to high water, which periodically flooded wide areas of agricultural land. In 1898 an efficient outlet was built. At present in central Italy there is a trend of decreasing rainfall and increasing temperature. That has caused a substantial lowering of the lake water level, with serious problems for the ecosystem, hygiene and economy: between 1989 and 2013 the outlet did not work, being water level too low. During this period the only lake outflow was intake for irrigation and evaporation, which caused an increase of salinity. On January 2014, after a period of exceptional high rainfall, the water level of the Trasimeno reached the outflow threshold of the outlet channel. To help solving the Lake problems, we built a monthly mathematical model, whose results indicate that approximately 15Mm3/year need to be added to the lake to effectively combat cyclic problems of low levels, increased salinity and the connected risk of water quality deterioration. However, should the worst IPCC scenarios prove founded, the addition of this water volume would no longer be sufficient to prevent a marked average decrease of Trasimeno volume. (Project funded in part by Provincia of Perugia and by Fondazione Cassa di Risparmio di Perugia, project 2010.011.0442).

PRESENTATION TYPE: ORAL

CLIMATE CHANGE AND RECLAIMED WATER; STORAGE, RECHARGE AND RESOURCE SAFETY

Miquel Salgot
Universitat de Barcelona, Spain
Giuseppe L. Cirelli
Department of Agro-food and Environmental Systems Management, University of Catania, Catania

Climate change is recognized to modify precipitation patterns, changing water availability at the basin level. Absolute knowledge of future changes at small scale does not exist, but it is accepted that the Mediterranean will suffer especially, diminishing water availability in the entire basin. To improve resilience to climate change, non-conventional resourcescan substitute conventional water resources. Reclaimed water is generated all the year round, but it is not used continuously, especially for irrigation purposes. For reclaimed water to be fully reused, storage is basic. Small reservoirs and Managed Aquifer Recharge(MAR) are known technologies for long-term storage. At small scale, resource availability increase is undertaken by using seasonal surface storage for agriculture, wastewater reservoirs (WWRs) and for other purposes, e.g. golf courses lakes. Water bodies filled with reclaimed water need to be carefully managed, at short and long term, to maintain or improve their water quality. In Sicily (Italy) seasonal storage for reuse in agriculture is described, especially the research carried out on small WWRs operating in batch or continuous. These facilities create lentic ecosystems with a role in ecology and recovery of marginal lands. In Sabadell (Spain) aquifer recharge and recovery with reclaimed water (MAR) additionally treated with constructed wetlands in a river basin is shown. If climate change reduces water resources availability, measures that decrease the dependence of conventional resources, increase water in ecosystems and re-establish the relation between river water and associated aquifers should be useful for increasing the resilience of the ecosystems, always considering water safety.

PRESENTATION TYPE: ORAL

MS03-02
Climate driven impacts

LAGOONS AND LAKES IN WESTERN GREECE: HUMAN-MADE IMPACT ON THE NATURAL ECOSYSTEMS AND GEOMOMORPHOLOGICAL CHANGES

Francesco Marabini

National Research Council, Institute for Marine Science (ISMAR), 101 P. Gobetti str., 40129, Bologna (BO), Italy

Maceo Giovanni Angeli

National Research Council, Research Institute for Hydrogeological Protection (IRPI), 06128, Via Madonna Alta, 126 Perugia (PE), Italy

George Efthimiou

Technological Educational Institute of Sterea Hellas, Department of Forestry and Management of Natural Environment, GR- 36100, Karpenisi, Hellas

Konstantinos Mertzanis

University of the Aegean, Faculty of Management, Department of Financial and Management Engineering, GR- 82100, 41 Kountouriotou str., Chios, Greece

Kyriaki Papadopoulou- Vrynioti

National & Kapodistrian University of Athens, Department of Geology & Geoenvironment, GR- 15784, Panepistimioupoli, Zografou, Athens, Greece

KEYWORDS: GEOMORPHOLOGY, PROTECTED WETLANDS, SHORELINE REGRESSION

The intensification of human interventions, especially after the decade of 1950, in the coastal zone and the deltas as well as in the catchment basin of some wetlands, in Greece, have affected the natural ecosystems one way or another and to a different extend, depending on the type, the size and the operation and the location of the intervention or activities. The main factors responsible for the intense human activity in these areas are the extensive biodiversity and productivity that characterize the littoral and inlandwetlands in Greece, as well as their specific geological, hydrological, geomorphological and soil characteristics as well as, in some cases, their accessibility. Characteristic examples of wetlands that have been impaired by anthropogenic interventions, are the protected wetlands that exist in Western Greece (Epirus and Aitoloakarnania) such as those in the delta area of some rivers (r. Arachthos, r. Acheloos), Kalodikifen and Ziros lake. The purpose of this work is: a. to recognize the main human activities in the catchment basins and the deltas under study, b. to report a synthesis of the environmental and geomorphological studies on the selected wetlands. c. to detect the environmental impacts and the geomorphological changes caused by the above mentioned human activities as well as the problems that follow, which affect these wetlands.

PRESENTATION TYPE: POSTER

POTENTIAL IMPACTS OF CLIMATE CHANGE ON THE ARTISANAL FISHERIES OF TROPICAL AFRICAN SHALLOW LAKES

Moshood Mustapha
University of Ilorin, Ilorin, Nigeria

KEYWORDS: CLIMATE CHANGE, ARTISANAL FISHERIES, SHALLOW LAKES

African shallow lakes support productive artisanal fisheries by contributing to livelihoods and accounting for more than 80% of fish production. These lakes are vulnerable to climate change arising from global warming, increasing temperature and changes in ecosystem processes that brings flooding, precipitation and run-off with potential negative impacts on fish productions, assemblages, breeding, resistance to species invasion, fishing activities, catch per unit effort, wild seed supply, fish meal and oil and likelihood of spread of vector-borne diseases. Climate change could extirpate fish population, reduce recruitment, exacerbate invasion by alien species, cause shift in species distribution and migration, disrupt genetic diversity, and bring localized extinction among others. Fishing gears, processing, marketing, fishing periods and infrastructures could be affected and total abandonment of artisanal fisheries could occur. Understanding climate change and its impacts on artisanal fisheries will provide accurate decision, capacity building and adaptive management in solving the problems. It will provide practical, scientific and socio-economic actions to mitigate the challenges currently and in future. Climate change will produce synergistic effects on the artisanal fisheries of shallow lakes with considerable uncertainty to the extent, magnitude, rate and direction of changes and impacts. Study of vulnerability of artisanal fisheries to climate change in the likelihood of episodic events, sensitivity and adaptive capacity should be the focus of scientific research. Prediction models of climate change perturbations on fish response in terms of feedbacks, thresholds, adaptations, migrations, breeding and so on could mitigate the impacts and ensure sustainability of artisanal fisheries in these shallow lakes.

PRESENTATION TYPE: ORAL

GLOBAL CRISIS OF WATER RESOURCE IMMINENT IN 21ST CENTURY AND THE TASK OF JAPAN

Yarai Sato
Terra Corporation, Japan

The global population in 1945 when I was born was 2.5 billion. And now it is 7.2 billion in 2014. There are three global crises we are facing in 21st century, such as energy, food and water. Now those three resources are eccentrically-located on the earth and always 1.1 billion people are on starvation and 1.3 billion people don't access quality water currently. In 2050 the global population will become 10 billion and there might happen a lot of conflicts around the world in desire for those three resources. Japan has a very important role to play tackling those conflicts. Japan has only 4 % of the energy self-sufficiency ratio and only 40 % of food self-sufficiency ratio. In order to curtail global conflicts, Japan has most important role to carry out. Three major strategies are proposed. The first is to allocate appropriate population distribution in accordance with global agricultural potential and productivity. The second is to steer integrated promotion in both water supply and sewerage sectors. The third is to control the economic growth in the world by philosophical politicians.

PRESENTATION TYPE: ORAL

RESPONSES OF BIOTA TO CLIMATE-RELATED FACTORS IN LAKES OF NORTH-EASTERN BALTIC REGION

Nadezhda Berezina
Zoological Institute of the Russian Academy of Sciences, Saint-Petersburg, Russia

KEYWORDS: CLIMATE, BIOTA RESPONSE, EUROPEAN LAKES

The inland waters are among the most vulnerable ecosystems to climate change. Analysis of long-term data sets showed that many of the effects of changing climate are already occurring in many lakes across Europe. They include increase in water temperature, reduction in lake ice-cover, change in water levels, habitat structure and water residence time. These changes in environmental conditions can affect directly or indirectly the biota, mainly species population dynamics and geographical distributions. In spite of a number of publications testifying to changes in climate variables for different European lakes, little is known about the responses of biota to climate change. This paper aims to reveal current changes (recent decades) in regional climatic variables like water temperature, the duration of the ice-free period and the precipitation rate, as exemplified by Petrozavodsk Bay (Lake Onega, European Russia), and to analyse their relationships with the global climatic indices and structural characteristics of biota (chlorophyll concentration, phytoplankton and zoobenthos abundance/biomass) in the lake ecosystem, which lies within the Baltic Sea catchment area. Spearman's rank correlations and multiple regression analysis confirmed significantly that the global climate governs primarily the regional climatic variables and productivity level in the lake's ecosystem, whereas most of the biotic characteristics respond to regional climate. For north-eastern European region lakes higher temperatures are likely to lead to higher primary productivity with more intense algal blooms, the loss of cold stenothermic species and the invasion of new eurybiotic species from southern regions finally resulting in a change in food-web structure.

PRESENTATION TYPE: ORAL

OBSERVED LAKE BAIKAL PLANKTON TRENDS - RESULT OF NATURAL PROCESSES OR CLIMATE CHANGES?

Eugene Silow
Irkutsk State University, Irkutsk, Russia
Svetlana Shimaraeva
Irkutsk State University, Irkutsk, Russia
Elena Pislegina
Irkutsk State University, Irkutsk, Russia
Lyudmila Krashchuk
Irkutsk State University, Irkutsk, Russia
Olga Rusanovskaya
Irkutsk State University, Irkutsk, Russia
Konstantin Onuchin
Irkutsk State University, Irkutsk, Russia

KEYWORDS: CLIMATE CHANGE, HUMAN INFLUENCE, NATURAL DYNAMICS

We have used data of 60 years of plankton sampling. We've used data for 1950 – 2010. Since 1945, data have been collected at least monthly, generally every 7-10 days, in depth profiles from the surface to 250 m at a single main station (Point #1) in the Southern basin approximately 2.2 km offshorefrom Bol□'shie Koty (51o 54□.195' N, 105o 04.235 E) where water depth is approximately 900 m. This site is typical for the open Baikal and seasonal and interannual dynamics of ecosystem components here is in good accordance with the rest of the lake [Kozhov, 1963; Kozhova, Izmestyeva, 1998]. Thin ice prohibits collection in some months, usually January. Water temperature is measured using a mercury thermometer in samples retrieved on deck with a Van Dorn bottle. Secchi depth, the depth at which a standard white disk disappears from view in the water column, is routinely measured as an index of water quality. Phytoplankton samples are enumerated at the species level. Discrete depths of 0, 5, 10, 25, and 50 m are targeted for measurement of abiotic variables and sampling of phytoplankton with a 10 L Van Dorn bottle. For temperature and biological data, we averaged data within the top 50 m of the lake, the portion of the water column containing most of the lake's photosynthetic production, as well as the summer thermocline and the most of the plankton organisms [Kozhov, 1963, Kozhova, Izmestyeva, 1998]. To examine long-term trends for Lake Baikal temperature, we averaged data by months to create values for certain months. Zooplankton samples are enumerated at the species level and also identified by age class. Single zooplankton samples are collected with a closing plankton net (37.5-cm diameter, 100-mkm mesh) from depth layers of 0–10, 10–25, and 25–50 m. Zooplankton samples have been fixed and stored in formalin throughout the long-term monitoring program. The analysis of data of long-term observations after under-ice phytoplankton demonstrated the presence of some succession in spring phytoplankton (decrease of share of endemic algae), less expressed by biomass then by number, i.e. there are less large cell algae and more small cell. The analysis of the summer complex of the alga species demonstrates the following. Some non-endemic species show statistically significant positive trend for August, but there are also tendencies forincrease for July and September. Analysis of zooplankton dynamics demonstrates no noticeable trends for main component of zooplankton, Epischura baikalensis, though some increase of co-dominant species Cyclops kolensis, decrease of number of endemic Rotifera, growth of number of Cladocera, and of non-endemic Rotifera. These trends can be explained by: 1) Global Climate Change (though temperature of the lake shows long-term oscillations). 2) Regional Warming (due to building of reservoirs system in 1950s-1970s). 3) Local Chemical Pollution (due to industrial and agricultural activity in watershed and airshed basins of lake). 4) Natural Oscillating Behaviour of Plankton Components.

PRESENTATION TYPE: ORAL

IMPACT OF CLIMATE CHANGES ON THE NONLINEAR DYNAMICS OF EUTROPHICATION PHENOMENA OF COASTAL LAGOONS IN PONTINIA RE

Francesco Cioffi
DICEA-Sapienza Università di Roma, Rome, Italy
Federico Conticello
DICEA- Sapienza Università di Roma, Rome, Italy

KEYWORDS: LAGOON, CLIMATE CHANGES, EUTROPHICATION

Impact of climate changes on the nonlinear dynamics of eutrophication phenomena of coastal lagoons in Pontinia region. Francesco Cioffi, Federico Conticello Department of civil, constructional and environmental engineering (DICEA), La Sapienza ' University of Rome, Via Eudossiana 18,00184 Rome , Italy (francesco.cioffi@uniroma1.it) Climate change poses a number of problems for the management and restoration of coastal lagoons. Changes due to anthropogenic global warming in rainfall seasonality, intermittence and intensity together with variations of temperature and sea level (SL) may interact and determine the potential outcomes for hydrodynamics, eutrophic dynamics and ecological diversity of such environments. In fact, ecosystems of lagoons exhibit very complex dynamics, due to the nonlinear interactions of biological, chemical and hydrodynamic processes that influence the cycles of carbon (vegetal growth, organic detritus production and mineralization), nutrients, sulphur, and all those species involved in ecological phenomena. Such a dynamic is influenced by various external forcing variables—tidal flows, wind speed, temperature, light intensity, nutrient external load—that in most of the cases are periodical or multi-periodical. Anthropogenic or climate changes in one or more of these external variables can trigger shifts between ecosystem states which can be evidenced by species composition shift, higher vulnerability of the lagoon to summer water anoxia, more frequent fish kill. In this study we explore the ecological response of coastal lakes in Pontinia region, to the changes along 21 century -in according to the hypothesized CMIP5 global warming scenarios- of forcing factors, as precipitation, sea level and temperature.

PRESENTATION TYPE: ORAL

GROUNDWATER DEPENDENT LAKES: A CASE OF TWO COASTAL LAKES AT RISK IN SOUTHEAST VIET NAM

Phan Thi Kim Van
Vietnamese Academy of Science and Technology, Ha Noi, Vietnam
Giuseppe Arduino
UNESCO, France
Nguyen Thi Kim Thoa
Vietnamese Academy of Science and Technology, Ha Noi, Vietnam
Palo Bono
Sapienza Università di Roma, Rome, Italy
Clarissa Brun
ZZV - Institute of Public Health Chemistry Department - Geoisotopical Unit, Koper, Slovenia

KEYWORDS: GROUNDWATER DEPENTENT LAKES, COASTAL LAKES, ENVIRONMENTAL IMPACTS

This paper presents the results obtained during an investigation into two lakes, Bau Ong and Bau Ba, located in Bau Trang (east of the city of Phan Thiet) in Binh Thuan Province, Southeast Viet Nam; an area undergoing massive desertification processes and impacted by human activities where coastal sand dunes largely occur. The study of the Bau Ba and Bau Ong lakes was carried out within the framework of a larger hydrogeological investigation on water resources assessment and management, notably the “Assessment of groundwater resources in the sand dune coastal area of Binh Thuan, Southeast Viet Nam”project, during the period 2004 to 2010. The two lakes (at an elevation of approximately 30 m a.s.l) stretch for approximately 6 km in a NW-SE direction (Bau Ong north west – Bau Ba south east) perpendicular to the coast line located at a distance of around 2 km; their maximum width comprises between 300 and 500 m, with maximum depths of roughly 16 and 20 m respectively and a total volume of 5.7 Mm3 (Bau Ba) and 2.6 Mm3 (Bau Ong). The outlet of the lakes is located 400 m from the shore line and is represented by a coastal spring in the sand dunes, with a discharge of between 70 to 200 l/s. Chemical and stable isotope analyses of the lake’s water, the outlet spring and groundwater taken from an observation well located in the vicinity of the lake, demonstrate that they are composed of different water types, characterized by complex mixing processes. Current environmental impacts on the lakes are represented by desertification processes, due to the progression of dunes, and by quarrying activities over large areas of the dunes for the extraction of Titanium sands. This project formed part of both the UNESCO International Hydrological Programme (IHP) and the Italian Ministry for the Environment Land and Sea (IMELS) “Water Programme for Africa, Arid and Water Scarce zone - Vietnam component”, funded by IMELS, the Vietnamese Government, the International Council for Science (ICSU), and UNESCO-IHP.

PRESENTATION TYPE: ORAL

MS03-03S

Special Session - Climate Change: lakes and water resources in Mountain Regions

HIGH-MOUNTAIN LAKES AS SENTINELS OF ENVIRONMENTAL CHANGES

Ruben Sommaruga
Universitiy of Innsbruck, Insitute of Ecology, Innsbruck, Austria

High-mountain lakes (HML) are excellent sentinels of different global changes because their catchments have no direct anthropogenic influence and therefore, are strongly influenced by changes taking place in the atmosphere. HML located in the temperate zone are ecosystems where organisms live under a delicate balance as a consequence of the dominant harsh environmental conditions such as low water temperatures, high UV radiation, and low nutrient/food concentrations. Their high sensitivity to different global changes has the potential for further alteration in species composition. In this talk, I will first show the most important environmental changes across the altitudinal gradient and discuss relevant global changes taking place or expected to alter the biodiversity and function of these ecosystems. Among them, I will highlight the importance of climate change in creating many new turbid high mountain glacier-fed lakes as a consequence of the current rapid retreat of glaciers. Thus, climatic warming is accelerating changes in water turbidity and in other physicochemical factors of glacier lakes with clear consequences for plankton community structure. Another threat is arising from high nickel concentrations in alpine lakes influenced by rock glaciers withvalues sometimes exceeding the threshold for drinking waters. Further, the increase in atmospheric deposition rates of nitrogen is an important global change resulting in the replacement of algal species in HML and we have recently unrevealed its impact in modulating the ability of planktonic organisms to efficiently protect against the damaging effects of UV radiation. Finally, I will show that knowledge obtained for HML in the temperate zone need to be compared with HML in the tropical region that show very different limnological characteristics. By studying HML in different parts of the world, we may obtain a better knowledge on their ecology and their sentinel value at a global scale.

PRESENTATION TYPE: ORAL

TEMPORAL CHANGES IN IONIC COMPOSITION OF LAKES IN THE EASTERN ALPS

Bertha Thaler
Environmental Protection Agency,Bolzano, Italy
Danilo Tait
Environmental Protection Agency, Bolzano Italy

KEYWORDS: ALPINE LAKES, ROCK GLACIER, SULPHATE

During the last two decades, the ionic concentration has rapidly increased in some water bodies of South Tyrol, a province of Northern Italy. The chemical composition of these surface waters was compared to all other available surface water data for the province. The distribution of sulphate and magnesium concentrations of nearly 200 lakes of South Tyrol shows that only a few of them exhibit high concentrations of these two solutes, and nearly exclusively high altitude lakes. The majority of lakes show negligible temporal changes in their ionic composition or even lower sulphate concentrations than in the recent past due to its decreased level in atmospheric precipitation in the last years. The observed increased ionic concentrations are too high to depend only on enhanced weathering driven by climate warming, also because the watersheds of high altitude lakes are mostly small and the water travel time is short. It is assumed that the main driving factor is the melting of rock glaciers which were detected within all watersheds where the increase in solute concentrations was observed. The water melting from rock glaciers shows high concentrations of solutes, produced by chemical and biological processes taking place within them. The final products of these processes and the concentration level of the outflowing solutes, in some cases also heavy metal ions like nickel and manganese, seem to depend on the lithological composition of the rock glacier itself.

PRESENTATION TYPE: POSTER

REGIME SHIFT TRIGGERED BY AN EXTREME CLIMATIC EVENT IN AN OLIGOTROPHIC MOUNTAIN LAKE

Giampaolo Rossetti

Department of Life Sciences, University of Parma, Parma, Italy

Isabella Bertani

LifeWatch-Ita - Ecological Interactions Thematic Center, CNR-IBAF, Institute of Agroenvironmental and Forest Biology, Monterotondo Scalo (RM), Italy

Raul Primicerio

Faculty of Biosciences, Fisheries and Economics, The Arctic University of Norway, Tromso, Norway

KEYWORDS: REGIME SHIFT, FOOD WEB, ECOSYSTEM RESILIENCE

Climatic extremes, especially heatwaves and droughts, have increased in frequency, duration and magnitude in many regions of the world as a result of climate change. This trend is predicted to continue, thereby raising urgent questions regarding their ecosystem-scale consequences on freshwater systems, in which abrupt shifts to a contrasting regime can be triggered by environmental perturbations. We explored the impacts of a summer heatwave on a small, dimictic lake located in the Northern Apennines (Italy) at an altitude of 1527 m a.s.l., that is part of the LTER Network. Its simple food web, with relatively few trophic levels, facilitates the detection of key changes in community structure and the associated driving mechanisms. A sudden transition from a phytoplankton- to a macrophyte-dominated regime occurred during the 2003 heatwave. We investigated candidate mechanisms driving the switch from pelagic to benthic control of primary production, and we examined physico-chemical and biological time series to identify the major ecosystem-level consequences of the switch. Enhanced light availability due to water level reduction most likely created favorable conditions for the rapid establishment of benthic vegetation across the lake bottom. Our results provide evidence of abrupt and extensive ecological changes that are indicative of a regime shift. We show that ecological implications of the shift propagate across multiple trophic levels and determine marked changes in community structure that persist long after the climatic anomaly.

PRESENTATION TYPE: ORAL

HIGH ALPINE PONDS SHIFT UPWARDS AS AVERAGE TEMPERATURES INCREASE: A CASE STUDY OF THE ORTLES-CEVEDALE MOUNTAIN GROUP (SOUTHERN ALPS, ITALY) OVER THE LAST 50 YEARS

Franco Salerno
IRSA-CNR , Brugherio Italy
Sudeep Thakuri
EV-k2-CNR, Bergamo, Italy
Gianni Tartari
IRSA-CNR , Brugherio Italy

KEYWORDS: CLIMATE CHANGE, PONDS, GEOMORFOLOGY

Alpine ecosystems are especially vulnerable to climate change, and lake and ponds act as early indicators. Here, we describe our findings for the Ortles-Cevedale mountain group (Stelvio National Park, southern Alps, Italy), where we used remote sensing to analyze more than 100 water ponds during the last 50 years (1954-2007). We found that since the 1980s, some lower elevation ponds (2900 m a.s.l.), we observed that since the 1950s, lakes have increased in size and that new lakes have appeared as a consequence of glacial shrinkage and retreat. However, these new lakes possess an ephemeral nature. The appearance of new environments is usually followed by their rapid disappearance and by a concomitant appearance of new ones, which is a clear sign of a transition from a glacial system to a paraglacial one. Surface area changes have also proved to be a highly visible and easily measurable signal of the impact of climate change on the alpine environment, as already demonstrated in other remote areas of the world. There is a clear need to extend this analysis to other sites in the Alps to gain a regional understanding of the phenomenon. The findings of this study make it possible to interpret the variations created by climate change in these environments, in terms of alteration of their ecological role and the loss of ecosystem services.

PRESENTATION TYPE: ORAL

CLIMATE CHANGE IMPACT ON REMOTE LAKES OF MT EVEREST (NEPAL)

Franco Salerno
IRSA-CNR, Italy
Michela Rogora
ISE-CNR, Italy
Andrea Lami
ISE-CNR, Italy
Gabriele Tartari
ISE-CNR, Italy
Sudeep Thakuri
Ev-K2-CNR, Italy
Gianni Tartari
IRSA-CNR, Italy

KEYWORDS: CLIMATE CHANGE, REMOTE LAKES, GEOCHEMISTRY

The SHARE WATER Project aims to assure a continuous environmental monitoring in mountain sites through long-term, high quality data series and to contribute to the study of climate change impacts on water resources. Within this framework, we refer here the main findings of research focused on climate drivers of change and observed impacts on lakes on the southern slopes of Mt Everest (Nepal). In particular we focus on both the drivers of change and the impacts on a wide lake population, presenting 1) a daily temperature and precipitation reconstruction for the last twenty years (1994-2013) using all the available in situ measurements; 2) the impact of melting processes on lake morphology 3) the changes occurred in the water quality of some lakes located between ca. 4500 and 5500 m a.s.l since the 1990s. Our findings testify that some climate-related signals are highly visible and easily measurable in lakes. Due to their sensitivity, physical and chemical properties of remote lakes can be used as sentinels of climate-related changes.

PRESENTATION TYPE: ORAL

A SEMI-SUBMERSIBLE DRONE FOR LAKES ENVIRONMENT MONITORING AND ACOUSTIC DATA ACQUISITION

F. M. Raimondi

G. Lena

S. Proietti

P. Sdringola

KEYWORDS: SHALLOW WATER MONITORING, HYDROGEN, TELECONTROLLED, SATELLITE, SEMI-SUBMERSIBLE

The proposed project involves the implementation and the experimentation of an innovative nautical telecontrolled robotic vehicle (HS-USV) with a surface and semi-immersion capability. This vehicle is based on a pending patent belonging to Palermo University (Patent RM2012A000209) concerning innovative semi-submersible vehicles (HS-Drone), that can be remotely controlled from the ground, air, satellite and sea and that will be powered by fuel cells and photovoltaic generator. The Drone is hosts for the satellite communication equipment, the downloading data equipment and the supply of hydrogen for the fuel cell. The hydrogen will be produced directly on board with renewable energy based technologies, as result of interdisciplinary collaboration with the Engineering Department of the University of Perugia. The Drone will be equipped with on-board control systems for autonomous navigation (preset routes) recognition and obstacle avoidance and will be able to perform the analysis of subsea data in real time and off line. These capabilities will be guaranteed by known algorithms of artificial intelligence in both the on-board operational controls and the acquisition and data analysis (Genetics Algorithm, Neural Net, Fuzzy Logic, Bayesian Net) but in an innovative context. This system can be solved the typical logistic problem occurring in very shallow water contexts (such as coastal and lacustrine environment), where the low depth of the water column (generally less than 10 m) present several challenges, including near-field effect and operability difficulties. The proposed system can be used for applications in the fields of lakes monitoring, organic fish - marine, hydrography, geology / geophysics, oceanography, underwater acoustics and environmental monitoring with particular attention to climate change impact indicators. The project will have important implications, summarized as follows: improvement of the current status of remote operations in the field of marine and oceanography and water column data collection, improvement of safety, improvement of competitiveness and reduction of the impacts arising from work in offshore conditions.

PRESENTATION TYPE: ORAL

SEDIMENT CORING OF THE PROGLACIAL LAKE DONGUZ-ORUN (NORTHERN CAUCASUS, RUSSIA)

Mikhail Alexandrin
Institute of Geography, Russian Academy of Sciences, Russia
Olga Solomina
Institute of Geography, Russian Academy of Sciences / Tomsk State University, Russia
Ivan Kalugin
Institute of Geology and Mineralogy, Siberian Branch, Russian Academy of Sciences, Russia
Andrey Darin
Institute of Geology and Mineralogy, Siberian Branch, Russian Academy of Sciences, Russia
Atle Nesje
Department of Earth Science, University of Bergen, Norway / Uni Research/Bjerknes Centre for Climate Research, Norway

KEYWORDS: LAKE SEDIMENTS, LACUSTRINE SEDIMENTS, PALEOLIMNOLOGY, GLACIER VARIATIONS, CAUCASUS, CLIMATIC RECONSTRUCTIONS, HIGH-RESOLUTION RECONSTRUCTIONS

The climatic history of the Caucasus Mountains is poorly studied. No high-resolution and long-term reconstructions of glacier variations and climatic parameters based on lake sediments are known for the region. Meanwhile, lakes of Western and Northern Caucasus offer a vital source of paleoclimatic information. Coring of the Lake Donguz-Orun took place in 2012 during the field expedition of the Institute of Geography, Russian Academy of Sciences. A modified piston corer mounted on the inflatable catamaran was used. A 28-cm long core was retrieved from a water depth of 7 m. The sediment core revealed a regular lamination showing the signs of classical glacial varves. The upper part of the sediment core was exposed to the high-resolution scanning geochemical analysis using the XRF-SR technology (Institute of Geology and Mineralogy SB RAS, Novosibirsk). Calculation of Rb/Sr peaks (presumably marking the spring flood) along with the visual calculation of the layers yield the sedimentation rate around 2 mm/yr. Similar results are derived from the dating using 137Cs and 210Pb. With this high accumulation rate, the sediment core of Lake Donguz-Orun represents an important source of information for high-resolution reconstructions of climatic parameters and glacier variations of the region. Subsequent analyses of the sediment core were carried out within the facilities of the University of Bergen, Norway and included geochemical XRF-analysis and magnetic properties of the sediment. In order to clarify the recent history of the Donguz-Orun glacier, lichenometrical and dendrochronological dating of its lateral and terminal moraines was also produced.

PRESENTATION TYPE: POSTER

HIGH ALTITUDE HIMALAYAN LAKES AND BIOTIC RESPONSE TO GLOBAL ENVIRONMENTAL CHANGE

Subodh Sharma
Department of Environmental Science and Engineering, Kathmandu University, Nepal
Chhatra Mani Sharma
Lappeenranta University of Technology, Finland
Rosha Raut
Aquatic Ecology Centre, Kathmandu University, Nepal

KEYWORDS: HIGH ALTITUDE LAKES, BIOTIC RESPONSE, CLIMATE CHANGE

Four high altitude Himalayan lakes in Nepal, namely Gokyo (4,750 m asl), Panchpokhari (4,010 m asl), Gosaikunda (4,000 m asl), and Rara (3,000m asl) were compared for heavy metals in the lake sediments. Response of non biting midges (Insecta: Chironomidae) to global environmental change based on sub fossil remains of the head capsules in the sediments was also studied. Results revealed most (arsenic, cupper, manganese, zinc, potassium, and sodium) of the analyzed metal concentrations below the level recommended by the WHO for safe drinking water. Lead (Pb) and cadmium (Cd) levels, however, exceeded the limits in some of the samples creating concern for human health in the lake Gokyo. Sediment samples collected from the littoral zone of lake Gosaikunda contents very high concentration of iron. The comparison between the heavy metals and the chironomids abundance showed negative correlation in the lake Gosaikunda up to a depth of 5cm in the littoral zone. Further studies based on sub fossils of chironomids in the sediments of lake Gokyo revealed decrease in head capsules up to a depth of 5cm followed by an increase afterwards indicating clear symptoms of environmental change in recent years probably caused by the deposition of pollutants in the high altitude Himalayan lakes. Samples from Panchpokhari and Rara lakes are being analyzed.

PRESENTATION TYPE: ORAL

ROLE OF MOUNTAIN LAKES BIOLOGY IN DETECTING CLIMATE CHANGE IMPACTS

Angela Boggero
CNR Istituto per lo Studio degli Ecosistemi, Verbania, Italy
Andrea Lami
CNR Istituto per lo Studio degli Ecosistemi, Verbania, Italy
Simona Musazzi
CNR Istituto per lo Studio degli Ecosistemi, Verbania, Italy
Michela Rogora
CNR Istituto per lo Studio delgi Ecosistemi, Verbania, Italy
Silvia Zaupa
CNR Istituto per lo Studio delgi Ecosistemi, Verbania, Italy

KEYWORDS: MACR-INVERTREBRATES, DIATOM, ALPIN LAKES

Remote lakes are pristine, undisturbed ecosystems inhabited by species able to sustain harsh climatic condition, a long period of ice cover, low nutrient levels and strong sunlight. Freshwater ecosystems in mountain areas are often threatened by pollution and climate change that may cause biodiversity losses, or significant changes in community composition. A research study has been performed in the Stelvio National Park (SNP, Central Alps, Italy) in 2011-12 to assess waster quality of some lacustrine environments using macroinvertebrates and diatoms, two of the major sensitive biological quality indicators, and chemical characteristics. The study was performed in the framework of SHARE Stelvio, an interdisciplinary program for detecting early evidences of climate change in the SNP. The final aim of our study was to identify and promote conservation practices of water resources and eventual mitigation measures against the impact of climate change. Samples were collected in different areas of the SNP on 9 lakes, following a European wide standardized sampling protocol, through littoral handle netting, direct stones brushing, and outflow water sampling. Results, in the case of macroinvertebrates, showed a clear shift in community composition between very high and less high altitude lakes caused by the recent origin of the first ones. As regards water chemistry, the collected data revealed an extremely high variability of chemical composition, even in very limited areas. Through multivariate statistical analysis, the distribution of diatoms and macroinvertebrates in relation to abiotic factors (lake geographical and morphological features, water chemistry) will be discussed.

PRESENTATION TYPE: ORAL

CLIMATE CHANGE IMPACTS ON GLACIAL AND PERI-GLACIAL ENVIRONMENTS OF GOKYO VALLEY, SAGARMATHA (EVEREST) NATIONAL PARK, NEPAL

Rajendra Bhandari
Kathmandu University, Nepal
Tanuja Shrestha
Kathmandu University, Nepal
Subodh Sharma
Kathmandu University, Nepal
Juerz Merz
Kathmandu University, Nepal
Robin Garton
Kathmandu University, Nepal

KEYWORDS: GLACIAL LANDFORMS, SUPRAGLACIAL LAKES, ROCK GLACIERS

Glacial and peri-glacial landforms within Himalayan glaciers may behave differently under the influence of climate change. Moreover, the growth of glacial lakes has been major concern among the scientific communities in verge of glacial lake outburst flood risk. This research work includes the documentation, description and mapping of glacial and peri-glacial landforms in the Gokyo Valley focussing their genesis under the influence of climate change. Similarly, temporal change in the surface area of supra-glacial lakes within lower reaches of Ngozumpa Glacier is presented. Garmin GPS device was used for locating the landforms, however Google Earth information were also used for locating inaccessible landforms. GIS and remote sensing techniques were utilized along with combination of ground based mapping and LandSat TM imagery (30 m resolution) process for determining growth rates of supraglacial lakes from year 1992 to 2010. Temperature data loggers were used during thawing period at two depths (5 cm and 40 cm) to identify and assess the status of peri-glacial landforms in the Valley. Among various identified and mapped glacial landforms, about 100 meters shift in left lateral moraine and presence of subsequent recessional moraines accounted the influence of climate change resulting glacier retreat interrupted by temporary pause or slight readvance of Ngozumpa. Similarly, occurrence of 15 rock glaciers (five were inactive) and seasonally frozen grounds with presence intact ground ice indicates seasonal and/or perennial frozen condition complying to mean annual temperature of below 0 °C in the site. There was decline in surface area of supra-glacial lakes in lower reaches of the glacier from 1992 to 2000, nevertheless sharp growth of surface area from 2000 onwards was computed with growth rate of 10.78 % per annum. In the same years, the average annual temperature trend showed the rise of 0.94 °C (2001 to 2010). This growth trend could be consequence of melting and calving of exposed ice cliffs, rapid shoreline retreat and surface ablation under the influence of rise in temperature and enhanced by low relief in terminus of Ngozumpa. Hence shifting of lateral moraines, presence of discontinues permafrost and sharp rise in the surface area of supra-glacial lakes could be accounted as per the rising trend of temperature in the Valley.

PRESENTATION TYPE: POSTER

CLIMATE CHANGE TRENDS ON WORLD'S HIGHEST LAKE, GOKYO LAKE SERIES, SAGARMATHA (EVEREST) NATIONAL PARK, NEPAL

Subodh Sharma
Kathmandu University, Nepal
Chhatra Mani Sharma
Kathmandu University, Nepal
Smriti Gurung
Kathmandu University, Nepal
Ingrid Juettner
Kathmandu University, Nepal

KEYWORDS: CLIMATE CHANGE, HIGH ALTITUDE LAKES, HIMALAYA

The Gokyo lake series are the world's highest wetland system comprising of six main lakes. The study performed includes bathymetry, morphometry, water quality, diatoms and macroinvertebrates richness. Lake Four, also called Donang Lake, is the largest lake (0.573 Km2, max depth= 62.5 m) in the series. It also showed highest fluctuations in the water level, with a decrease of 17 hectares of surface area between May to June in 2010. Sedimentation rates are in accordance with the other high altitude lakes and measures in the range from 0.07 to 0.083 cm per annum. The mercury pollution in water based on the analysis in lake sediments clearly indicated an impact of long range transport of pollutants. Of the sub-fossils of chironomids head capsules Micropsectra sp. and Pseudodiamesa sp. was dominant in the sediments of lakes, typical of cold oligotrophic lakes. There was a clear demarcation in both macroinvertebrates and diatom composition between Lake Four and the other lakes in the series. Achnanthidium microcephalum, A. macrocephalum, and Muelleria indet were characteristic taxa of Lake Four, reflecting typical high altitudes flora.

PRESENTATION TYPE: POSTER

LONG-TERM CHEMICAL CHANGES IN REMOTE LAKES AS AN EFFECT OF CLIMATE WARMING

Michela Rogora
CNR Institute of Ecosystem Study, Verbania Pallanza, Italy
Aldo Marchetto
CNR Institute of Ecosystem Study, Verbania Pallanza, Italy
Gabriele Tartari
CNR Institute of Ecosystem Study, Verbania Pallanza, Italy

KEYWORDS: ALPINE LAKES, HYDROCHEMISTRY, CLIMATE

The water chemistry of mountain lakes and its change in time is affected by variation in atmospheric deposition and climate. The effects of climate warming on mountain lakes are mainly indirect, and result from a combination of multiple stressors. Climate affects both biological and physico-chemical processes, such as weathering of rocks and soils. Particularly important is the indirect effect of change in snow and glacial cover in lake catchments. In this study we focused on the possible effect of climate change on chemical variation in the chemistry of alpine lakes over a 30-year period. We analysed long-term data (major ions and nutrients) available for about 40 lakes in the Western Alps and assess changes in relation to the main meteorological variables (temperature, precipitation, snow cover). High frequency monitoring data exist for a few sites, belonging to the LTER network, and allowed an analysis of short-term changes in relation to extreme meteorological events (e.g. heavy snowfall, heat waves). A general tendency towards increasing conductivity and solute content in lake water was detected. A change in the ionic composition was also observed, with an increasing contribution of sulphate to the total ionic content. Several lakes showed a positive trend of sulphate concentrations, in contrast with the decrease of sulphate deposition which has affected the study area in the last decades. A climate effect was hypothesized to explain these trends: reduced snow cover in the catchments and glacier and permafrost degradation were identified as the main drivers of change.

PRESENTATION TYPE: ORAL

A NON-HOMOGENEOUS MARKOV MODEL FOR THE DEFINITION OF CLIMATE CHANGE SCENARIOS FOR COASTAL AREAS: THE CASE OF THE AGRO-PONTINO PLAIN

Lucia Marotta
School of Engineering, University of Basilicata, Potenza, Italy
Vito Telesca
School of Engineering, University of Basilicata, Potenza, Italy
Upmanu Lall
Dept. of Earth & Environmental Eng., Columbia University, New York, U.S.A.
Federico Rosario Conticelli
Dept. of Hydraulics, Transport and Roads, University of Roma 'La Sapienza', Roma, Italy
Francesco Cioffi
Dept. of Hydraulics, Transport and Roads, University of Roma 'La Sapienza', Roma, Italy

KEYWORDS: CLIMATE CHANGE, DOWNSCALING TECHNIQUES, NONHOMOGENEOUS HIDDEN MARKOV MODEL

This study addresses to the possible changes in Agro-Pontino rainfall under different global warming scenarios for the 21st century. The Agro-Pontino-plain is a reclamation region and presents the typical hydro-geological features of Mediterranean coastal environments. It is densely populated and productive, therefore, climate changes could adversely affect the socio-economic development of the area. Currently, due to the coarse resolution of Global-Circulation-Models, local climate variables simulations for limited size area are not accurate. Nonetheless, GCMs simulations of large-scale upper-air fields are generally considered reliable, therefore to bridge the gap between GCMs and local-scale processes different downscaling techniques are carried out. Here, a Hidden-Markov-Model and a Non-Homogeneous-Markov-Model are developed using a 54-years record (1951-2004) of daily rainfall amount at 9stations in Agro-Pontino-plain and re-analysis fields of atmospheric variables. In HMM and NHMM runs, we directly consider the entire year, rather than an a priori demarcation of seasons. The idea is to identify, directly using the HMM, the seasonal precipitation characteristics which may be related to the temporal sequence of 'hidden states' of atmosphere, subsequently modeled as dependent on appropriate fields of selected atmospheric variables. Daily rainfall variability is described in terms of occurrence of 5 'hidden weather states' identified by the HMM and associated to variables representing the main characteristics of large-scale atmospheric circulation as obtained by re-analysis data, then, using NHMM, calibration&validation tests are made to identify the optimal predictors - GeoPotential Height and Temperature at 1000hPa, Meridional&Zonal Wind at 850hPa and Precipitable Water - to reproduce better the observed rainfall features on Agro-Pontino-plain.

PRESENTATION TYPE: POSTER

MS04-01

Advances in ecosystem monitoring and measuring technologies

SPATIAL DATABASE OF POLISH LAKES

Wojciech Sobolewski
Maria Sklodowska Curie University, Faculty of Earth Science and Spatial Management, Department of Hydrology, Poland
Piotr Bednarczyk
Maria Sklodowska Curie University, Faculty of Earth Science and Spatial Management, Labolatory of Geoinformatics, Poland

KEYWORDS: LAKELAND, DATABASE, GIS, WEB MAPPING, WEBGIS, LAKE PROTECTION, LAKE MANAGEMENT, LAKE MONITORING

The aim of the online atlas and database of Polish lakes was to create a national platform for cooperation, which now serves primarily scientific institutions participating in the project. Currently implemented stage consists of collecting data from multiple sources (including unpublished data) and the integration of these data to create a single set of information, structured according to pre-established uniform criteria. The use of GIS allows to visualize the results of studies that are clear and understandable to many interested customers, also outside the academic community (educational institutions, Environmental protection institutions, local government, government, non-governmental organizations - NGOs and others). Use of the Web server to publish the data and analysis results expands the number of potential users of the developed information service. Spatial database of Polish is a good tool for managing environmental resources.

PRESENTATION TYPE: ORAL

ECOSYSTEM HEALTH REPORT CARD: AN EFFECTIVE TOOL TO MONITOR AND TRACK THE HEALTH OF LAKE ECOSYSTEM

Ajit Pattniak
Chilika Development Authority, Bhubaneswar, Odisha, India

KEYWORDS: ECOSYSTEM HEALTH, CHILIKA LAKE, ECOSYSTEM MONITORING

Ecosystem health report cards are transformative assessment and communications products that compare environmental data to scientific or management thresholds and are delivered to a wide audience on a regular basis. Chilika lake is a Ramsar site located along east coast of India was in a degraded condition till late 1990's. Chilika Development Authority (CDA) adopting ecosystem approach restored the lake successfully in 2000. As a monitoring tool, ecosystem health report card has been used effectively to track the ecosystem annually. For measuring the ecosystem health of Chilika lake, 10 indicators organised in to three main indices i.e. water quality, fisheries, & biodiversity. For each indices i.e. water quality indices (i) water clarity, (ii) DO (iii) total chlorophyll & for biodiversity indices (i) bird (ii) dolphin (iii) benthic faunal diversity (iv) phytoplankton diversity & for fisheries indices (i) total catch (ii) size (iii) diversity has been taken in to account. The grades are calculated from the average of water quality, fisheries & biodiversity indices, comprised of data collected during the course of lake monitoring and the lake scored " B" for ecosystem health based on performance of water quality, fisheries & biodiversit indices, which is satisfactory. The primary purpose of the report card of the lake is to take monitoring and research information and communicate this acquired knowledge to a broad audience, including resource users, policy makers, scientists and the public in a simple format for better understanding and governance.

PRESENTATION TYPE: ORAL

ENUMERATION OF BENTHIC ANIMALS USING AN ROV IN A DEEP LAKE

Kanako Ishikawa
Lake Biwa Environmental Research Institute, Japan
Eiso Inoue
Lake Biwa Environmental Research Institute, Japan
Takamaru Nagata
Lake Biwa Environmental Research Institute, Japan
Chumming Jiao
Lake Biwa Environmental Research Institute, Japan

KEYWORDS: AN UNDERWATER ROBOT, BENTHOS, LAKE BIWA

Enumerating benthic animals on the bottom of a deep lake is not an easy undertaking. Core samplers and fishing nets, such as dredges, are commonly used. Unfortunately core samplers cannot take large samples and, because of boat rolling, dredging nets do not always reach lake bottom, making it difficult to obtain the highly accurate data required for ecological analysis. Recently, observation methods have been developed that use digital images captured with an underwater robot. In the present study, a ROV (a remotely operated vehicle) was equipped with a parallel angle high resolution camera and used to enumerate benthos on lake bottoms. Monthly observations of benthos at 90 m depth in Lake Biwa using the ROV have been collected since March 2012. We compared the biomass of Jesogammarus annandalei, Bdellocephala annandalei, Palaemon paucidens obtained by three methods: core sampler, nets and ROV. The largest benthic biomass for J. annandalei at 90 m depth gathered with an Ekman core-sampler was about 70% of that calculated using the ROV method.Further, biomass values determined from dredge samples did not correlate with those from the core sampler or the ROV. We concluded, therefore, that the ROV method is an effective means to enumerate benthic biomass on the sediment of deep lakes.

PRESENTATION TYPE: ORAL

CHANGING ANTIFOULING FORMULAS: THE TWO MAIN NW ITALIAN LAKES REVEAL THE TREND

Tommaso Scanzio
Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, Italy
Paola Brizio
Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, Italy
Claudio Foglini
Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, Italy
Erika Burioli
Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, Italy
Stefania Squadrone
Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, Italy
Antonia Concetta Elia
Dipartimento di Chimica, Biologia e Biotecnologie, Università degli Studi di Perugia, Italy
Maria Cesarina Abete
Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, Italy
A.J. Martin Dorr
Dipartimento di Chimica, Biologia e Biotecnologie, Università degli Studi di Perugia, Italy
Marzia Righetti
Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, Italy
Marino Prearo
Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, Italy

KEYWORDS: ANTIFOULING, ORTA LAKE, MAGGIORE LAKE

The contamination of navigable waters has been widely studied and eventually tackled by cogent restrictions on the chemical products for the hull maintenance. However, pollutants such as heavy metals are still released by antifouling paints. In winter 2013, 8 samples from the Southwestern coasts of the Maggiore Lake (ML) and 3 from the Northeastern coasts of the Orta Lake (OL) were collected in order to test the surface waters from touristic harbors. The concentrations of Copper (Cu), Tin (Sn) and Zinc (Zn) were inspected. Analysis of appropriately prepared samples was conducted by inductively coupled plasma mass spectrometry (ICP-MS). The results showed levels of Sn below the spectrometer sensitivity (0.5 ppb) in both lakes, while significant values of Cu (LM: 1.085 ppb, St Dev 0.667; LO: 2.304, St Dev 0.621) and Zn (LM: 2.102 ppb, St Dev 1.173; LO: 8.689 ppb, St Dev 1.274) were detected. Low levels of Sn suggested that the ban from paint mixture effectively contributed to reduce the environmental concentrations of this highly toxic compound. The effects of Cu and Zn that are still permitted as active principle of antifouling products by CE Reg. n° 4051/2007 ned to be investigated to better understand the effective release of antifouling paints and their effects on the lacustrine ecosystem.

PRESENTATION TYPE: POSTER

THE FUTURE FOR INLAND WATER QUALITY MONITORING

Els Knaeps
VITO, Belgium
Ils Reusen
VITO, Belgium
Mariano Bresciani
CNR-IREA, Italy
Karin Schenk
Eomap, Germany
Peter Hunter
The University of Stirling, United Kingdom
Dimitry Van der Zande
RBINS, Belgium
Miguel Dionisio Pires
Deltares, The Netherlands
Giorgio Dall'Olmo
PML, United Kingdom
Mátyás Présing
MTA OK, Hungary
Arturas Razinkovas-Baziukas
Klaipedos Universitetas, Lithuania

KEYWORDS: REMOTE SENSING, WATER QUALITY

The majority of Europe's inland water bodies cannot be properly monitored with today's remote sensing systems because the lakes are often small and irregularly shaped. Sensors such as MODIS do not provide the required spatial resolution to fulfill the monitoring requirements. Some recently launched and upcoming sensors such as Landsat-8 OLI, Sentinel 2-MSI and the EnMAP hyperspectral imager are not designed as an ocean colour mission, but their specifications could meet some requirements of this community. However, additional research and the identification of end-users requirements is needed to ensure full exploitation of these sensors for inland water quality monitoring (WQM). A new FP7-SPACE collaborative project, INFORM, linked to the EU Copernicus programme will open new perspectives for the use of these new sensors for inland WQM. The project aims to develop novel and improved user-driven products for inland WQM by using innovative methods integrated into biogeochemical models which fully exploit the capabilities of the upcoming Earth Observation (EO) missions. INFORM aims to fill current gaps by developing new and improved products for several new (e.g. Landsat-8) and upcoming satellites (e.g. Sentinel-2, EnMAP) which will provide a wealth of new data at increased spatial, spectral and temporal resolutions. To develop these new and improved products, a large suite of in-situ and airborne hyperspectral images of European inland waters is already available for INFORM. The APEX airborne hyperspectral imaging sensor, together with in-situ measurements, will be used for simulation of the upcoming satellite data, algorithm development and products validation. INFORM products will be used as input and calibration of models which simulate the dynamics of nutrients, phytoplankton types and dissolved oxygen. End-user interaction will steer new data gathering and algorithm development to guarantee uptake of INFORM products by water managers, modellers and policy makers. Finally, INFORM developments will lead to recommendations for future EO missions taking into account requirements for inland WQM. Here we will report on the outcome of the INFORM end-user advisory board meeting and show the first products demonstration the capabilities of the new sensors for inland WQM. The research leading to these results has received funding from the European Community's Seventh Framework Programme ([FP7/2007-2013]) under grant agreement n° 606865.

TRASIBOT: AN UNMANNED SURFACE VESSEL FOR WATER ECOSYSTEM MONITORING

Stefano Chiesa
Siralab Robotics srl, Italy
Susanna Ciaramelletti
Dipartimento di Ingegneria, Università Degli Studi di Perugia, Italy
Roberto Chieruzzi
Siralab Robotics srl, Italy
Vito Ciullo
Siralab Robotics srl, Italy
Stefano Pagnottelli
Siralab Robotics srl, Italy
Michele Feroli
Siralab Robotics srl, Italy
Paolo Valigi
Dipartimento di Ingegneria, Università Degli Studi di Perugia, Italy
Daniela Gigante
Dipartimento di Chimica, Biologia e Biotecnologie, Università Degli Studi di Perugia, Italy
Giorgio Belloni
Siralab Robotics srl, Italy

KEYWORDS: USV, ENVIRONMENTAL, MONITORING

In this work the unmanned electrical surface vessel TrasiBot is described. The purpose of the vehicle is to perform different kinds of environmental analysis in a lacustrine scenario (e.g. environmental parameters monitoring and water analysis). The use of an unmanned vehicle has several advantages compared to usual methods. Automating the process, periodical analysis campaigns that could last even more than a day can be performed. In addition they may provide a greater number of georeferenced environmental data.The analysis results can be collected in the boat and data can be transmitted via a radio link to the base station or shared via a web interface. The system allows citizens to view real-time data via a website increasing the social participation in the environmental quality monitoring issue. The vehicle is equipped with different sensors and devices like a sampler, a multiparameter water quality sonde, cameras for classify underwater and coastal vegetation and so on. It's also equipped with all the needed electronic devices for navigation control. TrasiBot is able to navigate in total autonomy across a list of preprogrammed way-points, in each of them it can perform a specific task. In this work we describe in detail the robot architecture, the control system, tasks that the USV can accomplish and how it can do it. In particular we describe also all the safety precaution adopted in order to obtain a RINA compliance which provides ship classification, certification and testing.

PRESENTATION TYPE: ORAL

CATONE UNMANNED SURFACE VESSEL: A NEW, SAFE AND COST EFFECTIVE TOOL FOR LAKES AND RESERVOIRS HYDROGEOLOGICAL AND ENVIRONMENTAL SURVEYS

Pierluigi Duranti
aerRobotix, Italy

KEYWORDS: UNMANNED SURFACE VESSELS, DAMS SEDIMENT REMOVAL, BATHIMETRY

Carrying out surveys with boats over fresh water surfaces often require to face relevant logistic constraints, practical difficulties and possible risks for the operators. Operationally the craft must accommodate the helmsman, system operator/s and the relevant equipment but certain lakes, dams, rivers, canals, water reservoirs or fresh water basins suggest or even impose small vessels. Basins to be monitored are often lonely places, in mountain or in isolated areas, sometimes not well accessible by car and occasionally difficult to reach even on foot. The coast low water depth can make it difficult to launch traditional boats without a risk to propellers and/or rudders coming in contact with the basin floor. Environmental constraints can prevent the use of outboard engines. Good alternatives are offered today by the emerging technology of Unmanned Surface Vehicles (USV) thanks to the achievements in miniaturization of survey equipment. Significant advances in navigation and communication electronics have allowed to automate the complete survey process, thus making the presence onboard of the operators at least unnecessary and the whole process more cost effective. The Italian company aerRobotix have developed and patented a family of small USV, named CatOne, which present innovative solutions that make it unique, including an automatic winch for casting measuring devices at predefined depth. Based on a number of successful experiences acquired with CatOne over dams basins, rivers, lakes and quarry lakes this paper describes the new approach, the relevant lesson learned and points out its advantages with respect to traditional systems.

PRESENTATION TYPE: ORAL

BATHYMETRIC DATA AND DIMENSIONLESS DEPTHS OF SOME MAJOR LAKES IN NEPAL

Jagat K Bhusal
International Hydrological Programme, National Committee of Nepal, Nepal

KEYWORDS: LAKES IN NEPAL, GLACIER LAKES, NON-GLACIER LAKE

A lake is an inland basin filled with water. In Nepal, there are about 700 significant lakes. The exact number of Lakes in Nepal is yet to be identified. A preliminary inventory revealed that 65 percent of lakes fall on small category . Lakes with area greater than 50 hectares are less than 5 percent. This paper deals on the physiographic data of some major lakes especially bathymetric parameters of Tilicho lake at 5000 meter altitude, Rara Lake at 3000 meter altitude, Mai-Pokhari at 2100 meter altitude and Ghodaghodi lake at 170 meter altitude. The water quality status of Rara lake is unpolluted whereas water bodies located inside the urban areas are extremely polluted. The dimensionless depth of a lake that is defined as the ratio between cubic root of lake volume and square root of lake area, is found to be greater than 0.25 in mountain region and less than 0.2 in Tarai plains. The dimensionless depth is used to assess total volume of water of lakes with similar category. The total volume of water stored in 700 significant lakes of Nepal is estimated to be about 2.5 billion cubic meters. However, such research is yet to be further carried out on high resolution areal maps with GIS tools. Keywords: , Rara,, Tsho-Rolpa, Maipokhari, Ghodaghodi, Himalayas, ,

PRESENTATION TYPE: ORAL

THE USE OF NOVEL TECHNIQUES TO MONITOR, MODEL AND ASSESS THE STRUCTURE AND FUNCTION OF LAKES

Stephen C. Maberly

Lake Ecosystems Group, Centre for Ecology & Hydrology, Lancaster Environment Centre, Lancaster, UK

Ian D. Jones

Lake Ecosystems Group, Centre for Ecology & Hydrology, Lancaster Environment Centre, Lancaster, UK

R. Iestyn Woolway

Lake Ecosystems Group, Centre for Ecology & Hydrology, Lancaster Environment Centre, Lancaster LA1 4AP, UK

Martin A. Rouen

Lakeland Instrumentation Ltd., Grange over Sands, UK

Andrew N. Tyler

Department of Biological and Environmental Sciences, University of Stirling, Stirling, UK

KEYWORDS: DEPTH-RESOLVED, EARTH OBSERVATION, HIGH-FREQUENCY

Traditional lake monitoring at weekly to monthly intervals has generated invaluable datasets that document seasonal patterns of change in response to weather and long-term changes in response to local, regional and global anthropogenic pressures. These datasets have underpinned the development of lake ecology, lake management and legislation to protect lakes. There are, however, several limitations with this approach. Firstly, the number of lakes that have, and can be, measured in this way is a tiny proportion of the global total and different methods are used at individual sites: consequently, the status of most lakes, especially remote ones, is unknown and valid comparisons can be compromised by methodological differences. Secondly, rates of change in lakes can be rapid, generated by microbial populations with short generation times and high rates of biogeochemical exchange, and by large and persistent effects of short-term external stressors: consequently, substantial change at daily and diel timescales is not resolved by traditional methods. Finally, depth is an important factor controlling lake function during stratification but high-frequency and multi-parameter depth-profiles are rare: consequently, the full picture of lake biogeochemistry is lacking. In the last decade, technological developments in a range of areas have produced valuable opportunities to overcome these limitations. This talk will outline the complementary benefits provided by high-frequency monitoring at one or a network of sites, automatic collection of depth-profiles, development of open-access software for consistent calculations and the growing power of Earth Observation.

PRESENTATION TYPE: ORAL

THE LLDA WATER MONDRIAAN, AN INNOVATIVE COMMUNICATION TOOL ON WATER QUALITY

Jocelyn Sta. Ana
Laguna Lake Development Authority, Philippines
Ireneo G. Bongco
Laguna Lake Development Authority, Philippines
Adelina C. Santos-Borja
Laguna Lake Development Authority, Philippines

KEYWORDS: SIMPLE METHOD, COLOR-CODED WATER QUALITY, STAKEHOLDERS

The Water Mondriaan is a simplified method of presenting the water quality status of the Laguna de Bay and its tributaries. It was developed in 2002 during the Dutch-funded Sustainable Development of the Laguna de Bay Environment Project of LLDA and named after the famous Dutch Painter, Piet Mondriaan, since the method of presentation adopted his style and used of the primary colors. Through the Water Mondriaan, the results of the water quality monitoring done by LLDA in identified lake and river monitoring stations are just simply compared for compliance to the Department of the Environment and Natural Resources (DENR) water quality criteria for freshwater systems with the use of a computer program. Consequently, color-coded schematic maps are produced indicating which among the lake and river monitoring stations have water quality good for drinking, recreation, fishery and irrigation purposes. The color-coded presentation provides the LLDA's policy-making body and the various stakeholders of the Laguna de Bay Region an immediate and comprehensive overview of the lake's water quality condition for selected parameters, without any need for highly technical details. Thus, the information from the Water Mondriaan can be very useful in developing appropriate water resource management plan and strategies for the purpose of improving the over-all lake's water quality in the future.

PRESENTATION TYPE: ORAL

MS04-02S

Special Session - Hydrological monitoring of the worlds large lakes and reservoirs

MORPHO-BATHYMETRICAL CONDITIONS AND THE SILTING RATE IN STANCA-COSTESTI RESERVOIR

Gheorghe Romanescu
Alexandru Ioan Cuza University of Iasi, Romania
Cristian Stoleriu
Alexandru Ioan Cuza University of Iasi, Romania
Ana Maria Romanescu
Alexandru Ioan Cuza University of Iasi, Romania
Alin Mihu-Pintilie
Alexandru Ioan Cuza University of Iasi, Romania

KEYWORDS: BATHYMETRY, EROSION, LAND USE

Stanca-Costesti Reservoir holds the largest amount of water among reservoirs located in Romania and is known to have multiple purposes, such as flood mitigation, hydropower production, irrigation etc. Our bathymetric survey was conducted along longitudinal, as well as transverse alignments, so as to cover the entire lacustrine surface by using an echo sounder. We employed data from three different surveys, i.e. topo (dating back to 1977, before the onset of flooding) and bathymetrical (1986 and 2000) surveys. The drainage basin of this reservoir extends accross three countries, Romania, Ukraine and Republic of Moldova, and whereas the mountain sector of the basin is mostly covered by forest, the lowland (the Moldavian Plateau) is used for agricultural purposes, i.e., cereal crops. Thus, deforestation and inappropriate tillage techniques employed within this basin result in increased soil erosion. The terraces formed along the downstream sector of the reservoir are not covered by alluvium, whereas the corresponding terraces from its upper sector have been overlain by submerged glacises. Moreover, by the Ciugur river mouth we observed a submerged valley, as well as several submerged natural levees. The deepest area of the reservoir (29.2 m) is located off the dam and is thought to be the outcome of a circular current generated by the lake bottom morphology. The total volume of the accumulated alluvium amounts to 34779189 m3. The silting degree is rather high, ranging up to an index value of 7.3% over 33 years.

PRESENTATION TYPE: POSTER

HYDROWEB: A LAKE DATABASE FROM SATELLITES

Jean-Francois Cretaux
CNES/Legos, France
Adalbert Arsen
CNES/Legos, France
Marie-Claude Gennero
CNES/Legos, France
Muriel Bergé-Nguyen
CNES/Legos, France
Stephane Calmant
IRD/Legos, France
Philippe Maisongrande
CNES/Legos, France

KEYWORDS: REMOTE SENSING, WATER HEIGHT, SURFACE AND VOLUME, DATABASE

We present the current state of the Hydroweb database as well as developments in progress. Hydroweb (http://www.legos.obs-mip.fr/soa/hydrologie/hydroweb/) provides offline water level time series on rivers, lakes and reservoirs based on altimetry data from several satellites (Topex/Poseidon, ERS2, Jason-1&2, GFO, Icesat and ENVISAT). In addition to Hydroweb, a lake data centre is under development at the Legos in coordination with Hydrolare Project leaded by SHI (State Hydrological Institute of the Russian Academy of Science). It will provide the level-surface-volume variations of about 100 lakes and reservoirs, calculated through combination of various satellite images (Modis, Asar, Landsat, Cbers) and radar altimetry (Topex / Poseidon, Jason-1 & 2, GFO, Envisat, ERS2, Saral/Altika, Cryosat-2). The final objective is to support the Hydrolare project (lake data centre from In situ observation) from satellite data for the monitoring of the Essential Climate Variables (ECVs) for lakes included in the Global Terrestrial Network (GTN-L) under the supervision of WMO (World Meteorological Organization)and GCOS (Global Climate Observing System). In a longer perspective, the Hydroweb data base will integrate data from future missions (Jason-3, , Sentinel-3, Jason-CS, Icesat-2) and finally will serve for the design of the SWOT mission.

PRESENTATION TYPE: ORAL

THE SYSTEM OF HYDROMETEOROLOGICAL OBSERVATIONS ON LAKES AND RESERVOIRS OF THE RUSSIAN FEDERATION

V.Vuglinskii
State Hydrological Institute, St.Petersburg, Russia
T.Fuksova
State Hydrological Institute, St.Petersburg, Russia

KEYWORDS: LAKES AND RESERVOIRS, HYDROLOGICAL OBSERVATIONS, HYDROLOGICAL INFORMATION

There are more than 2,200,000 lakes and reservoirs in the territory of the Russian Federation which are located in different landscape zones. Although routine hydrometeorological observations of certain lakes regime date back to the mid-19th century, a state observion network for lakes and reservoirs operating on the basis of common standards and regulations was established and intensively developed in the period from 1930 to 1986. In different years observations were carried out at 826 hydrological stations and 1252 offshore points on 432 lakes and reservoirs. Hydrological stations perform observations of water level and temperature, air temperature and precipitation as well as the state of ice cover near the shore. Vertical profiling of water temperature at various depths, state of ice cover, currents etc. is made at certain points in offshore areas. All observations are made by the staff of territorial branches of Roshydromet (UGMSs) under methodological guidance provided by the State Hydrological Institute (SHI). Results of hydrological observations on lakes and reservoirs were published in hydrological yearbooks. Since 1989, these yearbooks have been mostly prepared using computer technologies developed at SHI. An electronic archive of long-term data since the beginning of observations has been established and is periodically updated. SHI manages a database where results of observations and long term series are archived. In 2009 the International Data Centre on Hydrology of Lakes and Reservoirs (HYDROLARE) was established at SHI under the auspices of WMO and Roshydromet which hosts an international database on lakes and reservoirs. The website of the centre is: www.hydrolare.net.

PRESENTATION TYPE: ORAL

ICE AND SNOW COVER OF EURASIAN LAKES AND INTERNAL SEAS FROM SATELLITE AND IN SITU OBSERVATIONS

A. V. Kouraev
University of Toulouse, France; State Oceanography Institute, St. Petersburg branch, Russia
M.N. Shimaraev
Limnological Institute, Siberian Branch of Russian Academy of Sciences, Irkutsk, Russia
F. Rémy
CNRS, LEGOS, Toulouse, France
M.A. Naumenko
Limnology Institute of the Russian Academy of Sciences, St. Petersburg, Russia
A. Ya. Suknev
Great Baikal Trail Buryatiya, Ulan-Ude, Russia

KEYWORDS: ICE AND SNOW COVER, REMOTE SENSING, LAKES AND INTERNAL SEAS

We present studies of ice and snow cover of continental water bodies using the synergy of more than 15 years-long simultaneous active (radar altimeter) and passive (radiometer) observations from radar altimetric satellites (TOPEX/Poseidon, Jason-1, ENVISAT and Geosat Follow-On) complemented by SSM/I passive microwave data. Five largest Eurasian continental water bodies - Baikal, Ladoga and Onega lakes and Caspian and Aral seas are selected as examples. An ice discrimination approach based on a combined use of the data is presented, as well as validation of this approach using in situ and independent satellite data in the visible range. We then analyse the long-term evolution of ice conditions for the lakes and inland seas using historical data and recent satellite observations. We also present our results of the field studies on the lakes Ladoga and Baikal. We address the formation of giant rings on Baikal Lake ice. We present observation of the formation, development and disappearance of these rings using various satellite data, the timing of and duration of their existence, as well as ice cover and water structure before and during the appearance of rings. This research has been done in the framework of the Russian-French cooperation GDRI "CAR-WET-SIB", CNES TOSCA AO, ANR "CLASSIQUE", CNRS-Russia "Franco-Siberian Center for Research and Education" and PICS BALALAIKA, ESA Proposal C1P.13132, Russian FZP 1.5 and EU FP7 "MONARCH-A" projects.

PRESENTATION TYPE: ORAL

HYDROLARE – MAIN TASKS AND FIRST STEPS OF THE ACTIVITY

Valerii Vuglinskii
State Hydrological institute, St. Petersburg, Russian Federation

KEYWORDS: HYDROLOGY, LAKES AND RESERVOIRS LAND OBSERVATIONS, INTERNATIONAL DATA BASE

The International Data Centre on Hydrology of Lakes and Reservoirs (HYDROLARE) was established at the State Hydrological Institute (St.Petersburg, Russian Federation) in accordance with the agreement between WMO and Roshydromet. It has been operating since 01.01.2009. The main objectives of the Centre are to collect data on hydrology of lakes and reservoirs, to contribute to spreading and exchange of information on hydrological regime of lakes and reservoirs on a global scale, to assist WMO members in realization of international projects using data on lakes and reservoirs of the world. The HYDROLARE database contains long term series of water level, water temperature and ice thickness data for lakes and reservoirs of Russia and Former Soviet Union republics, Australia, Finland, Sweden, Switzerland Slovenia, USA and others WMO members. HYDROLARE website is managed and constantly updated. A technology for displaying information about database content using Google maps was put into operation. In cooperation with Legos/CNES (France), a direct access from HYDROLARE to Hydroweb website to obtain satellite lake level data (for lakes available in both databases) and vice versa was made available. An international two-day workshop on hydrological monitoring of lakes and reservoirs will be organized jointly by WMO and HYDROLARE under the umbrella of the Fifteenth World Lake Conference (Perugia, Italy, 1-5 September 2014). The report provides the detailed information about HYDROLARE activities.

PRESENTATION TYPE: ORAL

COMBINED USE OF SATELLITE ALTIMETRY AND IMAGERY FOR MODELLING WATER VOLUME CHANGES OF TRêS MARIAS RESERVOIR, BRAZIL

Luiza Gontijo Álvares de Campos Abreu
Universidade Federal de Minas Gerais, Brazil
Philippe Maillard
Universidade Federal de Minas Gerais, Brazil

KEYWORDS: SATELLITE ALTIMETRY, WATER VOLUME, RESERVOIR

Satellite altimetry is a well-known technique for measuring ocean level variation. The availability of data has fostered the development of applications to monitor continental waters such as rivers and lakes. The Três Marias Reservoir is located within the São Francisco river basin, a strategic national basin and important energy generation source. Monitoring volume variations of the reservoir is important for the decision making process regarding the closing and opening of floodgates to regulate the water flow to the semi-arid regions of Brazil. This study presents a method to combine satellite altimetry and imagery of the lake's surface to estimate volume changes and create a model from which volume changes could be computed from either the altimetry or the lake's surface area. Our purpose is to evaluate the method and its precision, and the possibility to apply it in other areas, such as wetlands and other lakes where in situ measurements are not available. Moreover, data of monitoring stations usually have an arbitrary altitude reference and are not available for the general public; the data from the satellite altimetry has the advantage of being of global reference (geoid) and being compatible with the establishment of a worldwide lake and reservoir database. We combined Envisat and SARAL/Altika altimetry data with Landsat imagery to cover the 2002-2013 period. The data was corrected using a novel processing technique resulting in a relative precision of 0.24 m (RMSE). The total volume change between 2003 (low level) and 2009 (highest level) was 8,6967 km3.

PRESENTATION TYPE: ORAL

DATABASE OF THE INTERNATIONAL DATA CENTRE ON HYDROLOGY OF LAKES AND RESERVOIRS

Sergei Gusev
State Hydrological Institute, Russia
Elena Kuprienok
State Hydrological Institute, Russia

The State Hydrological Institute (SHI) maintains the International Data Centre on Hydrology of Lakes and Reservoirs (HYDROLARE) established under the auspices of WMO and Roshydromet. The key function of HYDROLARE is managing the database on lake hydrology. The concept of the HYDROLARE database envisages collection, storage and provision of main characteristics of lakes and reservoirs hydrological regime for the period since the beginning of the observations until past year. These include mean monthly water levels, mean monthly and maximum annual water temperature, maximum annual ice cover thickness at stations as well as mean monthly water levels and water levels at the first date of each month averaged for water body. At present the database contains a range of lakes and reservoirs level data for 15 countries (848 stations and 588 water bodies). Most of the data come from Russia and 10 former USSR states. This dataset includes 459 stations at 297 water bodies of Russia and 319 stations at 206 water bodies of the former USSR states. The rest comprises data for Finland (36 stations at 36 lakes with surface area more than 100 sq km), Switzerland (34 stations at 26 water bodies), Cyprus (18 reservoirs) and the United States of America (the five Great Lakes). Information about current content of the database is available at: www.hydrolare.net. In the near future the database will be updated by lake data for Sweden, Slovenia, Mexico, the United States of America (the Mississippi basin), Australia, Kyrgyzstan and some regions of Russia. It is also planned to add data on water temperature and ice thickness as well as satellite altimetry levels of the world lakes obtained by LEGOS/CNES (France).

PRESENTATION TYPE: ORAL

MONITORING NETWORK STATUS OF THE MAIN COMPONENTS OF WATER BALANCE OF SEVAN LAKE AND ITS OPTIMIZATION BASED ON SCIENTIFIC METHODOLOGICAL APPROACH

Vardanyan L.V
Armstatehydromet, Armenia
Azizyan L.V.

Yeroyan E.P.

Danielyan A. G.

KEYWORDS: MONITORING NETWORK, WATER BALANCE, RUNOFF, PRECIPITATION, EVAPORATION

This article discusses the monitoring of the main elements of the water balance of Lake Sevan (runoff, precipitation, evaporation), and the water balance calculation methodologies are proposed based on the observational data. Lake Sevan is the second largest fresh-water mountain lake in the world. It is located at the altitude of 1916 m above sea level. There is a permanent hydro-meteorological monitoring of both Lake Sevan and its basin. The main elements used in the estimation of water balance are observed. The measurements include not only the natural outflow, but also elements of artificial outflow from the lake, such as managed release to the Hrazdan river, as well as the artificial increases of the lake level, due to transportation of water resources from the neighboring river basin by Arpa-Sevan tunnel. Measured and calculated values give us opportunity for calculating water economic balance in monthly and annual basis. It is suggested that the optimization of the scientific methodologies and hydro-meteorological monitoring of Sevan lake basin would lead to the improvement in accuracy of estimation of Lake Sevan water balance components.

PRESENTATION TYPE: ORAL

INVESTIGATION OF CASPIAN SEA LEVEL VARIATIONS BY THE MODERN METHODS

Elnur Safarov

Azerbaijan National Academy of Science, Institute of Geography, Azerbaijan

KEYWORDS: CASPIAN SEA ALTIMETRY

The Caspian Sea is the largest lake in the world. Sea level fluctuations are among the most outstanding issues of the Caspian Sea. These changes contribute to active debates among scientists. Although the network of sea level stations covers the coasts of all three regions of the sea, they are not capable to reflect the sea level variations over the all surface. The Caspian Sea is well observed by TOPEX/Poseidon, Jason-1, GFO and ENVISAT satellite altimeters. The technique of satellite altimetry demonstrates a great potential in study of the sea level variability. Therefore, it can be measured over the whole basin. This research illustrates the comparative analysis of sea level fluctuations in the Caspian Sea based on satellite altimetry and in situ data from more than 20 stations from 1992 to 2001. Investigation was carried out throughout the Northern, Middle and Southern Caspian regions. The comparative analysis of average yearly sea level of the Caspian Sea with satellite altimetry data revealed that the Middle Caspian exhibits higher coefficients of correlation than any other region of the Caspian Sea.

PRESENTATION TYPE: ORAL

THE CONTRIBUTION OF THE INSTITUTE OF LIMNOLOGY RAS TO THE DEVELOPMENT OF INFORMATION SYSTEMS IN LIMNOLOGY

Anna Izmailova
Istitute of Limnology, Russian Academy of Sciences (RAS), Russia

KEYWORDS: INFORMATION SYSTEMS, WEB-TECHNOLOGIES, LAKES OF THE EARTH

Three information systems (IS) “Ladoga Lake”, “Lakes of the Earth” and “Lakes of Russia” have been developed in the Limnology Institute of Russian Academy of Scienceson the basis of WEB-technologies with a view to providing information resources for geographical sciences. These systems were created in the form of domain-driven dataware with using of modern means of automated processing, including the analysis and visualization of data. IS “Ladoga Lake” contains the results of comprehensive monitoring of Ladogaincluding its hydrophysical, hydrochemical and hydrobiological parameters. Corresponding data sets were obtained at the Institute of Limnology and related institutes. IS “Lakes of the Earth” and “Lakes of Russia” provides information on the most important water bodies which is based mainly on literature data. They contain both formalized information stored in databases (available upon request), and plenty of text, charts and graphs. In 2012 IS "Lakes of Russia" has been modernized - a new information storage unit for summarizing information on lake resources of Russian Federation has been created. This information is the result of the present activity of the Limnology Institute, it contains: data on number of lakes, the total areas of lakes, lakes resources (volumes of water) by RF administrative units (subjects). It contains a general description of the subjects of RF and data on their climate and hydrography too. The developed software allows you to search and process information on lake resources of the RF subjects and moreover software provides an opportunity to conduct a comparative interregional analysis.

PRESENTATION TYPE: ORAL

HYDROLOGICAL MONITORING OF LAKE SAIMAA, THE LARGEST LAKE IN FINLAND

Esko Kuusisto
Finnish Environment Institute, Finland

KEYWORDS: LAKE SAIMAA, HYDROLOGICAL MONITORIN, ICE THICKNESS

Hydrological monitoring of Lake Saimaa, the largest lake in Finland Esko Kuusisto Finnish Environment Institute (SYKE) Helsinki, Finland Lake Saimaa is characterized by a very complex morphometry. There are over forty lakes in the world larger than Lake Saimaa (4280 km2), but as to the numerosity of islands (17216) and the length of the shoreline (15786 km) Lake Saimaa is number one in the world. The water level of Lake Saimaa has been monitored since 1847 and an outflow series can be constructed rather reliably from that year until today. Freezing and breakup dates are available from several observation sites since the late 19th century. Ice thickness has been observed since 1917, surface water temperature since 1924. In addition, there are shorter observation series on water temperature profiles and special measurements on current velocities and directions. The behaviour of shore ice and snow accumulation near the shores have been monitored for the protection of Saimaa ringed seal, the best-known endangered species in Finland. How well do observations at a single site represent the typical conditions of Lake Saimaa? This is discussed by comparing data of the same variable from different parts of the lake. For most variables it is obvious that point data are only indices – the morphology of the lake is just too complex.

PRESENTATION TYPE: ORAL

THE SURFACE WATER AND OCEAN TOPOGRAPHY MISSION: A COMING REVOLUTION IN OBSERVATION OF LAKE STORAGE DYNAMICS

Tamlin Pavelsky
University of North Carolina, USA

KEYWORDS: REMOTE SENSING, WATER STORAGE, GLOBAL

Globally, there are several million lakes larger than one hectare. Variation in the storage of water remains unobserved within nearly all of these lakes. In situ gauge networks, which measure water surface elevation rather than total storage, are limited to a tiny fraction of global lakes. Remote sensing techniques using altimeters to measure water surface elevation and imaging sensors to measure inundated area can measure storage change, but they are limited by the wide spacing and coarse resolution of nadir altimeter ground tracks. The NASA/CNES Surface Water and Ocean Topography (SWOT) Mission, planned for launch in 2020, will substantially alter our ability to observe lake storage variations. It will measure water surface elevation and inundated area over a ~120 km wide swath. Using these measurements, SWOT is required to measure lakes as small as (250 m)2, with a goal of measuring lakes as small as (100 m)2. The SWOT orbit repeat will be 21 days, but because coverage of the measurement swath overlaps, many individual lakes will be observed 2-8 times during each orbit repeat period. Using these new measurement capabilities, it will be possible for the first time to observationally quantify the role of lakes in regional and global water balances. Moreover, because lakes provide important links between the atmospheric and terrestrial water cycles, SWOT observations can be used to detect variable interactions between surface water and groundwater. Finally, it will be possible to quantify the management of artificial lakes and reservoirs, allowing improved quantification of human water use.

PRESENTATION TYPE: ORAL

UNDERSTANDING THE PROVENANCE AND TEMPORALITY OF DRIVERS OF LAKE CHANGE AS A VITAL STEP TOWARDS UNDERSTANDING LAKE BEHAVIOUR AND THEIR SENSITIVITY TO CLIMATE CHANGE

Eirini Politi
University of Dundee, Scotland, UK
Mark Cutler
University of Dundee, Scotland, UK
John Rowan
University of Dundee, Scotland, UK

KEYWORDS: GLOBAL, LAKE, HYDROLOGY

Lakes respond to multiple exogenous and endogenous drivers of change, including anthropogenically driven stressors such as climate and land use change. Understanding the provenance and temporality of these drivers is therefore vital to understand lake behaviour and their sensitivity as sentinels or regulators of climate change. One of the main aims of GloboLakes project, a global observatory of c. 1,000 of the world's largest lakes responses to environmental change, is to utilize existing global datasets of indicators to determine change within the lake catchments (e.g. precipitation, land use and population density) and characterise the complex ecological processes that have taken place within and around the lakes over the last 3 decades. The eventual compilation of robust time-series for the comparative analysis of patterns and rates of change linking to system sensitivities will allow interpretation and attribution of causes of lake change for all 1,000 lakes, and explain variability in lake response to environmental change across scales never before studied. However, the paucity of global time series of runoff, sediment and nutrient fluxes, which are considered major indicators of lake water quality change, leads to the investigation for techniques that can exploit existing global datasets to model these variables in large lake catchments, and an example is presented here. The potential of the Lake, Uplands, Wetlands Integrator (LUWI) hydrological model is explored using a rich dataset of field data from lakes in Quebec and its transferability to other sites around the globe is assessed using the GloboLakes database.

PRESENTATION TYPE: ORAL

MS04-03S

Special Session - Earth Observation of Inland and Near-Coastal Waters

MONITORING OF WATER QUALITY AND ECOSYSTEM INFORMATION IN LAKES USING SATELLITE IMAGES

Takehiko Fukushima
University of Tsukuba, Japan
Bunkei Matsushita
University of Tsukuba, Japan
Yoichi Oyama
University of Tsukuba, Japan
Wei Yang
Beijing Normal University, China
Fan Yang
BrainChild Inc., China
Lalu Muhamad Jaelani
University of Tsukuba, Japan

KEYWORDS: SATELLITE REMOTE SENSING, LAKE WATER ENVIRONMENT, MACROPHYTE

The examples of estimating the water quality (concentrations of chlorophyll a, tripton, and colored dissolved organic matter, Secchi depth, diffuse attenuation coefficients, inherent optical properties etc.), biological activities (primary productivity, etc.), and distributions of algal bloom and macrophytes (submerged, floating, and emergent plants) using satellite images (MERIS/Envisat, MODIS/Terra or Aqua, TM or ETM/Landsat etc.) are introduced for the water environment in East Asian lakes where turbid water conditions are rather popular. The importance of proper atmospheric correction algorithm, database on specific inherent optical properties, and generic procedure for the separation of lake surface into water, algal mat, and macrophytes is addressed in the context of less field validation campaign. Mapping of human footprint in lake watersheds e.g. farm land, impervious surface area, etc. is also exemplified in Japan and East Asian countries to evaluate the basin change influences on lake aquatic environment and ecosystems. Last, possibilities and future challenges of satellite remote sensing are discussed in order to apply it for regular world-wide surveillance of lake environment.

PRESENTATION TYPE: ORAL

LAKE PHENOLOGY: ECOLOGICAL INDICATORS FROM SATELLITE IMAGE TIME SERIES

Stephanie Palmer

Balaton Limnological Institute, Centre for Ecological Research, Hungarian Academy of Sciences, Hungary; Centre for Landscape and Climate Research, University of Leicester, UK

Daniel Odermatt

Brockmann Consult, Germany

Peter Hunter

Biological and Environmental Sciences, School of Natural Sciences, University of Stirling, UK

Carsten Brockmann

Brockmann Consult, Germany

Heiko Balzter

Centre for Landscape and Climate Research, University of Leicester, UK

Viktor R. Tóth

Balaton Limnological Institute, Centre for Ecological Research, Hungarian Academy of Sciences, Hungary

KEYWORDS: PHYTOPLANKTON PHENOLOGY, REMOTE SENSING, LAKE BALATON

Phytoplankton dynamics are important in inland waters due to their influence on water quality and ecosystem productivity. Satellite imagery has proven potential to complement conventional phytoplankton monitoring through spatially- and temporally- cohesive retrieval of chlorophyll-a (chl-a) concentrations. In addition to mapping chl-a concentrations for a given moment in time, it is also possible to derive phenology features from satellite image time series. Phenology features of interest include bloom onset, peak and end timing and rates of onset and decline, which can be compared between years, over the spatial extent of a given lake, and between lakes. These features have been demonstrated through laboratory, mesocosm and in situ data to be sensitive to environmental and climate changes. Shifts in these phenology features can have effects that propagate throughout the food web. The use of satellite imagery in phenological analysis has a long history in terrestrial settings, such as forestry and agriculture, and has more recently be demonstrated to provide enormous insight into phytoplankton dynamics of the pelagic ocean, but has not yet been adapted to lakes due to additional challenges in the remote sensing of chl-a in such settings. Potential ecological indicators related to lake phenology derived from MERIS satellite imagery are adapted and applied for the first time in a freshwater setting, Lake Balaton.

PRESENTATION TYPE: ORAL

BREAKING THE BARRIERS TO ADOPTING SATELLITE REMOTE SENSING FOR WATER QUALITY MANAGEMENT: MONITORING CYANOBACTERIA BLOOMS

Blake A. Schaeffer
U.S. Environmental Protection Agency, USA
Robyn N. Conmy
U.S. Environmental Protection Agency, USA
Ross Lunetta
U.S. Environmental Protection Agency, USA
Richard P. Stumpf
National Oceanic and Atmospheric Administration, USA
Darryl Keith
U.S. Environmental Protection Agency, USA

KEYWORDS: CYANOBACTERIA, SATELLITE REMOTE SENSING, WATER QUALITY MANAGEMENT

Remote sensing technology has the potential to inform and accelerate the engagement of communities and managers in the implementation and performance of best management practices. Over the last few decades, satellite technology has allowed measurements on a global scale over long time periods, and is now proving useful in characterizing lakes and reservoirs, which are relevant to water quality managers. Comprehensive water quality climate data records have the potential to provide rapid water quality assessments, thus providing new and enhanced decision analysis methodologies and improved temporal/spatial diagnostics. Four main barriers were identified by water quality managers that inhibit the consideration of satellite remote sensing data: cost, accuracy of data products in the particular waterbody of interest, satellite mission continuity, and obtaining management approval for including satellite data into their work. In the research presented here, a study on the monitoring of cyanobacteria from the European Space Agency's MEdium Resolution Imaging Spectrometer (MERIS) instrument was used to understand how some of these barriers could be addressed. Cyanobacteria cell count data from eight U.S. states were derived with data from MERIS. A validation of satellite estimates of cell counts was performed using available in situ data assembled over a 39-month period spanning 2009–2012. The goal of this project was to validate a cyanobacteria algorithm and develop a stakeholder tool with the capability to monitor cyanobacteria blooms near real-time.

PRESENTATION TYPE: ORAL

WATER QUALITY MONITORING IN LAKE TRASIMENO FROM SATELLITE DATA

Bresciani Mariano
CNR-IREA, Italy
Giardino Claudia
CNR-IREA, Italy
Musanti Mauro
CNR-IREA, Italy
Martinelli Angiolo
ARPA Lazio Sezione Provinciale di Rieti, Servizio Tecnico Direzione Roma, Italy

KEYWORDS: REMOTE SENSING, PHYTOPLANKTON, BIO-OPTICAL

This study uses multi-source remote sensing images to investigate the evolution in time and space of water quality parameters of Lake Trasimeno, a shallow and turbid lake in central Italy. MERIS images at a spatial resolution of 300 m have been used for generating maps of chlorophyll-a (Chl-a), total suspended matter, yellow substances and transparency and to map the occurrence of cyanobacteria blooms. Satellite-derived Chl-a concentrations where coupled with the results provided by applying the algorithms phycocyanin retrieval to MERIS data to have enhanced information about cyanobacteria bloom events and dynamics. For gathering finer scale information, a subset of images acquired from CHRISS and the aerial MIVIS sensors were further processed. The estimation of water quality parameters was achieved with different approaches: neural networks, semi-empirical algorithms and bio-optical modeling, all of them based on in situ data. The analysis allowed us to confirm that purposely corrected satellite images can quantitatively capture the dynamic of water quality parameters during time. The results quantitatively highlighted intense blooms while, in case of lower concentrations qualitative products showed the surface distribution of Cyanobacteria within the lake. MERIS-derived seasonal trends confirmed the meso-eutrophic status of Lake Trasimeno with anomalous temporal trend of both Chl-a concentrations and water transparency. The integrated approached, integrated with ancillary data, revealed how the amplification of the range of variation of the water levels, the increased anthropogenic pressure and the reduction of macrophytes beds, might be the most likely causes of the water quality deterioration in the last years.

PRESENTATION TYPE: POSTER

MONITORING THE SPATIO-TEMPORAL DYNAMICS OF WATER QUALITY IN LAKE MALAWI FROM SPACE

Steef Peters
Water Insight, Netherlands
Kathrin Poser
Water Insight, Netherlands

KEYWORDS: WATER QUALITY, REMOTE SENSING, LAKE MALAWI

Lake Malawi is a mostly oligotrophic lake, situated in the East African Rift Valley. Little information exists on the spatio-temporal and long-term dynamics of water quality in this lake. In a project within the EOworld program by the World Bank and ESA, the use of remote sensing for monitoring the ecological status of the lake was assessed. Several water quality parameters were derived from MERIS full resolution images and water temperature from AATSR images for the years 2010 and 2011. Here we present the observed spatio-temporal dynamics of chlorophyll-a and explore different approaches to explain the observed patterns. While the chlorophyll-a concentrations were found to be overall very low, an atypical high peak was observed in October 2010 in the Northern part of the lake. Such peaks have also been observed in Lake Tanganyika and seem to consist of cyanobacteria, sometimes leading to large fish kills. Several hypotheses explaining what caused this peak were investigated using ancillary information including surface temperature data and weather records. The most likely explanation was found to be that lake circulation driven by trade winds temporarily stopped. In the subsequent instable situation, vertical turbulent mixing caused a transport of nutrients from the deep nutrient-rich layers to the surface causing an algal bloom. Further investigation is necessary to understand the causes and effects of such algal blooms.

PRESENTATION TYPE: ORAL

GLASS GLOBAL LAKES SENTINEL SERVICES

Annelies Hommersom
Water Insight, Netherlands
Steef Peters
Water Insight, Netherlands

It is estimated that more than 8 million lakes larger than 1 ha exist worldwide. These lakes retain, store, clean, and provide water, constitute essential components of the hydrological and biogeochemical cycles, and influence many aspects of ecology, economy, and human welfare. Processes, such as eutrophication, acidification, water-level regulation and climate change influence the ecological status of lakes and their water quality. Monitoring of water quality, for example by optical remote sensing, is therefore of great interest. It is expected that the combined properties of the Sentinel-2 (high resolution) and Sentinel-3 (high temporal coverage) satellites will provide unprecedented capabilities for monitoring of global lakes and reservoirs. Therefore, the EU collaborative project Global Lakes Sentinel Services (GLaSS) is developing a prototype service infrastructure to ingest and process S2 and S3 data. GLaSS is working on the ingestion of large quantities of data and water quality algorithms adaptation to the high diversity of water types that can occur in lakes. The GLaSS system will be tested and demonstrated with global case studies of very different lake types with very different management questions. Products from algorithms developed in the GLaSS project and standard Sentinel-3 products will be validated on the basis of field data. GLaSS will also generate training and course material for potential users of the GLaSS system. This will make S2 and S3 data easy accessible for monitoring agencies, biologists, limnologists, and environmental scientists to use the data for their studies on e.g. environmental impact analysis.

PRESENTATION TYPE: POSTER

FLOATING LAYER DETECTION WITH REMOTE SENSING

Annelies Hommersom
Water Insight, Netherlands
Steef Peters
Water Insight, Netherlands

KEYWORDS: CYANOBACTERIA, REMOTE SENSING, FLOATING LAYER

Cyanobacteria in inland waters are an increasing problem. Depending on species, large mats, oily layers or suspended cells can be found. Some species are potentially toxic and are therefore a threat to swimming waters. The best way to obtain more information on blooms and factors that might trigger blooms is monitoring. In the Netherlands, monitoring is done by water boards, by in situ sampling. Using microscopes, species are identified and concentrations and cell volume determined. Although very precise, this method if very time consuming and can therefore not very regularly be applied to various water bodies. Remote sensing with high resolution imagery provides a possible alternative. To prepare for the use of e.g. Sentinel-2 data, in situ reflectance data of different types of floating layers have been collected. Based on these, a distinction is made between thick mats of floating cyanobacteria, oily layers and 'other' floating layers, such as duckweed.

PRESENTATION TYPE: ORAL

TOWARDS GLOBAL MONITORING OF EUTROPHICATION AND CYANOBACTERIA IN LAKES USING EARTH OBSERVATION

Mark William Matthews

University of Cape Town, Department of Oceanography, Rondebosch, Cape Town, South Africa

Daniel Odermatt

Brockmann Consult GmbH, Geesthacht, Germany

Stewart Bernard

Earth Systems Earth Observation, CSIR - NRE, Centre for High Performance Computing, Rosebank, Cape Town, South Africa

KEYWORDS: CYANOBACTERIA, REAL TIME MONITORING, SOUTH AFRICA

Global outbreaks of cyanobacteria (blue-green algae) blooms and increasing eutrophication amid warming climates come at a considerable cost to humans and the environment. As a result, many lakes are under threat from deteriorating surface water quality. There is an urgent need for tools allowing systematic and near real-time operational monitoring which enable rapid response and quantitative measures of mitigation and management interventions. In response, a novel technique has been developed for detecting trophic status and cyanobacteria in lakes using earth observation remote sensing data. The procedure, called the maximum peak height or MPH algorithm, is presently applied to the European Space Agency's Medium Resolution Imaging Spectrometer or MERIS data to derive a 10 year time series between 2002 and 2012 of eutrophication and cyanobacteria occurrence in lakes around the world. Results are presented from diverse lake environments, and its performance is assessed using a large global dataset of in situ chlorophyll a measurements. A South African case study of 50 small lakes demonstrates monitoring at sub-continental scales. The high temporal and spatial resolution satellite data of quantitative chlorophyll a estimates provides a never-before-seen view of the ecological production and functioning of lakes, and provides new insights into the phenology of cyanobacteria blooms and the potential changes in lakes in response to climate and other variability. Its application in operational systems with the upcoming ESA Sentinel-3 space mission makes global near real-time monitoring of cyanobacteria and eutrophication in lakes using satellite remote sensing a future reality.

PRESENTATION TYPE: ORAL

MONITORING AND RETRIEVING HISTORICAL DAILY SURFACE TEMPERATURE OF SUB-ALPINE LAKES FROM SPACE

Sajid Pareeth

GIS and Remote Sensing Unit, Department of Biodiversity and Molecular Ecology, The Research and Innovation Centre (CRI), Fondazione Edmund Mach (FEM), Trento, Italy

Markus Metz

GIS and Remote Sensing Unit, Department of Biodiversity and Molecular Ecology, The Research and Innovation Centre (CRI), Fondazione Edmund Mach (FEM), Trento, Italy

Markus Neteler

GIS and Remote Sensing Unit, Department of Biodiversity and Molecular Ecology, The Research and Innovation Centre (CRI), Fondazione Edmund Mach (FEM), Trento, Italy

Mariano Bresciani

National Research Council, Institute for Electromagnetic Sensing of the Environment (CNR-IREA), Milano, Italy

Fabio Buzzi

Regional Agency for Environmental Protection of Lombardy (ARPA Lombardia), Italy

Barbara Leoni

Department of Earth and Environmental Sciences, University of Milan-Bicocca, Milan, Italy

Alessandro Ludovisi

Dipartimento di Chimica, Biologia e Biotecnologie, Università degli Studi di Perugia, Perugia, Italy

Giuseppe Morabito

National Research Council, Institute of Ecosystem Study (CNR-ISE), Verbania Pallanza, Italy

Nico Salamaso

Limnology and River Ecology Unit, Department of Sustainable Agro-Ecosystems and Bioresources, The Research and Innovation Centre (CRI), Fondazione Edmund Mach (FEM), Trento, Italy

KEYWORDS: REMOTE SENSING, SUB-ALPINE LAKES, SURFACE TEMPERATURE

Thermal infra-red remote sensing methods provide great opportunity to study spatial and temporal temperature variations over land and water masses. In this study, we used MODIS (Moderate Resolution Imaging Spectroradiometer) Land Surface Temperature (LST) data by reconstructing them using a multi regression technique (FEM-CRI PGIS, http://Array, at 250 m resolution) and daily Lake Surface Water Temperature dataset (Arc-Lake 1995-2009, http://Array) at 0.05º spatial resolution retrieved using optimal estimation and probabilistic cloud screening from A(A)TSR (Advanced Along-Track Scanning Radiometer) aboard the Envisat satellite. The ability of remotely sensed datasets to capture the thermal variations over time was validated against historical monthly ground observation data collected in the largest Italian lakes – Como, Iseo, Garda, Maggiore and Trasimeno. The preliminary analysis over lake Garda was able to reconstruct the seasons on an annual scale while giving us a graphical view of intra-annual variations in the trends with residuals. The correlation between time series of satellite data LST (x, y, t) and the field measurements f (x, y, t) were found to be in acceptable range, with a correlation coefficient of 0.94. The time series methods STL – Seasonal Time series decomposition based on Loess method and BFAST – Breaks for Additive Season and Trend, were implemented and compared in their ability to derive changes in trends and seasonality with respect to the monthly field data. The time series trend analysis showed similar pattern from both the datasets reinstating the importance of remotely sensed data in climate change related studies.

PRESENTATION TYPE: ORAL

HARMONIZED WATER QUALITY MEASURES FOR LAKES AND RIVER FROM SPACE: OPERATIONAL TECHNOLOGIES FOR A TRANSNATIONAL AND LONG TERM MONITORING SYSTEM

Karin Schenk
EOMAP GmbH & Co.KG, Germany
Thomas Heege
EOMAP GmbH & Co.KG, Germany
Philip Klinger
EOMAP GmbH & Co.KG, Germany

KEYWORDS: WATER QUALITY, EARTH OBSERVATION, INLAND WATER MONITORING

Satellite based mapping of water quality has been developed and established in the past decades as a powerfully tool to monitor ocean and coastal areas worldwide. With an increasing number of spatially high resolved satellite sensors and improved algorithms, it is nowadays capable to monitor also smaller inland waters and rivers at pan-continental level. These capabilities will be significantly extended with the upcoming SENTINEL satellites of the European COPERNICUS program. In the frame of FRESHMON, a FP7 funded downstream project to foster space applications, significant efforts are done to create continuous and well accepted services for inland water monitoring at European level. Water quality products such as suspended matter, secchi depth, organic absorbers and chlorophyll of inland waters were generated and validated for a variety of temporal and spatial scales in different countries. The results underline the method is now capable for harmonized monitoring on intercontinental levels, covering long-term measurements as well ongoing near-real-time deliveries from fully operational processors, on multiple scales from small lakes and rivers to whole river systems. The capabilities, validation examples and technical restrictions of the new technology are discussed on base of various freshwater systems and several applications in different countries, over lakes and rivers. In order to guarantee the seamless integration of the new satellites into this operational water quality monitoring, continuous algorithm and workflow developments are undertaken for instance in context of two EU funded projects, GLaSS and INFORM, with first results presented here.

PRESENTATION TYPE: ORAL

MONITORING LAKE LEVEL WITH SATELLITE ALTIMETRY

Jérôme Benveniste
European Space Agency

KEYWORDS: SATELLITE RADAR ALTIMETRY, CRYOSAT, SENTINEL-3

Lake volumes respond to changes in precipitation integrated over their catchment basins and therefore can act as important, though indirect indicators of climate change on both regional and global scales. Major river systems are important targets of research covering a wide range of applications such as transport, flooding hazard, water and food resource management, studies of the hydrological cycle, and addressing the impact of land use and climate change Since 1982, research into the application of altimetry for monitoring river and lake levels has been carried out. This highlighted the advantages of using data derived from satellites due to the global coverage and regular temporal sampling of the processed data, but also identified the difficulties in interpreting radar altimeter measurements made over inland water. This paper will present to current capabilities of a global lake level observing system, using data from all flying altimeters. Furthermore, the European Space Agency (ESA) is investing in the preparation to fully exploit the future Copernicus Sentinel-3 radar altimetry mission over inland water through its programme element called SEOM (Scientific Exploitation of Operational Missions). Progress in the processing of the new generation radar altimeter operating in the synthetic aperture radar mode on Sentinel-3, already tested in small areas with CryoSat-2, providing increased resolution and precision, will be reported.

PRESENTATION TYPE: ORAL

LONG-TERM HYDROLOGICAL AND ECOLOGICAL CHANGES OF THE ARAL SEA OBSERVED BY SATELLITES

Wei Shi

National Environmental Satellite, Data, and Information Service (NOAA/NESDIS), USA

Menghua Wang

National Environmental Satellite, Data, and Information Service (NOAA/NESDIS), USA

KEYWORDS: ARAL SEA, HYDROLOGICAL AND ECOLOGICAL CHANGES , SATELLITE

The diminishing of the Aral Sea is “one of the worst environmental disasters in the world” (from United Nations Secretary-General Ban Ki-moon). In this study, 33-year satellite observations from Advanced Very High Resolution Radiometer (AVHRR), 21-year satellite altimetry sea level data from TOPEX/POSEIDON, Jason-1, and Jason-2, and 12-year satellite ocean color observations between 2002 and 2013 from the Moderate Resolution Imaging Spectroradiometer (MODIS) on the Aqua are used to quantify the long-term hydrological and ecologicalchanges in the Aral Sea. Total coverage maps since 1981 show constant decline of the Aral Sea. The coverage dropped from ~4.7–4.8×104 km2 in 1981 to about ¼ of the value in recent years. In the South Aral Sea, sea level shows steady decrease from 35 m above sea level to less than 26 m since 1993. Total loss of water storage since 1993 is estimated to be ~2.0×102 km3 for the South Aral Sea with a rate of ~0.16−0.20×102 km3/year before 2002 and a less value after 2002. In addition, both seasonal variability and significant interannual ecological changes are observed when the Aral Sea desiccated between 2002 and 2013. The Aral Sea shows enhanced chlorophyll-a (Chl-a) and diffuse attenuation coefficient at the wavelength of 490 nm (Kd(490)) during the autumn season. Waters in the Southeast (SE) Aral Sea are the most turbid with significantly higher Kd(490) than those in the other two Aral Sea sub-regions. Kd(490) gradually increased from ~2 m–1 in 2002 to ~3.5 m–1 after 2008 in the SE Aral Sea. In comparison, both Chl-a and Kd(490) were relatively stable for the North Aral Sea with Kd(490) ~1.0 m–1 and Chl-a ~10 mg m–3.

PRESENTATION TYPE: ORAL

EARTH OBSERVATION OF AQUATIC ECOSYSTEMS: ROADMAP TO GLOBAL RELEVANCE

Arnold Dekker
CSIRO, Australia
Blake A. Schaeffer
U.S. Environmental Protection Agency, USA
Steve Greb
Wisconsin Department of Natural Resources, USA
Tiit Kutser
University of Tartu, Estonia
Claudia Giardino
CNR, Italy
Milton Kampel
INPE, Brazil
Adrian Strauch
University of Bonn, Germany
Richard P. Stumpf
NOAA, USA
Erin Hestir
CSIRO, Australia

KEYWORDS: EARTH OBSERVATION, WATER QUALITY, WETLANDS

Earth observations are a suitable tool for mid to large-scale detection, monitoring and assessment of inland and coastal waters and wetlands. Earth observation explores the temporal and spatial patterns of several biological, chemical and physical properties, key biodiversity variables, of aquatic ecosystems. While Earth observation processing and analysis techniques to characterize the bio-geophysical properties and ecosystem function of coastal and inland waters and wetlands are maturing, a step change is needed to increase uptake by the wider scientific and management communities. This may be possible through timely access to appropriate and reliable water quality and ecosystem observation products of known accuracies and agreed interpretation. The Group on Earth Observations (GEO) Water Task “Inland and Near-shore Coastal Water Quality” and the GEO “Biodiversity Observation Network” (GEO BON) are pursuing these goals. The approval by the International Ocean Colour Coordinating Group (IOCCG) of the “Earth Observations in Support of Global Water Quality” working group will greatly enhance the GEO efforts over the next two years. International projects and project calls (e.g. Horizon2020) are maturing this field of research and applications. We suggest the creation of a Roadmap 2015-2025 which takes the state-of-the-art in Earth observations of aquatic ecosystems and involves the global aquatic ecosystems scientific user community to explore synergies and to enhance the community of practice. One key objective of the roadmap is to consider aquatic systems across the landscape, linking freshwater, coastal in a whole-of system approach, integrating the GEO Biodiversity and GEO “Water” interests.

PRESENTATION TYPE: ORAL

ESTIMATING INLAND WATER QUALITY FROM WORLDVIEW-2 IMAGERY: DECOUPLING OPTICAL PROPERTIES

Janet Anstee
CSIRO Land and Water, Australia
Vittorio Brando
CSIRO Land and Water, Australia; National Research Council (CNR), Italy
Nagur Cherukuru
CSIRO Land and Water, Australia
Elizabeth Botha
CSIRO Land and Water, Australia
Tim Malthus
CSIRO Land and Water, Australia
Erin Hestir
CSIRO Land and Water, Australia
Arnold Dekker
CSIRO Land and Water, Australia

KEYWORDS: ADAPTIVE LINEAR MATRIX INVERSION, REMOTE SENSING, OPTICAL COMPLEXITY

A non-natural eutrophic inland lake was selected for this study, which has distinct seasonal patterns and significant spatial heterogeneity with optical constituents varying from algal blooms to suspended matter-laden flood waters. The lake's optical complexity is driven by the geomorphological processes and seasonal influences. In such an optically complex system, standard band ratio algorithms have not succeeded in accurate retrievals of water quality variables. With increased spectral resolution, the 8-band WorldView2 sensor has potential for the accurate detection of water quality variables. An adaptive linear matrix inversion algorithm (a-LMI), parameterised with in situ and laboratory bio-optical properties, was applied to the World View-2 data to retrieve key water quality variables (chlorophyll-a, coloured dissolved organic matter and non-algal particulates). For quality assessment of the retrievals from the remotely sensed data, Ecolight radiative transfer simulations of remote sensing reflectance (inputs were in situ absorption and beam attenuation measurements of three fieldworks) were used to validate the model, as no in situ measurements concurrent with the imagery existed. It was found that the variability of the bio-optical properties of the lake were too complex for band ratio algorithms and for a single fixed Specific Inherent Optical Property model parameterization. The a-LMI method, with its variable SIOP model decouples the optical properties of the water constituents, was then applied to the WorldView2 imagery where the retrieved seasonal variations in the derived water quality products have compared satisfactorily with data from an independent water quality sampling program.

PRESENTATION TYPE: ORAL

ROBUST REMOTE SENSING ALGORITHMS TO DERIVE DIFFUSE ATTENUATION COEFFICIENT FOR OPTICALLY-COMPLEX WATERS

Krista Alikas
Tartu Observatory, Estonia
Susanne Kratzer
Stockholm University, Stockholm, Sweden
Anu Reinart
Tartu Observatory, Estonia
Tuuli Kauer
Estonian Marine Institute, University of Tartu, Tallinn, Estonia
Birgot Paavel
Estonian Marine Institute, University of Tartu, Tallinn, Estonia

KEYWORDS: DIFFUSE ATTENUATION COEFFICIENT OF DOWNWELLING IRRADIANCE, LAKES, MERIS

In this study an empirical algorithm is developed for optically-complex waters to retrieve the diffuse attenuation coefficient of downwelling irradiance (Kd(λ)) from satellite data. A band ratio algorithm, originally developed by Austin and Petzold (1981), was used with modifications. Due to MERIS characteristics, several bands in the longer wavelengths in the visible spectrum (560, 620, 665, 680, 709 nm) were available to retrieve better reference conditions over coastal and inland waters. Various sets of band ratios were tested to achieve the best estimates for Kd(490). Two alternative processors for atmospheric correction and water quality parameters (C2R, FUB WeW) were applied and compared to the MERIS standard processor (MEGS). MERIS-derived Kd(490) values were compared with values measured in optically-complex coastal waters in the Baltic Sea and in Nordic lakes which showed reliable estimates. The results indicate that for empirical band ratio algorithm, the root mean square error (RMSE, %) decreases and the coefficient of determination (R2) increases when using longer wavelengths in the visible spectrum as a reference band. It was found that the best estimates were retrieved from MERIS data when using the ratio of Rrs(490)/Rrs(709) for coastal waters (Kd(490) 2.5 -1) and ratio Rrs(560)/Rrs(709) for more turbid inland waters (Kd(490) > 2.5 m-1). As a result, a combined algorithm was developed, which provides a promising approach (R2 = 0.98, RMSE 0.17, N=34)for estimating Kd(490) over a wide range of values (0.3 – 6.1 m-1).

PRESENTATION TYPE: ORAL

DETECTION AND MONITORING CAPABILITIES OF FUTURE SATELLITE SENSORS FOR LAKES AND RESERVOIRS

Erin Hestir
Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia
Claudia Giardino
National Research Council, Institute for Electromagnetic Sensing of the Environment (CNR-IREA), Italy
Mariano Bresciani
National Research Council, Institute for Electromagnetic Sensing of the Environment (CNR-IREA), Italy
Erica Matta
National Research Council, Institute for Electromagnetic Sensing of the Environment (CNR-IREA), Italy
Vittorio Brando
National Research Council, Institute for Electromagnetic Sensing of the Environment (CNR-IREA), Italy

KEYWORDS: EARTH OBSERVATION, HYPERSPECTRAL, WATER QUALITY

Although they occupy a relatively small portion of the Earth's surface, lakes and reservoirs play an important role in supporting biodiversity, ecological function and ecosystem services. Earth observation has been identified as an approach for providing the systematic, repeatable measurements needed to resolve lake and reservoir physical and ecological processes. However, due to their dynamic nature and because they are relatively small and sparse on the Earth's surface, Earth observation of lakes has been limited. Sensors are needed that can capture the small spatial extents of freshwater systems at spectral resolutions that measure ecological function and temporal resolutions that can resolve freshwater dynamics. High spectral resolution imagers such as MERIS, Hyperion and HICO have demonstrated the capabilities of spaceborne sensors to resolve the biophysical properties of lakes and reservoirs such as lake extent, water quality and macrophyte cover. With the advent of Sentinel-3, EnMap, PRSIMA and HysPIRI, Earth observation applications for lakes will progress even further. Improved spatial resolution will resolve more small and medium lakes. Increased frequency of overpasses will enable detection of environmental processes. Improved sensor performance such as high spectral resolution at higher fidelity will allow for sophisticated measurements, such as the retrieval of secondary phytoplankton pigments. Based on case studies on Italian and Australian lakes and reservoirs, we present how the improvements that are expected from upcoming satellite missions will allow us to deliver improved products for lake and reservoir research and management.

PRESENTATION TYPE: ORAL

REMOTE SENSING INVETORY OF LAKES ON EARTH

Charles Verpoorter
INSU-CNRS, UMR 8187, LOG, Laboratoire d'Océanologie et des Géosciences, Université de Lille Nord de France, ULCO, France
Tiit Kutser
Estonian Marine Institute, University of Tartu, Estonia
David A. Seekell
Department of Environmental Sciences, University of Virginia, USA
Lars J. Tranvik
Department of Ecology and Genetics/Limnology, Evolutionary Biology Centre, Uppsala University, Sweden

KEYWORDS: REMOTE SENSING, GLOBAL INVENTORY

There is strong need from both global and regional prospective to have accurate information about the number, size and distribution of lakes. The current knowledge about the total number and area of lakes around the world relies on data with variable quality and statistical estimates with questionable accuracy. The largest uncertainties are related to smaller lakes. We used the GeoCoverTM Circa 2000 database, that consists of Landsat 7 ETM+ satellite imagery with 14.25 m spatial resolution, to produce a global lake map that covers all water bodies greater than 2030 m2 in size. Our estimates show that there are ~117 million lakes on Earth and about 27 million of them are greater than 1ha. These water bodies cover a total area of around 5 million km2 which correspond to 3.7% of the global land area. The water bodies that are greater than 1ha in size cover a total area of ~4 million of km2 which corresponds to 3.4% of the global landmass.

PRESENTATION TYPE: ORAL

INTEGRATED ASSESSMENT OF LAKE TAIHU AREA BASED ON EARTH OBSERVATION FOR UNDERSTANDING THE DRIVING FORCES OF WATER QUALITY THREATS IN THE LAST DECADE

Paolo Villa
Institute for Electromagnetic Sensing of the Environment, CNR (IREA-CNR), Milano, Italy
Hongtao Duan
Nanjing Institute of Geography and Limnology, CAS (NIGLAS), Nanjing, China
Mariano Bresciani
Institute for Electromagnetic Sensing of the Environment, CNR (IREA-CNR), Milano, Italy

KEYWORDS: ALGAL BLOOMS, INTEGRATED ASSESSMENT, MODIS

Inland water quality can be strongly affected by anthropic activities and their influences on the landscape; Earth Observation (EO) can deliver a wide range of information on spatial-temporal environmental dynamics both in the water and the land domain, and is therefore the most relevant and potentially effective candidate tool for monitoring complex ecosystems such as inland, coastal and transitional environments.Lake Taihu, located in southern Jiangsu province, China, is a widely studied highly eutrophic shallow lake. A number of studies have recognized the complex integration of many environmental factors causing algal blooming, but quantitative understanding of such water threats phenomena is still lacking.This work focuses on the comparative assessment of algal blooms areal extension and seasonality with agricultural activities and crop characterization (double crops with winter wheat and paddy rice cultivation) derived from multi-temporal MODIS satellite data, acquired over the Lake Taihu basin from 2000 to 2013. MODIS data processing provided series of two descriptors to be put in comparison: NDVI inter-annual variability maps (a proxy of crops phenology) and monthly mean areal extension maps for algal blooming in Lake Taihu (mainly consisting of cyanobacteria).Results highlight some anomaly across the years 2006-2007, which marked a turning point for the environmental system: a critical drop in productivity for winter cropping season in 2006, followed by the agricultural strong rebound in 2007 winter cropping season paired with the two massive algal blooming phenomena of the decade. Blooming starting season too seem to show some links to winter crops productivity.

PRESENTATION TYPE: POSTER

GLOBAL OBSERVATORY OF LAKE RESPONSES TO ENVIRONMENTAL CHANGE (GLOBOLAKES): UPDATE

Andrew Tyler
University of Stirling, UK
Peter Hunter
University of Stirling, UK
Spyrakos Evangelos
University of Stirling, UK
Caitlin Riddick
University of Stirling, UK
Steve Groom
Plymouth Marine Laboratory, UK
Victor Martinez Vicente
Plymouth Marine Laboratory, UK
Claire Miller
University of Glasgow, Scotland, UK
Ruth Haggarty
University of Glasgow, Scotland, UK
Mark Cutler
University of Dundee, UK
Eirini Politi
University of Dundee, UK

KEYWORDS: EARTH OBSERAVTION, WATER QUALITY , BIO-OPTICAL PROPERTIES

GloboLakes is a five-year NERC funded research programme investigating the state of lakes and their response to environmental drivers of change through the realization of a near-real time satellite based observatory (Sentinel 3) with archive data processing (MERIS, SeaWiFS) to produce a ~20-year time series of observed ecological parameters and lake temperature for over 1000 lakes globally. This will be supported by linked auxiliary data on catchment land-use and meteorological forcing. The Earth observation component will focus on the retrieval of: (i) surface water temperature (LSWT); (ii) the concentration of coloured dissolved organic matter; (iii) suspended solids that derive largely from the catchment; (iv) the abundance of phytoplankton (chlorophyll a); and (v) the abundance of cyanobacteria (C-Phycocyanin). Here we will present an update on the project and its science programme. An analysis of the variability in IOPs within and between lakes from our own data will be presented, including the challenges of adopting ocean colour derived procedures for lake bio-optical measurement. We will introduce the network of partners around the world that we have built through the LIMNADES (Lake Bio-optical Measurements and Matchup Data for Remote Sensing) database, the type of resource widely recognised by the Earth observation community as fundamental to the development of robust remote sensing algorithms. We will also outline the selection of the ~1000 lakes and provide examples of time series analysis and clustering of LSWT as we develop methods to analyse our data to understand the drivers influencing the change in lake condition around the world

PRESENTATION TYPE: ORAL

SEMI-EMPIRICAL ALGORITHM COMPARISON AND MODEL TUNING FOR ESTIMATING CHLOROPHYLL-A CONCENTRATION IN A TROPICAL RESERVOIR: CASE STUDY OF ITUMBIARA, BRAZIL

Milton Kampel
INPE, Brazil
Enner Alcântara
UNESP, Brazil
Igor Ogashawara
INPE, Brazil
Jose Luiz Stech
INPE, Brazil

KEYWORDS: CHLOROPHYLL-A CONCENTRATION, TROPICAL RESERVOIR, BAND-RATIO EMPIRICAL ALGORITHM

Chlorophyll is a green pigment found in almost all marine and freshwater phytoplankton species. Chlorophyll-a concentration (Chl-a) is measured as an indicator of phytoplankton abundance and biomass in marine and inland waters and is a commonly used measurement of water quality. Satellite retrieved chlorophyll data is also used to estimate the rate of global primary productivity. Accurate estimation of chlorophyll-a concentration in near-coastal and inland waters through remote sensing is a challenge due to the optical complexity of water constituents. The aim of this work was to evaluate the performance of two and three band empirical models used to estimate Chl-a on a tropical aquatic system. The study was conducted in the Itumbiara Reservoir (18°25'S, 49°06'W), located in Midwest Brazil between the states of Minas Gerais and Goiás. Two field campaigns were undertaken in May and September 2009, respectively. Linear and polynomial calibrations of the algorithms were obtained with the use of above and in-water spectroradiometric remote sensing reflectance (Rrs) and in situ Chl-a data concurrently collected in May 2009. Models were validated with the use of data from September 2009 campaign. Moreover, a regional empirical model was developed based on correlation between analytically measured Chl-a and band ratios. The webtool Interactive Correlogram Environment (ICE –) was used for establishing the relationships. The models were spectrally tuned in accordance with optically active constituents for more accurate Chl-a estimation in the Itumbiara reservoir.

PRESENTATION TYPE: POSTER

INDICATING LAKE BIODIVERSITY BY MEANS OF EARTH OBSERVATION

Carsten Brockmann
Brockmann Consult GmbH, Germany
Daniel Odermatt
Brockmann Consult GmbH, Germany
José Carlos Brito
CIBIO, Portugal
Joao Carlos Campos
CIBIO, Portugal
Petra Philipson
Brockmann Geomatics, Sweden
Per Wramner
Brockmann Geomatics, Sweden
Marc Paganini
ESA ESRIN, Italy

KEYWORDS: BIODIVERSITY, WATER QUALITY

Lake water quality and quantity are fundamental livelihoods for species living in and near the water. Both are subject to increasing environmental pressure, including eutrophication, climate change, anthropogenic consumption and pollution, or structural interventions. According to the Secretariat of the Convention on Biological Diversity (CBD), the rate of loss of freshwater species diversity is the fastest for any of the world's major biomes. The Living Planet Index signifies that the rate of loss of freshwater biodiversity between 1970 and 2000 was almost double that of marine and terrestrial biomes. Satellite Earth Observation provides a unique means to identify recent, spatially explicit trends in water quality and quantity. Globally consistent methods and products are available, and the sensors in use are steadily improving in spatial and temporal resolution. The ESA DUE Diversity II Inland Waters project component aims to make this data source useable for biodiversity and habitat monitoring in lakes around the world. All suitable data acquired by ESA's ENVISAT between 2002-2012 have been processed, and suitable biodiversity indicators are derived using statistical and empirical approaches. Biodiversity indicators are derived by means of three different approaches. First, it is assessed to which environmental factors lake-specific species richness can be assigned, using decadal means of water quality parameters and biodiversity inventory data available for about 50 lakes. Second, regression analyses between biodiversity trends and remotely sensed parameters are carried out for 10 lakes. And third, user consultation meetings with local experts were organized in order to define advanced aggregation schemes of water quality. Such schemes represent environmental conditions during periods that are vital for productivity, but also periodic changes in water quality parameters that may indicate the balance of a lake's species community structure. Indicator as well as water quality parameter datasets are made available for free download, covering the entire decade of data for 300 lakes. Adaptation and further improvement of the chosen approaches is prepared in view to the Sentinel sensors that are to be launched next year.

PRESENTATION TYPE: ORAL

A 2002-2012 REMOTELY SENSED WATER QUALITY DATABASE FOR 300 LAKES WORLDWIDE

Daniel Odermatt
Brockmann Consult GmbH, Germany
Carsten Brockmann
Brockmann Consult GmbH, Germany
Petra Philipson
Brockmann Geomatics, Sweden
Kerstin Stelzer
Brockmann Consult GmbH, Germany
Marc Paganini
ESA ESRIN, Italy

KEYWORDS: WATER QUALITY, REMOTE SENSING, OPEN SOURCES DB

Remote sensing allows for consistent and reproducible estimation of environmental parameters at low cost and synoptic scales. These acquisition parameters create an unparalleled potential to provide global environmental information without proprietary restrictions. With regard to the retrieval of inland water quality parameters, sensors with high spectral, radiometric and temporal resolution are required to resolve relevant natural dynamics. These requirements were first met by ESA's ENVISAT satellite, which was in operation between 2002-2012. The applicability of data acquired by ENVISAT's optical, thermal and altimetric instruments was demonstrated in a variety of scientific studies throughout the past decade. ESA has put increasing efforts in providing suitable tools and processing the archived ENVISAT data using state of the art methods, in order to make added value products accessible to users outside the remote sensing community. In the scope of the ESA DUE Diversity II project, a comprehensive database is created consisting of water quality and quantity parameters for 300 lakes. This effort builds on water temperature and surface level products processed in the scope of ESA's ARC Lakes and River and Lake projects, respectively. Additional efforts are made to retrieve robust estimations of chlorophyll-a, suspended matter, coloured dissolved organic matter and turbidity, and indicators for cyanobacteria and floating organisms from optical measurements. An extensive validation study is performed using in situ measured reference data provided by several scientists and authorities around the world. The results enable a reliable selection of suitable algorithms, taking into account the conditional comparability of all data sources. A consolidated processing chain is used to produce monthly, yearly and decadally averaged map products as well as spatially averaged time series. Several case studies are presented to demonstrate the use of the derived products, including interpretation by local experts. All products are made available on an FTP server for public access, and support is available for interested users.

PRESENTATION TYPE: ORAL

CHARACTERIZING COLD FRONTS EFFECTS ON WATER QUALITY OF A TROPICAL RESERVOIR, ITUMBIARA (GO), BRAZIL, BASED ON MODIS AND IN SITU DATA

Milton Kampel
INPE, Brazil
Gabriel Moiano Cesar
INPE, Brazil
Jose Luiz Stech
INPE, Brazil

KEYWORDS: WATER QUALITY, COLD FRONTS, TROPICAL RESERVOIR

Water quality assessment in aquatic systems is a relevant application of remote sensing. Water resources are critically influenced by human activity. Aquatic systems respond to climatic conditions that vary over different space-time scales. On a few days, the passage of frontal disturbances promotes transient phenomena (winds, storms) affecting the water quality of tropical reservoirs. This study evaluates the effects of meteorological factors on the water quality of the Itumbiara reservoir, Midwest Brazil, using MODIS images and hydro-meteorological data obtained with a buoy and field campaigns. Cold front events are described between September 2009-March 2011. May and August presented higher frequency of events (2-3 in average), while November was the month with longer events. Seasonal variations and the effect on limnological parameters were also observed. In situ spectroradiometric data, concurrently acquired with chlorophyll-a and turbidity measurements, were used to derive empirical relationships applied to MODIS imagery. A partitioning and bio-optical characterization analysis divided the reservoir in three compartments - its main body, the Corumbá and Paranaíba tributaries, and a third region influenced by the Araguari River. Applying the spectral linear mixture analysis over a time-series of 8-days MODIS reflectance, the optically active constituents in the water body were distinguished. During dry season there was the dominance of CDOM and during rainy season there was more variation. The Relative Water Column Stability suggested that the largest vertical mixing in the Itumbiara reservoir occurs during austral winter. Remote sensing techniques demonstrated good potential for management and monitoring the surface waters of tropical reservoirs.

PRESENTATION TYPE: POSTER

ANALYSIS OF WATER QUALITY AND GOLD MINING ACTIVITIES IN TAPAJóS RIVER BASIN/BRAZILIAN AMAZON: AN OPTICS AND REMOTE SENSING APPROACH

Felipe Lobo
Spectral Lab, Department of Geography, University of Victoria, Victoria, Canada
Maycira Costa
Spectral Lab, Department of Geography, University of Victoria, Victoria, Canada
Evlyn Novo
evlyn@ltid.inpe.br

KEYWORDS: WATER SILTATION, OPTICAL PROPERTIES , REMOTE SENSING

Water siltation caused by artisanal gold mining has impacted the Tapajós River Basin in the Amazon Basin for the last 40 years, but its consequences to the aquatic environment are still not fully understood. To address this, water quality parameters and optical properties were sampled along the Tapajós watershed during high (May, 2011) and low (September, 2012) water level periods. Also, satellite images (Landsat-5/TM and IRS/LISS III) were used to retrieve water quality parameters from tributaries that were not sampled. An image processing, including atmospheric correction and image inter-calibration validated with in situ radiometric data (n=23), is proposed. A wide range of TSS varying from non-mined river (3.3 mg/l) to highly impacted rivers (up to 113.3 mg/l) is reported. A full quantification on how increasing TSS affects light attenuation by scattering and absorption properties is given. In short, scattering properties goes from 2.2 m-1 in non-mined rivers to 64.4 m-1 in that highly mined river. Increasing scattering coefficients reduced euphotic zone (Zeu) from 6.3 to 1.9 m, in non-impacted to highly impacted tributaries, respectively. TSS derived from remote sensing data indicates where and when (seasonal variations) mining activities are currently taken place. Overall, during low water season the mining activities are more intense which directly affects the TSS concentration. As a result of the cooperation among Canadian and Brazilian institutes, the findings of this project may be incorporated into the protected areas monitoring program.

PRESENTATION TYPE: ORAL

MS04-04S

Special Session - GIS-based modelling and mapping in limnology and hydrology

USING HIGH PERFORMANCE COMPUTING TO ENABLE INTERACTIVE DESIGN OF MEASURES TO IMPROVE WATER QUALITY AND ECOLOGICAL STATE OF LAKE MARKEN

John Donners
SURFsara, Netherlands
Menno Genseberger
Deltares, Netherlands
Bert Jagers
Deltares, Netherlands
Christophe Thiange
Deltares, Netherlands
Matthijs Schaap
Deltares, Netherlands
Pascal Boderie
Deltares, Netherlands
Andrew Emerson
Cineca, Italy
Massimiliano Guarrasi
Cineca, Italy
Tijs de Kler
SURFsara, Netherlands
Maarten van Meersbergen
Netherlands eScience Center, Ntherlands

KEYWORDS: ECOLOGICAL STATE, INTERACTIVE DESIGN, HIGH PERFORMANCE COMPUTING

For several Dutch shallow lakes, high suspended sediment concentrations result in reduced ecological values and prevent goals and standards from being met (Water Framework Directive, Natura 2000).Mainly due to wind driven waves (fine) sediment particles on the bed are resuspended and transported by hydrodynamic flow. High concentrations of suspended sediment particles generally result in low transparency values. Light on the bottom is important for waterplants to grow, gradients between clear and turbid water are important for fish-eating waterbirds to get food.Given this background of underlying physical and ecological processes and interconnections, currently several measures are studied to improve the ecological state of Lake Marken. These measures involve the construction of structures in the lake that influence the physical processes to improve waterquality and ecological state.The design process of the structures asks for an interactive approach in which different aspects (economical, engineering, recreational, safety for flooding, ecology) from different stakeholders can be combined. For this purpose, for Lake Marken in the Netherlands, a multidisciplinary coupled model exists. However, due to current wall-clock times for scenario runs with the model, interactive sessions (that combines drawing measures with calculations effects with the model with stakeholders) are not feasible yet.This poster shows results of a researchproject by Deltares, SURFsara, and Cineca (partly sponsored by PRACE - FP7) to enable interactive sessions with the model in the near future.

PRESENTATION TYPE: POSTER

AGRICULTURAL WATER MANAGEMENT IN A MULTIPURPOSE SCENARIO

Stefano Casadei
University of Perugia, Italy
Arnaldo Pierleoni
T4E S.r.l., Italy
Michele Bellezza
T4E S.r.l., Italy
Luca Casagrande
T4E S.r.l., Italy

KEYWORDS: WATER RESOURCES MANAGEMENT, WEB-GIS, SPATIAL DECISION SUPPORT SYSTEM

The issue of water resources management requires more approaches in which multiple skills and capacities are nested together (integrated water resources management process), especially when critical situations are taken into account, such as: lake areas and possible climate change scenarios. The various disciplines involved are: climatology, meteorology, hydrology, ecology, environmental science, agricultural science, water resources engineering, socioeconomics, law and public policy. In this context, Decision Support Systems (DSS), applied to the management of water resources, play an essential role since they must allow the different stakeholders and know-hows involved to summarize results and produce decisions on a common and shared basis. The irrigation water use is most common and demanding with respect to other uses and it often enters in competition with other kind of uses for the exploitation of surface water. For this reason a DSS has been studied to support the management of water withdrawals, with particular attention to irrigation use. The Hydrogate Project is a spatial decision support system (SDSS) developed by the University of Perugia and the T4E S.r.l., which is characterized by the integration of hydrological modeling scripts with the capabilities of a GIS system all made available via WEB. So, this WEB-based system, under the control of an administrator, can provide on the one hand the possibility to have a common database of water use and on the other, the possibility to share, with all the stakeholders, this data, results, analysis tools and GIS integration to better assess the available water during the decision-making process.

PRESENTATION TYPE: ORAL

THE EFFECT OF HYDROLOGICAL CONNECTIVITY AND LAND MANAGEMENT ON MACROPHYTE SPECIES RICHNESS AND DIVERSITY IN UK LAKES

Junyao Sun
University of Stirling, UK
Peter hunter
University of Stirling, UK
Nigel Willby
University of Stirling, UK
Andrew Tyler
University of Stirling, UK

KEYWORDS: MACROPHYTES, CONNECTIVITY, LANDSCAPE

Macrophytes (aquatic plants) play a very important role in maintaining ecosystem structure and function in lakes. However, increasing human modification to lakes and catchment has led to increased eutrophication and consequently the degradation of macrophyte communities has become a common phenomenon throughout the world. The controls on macrophyte diversity are however complex and recent research has shown that the lake-scale impacts of processes such as eutrophication can be constrained and shaped by landscape-scale factors such as lake connectivity. The aims of this study were to: (1) determine the relationship between lake landscape position and macrophyte species richness; and (2) investigate the interaction between determinants of macrophyte diversity at the lake-scale (e.g. water quality) and landscape-scale (connectivity and diversity). We used long-term macrophyte and physicochemical monitoring data from 350 UK lakes and investigated the relationships and interactions with landscape variables developed in GIS using mixed effect models. The preliminary results suggest that the location of the lake within the wider landscape and catchment influences macrophyte richness and that while lake-scale factors such nutrient availability are the predominant controls on macrophyte diversity these relationships are themselves influenced by hydrological connectivity and landscape diversity. Improving our understanding these complex interactions is important for the restoration and maintenance of lake eco-macrophyte system services.

PRESENTATION TYPE: ORAL

APPLICATION OF GIS AND REMOTE SENSING TECHNIQUES TO ANALYZE LAKE WATER BALANCE IN A SPARSELY GAUGED CATCHMENT: CASE STUDY BURABAY NATIONAL NATURE PARK, KAZAKHSTAN

Gani Nessipbekov
Nazarbayev University Research and Innovation system, Kazakhstan
Marzhan Kabiyeva
Nazarbayev University Research and Innovation System, Kazakhstan
Vadim Yapiyev
Nazarbayev University Research and Innovation System, Kazakhstan

KEYWORDS: GIS, REMOTE SENSING, WATER BALANCE

The Burabay National Park (BNP) is located in the North of Kazakhstan within the watershed of the Esil river basin, which in turn is the part of a big Ob river basin. The whole lake system is bounded within 52°59¢ - 53°07¢N and 70°13¢ - 70°17¢E and at an average altitude of around 341 meter above sea level. The area is characterized by strong continental climate with an average annual rainfall of 317 mm and evaporation rates of 600-700 mm. Remote sensing techniques have been widely used to study components of hydrological cycle in different geographical locations. However, no comprehensive work has been done to study lake systems in strongly continental climates with mean annual temperature difference of around 60o C using GIS and Remote Sensing. This study intends to assimilate data using Remote Sensing techniques and utilize GIS as a platform for building Decision Support System for sustainable lake management under continental climate conditions.

PRESENTATION TYPE: ORAL

UAV AND GIS INTEGRATED VEGETATION ANALYSIS OF TRASIMENO LAKE

Sara Venturi
University of Perugia, Italy
Silvia Di Francesco
Università Niccolò Cusano, Italy
Piergiorgio Manciola
CIPLA - Centro Universitario per l'Ambiente, Italy

KEYWORDS: UAV MONITORING SYSTEM, REMOTE SENSING, GIS

Photogrammetric and remote sensing methods based on micro-UAV (Unmanned Aerial Vehicles) are nowadays interesting. An optimal use deals with: i) the monitoring of environmental parameters describing water quality of inland waters; ii) the integration of usual limnological investigations. These performances are due to the micro-UAV portability and controllability, to its costs lower than traditional remote sensing and to technological progress in sensors miniaturizing. The almost consolidated GIS technology allows the integration between UAV information and the one obtained by others remote sensing systems (satellite images, vectorial maps, DEM). This integrated use allows the realization of a spatial controlling system finalized to the monitoring of environmental parameters and their space-time variation. This paper deals with the potentiality of using high resolution image data acquired by micro-UAV SR-SF6 (multi-rotor propellers VTOL - Siralab Robotics s.r.l.) in order to analyze on a temporal and spatial scale the extension of red beds (Common Reed) localized in the south of Trasimeno Lake. The Common Reed influences considerably the ecological balance of the Lake. Indeed the epiphytic microorganisms in the submerged part contribute both to the metabolism of nutrients and the killing of bacteria. Moreover the Common Reed affects the evapotranspiration levels representing a significant contribution to the Lake water balance. The use of remote sensing techniques for environmental parameters monitoring and control is in accordance with the goals of Water Framework Directive (2000/60/EC). In this way the micro-UAV SR-SF6 monitoring system is resulted extremely operative in terms of resolution, accuracy, reliability, portability and costs.

PRESENTATION TYPE: ORAL

DAM-BREAK RISK ANALISYS USING GIS

Chiara Biscarini
University for Foreigners of Perugia, Italy
Silvia Di Francesco
Cusano University, Italy
Piergiorgio Manciola
University of Perugia, Italy

KEYWORDS: DAM BREAK, RISK ANALISYS, GIS

The abstract presents a 3□dimensional unsteady□flow model, based on Navier Stokes equations applied to dam break flow . Flood disasters cause massive loss of human lives and immense damage to the infrastructure and economic activities all over the world. The numerical simulation of dam-break problems could be accomplished with geographic information systems and innovation maps. Spread of the flood wave after a dam break can be predicted using these enabling technologies. This kind of advanced modelling technology is becoming an inevitable tool for the decision-making process. A case study is presented of the Malpasset (France) arch dam Failure of 1959. The Malpasset dam-break is a unique example of the total failure of an arch dam. As a total failure assumption it is thus a rare opportunity for validating hydraulic modelling. Using GIS techniques and hydraulic modelling, possible effects and damage of a dam-break flood have been investigated and results were simulated to show significant dam break effects.

PRESENTATION TYPE: POSTER

GIS DATABASE OF ADMINISTRATIVE AND HYDROGEOMORPHIC PROPERTIES OF ITALIAN LAKES

Antonio Annis
University for Foreigners of Perugia, Italy
Valentina Abete
University for Foreigners of Perugia, Italy
Chiara Biscarini
University for Foreigners of Perugia, Italy
Fernando Nardi
University for Foreigners of Perugia, Italy

KEYWORDS: LAKES, GIS, DATABASE

Lakes are important because of the water resources and the naturalistic ecobiological properties, but also because the historical, cultural and socio-economical framework connected to the lacustrial setting. Natural and socio-economic information represent a multidisciplinary heterogeneous information framework that can be effectively managed, in a fast and powerful way, only using Geographic Information Systems (GIS). The use of GIS data and tools for lake information management, allows water management authorities, decision makers and scientists to obtain both administrative information, and hydro-morphometric parameters useful to the understanding and planning of actual versus extreme short-to-long-term scenarios in order to assess and preserve the quantitative and qualitative properties of lacustrial habitats. In this work, a database of the Italian lakes has been developed, bounded to the Italian administrative limits (Regions, Provinces, Municipalities), as a function of the hydrologic and morphologic properties of the water catchments. In particular, some indicators that relate the geometry of the lake and the relative authorities were introduced; also basin hydro-morphometric parameters are extracted using DEM-based terrain analysis algorithms and integrated in the GIS administrative database, giving birth to the first integrated administrative and hydrogeomorphic GIS database of Italian lakes.

PRESENTATION TYPE: ORAL

LAND USE CHANGES AND ASSOCIATED ENVIRONMENTAL IMPACTS IN TWO MEDITERRANEAN LAKES

K. Stefanidis
Department of Biology, University of Patras, Greece
Ai. Kostara
Department of Biology, University of Patras, Greece
E. Papastergiadou
Department of Biology, University of Patras, Greece

KEYWORDS: WATER LEVEL FLUCTUATIONS, LAND COVER/USE CHANGES, LANDSCAPE METRICS, WATER QUALITY

In this article we examined the spatiotemporal dynamics of land cover/uses and the landscape structure within the Natura 2000 area of lakes Vegoritis and Petron, located in northern Greece. LANDSAT images were assembled for classification of land cover/uses in a buffer zone defined by the Natura 2000 boundaries. Landscape metrics were calculated with FRAGSTATS from patches of land cover to quantify the landscape changes. Climate data and temporal series of water level, conductivity and chloride were analyzed for relationships between climate variability, hydrology and water quality. The results showed that between 1972 and 2011 almost 32% of the lake Vegoritis and 23% of lake Petron were replaced by cultivations and reed beds. Since 2002 a small water level increase allowed the formation of reed beds and macrophyte assemblages in the littoral zone. The landscape was characterized by high fragmentation indicating a heterogeneous spatial pattern and degradation of the rural habitats. Furthermore, precipitation appeared to follow a declining trend which correlated with the water level. Water level was correlated with the conductivity and chloride indicating an effect of the water loss on the water quality. Overall, the research suggested a combined effect of climate and land cover/use changes on the lakes ecology. The results of this study underline the importance for the implementation of a water management plan which includes specific actions targeted on sustainable agriculture policies.

PRESENTATION TYPE: POSTER

GIS HYDROGEOMORPHIC MAPPING OF LAKES AND WETLANDS IN ITALY USING DEMS

Antonio Annis
University for Foreigners of Perugia, Italy
Fernando Nardi
University for Foreigners of Perugia, Italy
Salvatore Grimaldi
Tuscia University of Viterbo, Italy

KEYWORDS: GIS, TERRAIN ANALYSIS, INLAND WATERS

This work presents the results of the application of GIS for the hydrogeomorphic characterization of inland waters on the Italian territory. The major Italian watersheds are analyzed using Digital Elevation Models (DEMs) and terrain analysis tools for extracting the main hydrologic and geomorphic features (river/lake basins, networks and valleys). In particular, the GIS capabilities of automatically extrapolating accurate geometric (area, volume, depth) information from digital topographic data and the impact of the DEM resolution and precision are evaluated by using different DEM datasets and in particular the global coverage of the NASA SRTM 90m DEM as respect to the high resolution LIDAR and INGV DEMs respectively at 1m and 10m resolution.

PRESENTATION TYPE: ORAL

MS05-01
Social and cultural aspects

LOOKING AT THE LOCAL CHARACTERISTICS AGAIN—PLANNING THE LOCAL BIODIVERSITY STRATEGY OF SHIGA WITH PUBLIC INVOLVEMENT

Moe Miyake
Shiga Prefecture, Japan

KEYWORDS: BIODIVERSITY, PUBLIC INVOLVEMENT, LOCAL CHARACTERISTICS

Biodiversity supports life and livelihood through providing a variety of benefits. For example, it produces products such as food and timber, cultivates culture that is rooted in the local climate, and prevents or reduces natural disasters. In that sense, we can live our lives safely and peacefully thanks to biodiversity. We started planning The Local Biodiversity Strategy of Shiga in 2013 as a basic strategy for the conservation and sustainable use of biodiversity to maintain the ecosystem service for future generations. The Convention on Biological Diversity points out the need of the strategy in the sixth article. Though biodiversity needs to be considered from the global point of view, the local biodiversity strategy is also important in that, it is based on the natural and social characteristics of the locality because each locality has its own characteristics. Shiga has specific natural characteristics such as having Lake Biwa in the center. On the other hand, in regards to social characteristics, we are keeping close relationships with nature in our livelihoods. It is only in each locality that we stock traditional knowledge about the use of nature in our daily lives, such as meals, play and festivals. We set up 11 working groups, such as "conservation of rare species", " management of invasive species", "tourism" and "culture and traditional handiworks", in which we discussed about the present condition and problems of the local biodiversity with public involvement. The number of participants reached 70. It is unique to Shiga that the process itself of planning the strategy makes the most of human resources in the locality. The local biodiversity strategies tend to be uniform following the national biodiversity strategy. But we have successfully been planning to be unique by looking at the local characteristics again with public involvement.

PRESENTATION TYPE: ORAL

TELLING ITALIAN LAKES IN NEWSPAPER. A SEMIOTIC APPROACH TO THE NARRATIVE REPRESENTATION OF LAKESCAPES

Giovanna Zaganelli
University for Foreigners of Perugia, Italy
Toni Marino
University for Foreigners of Perugia, Italy

KEYWORDS: LAKESCAPE, NARRATIVE, SEMIOTICS, VISUAL RHETORIC

Lakes have had several representations in the world of art, film and literature, which have often helped to create an “imaginary” where lakes are, from time to time, a place of reflection and a pause in narration or, conversely, a place of action. More often lakes are mysterious and magic places. But what about the representations of lakes in journalistic speech? The speech of newspaper supports and points out the mysterious charm or it provides a more detached vision, which can range from a scientific approach (e.g. inserts dedicated to science and new technologies) to more narrative style of the news story and reportages (in some cases merging them in the pages devoted to the promotion of tourism). This paper investigates the journalistic representations that newspapers give to the readers about the Italian lakes, focusing in particular on a case study : the lake Trasimeno. Starting form an empirical methodology of textual research and from the establishment of an homogeneous sample of texts – stratified according to the various sections and characterizations (national or local) of Italian newspapers – this paper analyzes A) the processes of “theming” related to the lakescapes (lexical and visual isotopic chains); B) enunciative strategies used by journalistic discourses to construct their representations of lakescapes; C) narrative strategies used to assign a role to the lake in the plot, characterizing it as a theater of action. This paper aims to provide a taxonomy of the imaginary around the lakes, trying to define possible contextual labels associated to it (schemata) and the actions that readers consider consistent or likely within these (scripts) . The methodology of the analysis focuses on semiotic approach that ranges from classical theories on narrative processes (Greimas , Genette) to cognitive studies on plotting and narration (Bruner, Herman , Turner) .

PRESENTATION TYPE: ORAL

HISTORY AND NATURE: A METHODOLOGICAL ISSUE

Regina Lupi
University of Perugia, Italy

KEYWORDS: ENVIRONMENTAL HISTORY, HISTORY OF CANTICUS, METHODOLOGY

I would present the method that the research group History of CANTICUS applied to environmental history and to the case-study Lago Trasimeno. With reference to the most updated scholarly proposals, we believe that we cannot study environment only as a natural object, because the environment is a cultural, social and historical product. All over the centuries and in different anthropological contexts, human beings elaborated very different ideas of 'nature' and 'culture' and these terms have been sometimes in conflict and sometimes not. So history can be a good platform to study the nexus between all the facets of society and scientific disciplines (such as political thought, economic history, anthropology, biology, law and economy…) and to find an answer to the major issues about sustainable growth and environment in the contemporary world. There is another methodological issue strictly pertaining to history: periodization. The many specializations of this discipline are characterized by their own rhythm of time. In other words, history has many kinds of breadth, more or less wide. With regard to history of nature, environmental history has been focused only on long term phenomena, because nature changes very slowly. However, when environmental history meets man, the time perspective should be different; the action of man on nature can be explained only if we find a mix between the time of nature and the time of man.

PRESENTATION TYPE: ORAL

INLAND WATERS CULTURE AND CIVILITY: THE LINGUISTIC ITALIAN LAKES ATLAS (ALLI)

Antonio Batinti
Voxteca - University for Foreigners of Perugia, Italy
Antonello Lamanna
Voxteca - University for Foreigners of Perugia, Italy
Ermanno Gambini
ALLI - University of Perugia, Italy

KEYWORDS: ITALIANS LAKES, GEOLINGUISTIC AND ETHNOLINGUISTIC PROJECT, THE LINGUISTIC ITALIAN LAKES ATLAS

The Linguistic Italian Lakes Atlas is a geolinguistic and ethnolinguistic project with the aim of collection, documentary research and study of life, history and language of the communities lived by italian inland waters. First investigations was carried out in Umbria during the seventies by the project creator prof. Giovanni Moretti, allowed to develop new instruments and methods for collection and research. The linguistic and ethnolinguistic raw materials, organized in 63 points of investigation in the italian areal, have been examinated under different observation points by linguistics, anthropologists, historians, archaeologists, and researchers interested to investigate on water related topics including the man-water relation. Fifty publications, achieved during the project, have contibuted to fill some gaps in the history of italian linguistic studies. Therefore, new inter-disciplinary curriculas have opened, in a field of experience composed of productive and terminological sectors, until that moment threatened by profound transformations. The ALLI project was officially born in 1982 during the first conference that took place at Castiglione del Lago-Passignano entitled "Language, history and life of italian lakes", at the documentary reseach centers in lake Trasimeno (San Feliciano di Magione, Passignano) and in some other italian lakes.Some of the points of the investigation are destined not only to specialists, with the goal of a better knowledge about inland waters culture.

PRESENTATION TYPE: ORAL

THE LADY OF THE LAKE

Massimo Ciavolella
Department of Italian, University of California at Los Angeles (UCLA), USA

KEYWORDS: MEDIEVAL LEGEND, WESTERN CULTURE

In medieval Arthurian legends the Lady of the Lake is the most important character after that of the king; she is the foster-mother to Sir Lancelot and raises him beneath the waters of her lake. While early Arthurian versions portray her power as benevolent, in later iterations she can appear as a malevolent force, for her power derives from the murky waters of the lake in which she lives. Her character is especially intriguing because it traverses the breadth of western culture -- Gustave Doré, Aubrey Beardsley, the proverbial Walter Scott or Alfred Lord Tennyson, Gioachino Rossini to Lisa Thiel, and more recently stylized in Raymond Chandler, cinema ("Excalibur," in 1981), Marvel comic books, graphic imagery, and television.

PRESENTATION TYPE: ORAL

BETWEEN POPE AND KING: IDEAS AND PRACTICES OF ENVIRONMENTAL MANAGEMENT IN CENTRAL ITALY (1860-1890)

Sara Alimenti
University of Perugia, Italy

KEYWORDS: ENVIRONNEMENTAL HISTORY, HISTORY OF POLITICAL TOUGHT , TRASIMENO LAKE

Since the beginning of the XIX century in central Italy new Institutions were created to manage the environment and the natural resources, especially in particular and residual natural areas.Such Institutions also answered issues arising from the socio-economic transformation and the emergence of new social actors. The project aims to reconstruct the debate about the creation of “consorzi” in central Italy, during the transition from Papal State to the Kingdom of Italy. The debate is analyzed under the perspective of the history of ideas and political thought and the project is focused on the growing dialectics between "private interests" and "public utility". In this perspective, the analysis will focus on the specific case of Reclamation Consortium of Lake Trasimeno, created in 1877 by the Province of Perugia. The cited Consortium initially created to solve the problems of depth variation of Lake Trasimeno and swamping, extended its scope to the socio-economic development of Trasimeno area.

PRESENTATION TYPE: ORAL

PROBLEMS AND PROSPECTS OF INLAND WATER FISHING IN MALAWI

Ichiro Imai
Kwanseigakuin University, Japan

KEYWORDS: LOWER SHIRE RIVER , FISH RESOURCES, SUSTAINABILITY OF FISHING

In this article, the real state of fishing actiivties around the Lower Shire River is described and analysed at first. It is based on the data which was collected in the field research and references. Secndly, this article tries to find out several points og fishing in the area, and considers how to resolve the matters. It pays attention to the fishing activity which is carried out around the Elephant Marsh and the Bangula Lagoon, and the author carried out inquiry based on interviews from the fishermen and the fish traders. As the result, ethnicity of the fishermen and traders, fishing period, fishing methods and system of fish selling are become clear. Many of the fishermen are the Sena and the Maganja, who reside in the area of the Lower Shire Valley. Many of the fishing units choose fishing method of cast net or fish basket. From results of the interviews and observation, it is cleared that although fishing and fish trading have become active in the recent years, scale of fish economies is still much smaller than that of the Lake Malawi area. However, it is pointed out that commercial fishing methods which aims to catch much fish are carried in the water areas of Malawi. This article concludes that the stakeholder which includes fishermen, traders, local communities and government offices (Fisheries Department) should examine thoroughly about influence by the introduction of commercial fishing methods.

PRESENTATION TYPE: ORAL

LIGHT AND DARKNESS: WESTERN IMAGERY AND LAKESCAPES

Rosanna Masiola
Department of Human and Social Sciences, University for Foreigners of Perugia, Italy

KEYWORDS: WESTERN IMAGERY, LITERATURE, LAKESCAPES

This contribution relies on an interdisciplinary approach between literature, visual arts and human geography. It combines iconography, literature and chronicled events. It aims at showing diachronic variation in terms of cultural representation and narratives about lakes and lake-scapes. The term lake-scape derives from the field of the visual arts and contains the vital link between the lakes, visual and verbal description. Lakescapes thus feature narrations and representations, evidencing shifts in perspective and beliefs. A recurrent binary opposition between the sense of light and place of delight, and, a sense of darkness, mystery, death seems to be a constant feature which can be better analyzed in a comparative thematic approach. Historical examples in literature feature Lake Tiberias (aka Sea of Galilee, Lake Gennasaret), Lake Averno, Lake Como, Lake of Lugano (aka Lake Ceresius), Loch Ness, Lake Leman (aka Lake of Geneva), the Lake Districts, and some lesser known Italian lakes (i.e. Alleghe, Barcis). The two-fold imagery and ambiguity of lake 'topophilia' and lakes as 'mortiferous' seem to combine a sense of place (genius loci), and the more recent appeal of innovation and eco-tourism. More than any other eco-system, lakes are challenged by the survival of the creatures of the lake, and the need for preservation of literary and cultural heritage. Literary descriptions of lakes have featured aesthetic schools and European movements. These are inclusive of classic myths, local tales and are teeming with the lacustrine life of reeds, flowers, frogs, the 'Swan Lake,' the myth of Melusina, the Winds in the Willows, fish and fishermen.

PRESENTATION TYPE: ORAL

THE LAKE AS AN UNHEIMLICHE FIGURE IN CONTEMPORARY CINEMA: TWO ITALIAN CASES

Giacomo Nencioni
University for Foreigners of Perugia, Italy

KEYWORDS: CONTEMPORARY CINEMA, ROLE OF PLACES, LANDSCAPE IN MOVIE

In the history of cinema, lakes have often represented places in which familiar and unfamiliar coexist, and as movie sets, not only in the horror genre, they have assumed the role of disturbing places.A lake can be the theatre of a quiet family vacation as much as a place in which corpse come out of the water to tell the story of a murder, or where a supernatural phenomena reveals itself.This coexistence of familiar and uncanny, the status of closed but yet mysterious spaces makes them a remarkable and unique example of the freudian Unheimliche category in movies: lakes can be metaphors of a personal or collective hidden trauma that finds his way out through dark water like a symptom in psychotherapyFrom Psycho to Twin Peaks, from Creepshow 2 to Friday the 13th, the paper will explore the relation between physical and emotional landscape in movie that involve the lake figure, focusing on two recent italian movies, La ragazza del lago (Andrea Molaioli, 2007) and Puccini e la fanciulla (Paolo Benvenuti, 2008), which thematize this relation in a particurarly original way. Essential bibliography Albano L., Lo schermo dei sogni. Chiavi psicoanalitiche del cinema, Venezia, Marsilio, 2004.Bellavita A., Schermi perturbanti. Per un applicazione del concetto di Unheimliche all'enunciazione filmica, Milano, Vita&Pensiero, 2005.Bernardi S., Il paesaggio nel cinema italiano, Venezia, Marsilio, 2002.Freud S., Saggi sull'arte, la letteratura e il linguaggio, Torino, Bollati Boringhieri, 1991.Orlando F., Per una teoria freudiana della letteratura, Torino, Einaudi, 1973.

PRESENTATION TYPE: ORAL

MS05-02
Lake Basin Heartware

CHALLENGES IN RESTORING RELIGIOUS LAKES: PUSHKAR

Jagdish Kapri alias Swamiji
Pushkar Sarovar Samvardhani, India

KEYWORDS: PUSHKAR, SAROVAR, LAKES, BRAHMA, ILBM, WATER CONSERVATION, PILGRIMAGE, CAMEL FAIR

Pushkar Sarovar (lake in Sanskrit) comprises of three water bodies dedicated to the Hindu Trinity of Brahma, Vishnu and Mahesh.In Pushkar God is personified as water and worshiped. The most prominent temple of Lord Brahma is also in Pushkar. Pushkar is revered as ancient and one of the five sacred lakes of Hindus. Known as Teerthraj (king among places of pilgrimage) Pushkar finds mention in Puranas, Ramayana, Mahabharata and Abhigyanshakuntalam an epic by Kalidas. Lord Rama is believed to have visited Pushkar with his wife Sita and brother Laxman during exile and so also the Pandava brothers during their exile. Pushkar has also been home to many sages and saints ever since. Ponds, places and caves named after Pandavas and sages existing even now are reminiscent of old times. The opinion on the origin of Pushkar Lake is divided. Hindu scriptures (Padma and Harvansha Purana) attribute it to Brahma, the creator of Universe and consider it as ancient as creation itself; whereas the scientists consider it a manmade lake. Shaivites believe that Pushkar originated from tears of Shiva that were shed after the death of his wife Sati, besides another sacred pond which is now in Pakistan. In his recent book a columnist and historian Janak Jhunjhunwala has tried to link the Biblical Garden of Adam and Eve to Pushkar. The Pushkar Lake surrounded by 52 Ghats (steps for bathing) is categorized as a Sacred Lake as per Classification of Lakes in India. The Pushkar Lake does find mention in coins of circa 4th Century BC. The inscriptions found at Sanchi in Madhya Pradesh attest to the lake's existence to the 2nd Century BC. .There is enough evidence to suggest that Pushkar was a pilgrimage center thousands of years ago though it was not on the ancient trade route!The texts in Pali/Prakrit suggest that Pushkar was a thriving Buddhist learning center in 2nd Century BC. Situated at latitude of 26” and 27’ N and longitude of 74” 37’ E and 560 meters above the sea level in the western Indian state of Rajasthan. Pushkar is surrounded by Aravali range of hills on three sides and the Thar Desert to the west. Pushkar is home to over 500 temples, all kinds of heritage and a variety of flora and fauna. Pushkar hosts the most colorful cattle (Camel) fair in the world. The soil and topography in the catchment are predominantly sandy with very low water retention capacity. The land use pattern in the Pushkar valley that drains into the lake comprises 30% of the area under shifting sand dunes, 30% under hills (degraded and barren) and streams and 40% of the area is agricultural. The catchment area of Pushkar Lake is 1124 hectare and lake area is 12 hectare. The depth is approximately 8.3 meter. The carrying capacity of water is 79287 cubic meter. Water quality is deteriorating gradually due to flowing of sewer and waste water and solid waste in monsoon season. People offering pind (ball of barley flour), grains, flowers and asthi (human bone-ash) directly into the lake is also a cause of water quality deterioration. Silt laden rain water flows from catchment area to lake, causing siltation. Desertification and siltation are other burning issues. There are interesting tales about the healing properties of Pushkar waters. A Rajput ruler of Mandore, Nahar Rao Parihar, who was cured of his Leukoderma, was so pleased that he restored the lake and the town in the ninth century. Later during the Mughal era the tyrant Emperor Aurangzeb is believed to have suddenly turned grey after he washed his face in Kanishtha Pushkar giving it the name Budha (old) Pushkar. Millions of people have since visited the lakes to take a holy dip for emancipation (moksha), to rid themselves of sins and also to cure skin problems. Today Madhya Pushkar (middle), a huge step well has completely dried up and Kanishtha or Budha Pushkar is at the verge of extinction. The main Sarovar has dried up twice in last ten years and water level is being maintained by pumping in 3 million liters of fresh ground water every day. With ground water level depleting rapidly (from 3 meters 30 years ago to 30-40 meters today), population and pilgrims on rise and possibility of rains failing again (average annual rainfall 400-600 millimeters) the very existence of Pushkar is at stake. This prompted the government to make interventions in terms of excavation of lake and construction of 3 concretized channels. However, the situation has not really improved despite huge investment already made and more is in the pipeline. The key lake basin governance issue therefore is an immediate scientific and

technical intervention to check the continuing seepage and improve water level and quality in all three water bodies in near term and improve the ground water situation in Pushkar in the long run. The Paper examines how the six-pillar ILEC/ILBM Framework for sustainable management and conservation of lakes and their basin resources can be effectively applied to address the complex issues faced by lakes and their basins in Pushkar reeling under the weight of religious and cultural beliefs, increasing population, growing influx of pilgrims and tourist and virtual control of an orthodox priests' lobby over the Lakes and Ghats.

PRESENTATION TYPE: ORAL

AWAKENING ACTIVE RESPONSIBILITY TO PROTECT AND RESTORE RIVER CULTURE' THROUGH MULTIDIMENSIONAL HEARTWARE: A CASE STUDY OF BHIMA RIVER AND UJJANI LAKE CATCHMENT, WESTERN MAHARASHTRA, INDIA

Sandeep Joshi
Shrishti Environment and Sustainability Society, India
Vinod Bodhankar
SETU, India

KEYWORDS: AWAKENING, RIVER-SENSITIVE, COMMUNITY ACTION

Rivers from Pune city pollute Bhima River and tail-end Ujjani Lake 200 km downstream trampling the human rights of safe drinking water of 10 million populations. A mindset-change is needed in upstream urbanites to ensure life-style-change which reduces collective-polluting-impacts on ecological health and population health. To achieve this, three aspects in people have to be reached – head, heart and hands. Pune Metro acts on understanding (head) and tax-funded actions (hands) but lacks heart - a concern for quality of lentic-lotic aquatic system in basin, sensitivity to eco-space of water-dependent-species and well-being of downstream populations. Since last decade, chief stakeholders – people, NGOs, industry and government are making entire community river-sensitive by adopting traditional wisdom, awakening Spiritual, Historic, Cultural, Family and Community values as River-Pilgrimage – water-friendship journeys activate 'service to environment'; Spiritual Festivals activate 'service to nation'; community and social movements activate 'Service to Rivers' and Sagarmita Abhiyaan activates 'Personal Duty' – thus seeding the population with spiritual-action to 'develop life in service to dynamic harmony of nature' and activating 'heartfelt concern for water' in daily actions of individuals, families, professionals, businessmen, farmers, institutions and government.

PRESENTATION TYPE: ORAL

COLLABORATION: THE PHILOSOPHY BEHIND THE LAKE BASIN "HEARTWARE" CONCEPT

Sergio Antonio Silva Muñoz
Department of Civil Engineering, University of Guanajuato, Mexico

KEYWORDS: COLLABORATION, LAKE BASIN, HEARTWARE

Problems in Lake Basins occur where ecosystems and human social systems converge in a non-articulated way, and they cannot be completely analyzed and overcome by science or technology because they are partly a result of the diversity in human perceptions, expectations, and values. This makes good solutions difficult to achieve. In this sense, Austin Declaration 2011 (WLC14) remarks that stakeholder involvement is essential for successful lake basin management. However, LBM is often done by relying upon scientific and economic expert opinions and information to the exclusion of other sources, resulting in a failure to develop or consider other feasible options that fall outside those scientific and economic boundaries. In particular, information that reflects aesthetic, spiritual, ethical, intrinsic, or normative values is often disregarded and environmental concerns and values expressed by stakeholders in terms laden with emotions are ignored in any lake basin management planning process. Therefore, while lake basin management plans should reflect the often indescribable character of society, many of the non-economic values and Nature consciousness held by the public are usually not incorporated into final plans. In the search for the social sustainability of integrated lake basin management plans, a major focus of the last three years has been the enhancement of Lake Basin "Heartware" as an alternative concept to incorporate Lake Basin stakeholders' intangible values, interests, concerns and positions in Lake Basin management plans. Thus, since collaboration is based upon an application of social learning theory and works by linking formal, theoretical knowledge to informal, practical wisdom through face-to-face dialogue among stakeholders in a joint problem process -where participants share information and power as they take joint responsibility in attempting to make decisions, reach solutions, or resolve any lake basin management issue-, this paper presents collaboration as the philosophy behind the Lake Basin "Heartware" concept that might enable it to overcome those scientific and economic barriers impeding to consider immaterial ideals in the lake basin management planning processes.

PRESENTATION TYPE: ORAL

THE WOMEN RAFTERS OF LAKE PANDIN AND THEIR CONTRIBUTION TO CONSERVATION

Adelina C. Santos-Borja
International Linkages and Research Development Unit, Laguna Lake Development Authority, Philippines
Cristina T. Abrego
Lake Pandin Fisheries and Aquatic Resource Management Council, Philippines

KEYWORDS: WOMEN RAFTERS, BALANCED LIFE, LAKE PROTECTION

Lake Pandin is the most beautiful among the seven crater lakes of San Pablo City. The lingering threat of using the lake for livelihood in an unsustainable way has threatened its inherent beauty. This paved the way for a citizen group to introduce to the fishing community the idea of conserving the lake's resources through tourism activities. The use of bamboo rafts to take tourists to the lake to appreciate the beauty of the surroundings and taste the spring water that drains into the lake was operationalized with seed money from private donors. The women took it upon themselves to operate the bamboo rafts and organized themselves into the Samahan ng Kababaihang Mangingisda at Bangkera sa Lawa ng Pandin (Association of Women Fisherfolks and Rafters in Lake Pandin). Still, the prime importance is to keep the balance of being rafters and fulfilling their roles as mothers and wives. To further augment their income, they offer home cooked staple food to the tourists while touring the lake in the bamboo raft. Their hospitality is well-appreciated by visitors who in their own way have become their marketing agents. Aside from rafting, the women and their families regularly clean the vicinity. To date, the most pressing threat both to the women rafters and the lake is land development initiated by the owners of private lands surrounding the lake. The women have vowed to keep on paddling their bamboo rafts for the sake of Lake Pandin; "protecting Lake Pandin is protecting our families also."

PRESENTATION TYPE: ORAL

THE HEARTWARE CHALLENGES IN LAKE BIWA COMPREHENSIVE CONSERVATION PLAN

Naoko hirayama
The University of Shiga Prefecture, Japan
Masahisa Nakamura
Shiga University, Japan

KEYWORDS: LAKE BIWA, SHARED VALUES, SANPO-YOSHI

The Lake Biwa Comprehensive Conservation Plan (LBCCP) was inaugurated in 1999 by the Prefectural Government of Shiga, Japan. It is a long-term plan targeting 2050 as its planning horizon. It is more a vision plan with the aim for basing governance improvement spearheaded by the Shiga Government, with no legal provision for specifically earmarking the national financial resources. It contracts remarkably against the Lake Biwa Comprehensive Development Project (LBCDP, 1972-1997) which was basically an infrastructure development plan facilitated by the special legal framework for national and local financial mobilization. Being more a governance improvement process than a governmental plan to be implemented by the sector agencies, LBCCP expects the general public to play a very significant role. From its preparatory phase, the Shiga Government made every effort to reach out to the Lake Biwa communities at large to play a proactive role in the development and implementation of the local projects. In the process, it became quite clear that there has to be the historically fostered shared values, otherwise referred to as the “heartware” of Integrated Lake Basin Management (ILBM). Among them, for example, is a concept of “Sanpo-Yoshi”, an Ohmi (the current Shiga Prefecture) merchant philosophy of a three-way satisfaction, the seller, the buyer and the community, instilled in the mind of the merchants traveling across Japan since mid-18th Century. The presentation will introduce these and other heartware examples to be valued in the course of LBCCP.

PRESENTATION TYPE: ORAL

PARTICIPATORY LANDSCAPE DRAWING OF THE PAST DAILY-LIFE MEMORIES AS A MEANS FOR REGAINING THE COMMUNITY IDENTITY. A MENTAL IMAGERY DRAWING: PRACTICES AND PROSPECTS

Yohei Ueda
University of Shiga Prefecture, Japan
Katsura Nakano
Shiga University, Japan
Naoki Umezawa
Shiga University, Japan

KEYWORDS: COMMUNITY MEMORY, HISTORIC LANDSCAPE, PARTICIPATORY APPROACH

Over the past several decades in Japan, the unique local lifestyles and cultures evolved in close but diverse relationships with the surrounding natural environments have gradually diminished to become uniform across the country. In an attempt to address this unfortunate trend, an approach has been devised, in collaboration with the participating citizens, to reinstate the locally specific lifestyles and cultures while invigorating the long-fostered local wisdom and creativity. The approach is for the willing community members of all ages and social statuses to collaboratively prepare a landscape picture, based on their five-sense memories of the community. In the process, they will portray their memories on the past events, while reflecting also on the environmental implications of their daily conducts. The resulting landscape painting may now be regarded as a portrayal of their community as a cosmos. In the course of their endeavor to prepare such an artwork, the community may now be able to share their memories imbedded therein, while discovering, sharing, and passing on to the next generation many of their life stories. These portrayal paintings are called “Furusato Ebyoubu”, or the “folding screens of the home community”. The community members can, in due respect to the relationship between man and nature, among the people, and with the history, talk about various scenes reflected in the painting “to foster the past memories and to create the future”. The interest in this innovative approach, while still centered in Shiga Prefecture, is steadily growing elsewhere in Japan.

PRESENTATION TYPE: ORAL

HEARTWARE, AN INDISPENSABLE TOOL TO PROTECT WATER AND LIFE

Yasue Hagihara
International Lake Environment Committee Foundation (ILEC), Japan
Masahisa Nakamura
Research Center for Sustainability and Environment, Shiga University, Japan
Kiyoko Takemoto
Research Center for Sustainability and Environment, Shiga University, Japan

KEYWORDS: ILBM, PARTICIPATORY MANAGEMENT, EXPERIENCE SYNTHESIS

Over the past decades, the International Lake Environment Committee Foundation (ILEC) has been promoting the concept of Integrated Lake Basin Management (ILBM), a methodological framework for management of lakes and their basins. It aims at contributing to gradual, continuous and holistic improvement of lake basin governance over a long period of time. While pursuing ILBM in collaboration with Shiga University, Japan, ILEC has witnessed a number of cases where what is called “Heartware” plays an important role intertwining “Software” (Institutions, Policies, Participation, Information and Knowledge) and “Hardware” (Technology and Finance) to implement intervention projects. The concept of Heartware pertains to the long-term human-nature interactions involving religious and traditional values, as well as communal memories and folklore that have been passed down through generations in basin communities. It is also closely related to the concept of “shared values” which connect people, communities and generations in their participation in lake conservation initiatives. Some of the ILBM Heartware cases have been reported in the international workshops and symposiums held at Lake Chilika (India), Lake Biwa (Japan), the Seven Lakes of San Pablo (the Philippines), and Selangor River (Malaysia),with participants including regional/international experts, government officials, citizen groups and students. ILEC wishes to increase the number of ILBM Heartware cases in other parts of Asia and in other regions so that the concept may be further enriched, and that comparative analysis of the results might produce a typology for facilitating further promotion of ILBM globally.

PRESENTATION TYPE: ORAL

MS05-03
Lakescapes and water architecture

COMO LAKE AND TOURISM IMBALANCES. THE LIMITS TO SUSTAINABLE DEVELOPMENT

Giuseppe Muti
University of Cassino and Southern Lazio, Italy

KEYWORDS: LAKE COMO, LACUSTRINE TOURISM SYSTEM, IMBALANCES, SUSTAINABILITY

Lake Como is one of the most famous tourism brands worldwide. The visual representation of the basin profile with the icon of Bellagio has a global appeal. As a tourism destination, Lake Como is however characterised by little tourism flows. A variety of critical issues call for a better understanding of Lake Como and tourism in multiple scientific fields. On one side, the destination has a consolidated image based on luxury tourism; this image negatively influencing the circulation of alternative images based for instance on sport and nature. On the other side, some statistical problem at regional level undermine data analysis; this biasing planning and management in tourism policies. This paper discusses Como Lake tourism imbalances and presents early results of an on-going research on these topics. The list of major problematic topics includes first the geographical concentration of tourism flows and seasonality. Second, different typologies of tourism are not consistent with the opportunities offered by the larger environment. For instance, environmentally sustainable tourism is little practiced even though the natural environment would provide numerous sources for ecotourism. Third, hospitality is unequally distributed. Larger luxury resorts owned by exogenous entrepreneurs dominate the sector. On the other side, unauthorized building – a somehow famous phenomenon in Italy – and territorial dissipation prevent solid data on second homes that might constitute an alternative to the former. Firth, cooperation in tourism is fragmented and tourism as a sustainable local development is not clearly supported. Civil society is scarcely involved in civil society. Last, the relations between tourism and other economic and social function is not well balanced, while the socio-economic transition to a post-industrial model s not accomplished yet. By discussing these limits to Lake Como sustainable developments, a new functional and tourism regionalisation is proposed as an exit strategy.

PRESENTATION TYPE: POSTER

BASIN MANAGEMENT FOR PROTECTION OF A TROPICAL LAKE: EXPLORING ALTERNATIVES

Pradeep Shrivastava
Department of Environmental Science and Limnology, Barakatullah University, India
Abha Swarup
Department of Environmental Science and Limnology, Barakatullah University, India

KEYWORDS: LAKE BASIN, SOIL EROSION, LAND USE

The present study was carried out on a typical tropical lake also recognized as Ramsar site in city of Bhopal in India with water spread area of 35 sq km and 365 sq km as it basin. In the conservation and protection plan under development for this lake, catchment management has been the major concern as 80% of the area is rural in nature and has 84 villages. has agriculture as predominant land use covering approximately 80% of the area of the lake catchment. The threat posed by the soil eroded from the agriculture field reported to be 1.47 m cum on annual basis. The lake volume is approximately 117 m cum and deposition of soil in the lake at this rate is likely to exhaust the lake volume in approximately 83 years period. In addition to this , the catchment also introduces huge quantities of nitrogen and phosphorus causing eutrophication. Tools and methods available for protecting lake from the effects of soil erosion are not found to be very effective, and therefore the lake volume or the life of the lake suffers from irreparable loss. The land use pattern of its catchment needs to be changed favourably changed to human habitation/population of suitable density. Catchment plays critical role but the inherent conflict between upstream and down stream population is a major concern and constraint. The proposed approach also creates potential livelihoods opportunities for the inhabitants of the catchment.

PRESENTATION TYPE: ORAL

MULTICITTàLAGO_ITALIA

Virginia Ortalli
University of Genoa, Faculty of Architecture, Italy

KEYWORDS: VOID, LANDSCAPE INFRASTRUCTURES, SHAPING SETTLEMENTS

Which will be the role of the lakes in the spread cities? Multicittàlago is a study about readings, discussions and views on lake urban regions. The analysis of urban form through the use of landscape represents the content, the originality and the potential chances of success for lake areas. Analyzing cities and metropolitan areas, a fragmented and sprinkled urban scenario emerges, due to a shift happened in the last decades: from close cities, where centre and suburbs were clearly identifiable as links between more clusters, to a planetary nebula, which is not clearly identifiable, with no form and boundaries. The critical question is what can happen if we act on the limit that is still visible? Lakes cannot be considered only as water mirrors, they are plenty systems included in a complex landscape, thick and full of various relationships. Re-thinking future perspective and planning lakes areas represent the kernel points and the opportunities for the transformation of a spread city in the urban net. Multicittàlago reveals the multi-dimensional complexities, externalities and cross-dependencies within the infrastructures. The research examines how a landscape, peculiar for its morphological characteristics, can be cultivated as a system that includes mobility, life, work, leisure and knowledge. The case study examines the region of pre-alpine lakes in the north of Italy and develops two different scenarios strictly joined each other, slow territories and low speed strategies focused on local, joined to metropolitan lake area system characterized by high speed strategies focused on global (megalopoli). The case study is compared with outcomes of other existing urban researches conducted on other lakes in the world.

PRESENTATION TYPE: ORAL

RE-CYCLING WATER ARCHITECTURE. ARCHITECTURAL AND LANDSCAPE REGENERATION OF OSTIA LAND RECLAMATION WORKS (ROME)

Piero Ostilio Rossi
Sapienza Università di Roma, Italy
Francesca Romana Castelli
Sapienza Università di Roma, Italy
Roberto Filippetti
Sapienza Università di Roma, Italy
Raffaella Gatti
Sapienza Università di Roma, Italy
Maria Clara Ghia
Sapienza Università di Roma, Italy
Caterina Padoa Schioppa
Sapienza Università di Roma, Italy
Roberto Cannoni
Sapienza Università di Roma, Italy

KEYWORDS: ARCHITECTURE, LANDSCAPE, WASTEWATER TREATMENT

The present work is part of a group research, coordinated by Piero Ostilio Rossi and Roberto Secchi, on the so-called "Coda della Cometa" ("The Tail of the Comet"), the urban sector that projects the city of Rome towards the sea. The special attention that this territory may deserve is due to its specific features and potentials. Indeed, it comprehends the international hub of Fiumicino Airport and the Ostia/ Fiumicino / Civitavecchia port system, key access to the city from the air and sea routes. “Engraved” by a strong bundle of infrastructure for mobility, as well as for waste disposal and hydrological control, this territory is increasingly expanding on metropolitan functions. From a city competition global perspective, the “Coda della Cometa” is meant to become the main axis of future urban development. Documented by maps, drawings and photographs the report is divided into seven sections: 1. Ponds of Ostia and Maccarese and marshes of the Agro Romano (Roman Rural Land); 2. Land Reclamation works of the late nineteenth century and the early years of the twentieth century: “Water Shapes”; 3. Landscape remediation; 4. Territorial transformation in the twentieth century and the present situation; 5. Re-cycling the Land Reclamation infrastructures: “the Low Line”; 6. The Land Reclamation hydrographic system and drosscapes: “Lands of Monsters”; 7. Re-cycling Drosscapes: Ostia Antica case study

PRESENTATION TYPE: ORAL

METROPOLITAN LAKES

Roberto Cherubini
Sapienza University of Rome

KEYWORDS: ARCHITECTURE, LAKES, TOWN DESIGN

The present collective research is an attempt to systematize the large variety of topological deformation that lakes can produce at territorial and urban level. In particular, the focus is addressed to those metropolitan areas where the substantial palindrome structure of lakes can be read beyond the specific local condition. Similarly to magnetic fields, lakes all over the planet share a common behavior. In order to build a robust argument, the International PhD Group has selected and documented International and Italian precedents.

PRESENTATION TYPE: ORAL

REDEVELOPMENT OF THE WATERFRONT OF BRACCIANO LAKE - ANGUILLARA SABAZIA'S WATERFRONT

Elvira Saja
Sapienza University of Rome, Italy
Orazio Carpenzano
Sapienza University of Rome, Italy

KEYWORDS: LAKE, WATERFRONT, REDEVELOPMENT

The thesis is the theme of redevelopment of certain areas inside the Bracciano Lake; in particular the project concerns the Anguillara Sabazia coast, a core settlement overlooking the lake. The thesis is developed in two parts, the first one about the analysis and classification and the second one about the project; the part of analysis describes the settlement system, the environmental system and the anthropic system. The settlement system point out the characteristics of the three cores settlement located around the lake: Anguillara Sabazia, Bracciano, Trevignano Romano; each lake has its own characteristics and relates to the lake in a different way. The environmental system describes the conditions and landscape constraints in which framing the Bracciano Lake. The anthropic system point out, all the human activities along the coast, flows, the infrastructure connection, cycling path, navigation routes inner the lake. From the shipping lanes to intercept sections of coast to be redeveloped identified as strategic locations with respect to coastal margins. This analytical defines the conditions useful to the project, the Anguillara Sabazia coast. The project is developed along the coast of 550 meters, the project area, becomes a filter space between the lake and the Anguillara Sabazia settlement. The main objective is to retrain the coast and to provide it in an appropriate manner of necessary equipment and services. The waterfront is the paths' design, the green system, parking areas, and any functions, suitably distributed along the coast ,for example: sailing school, retail space, an area dedicated to fishing, entertainment, and relaxation. The project has a low environmental impact, it integrates with the context without any obstruction to the lake's view; for this reason a part of the project will be developed at a lower level , without producing cubic and respecting the landscape and environmental restrictions.

PRESENTATION TYPE: ORAL

SALT MARSH DESIGN. CHIOGGIA HARBOUR AS AN ENVIRONMENTAL DEVICE

Cristina Imbroglini
Sapienza Università di Roma, Dipartimento di Architettura e Progetto, Italy
Orazio Carpenzano
Sapienza Università di Roma, Dipartimento di Architettura e Progetto, Italy

The Department of Architecture and Design of Sapienza University of Rome designed a project focused on Chioggia's harbours for the feasibility evaluation of the Strategic Harbour Plan. The project's intentions are to renew the awareness towards the harbour assets, coherent with functional and logistic demands, both actual and potential, of the different sectors (fishing, tourism, commerce, shipbuilding) and with the development hypothesis, being at the same time careful of the architectural apects and thesalt marsh city's identity. The project proposal seeks functional and spatial integration between the harbour, the city and the territory to realize new harbour areas and proper environmental filter and connection devices in accordance with the salt marsh ecologies. The plan of the new harbour areas has been built through an Architectural project, unusual but essential procedure if one intends the city's space and its relations with the water as a projectual consideration. Building in a salt marsh is the occasion for a landscape project: a new Environment intended as a usable space, ecologically efficient at the same time, not only able to minimize and balance the impacts connected with the existing built areas, but also to improve the environmental features, guarantee new habitats, reinforce the biodiversity in salt marsh ecosystems, reconnect the city and the salt marsh from a functional point of view with sport spaces and equipments, environmental education and naturalistic observation.

PRESENTATION TYPE: POSTER

PROJECT OF RIVER PARK – LOCATION OF BADINO (LATINA)

Veronica Marzullo
Sapienza Università di Roma, Italy

KEYWORDS: RIVER PARK, WATER, INTERCONNECTION

The project is an upgrading of the area of interest located in the resort of Badino , a suburbs of Terracina (LT), on the coast of Lazio, through the development of the river Portatore and the implementation of landscape and sailing arrangements. To start from the history of the site , an area firmly linked to the river and to the sea, as it was of the development of the Pontine marshes, to build a new landscape with historical and touristic purposes . For this I pursued an interaction between architecture and nature, which was made possible by allowing the river itself to be present in all project, through a system of purification and canalization which flows both in to canals inside the park, used as furniture and identity, irrigation for gardens, and also as various pools placed throughout the area: this was the basic concept for project's development. From here, the actual realization of a new natural park, rich in flora selected and arranged according to natural resources of the area, a new marina including a club house for rowing club, shopping area and Navy's offices with a new dock included . Particular attention has been paid to the river's banks, enhanced by pedestrian paths, equipped rest areas, piers for sailing boats, café, lookout. Project idea is aimed at making a single system which arises from the interconnection between existing subsystems and ones to be designed: nature, water and architecture, for a new landscape to live and perceive.

PRESENTATION TYPE: POSTER

AFTER MALARIA, GOALS AND RESULTS OF LANDSCAPE ARCHITECTURE

Gianluca Sanguigni
Sapienza University of Rome, DIAP, Italy

KEYWORDS: WETLAND, EMOTIONAL LANDSCAPE, COMPATIBLE USE

A big change happened in the landscape perception in the middle of 20th century in Italy after the eradication of the malaria. For ages, before knowing the scientific reason of the desease, people knew that the only way to preserve life was to keep far (in distance or elevation) from coastal lakes, lagoons and marches, especially in summer. This behaviour has affected lifestyles, landscape and townplanning (farmers didn't live on their fields, but moved every night to villages on hills), transmitting the idea that the wetland had always to be avoided, recognizing in it the origin of the problem and a place to be afraid of. However nowdays, when people could approach wetlands without fear, human pressure and urbanization imposed radical changes, not only with the loss of culture, traditions and local competences, but also with the big loss of biodiversity and eco system services, with effects on quality of life The new interest on wetland, as a fragile environment and an important part of water cycle, suggests a special attention to landscape architects. The research wants to point out the attemps and the results in the realized projects in the way to 1. Improve the knowledges and the experiences of the people on territory: the landscape project as emotional and learning path about animals, vegetation, human activities, mith, history 2. Put (or recover) productive activities or agricultural uses which are compatible with the territory and the environment 3. Connect urban centre and landscape in an harmonious link.

PRESENTATION TYPE: ORAL

LANDSCAPE INFRASTRUCTURES

Roberto Secchi
Sapienza Università di Roma, Italy
Giambattista Reale
Sapienza Università di Roma, Italy

KEYWORDS: INFRASTRUCTURE, RECLAMATION, RESOURCE

In a given area, infrastructure is what makes life possible, it is what makes it habitable. Not by any means but in the perspective of sustainability. For this reason, the very idea of infrastructure needs to be rethought in a comprehensive and non-specialist way. The strict functionalism in the view of efficiency is commensurate on limited objectives (non-integrated) that often generate irreversible issues. This applies as much to the mobility infrastructure as for those of the managements of the waters, the production and transport of energy or waste disposal. The new infrastructure should be designed as environmental infrastructure as well as targeted to individual technical purposes. The legacy of land reclamation of the Roman countryside is still alive but in great danger. The consortium of land reclamation that manages the network of canal system and manage the works to regulate the water flow, provides the balance of the hydrologic system in the metropolitan area Roman even with difficulties. The canal system extends towards the sea and the airport, an area that is strongly affected by development initiatives and the concentration of uses functioning at metropolitan scale. The massive urbanization process in the areas between the GRA and the seaside threatens this balance. The lack of maintenance of the channel system, the compromised efficiency of the facilities at disposal and the blindness of whom doesn't see the land improvement as a resource, it constitute a major threat of this balance of the water system.

PRESENTATION TYPE: ORAL

REQUALIFICATION AND REDEVELOPMENT OF A WATERFRONT AREA

Veronica De Santis
Sapienza Università di Roma, Italy

KEYWORDS: CULTURE, ART, NATURE

The focal point is the creation of a system of parks , accesses and themed gardens that creates a unique urban park, that stretches from the urban texture to the waterfront. The project begin from the analysis of the site and it evolves to the re-stabilization of the interrelationships with the social, environmental and historical context. The objective is the composition of collective interconnected urban spaces, aimed to the achievement ofnew landscape values . The environmental art is the vector of knowledge, in order to build a dialogue with theplace. ALL YOU CAN PARK, is an opportunity for reconfiguration of spaces , functions and pseudo- natural environment . The term CAN, as well as suggesting the amplitude of the possibility that a park can offer the visitor,it's also an acronym: : C as Culture & fun , A as Art & interaction and N as Nature & energy. The vegetation species chosen are related to the potential vegetation studies. The only exceptions have been made for the sensory and the succulents gardens. Thinking ALL YOU CAN PARK as a declination of the urban garden, the potential functions will be multiple and interactive. Apart from being a green oasis in the gray cement, the park also improves the landscape quality of the village and it mitigates the urban microclimate. Moreover, it 's an opportunity for the environmental restoration of abandoned countryside and for transforming the urban shape.

PRESENTATION TYPE: POSTER

URBAN REDEVELOPMENT OF WATERFRONT OF NAPLES: VIA CARACCIOLO

Francesca Riccardo
Sapienza Università di Roma, Italy

KEYWORDS: WATER, GARDEN, HISTORY

The waterfront of Naples is a work of art, architecturally and in its natural shape. This is the reason why it needs to be positioned amongst the finest places of the city, if not of the whole country, with a strong cultural idea, a dominant motif and a unique design concept. The idea is giving back to citizen an exceptional environment that is capable of suggesting emotions, interests and sensations all together in a seaside promenade. The planning proposal arises from the will of the municipal administration of Naples who demanded a pedestrian area on via Caracciolo, an important seaside axle that connects the east to the west side of the city. The analysis has focused on the urban role and the social value featured by the seaside for the city. Urban role which has to be replaced from being an important vehicular traffic point and returned to social activity with new reshaped functions which would now be walking, playing and strolling around. The project led to give new meaning to the area, freeing via Caracciolo from vehicles thanks to new elements of urban geography which would now be intended to be centre of activities to spend free time for leisure. Houses, workplaces, the everyday businesses on one hand and the open sea on the other. In the midst the blank space of the waterfront that is given back to citizen as a ledge on the sea.

PRESENTATION TYPE: POSTER

WATER IN THE URBAN LANDSCAPE

Claudia Sardella
Sapienza Università di Roma, Dipartimento di Architettura e Progetto, Italy

KEYWORDS: WATER, RESOURCE, URBAN LANDSCAPE

Water has been exploited over the ages for the most varied purposes such as defense, navigation, transport, irrigation to the point that it has progressively lost its importance and given way to a deterioration of the relationship between city, territory and the water system. By retracing the nature of the relationship between water and the urban landscape and by analyzing the use of water in contemporary landscape projects we can identify a set of conceptual and compositional features which are characteristic of the landscape project and able to shape and guide future projects. In the urban landscape, water must become a relevant element within the project given its direct and indirect repercussion on the transformation of the urban context and in the management of urban quality. Water enriches the urban landscape , making the city more livable and improving the micro-climate. Factors such as the scarcity of the water resource, flooding, as well as water contamination are signs of the bad relationship between major industrialized areas and this resource. From being an opportunity it has become a risk and a danger for the territory and its inhabitants. The objective is to integrate the element of water perfectly within the urban design. It is fundamental therefore that the new design be integrated within the pre-existing urban landscape so as to make the city not only more livable but also more attractive . Water can be reinterpreted as a symbol within the erected city able to create new relations among anonymous urban spaces , and must therefore be defined as a positive transformative element within the urban context able to transmit many benefits to its inhabitants .

PRESENTATION TYPE: POSTER

WATER IN THE CONSTRUCTION OF THE URBAN LANDSCAPE OF THE FUTURE

Achille Ippolito
Sapienza Università di Roma, Italy

KEYWORDS: WATER , URBAN LANDSCAPE, SUSTAINABILITY

From the results of studies done and examples identified, it is clear that natural elements are essential for the construction of the future urban landscape; hence vegetation and water must contribute as major players in the transformation of the urban landscape. The Expo in Zaragoza was centred on the theme of "water and sustainable development". We must operate following this principle. It is widely accepted that nature in the city helps to improve the environment, but it is necessary to set up a system to integrate this aspect with architecture in all operational designs. The relationship between water and architecture can and must be present both in urban decor and on a large scale. The fundamental role of the so-called "Waterfront" projects, which have involved ports as well as cities on the sea, rivers and lakes, are a good example of this. They are important not only for their primary role in requalification programs, but also in a perceptual sense, becoming the focal point of regeneration and often being the gateway to a totally new reference point for the urban landscape. There are numerous other examples, going beyond the simple renewal of waterfronts. Architecture confronts itself with water, converses with it and reacts, engaging whole populations whilst also activating a new perceptive model. This theme is not limited only to that of recovery, but falls into an operational mode, proposing new urban areas, with waterfronts and districts on the water. Modern cities have also rediscovered the role of fountains in public areas, for the environment as well as for the identity of a place, where water contributes to the construction of new public spaces following innovative concepts which enlarge the perception of the urban landscape. We will study the phenomenon of the future landscape.

PRESENTATION TYPE: ORAL

LAKE TRASIMENO: THE UMBRIAN SEA

Fabio Bianconi
University of Perugia, Department of Civil and Environmental Engineering, Italy
Valeria Menchetelli
University of Perugia, Department of Civil and Environmental Engineering, Italy
Luca Martini
University of Perugia, Department of Civil and Environmental Engineering, Italy
Paolo Belardi
University of Perugia, Department of Civil and Environmental Engineering, Italy

KEYWORDS: TRASIMENO, ARCHITECTURE, LANDSCAPE

This presentation offers a diachronic landscape analysis of the well-established image of Lake Trasimeno. The lake, with its three lush islands emerging from its waters – isola Maggiore (nicely spotted with a picturesque inhabited hamlet), isola Minore (a completely intact environment), and isola Polvese (scattered with important historical and artistic remains) — has a 45-kilometre perimeter and a surface area of 128 square kilometres (entirely fit for swimming). Through the centuries, the lake has always been a unique and precious resource for a region which has no direct and convenient water connection with the sea. Due to the fact that the lake is shallow and its waters regeneration very slow (there isn't, as a matter of fact, a natural tributary river to the lake), the ancient lacus Trasimenus shores were notoriously known to be swampy and insalubrious. On the other hand, these natural conditions have preserved the lake from being intensely urbanized. To improve the living conditions along the lake's shores, frequent works have been conducted in the area, all aimed at regulating water drain and consumption for farming purposes, though for thousands of years the inhabitants of the area have preferred living up-country and on the healthy hills around the lake (Castel Rigone, Magione, Montecolognola, Paciano, Panicale, San Savino, Tuoro); only occasionally, they have colonized the few rocky necks of land stretching into the lake (Castiglione del Lago, Monte del Lago, Passignano, San Feliciano). Since the last century, after completing the construction of dams, outfalls, and water channels, there have been various attempts to promote housing and, most of all, the construction of tourist resorts. As a result, vast areas adjacent to the lake's shores have been progressively occupied by semi-permanent campsites and development in the shape of sea resorts and sandy beaches. These recent initiatives have deeply transformed the landscape and the old iconographic tradition of the area inherited from the past; in some cases, unfortunately, the recent pervading presence of man has irreparably damaged the natural beauty of the scenery portrayed by the great Masters of the past (notably, the great Renaissance painter Pietro Vannucci, up to Gerardo Dottori) and celebrated in the writings of some of the greatest North European Grand Tour travellers who visited Umbria in the XVIII and XIX century (among them Hans Christian Andersen and George Byron).

PRESENTATION TYPE: ORAL

THE ALTERNATION, AS A RESOURCE FOR THE LAKE LANDSCAPE. THE CASE OF THE BARREA BASIN IN THE ABRUZZO NATIONAL PARK

Fabrizio Toppetti
Sapienza Università di Roma, Italy

KEYWORDS: WATER LANDSCAPES, RAMSAR CONVENTION, ABRUZZO NATIONAL PARK

The paper intends to present some theoretical considerations and the possible operational impacts related to the instability of the water landscapes from an experimental reflection carried out in the academic field on the case of Barrea Lake which is located in the Abruzzo National Park, outlining the topic in the current scientific debate, and in relation to some best-practices identified in the European panorama and beyond. The wetland that includes the basin and the ecotonal zones is inserted since 1976 in the protected areas list of the Ramsar Convention. The lake, formed in 1951 by a dam construction across the Sangro River, as many basins aimed for energy use, has a variable water regime. The dry up in summer is perceived as a source of impoverishment for biodiversity and as a negative factor for the overall quality of the landscape for instance to jeopardize the tourism economy of the area. This condition induces the Municipality and the local population to support the project for the construction of a new earthen dam, which would guarantee the permanence of a small upstream water reservoir, compromising the basin unity and its specific characters now consolidated. In alignment with the research and accomplishments, of major interest, experimented on similar situations in recent years, the topic of alternation is not considered as criticism but as a resource, in terms of delivery of ecosystem services and for the quality of the landscape in general, to be taken as a value (ecological and economic) within a new design vision integrated by the lake landscape.

PRESENTATION TYPE: ORAL

LANDSCAPE WATER SURFACE - SUSTAINABLE HYDROLOGICAL SYSTEMS, DESIGN, TECHNOLOGY AND ENVIRONMENTAL AWARENESS

Cristina Costanzo
Sapienza Università di Roma, Facolta di Architettura, Dipartimento di Architettura e Progetto, Italy

KEYWORDS: HYDROGEOLOGICAL RISK, WATER STRESS, COLLECTIVE IMAGINARY

TOPIC In the most recent historical periods , the theme "water" in the landscape architecture has undergone something of a process of negation and marginalization, which has contributed over the years to a real trivialization of this resource . A "resource silence" that led to scenarios of uncertain and weak structure, where the fifth mingle recent urban edge and antique signs, macro -infrastructure stays and historical - cultural , ecological quality - environmental and detractors. A "silent" which, increasingly , is transformed into "scream", winning the public and causing profound changes and the search for a new balance. Thus, the water factor, which has historically been a critical component in the processes of structuring of the territory, has, over time, increasingly taken connotations related to the subject content of environmental design, becoming one of the most important keys of reading in the interpretation the emergence of new paradigms: the awareness of limited natural resources, the pursuit of ecological quality of housing systems, the modification of the relationship between nature / artifice, through the development of new technical possibilities unknown until a few years ago. TARGET The aim of the contribution is to extrapolate criteria and qualitative and quantitative parameters adapted to define a methodological support and application to the design of a new balance "hydro-logical" between abundance and scarcity of water. Objective through the reading and analysis of the case studies identified, and the identification of a set of reference guidelines under three categories of intervention: “Preventing Risk, Protection of poor water resource, Information and Environmental Awareness”. RESULT The final choices are extrapolated from the projects analyzed in the intelligence and reconstruction of a relationship of intelligibility between the parties (environment - social growth - economics and management) their foundations: § identification of the problem and hydrogeological risk management to protect the quality of water bodies; § the pursuit of a comprehensive view of the landscape of reference, to ensure widespread ecological and environmental quality; § enhancement in key fruition, interactive and security and the redefinition of the system of transport and communications; § the identification of a control logic territorial public, to ensure the balance between public and private interests; § participation in active choices of society, to achieve a sedimentation of knowledge and rules of behavior. STRENGTHSAND WEAKNESSES The strength common to these choices is the expansion of the development process of W over the technological and economic solution limited to the management of the effects, rather its transfer to the “ex-ante” resolution of the causes of discomfort, often the result of a reckless run innovation for its own sake, and I preferred, therefore, the assumption perceptive - cultural. It refers, therefore, to encourage a new attitude of active protection and management, which goes beyond the traditional conception markedly idealistic of the bond[1], in favor of a multidisciplinary approach to environmental design. However, the choice to rebuild a unified form for the guidelines to urban planning, environmental, technical, scientific, philosophical and cultural insights can skip those who recognize the specificity of the places the highest point of support compositional aspect. The diversity of landscapes was analyzed, namely, compressed into a single horizon of meaning, beyond the chaos, fragmentation and density of objects that permeate the other disciplines. This is not a process of homogenization, but the desire to demonstrate how the discipline of landscape can be the connective between technical and ecological art practice, beyond size, position and spatial conformation of the site. RECIPIENS In conclusion, although every innovation implies her fault[2], that his accident, the speech should be brought forward in the implementation of all the criteria for the design, implementation and evaluation of the sustainability of technologies generally applied to natural resources. In this sense, future research should not only address the interpretative aspects of the problem, rather than an experimental practice which cover the concrete actions as well as mental. Designers, companies and producers, technical and regulatory public bodies, as well as the scientific community and the local population, may act according to their respective powers: they can prove that belief precious that cannot be dictated but only lived: you can paint everything you just able to see it[3].

FICKLE LAKESCAPE PROJECT

Federico Di Cosmo
Sapienza University of Rome, Itay
Fabrizio Toppetti
Sapienza University of Rome, Italy

KEYWORDS: FICKLE LANDSCAPE, WATER FLOW, WATER ARCHITECTURE

This contribution presents the relationship between water lake flow and landscape shores. In particular, the Barrea Lake, located in the Abruzzo National Park, Italy, is the object under study. Innovative ways to take advantage of land richness and new government policy have brought to an extremely different design method for local arrangements. In this scenario, the work describes how to maintain the characteristics of Barrea Lake landscape, which has extremely changeable environmental conditions, and, at the same time, how to fulfill the new demanding requirements. Specifically, this project maintains and uses the landscape variability, always considered a weakness, turning it into strength. The result is a masterplan which enhances and increases the lake value. We can sum up by these key words the reasons why it is enriched and becomes more enjoyable due to the proposed solutions: - Reversibility: achievement of strong land-construction without modifying the current status of the water spatial dynamics - Slow mobility: three villages around the lake are connected by two kinds of mobility: cycle and pedestrian ways and ship canals. - Integration: the present urban and land structure is included and appraised by the project process in a new image of territorial division. - Re-built figurability, with new landmark elements. - Double usability: the land space design emphasizes the twofold function of this area due to the presence or absence of water.

PRESENTATION TYPE: POSTER

HYDRAULIC ENGINEERING MEETS LANDSCAPE ARCHITECTURE: A SMART AND SUSTAINABLE RE-DESIGN OF THE FLOOD PRONE HIGHLY URBANIZED COASTAL AREA OF THE CITY OF ROME

Fernando Nardi
University for Foreigners of Perugia
Francesca Romana Castelli
DIAP, Sapienza University of Rome, Italy
Orazio Carpenzano
DIAP, Sapienza University of Rome, Italy
Piero Ostilio Rossi
DIAP, Sapienza University of Rome, Italy
Lucio Ubertini
H2CU, Sapienza University of Rome, Italy

KEYWORDS: HYDRAULIC ENGINEERING, ARCHITECTURE, FLOOD RISK

Coastal areas in the proximity of major cities are often the subject of both intense and unregulated urbanization and significant water management issues (salinization, subsidence, flood risk, sewers, …). Efficient water risk management and land/urban/fluvial planning projects for those transitional areas represent a very difficult scenario because of the need of implementing diverse and multidisciplinary disciplines including specifically hydrogeology, hydrology, geomorphology, hydraulics, landscape and urban architecture. The combination of the competences pertaining to civil engineering and architectural territorial design are very difficult to integrate and territorial/urban planners and decision makers often gather dishomegeneous and non-integrated technical information regarding potential solutions from experts of different disciplines that don't "talk to each other". The coastal area of the Tiber river outlet in the proximity of the Rome urban area is a standard sample case of the lack of efficient and integrated architectural and engineering management and design. This works present the preliminary results of a combined effort of hydrologists, hydraulic engineers and landscape architecture experts for solving the flood risk and urban planning management issues affecting the Rome coastal area with specific regard to the redesign of the complex setting of the Ostia-Fiumicino area for smart, safe and sustainable living of coastal area populations.

PRESENTATION TYPE: ORAL

MS05-04
Human impact management

ENVIRONMENTAL MANAGEMENT AND LOCAL WISDOM: AN INSTRUCTIVE LEGEND OF BORITH LAKE, GILGIT-BALTISTAN, PAKISTAN

Khalida Khan
University of the Punjab, Pakistan
Rabia Faridi
University of the Punjab, CEMB, Lahore, Pakistan
Mohammad Naeem
PCSIR, Punjab, Pakistan
Mohammad Ikram
Center for Integrated Mountain Research (CIMR), University of the Punjab, Lahore, Pakistan.

KEYWORDS: ENVIRONMENTAL MANAGEMENT, , INDIGENOUS WISDOM, , LAKE BORAT, NORTHERN PAKISTAN

For environmental revitalization, indigenous wisdom can play a pivotal. To appraise the consistency of local knowledge resource, historical development of the Lake Borat, (the largest natural saline water lake in the North located 36□ 22□ 0□ N, 74□ 51□ 0□ E, surrounded by the Karakorum and Hidu-Kush Range) local community views were probed. Borat Lake is 80ft deep located about 2600 m asl spring water/ underground Lake identified as 'everlasting' saltwater lake (Chinese Engineers, 1977). Lake is a significant sanctuary for migratory wildfowl but is ignored. Local observations of the historical development of the Lake hardly ever accomplish harmony and local perceptions often different with every other verification. Moreover, results even vary obtained from chronological maps and aerial photographs. Given there was an incompatible and variable local community point of view about a moderately straightforward environmental concerns. The outlook of the residents towards these opportunities and problems both is quiet complex which reflects the traditional perceptions, social setup, knowledge and economic conditions. The study examines at length the environmental impacts and the outcome of the social set up on the livelihood, infrastructure and overall economy of the community. Introducing the Socio-Ecological Production Landscapes and Seascapes, knowledge/practices without disturbing the natural environment but by using the local wisdom in an innovative way is the core focus of the study. The configuration of the network in the study area will be developed by using GIS/RS techniques; a comprehensive study is suggested for recommending a plan to revitalize the lake and its watershed.

PRESENTATION TYPE: ORAL

THE REAL COST OF WASTEWATER TREATMENT

Jeffery A. Thornton
International Environmental Management Services Ltd.

KEYWORDS: WASTEWATER TREATMENT, DIRECT COSTS, INDIRECT COSTS

There is ongoing debate about the affordability of wastewater treatment, especially but not limited to debate in developing countries. Wastewater treatment is often seen as a luxury that can ill be afforded by governments that are increasingly short of funds. This presentation looks at some of the "costs" of nutrient enrichment in the aquatic environment. These costs include not only the actual cost of wastewater treatment facility operations--the collection, conveyance and treatment of wastewaters--but also at the non-monetary costs of environmental degradation. Polluted waters, impaired for many human uses, bring hidden costs which some governments may not consider in their determination of whether to treat wastewater at source. These costs include human health impacts associated with the transmission of water-borne diseases, public health concerns associated with parasites and other organisms transmitted through aquatic environments, toxic substances, lost aesthetics, and damaged infrastructure and equipment. Other costs such as lost revenues from decreased tourism, loss of favoured fishes for sale in domestic and export markets, and similar indirect consequences of polluted lakes and reservoirs also are discussed.

PRESENTATION TYPE: ORAL

THE TREASURES OF "LAKE BAIKAL BOX" FOR ALL THE PEOPLE ON THE PLANET

Nina Dagbaeva
Baikal Information GRAN, russia
Erdem Dagbaev
Buryat State University, Russia

KEYWORDS: LAKE BAIKAL BOX, ENVIRONMENTAL EDUCATION TECHNOLOGIES, POPULAR SCIENCE EDITIONS FOR CHILDREN

Lake Baikal preservation as the biggest fresh water tank on the planet is the goal of all the people, and especially of the people living on the coast. The main objective of Baikal information center "Gran", NGO which I leader, is ensuring the world community access to the information on the greatest lake. Baikal information center "Gran" has recently finished a project that helps children and adults to learn more about Baikal. The project was possible thanks to the public organization and university partnership. The unique educational and methodical set "Lake Baikal Box" includes student's book, educational game with cards, CD and two maps. It is published in two languages: Russian and English. The set is for children of primary and middle school age and it can be used during lessons in biology, history, native language, and also in extracurricular time as well as in projects. The creation of "Lake Baikal Box" should be considered as one of steps to the introduction of the "education for sustainable development (ESD)" concept, the essence of which is in implementation of practice-focused education. It is evident that orientation on practice in the Republic of Buryatia and other neighboring regions education fulfills in activities of unique Lake Baikal protection and preservation for future generations. This is an important issue of environmental education system. Data on flora and fauna, methodical materials, and also the information on history and today's lake preservation, creative tasks and quests are found in the set "Lake Baikal Box". We would like to discuss the problems of fresh water, preservation of the lake's biodiversity, ecotourism development, the problems connected with Baikal at the conference. The English variant of "Lake Baikal Box" could become an educational interdisciplinary subject for developed lakeside territories studied worldwide. The basic methodical principle of the educational set is based on the integral, interdisciplinary approach, as well as education for sustainable development. The projects offered for teachers and school students contain a wide range of social problems: preservation of health and support of local food production, preservation of green plantings and biological knowledge development, ethnic traditions study of water usage and biodiversity preservation and many other issues. We would like to present and offer for discussion at the conference these and other problems connected with Baikal as well as problems of popular science editions for children concerning world lakes as mirrors of the earth.

PRESENTATION TYPE: ORAL

MS05-05
Lake and archeology

TARSMINAS – TRASIMENO: AN ANCIENT PERCEPTION OF THE LAKE SYSTEM IN THE ETRUSCAN AGE

Luca Mignanelli
Associazione Nazionale Archeologi, Italy

KEYWORDS: TARSMINAS - TRASIMENO, DIVINITIES, LIVER

In the Tabula Cortonensis (a bronze plate from Cortona) we find, in Etruscan characters, the name which was likely used by the Etruscans to call the lake Trasimeno: Tarsminas. At the time the lake basin was divided between the surroundings territories of the Etruscan Centres of Chiusi, Cortona and Perugia. Around the coast of the lake there have been many findings: most of them referred to sanctuaries located in the areas of influence of the three Etruscan towns. The epigraphic data found in these findings make reference to the name of three divinities: Cavtha, Tec e Cel. The shape of the lake and the geographical distribution of the findings resemble the same position and distribution of these divinities in the Bronze Artifact known as “Piacenza Liver”. The Trasimeno Lake can be seen as a big sacred area (a templum) in which all the divinities had their own place and role. A religious system, animistic and naturalistic, as the Etruscan religion was dedicated to bios and thanatos, life and death, their cycles and passages. Another relevant aspect regards the way the ancient populations used to consider a lake, as inland and closed waters. Opposite to the nurturing benefits of lakes were the black and ominous sides of dark places, were the inland and closed waters were defined stagnis Thrasymennus opacis (Trasimeno, stagnant waters and opaque) as Silius Italicus in his Punica, IV, 737-738 describes the Lake during the Trasimeno Battle in the 217 B.C. In this context fits the myth of Trasimeno, a very handsome young man, kidnapped by the nymph Agilla and brought to the waters of the lake where he died.

PRESENTATION TYPE: ORAL

THE MIRROR OF DIANA: ARCHAEOLOGICAL RESEARCHES OF THE PERUGIA UNIVERSITY AT THE LAKE OF NEMI

Paolo Braconi
Univesità degli Studi di Perugia

Diana Nemorensis (Diana of the sacred wood) was an important divinity of the Latin peoples, revered on the shores of a small volcanic lake that the poetic tradition has defined "speculum Dianae", the mirror of Diana, today known as Lake of Nemi. It was one of the most famous sanctuaries of the Ancient World, partly still unexplored on the northern bank of the Lake. From years the Perugia University conducts archaeological searches that have allowed to reconstruct the form of the monumental complex, to identify the Temple of the goddess known from the sources, to discover a great Nympheum built by the emperor Caligola and to clarify some relationships with the attached theater. The Sanctuary is inserted in an ampler context of "sacred landscape" that involves other lakes and rivers of the territory dominated by the Volcano Laziale

PRESENTATION TYPE: ORAL

THE BASIN OF TRASIMENO LAKE IN PREHISTORY AND PROTOHISTHORY. RECENT INVESTIGATIONS AND HISTORICAL COLLECTIONS

Maria Cristina De Angelis
Soprintendenza per i Beni Archeologici dell'Umbria, Italy
Rita Paola Guerzoni
Università degli Studi di Perugia, Dipartimento di Lingue, Letterature, Civiltà antiche e moderne, Italy
Adriana Moroni Lanfredini
Università degli Studi di Siena, Dipartimento di Scienze Ambientali "G. Sarfatti" – Unità di Ricerca di Ecologia Preistorica, Italy
Simone Occhi
Archeologist, Italia
Fausto Pazzaglia
University of Perugia, Dept. of Physics & Geology, Italy

KEYWORDS: TRASIMENO LAKE, PREHISTORY , PROTOHISTHORY

The communication is a synthesis of the prehistoric, protohistoric archaeological and palaeo-environmental data in the basin of Trasimeno Lake. These data are the basis for the study of the forms and models of occupation and exploitation of this humid territory from the Lower Paleolithic and Neolithic until the Late Bronze Age and First Iron Age. The topic is also considered in the context of comparisons with other humid areas in Central Italy. The considered data belong to the Historical Collections of Perugia, sporadic discoveries, incidentalrecoveries and excavation works. The communication, interdisciplinary, required the efforts of different expertise, and is therefore collective.

PRESENTATION TYPE: ORAL

MS06-01
European alpine and subalpine lakes

IS LAKE MAGGIORE UNDERGOING A NEW EUTROPHICATION? CLUES AND HYPOTHESES

Giuseppe Morabito
National Research Council, Institute for Ecosystem Study (CNR - ISE), Italy
Marzia Ciampittiello
National Research Council, Institute for Ecosystem Study (CNR - ISE), Italy
Michela Rogora
National Research Council, Institute for Ecosystem Study (CNR - ISE), Italy

KEYWORDS: TROPHIC EVOLUTION, PHYTOPLANKTON, CLIMATIC FLUCTUATIONS

Lake Maggiore, a deep subalpine Italian lake, reached a stable oligotrophic status after a recovery process started at the beginning of 1980s. Oligotrophic condition is testified by the low concentrations of TP (around 11 µg/L at mixing) and chlorophyll (around 3 µg/L as annual mean). However, the most recent phytoplankton and water chemistry data (2008-2012), seem to indicate that a new trophic change is perhaps taking place. The most significant clues supporting this view are a slight increase of TP values and, mostly, some re-arrangement inside the phytoplankton assemblage, such as the non-occasional record of “eutrophic” species among the dominant taxa as well as the blooms occurred in the period 2008-2012. The present work will present and discuss some hypotheses to explain this unexpected trend, taking into account also the role played by the hydrological regime, now showing a year-to-year variability stronger than in the past, due to the increase of both the drought periods and the intensity and frequency of extreme precipitation events.

PRESENTATION TYPE: ORAL

LIMITS TO THE IMPROVEMENTS OF THE TROPHIC STATE OF MID-SIZED LAKES IN THE SOUTH ALPINE REGION: LESSONS FROM THE LAKE PUSIANO CASE STUDY

Gianni Tartari
National Research Council of Italy, Water Research Institute (CNR-IRSA), Unit of Brugherio. Italy
Franco Salerno
National Research Council of Italy, Water Research Institute (CNR-IRSA), Unit of Brugherio. Italy
Diego Copetti
National Research Council of Italy, Water Research Institute (CNR-IRSA), Unit of Brugherio. Italy

KEYWORDS: COMBINED SEWER OVERFLOWS, TROPHIC STATE, PHOSPHORUS LOADS

In the last decades, the trophic conditions of the Italian south alpine lakes underwent a substantial phosphorus concentration reduction. This reduction was particularly consistent between the mid-eighties and the beginning of two thousand years, when both restrictions of the phosphorus content in the detergents and implementations of sewage treatment services were carried out. Recently this improvement seems to proceed more slowly. Research undertaken on Lake Pusiano, a well representative mid-sized lake of the south alpine region, highline that one of the main reason is the presence of combined sewer overflows (CSOs) in the drainage system. In the Lake Pusiano (mean depth = 13 m; area = 5 km2) 94 CSOs were counted. Lake phosphorus concentrations in water column (at winter overturn) in mid-eighties were around 200 µg P L-1, while within the last decade they drop in a range of 40-50 µg P L-1. The current total phosphorus load was evaluated in 12-13 t P y-1 of which 11 (85%) attributed to the external load and 1-2 to the internal load. The contribution of CSOs to the external load was estimated in about 4.5 t P y-1 (more than 40%). As the results obtained on Lake Pusiano are likely generalizable to other environments, the presence of the CSO is a considerable complication to gain a further improvement in the trophic state of the mid-size lakes in north Italy. In particular this problem should be adequately taken into account to meet the objectives established by the European Water Framework Directive.

PRESENTATION TYPE: ORAL

POTENTIAL AND CHALLENGES FOR ECOLOGICAL RESEARCH IN MOUNTAIN LAKES: A LTER PERSPECTIVE

Giampaolo Rossetti
Department of Life Sciences, University of Parma, Italy
Giovanna Flaim
FEM Research & Innovation Centre, Italy
Michela Rogora
National Research Council, Institute of Ecosystem Study (CNR - ISE), Italy
Bertha Thaler
APPA Biological Laboratory of the Autonomous Province of Bozen, Italy

KEYWORDS: ECOLOGY, LONG-TERM STUDIES, NORTHERN ITALY

Here we summarize the results of some research projects, several of them within the framework of international co-operations, that have been conducted in eight lakes of the Alps and the Northern Apennines (Italy), belonging to the LTER site “Mountain Lakes” (LTER_EU_IT_009). These lakes are situated at altitudes ranging from 519 to 2269 m a.s.l.; they differ in morphological aspects, land cover typology, and anthropogenic disturbance. Long-term data series on lake physics, hydrochemistry and plankton populations are available for all lakes. Long-term ecological studies are recognized as an invaluable technique for understanding ecological processes and providing key insights into environmental change, natural resource management and biodiversity conservation. In addition mountain lakes, because of their specific characteristics, offer the opportunity to address important research topics. For example, we use mountain lakes located in remote areas as early warning indicators of changes in the atmospheric deposition of pollutants or in the local climate. We consider these lacustrine environments as ideal candidates for investigations on biotic interactions and processes at the whole-ecosystem level: in fact, the simple structure of their food webs, with relatively few trophic levels, facilitates the detection of key changes in community structure and the associated driving mechanisms. Other research efforts are oriented to the study of taxonomic, genetic and functional diversity of lake communities, dynamics of plankton populations, phenological trends, ecosystem modelling, vulnerability and adaptation to climate change.

PRESENTATION TYPE: POSTER

IMPACT OF ANTHROPOGENIC PRESSURES AND LONG-TERM CLIMATE CHANGES ON THE TROPHIC STATE OF LAKE GARDA (NORTHERN ITALY): A MULTIDISCIPLINARY ASSESSMENT

Nico Salmaso
Research and Innovation Centre, Fondazione Edmund Mach, Istituto Agrario di S. Michele all'Adige, Italy
Monica Tolotti
Research and Innovation Centre, Fondazione Edmund Mach, Istituto Agrario di S. Michele all'Adige, Italy
Manuela Milan
Research and Innovation Centre, Fondazione Edmund Mach, Istituto Agrario di S. Michele all'Adige, Italy; Department of Ecology and Environmental Science, Umeå University, Sweden
Shiva Shams
Research and Innovation Centre, Fondazione Edmund Mach, Istituto Agrario di S. Michele all'Adige, Italy; Human and Environmental Toxicology Group, Department of Biology, University of Konstanz, Germa
Camilla Capelli
Research and Innovation Centre, Fondazione Edmund Mach, Istituto Agrario di S. Michele all'Adige, Italy; Department of Evolutionary Biology, Università di Firenze, Italy
Adriano Boscaini
Research and Innovation Centre, Fondazione Edmund Mach, Istituto Agrario di S. Michele all'Adige, Italy
Sajid Pareeth
Research and Innovation Centre, Fondazione Edmund Mach, Istituto Agrario di S. Michele all'Adige, Italy; Ecosystem Research, Leibniz Institute of Freshwater Ecology and Inland Fisheries (IGB), Germany
Markus Neteler
Research and Innovation Centre, Fondazione Edmund Mach, Istituto Agrario di S. Michele all'Adige, Italy
Leonardo Cerasino
Research and Innovation Centre, Fondazione Edmund Mach, Istituto Agrario di S. Michele all'Adige, Italy

KEYWORDS: LAKE GARDA, EUTROPHICATION, CLIMATE CHANGE

Eutrophication still represents the main anthropogenic impact affecting the biological communities and water quality in the group of the large and deep lakes south of the Alps. Nevertheless, through the control of deep mixing dynamics and spring fertilization of surface layers, climate fluctuations further contribute to finely tune the year-to-year variations in phytoplankton structure and development of toxic cyanobacteria. The understanding of the complex functioning mechanisms controlling trophic status and implications for the use of water resources require an integrated approach, with a combination of different expertises linked to the different levels of ecosystem biocomplexity. In Lake Garda, since the 1970s mean annual concentrations of total phosphorus in the whole water column increased from ca. 10 µg/L to 18-20 µg/L. The original oligotrophic status of the lake was confirmed by paleolimnological analyses. On the decadal scale, the increase in trophic status was paralleled by a stronger development of cyanobacteria. At the annual temporal scale, cyanobacteria showed a strong dependence from the surface spring availability of TP. In turn, spring nutrient replenishment was related to deep mixing dynamics and specific large-scale atmospheric circulation patterns in the Mediterranean region. The relationships between teleconnection indices and the thermal characteristics of Lake Garda were evaluated also making use of remote sensing (MODIS and Envisat satellites). Finally, genetic and metabolomic analyses allowed a clear characterization of the dominant species (mainly Planktothrix rubescens), as well as the identification, by PCR and Real-Time qPCR, of microcystin and anatoxin producing genotypes.

PRESENTATION TYPE: ORAL

TROPHIC EVOLUTION OF A DEEP PRE-ALPINE LAKE (L. ISEO): SENSITIVITY TO CLIMATE CHANGE AND ANTHROPIC PRESSURE

Barbara Leoni
University of Milan-Bicocca, Italy
Valentina Soler

Letizia Garibaldi
University of Milan-Biocca, Italy

KEYWORDS: ANTHROPIC PRESSURE, GLOBAL CHANGE, LONG TERM ANALYSIS

Lake Iseo, a mid-size deep pre-alpine lake, (Northern-Italy), is the outlet of a strongly populated valley, whose highest part is dominated by the largest Italian glacier. Accordingly, it is a natural integrator of the effects of climate change and of anthropic pressure. Increasing nutrient and organic matter loading, it has seen a progressive increase in primary production, eutrophication process, reduction of hypolimnetic dissolved-oxygen and deterioration of water quality. Reactive phosphorus in the whole water column increased from around 10 µg P l-1 in 1967, to 20, 32, 50 and 65 µg P l-1 in 1973, 1980, 1990 and 2012, respectively. Global warming is increasing the water column stability and decreasing the frequency of lake overturn. Lake Iseo was recently contaminated by DDT residues, originating in this case from the melting of an high-mountain glacier. Several expertises, linked to the different levels of ecosystem complexity, have been applied to study the complex functioning mechanisms controlling trophic evolution: - long term term analysis of effects of the eutrophication and climate change at different time scales (annual, decadal) on the physical and chemical features, and on communities and water quality; -influence of the main modes of atmospheric variability (teleconnection indices) on the limnological characteristics of the lake on phenology of phyto- and zooplankton; -modeling of reaction of the lake's thermal structure to a future climate change scenario, using a catchment-wide approach, to prevent the deep circulation processes, the oxygenation of deep water and the fertilization of trophogenic layers.

PRESENTATION TYPE: ORAL

RECENT CHANGES IN PLANKTONIC DIATOMS IN ALPINE LAKES: ENVIRONMENTAL DRIVERS AND RELEVANCE FOR ECOSYSTEM QUALITY ASSESSMENT

Monica Tolotti
Fondazione Edmund Mach, Istituto Agrario di San Michele all'Adige, Italy
Manuela Milan
Research and Innovation Centre, Fondazione Edmund Mach, Istituto Agrario di San Michele all'Adige, Italy
Martin Dokulil
Institute for Limnology, Austrian Academy of Science, Austria
Dietmar Streile
Limnological Institute, University of Konstanz, Germany
Nico Salmaso
Research and Innovation Centre, Fondazione Edmund Mach, Istituto Agrario di San Michele all'Adige, Italy

KEYWORDS: ALPINE LAKES, PLANKTONIC DIATOMS, ENVIRONMENTAL DRIVERS

Nutrient (i.e. phosphorus) enrichment of alpine lakes is accompanied not only by increasing phytoplankton biomass, but also by substantial changes in algal species composition, in which planktonic diatoms play a key role. Increase in small centric Cyclotella species is commonly observed in oligotrophic lakes moving toward mesotrophic status, while changes from meso-to eutrophic conditions is often characterized by increasing Fragilariaceae (e.g. Asterionella formosa, Fragilaria crotonensis). There is increasing evidence that recovering lakes in the northern hemisphere are not returning to their original ecological status, as dense Fragilariaceae populations are maintained, or abruptly developed, despite the decreasing lake phosphorus level. Superimposed environmental changes are supposed to create lake conditions never experienced before, which are responsible for further species reorganization and the hysteresis of lake trophic evolution. This phenomenon has been more extensively investigated in mountain lakes of N-America, where it has often been ascribed as related to atmospheric driven nitrogen enrichment. Lake warming is, on the other hand, considered to sustain increases in small Cyclotella species. Here we analyze data on recent diatom changes from paloeo- and neolimnological investigations of a set of small to large mesotrophic lakes in the Alps in order to: a) explore the complexity of the environmental control over diatom development; b) try to discriminate effects of overlapping nutrients and climate changes; c) outline the relevance of nitrogen as ecological driver in Alpine lakes and the necessity to consider it for lake ecological assessment and managing purposes.

PRESENTATION TYPE: ORAL

MANGANESE CYCLE IN THE MEROMICTIC LAKE IDRO

Pierangela Cristiani
RSE - Ricerca Sul Sistema Energetico SpA, Italy
Edoardo Guerrini
Università degli Studi di Milano, Italy
Stefano Pierpaolo Trasatti
Università degli Studi di Milano, Italy

KEYWORDS: SUBALPINE LAKES, MANGANESE, MEROMICTIC STRATIFICATION

The meromictic subalpine lake Idro situated in the north of Italy is here described from a physico-chemical point of view. The glacial origin of the lake, together with the steep walls of the basin and the maximum depth of 120 m, creates the conditions for the evolution of a stable meromictic condition during the year. A first layer of water (about 50 m) is continuously recirculated and oxygenated; a second layer experiences depletion of oxygen; a third layer consists in stationary water in the depth of the lake. A peculiarity of this lake is the presence of a cloudy white layer, detected at 40-60 m of depth by scuba divers and never reported in literature. The hydrographic basin is mostly composed of dolomite, the typical rock of the Alps. The general chemical composition is Mg(Ca)CO3, but it could include impurities such as Fe and Mn. Chemical analysis of carbonatic dolomite minerals and bituminous limestones sampled at different depth confirmed the presence of traces of Mn and P, susceptible to acidic dissolution, leaching and re-precipitation into water. Many are the peculiarities converging to produce a unique environment for Mn cycling in the mixolimion, chemocline, and monimolimion characterizing the lake. On the basis of home-built sensors and a multiparametric probe, oxygen, pH, sulphide, conductivity, red-ox and temperature profiles were determined. Strict correlations were found between these parameters and the different oxidation states of Mn (Mn+2, Mn+3 and Mn+4) detected in the water and in the particulate. Equilibria with Fe and other elements have been considered. Laboratory experiments have confirmed the assumed model. Acknowledgments: Financial support by FSE-Lombardia, project number 17157, is gratefully acknowledged.

PRESENTATION TYPE: ORAL

CHARACTERIZATION OF MICROBIAL COMMUNITY COMPOSITIONS OF ALPINE LAKES DIFFERING IN WATER TEMPERATURE, THERMAL STRATIFICATION AND NUTRIENT LEVEL IN RESPONSE TO CLIMATIC CHANGE

Stephan Blank
University of Innsbruck, Research Institute for Limnology Mondsee, Austria
Li Deng
Helmholtz Zentrum München, Dep. of Groundwater Ecology, Germany
Johannes Pröll
Austrian Red Cross, Blutzentrale Linz, Linz, Austria
Norbert Niklas
Austrian Red Cross, Blutzentrale Linz, Linz, Austria
Christian Gabriel
Austrian Red Cross, Blutzentrale Linz, Linz, Austria
Rainer Kurmayer
University of Innsbruck, Research Institute for Limnology Mondsee, Austria

KEYWORDS: ALPINE LAKE, PLANKTONIC COMMUNITY, ECOLOGICAL FACTORS

The influence of rising air temperature is known to be particularly pronounced in alpine ecosystems as they are generally inhabited by cold-adapted stenothermic species which would become extinct. In a similar vein, it has been suggested that undercooled alpine lakes are most vulnerable to a warmer climate, as a sudden rise in temperature would significantly shift species occurrence towards more opportunistic algal groups such as bloom-forming Cyanobacteria. For the characterisation of pelagic microbial community composition in relation to a large number of chemical-physical environmental parameters, we used ultra-deep sequencing of the 16S rRNA gene as amplified from the pelagial of five alpine lakes of the Niedere Tauern region (1700-2118 m a.s.l.) during the years 2009-2011. The summer mean water temperature of the lakes differed significantly by approx. 4 °C, which was rather due to local influences than due to the influence of the altitude. The lakes were oligotrophic (Total phosphorus: 1.8-7.7 µg L-1) and the absolute bacterial numbers were correlated with phytoplankton biomass, as indicated by chlorophyll a (R2 = 0.17□0.67, per lakes were more sensitive to climatically induced reduction in ice cover duration. Unicellular cyanobacteria (Cyanobium, Synechococcus), diatoms (Cymbella, Nitzschia, Skeletonema), and some heterotrophic bacteria (Planctomyceataceae, Saprospiraceae, Ilumatobacter, Verrucomicrobiacae) were most strongly related to reduced ice cover duration. It is concluded that the influence of on average warmer years (such as during 2011) is superimposed on the local factors (such as physical-chemical variables), which still play the dominant role in governing plankton community composition.

PRESENTATION TYPE: ORAL

THE ERADICATION OF INTRODUCED FISH IN HIGH ALTITUDE LAKES IN THE GRAN PARADISO NATIONAL PARK

Rocco Tiberti
Gran Paradiso National Park; University of Pavia, Department of Earth and Environmental Sciences, Italy
Bruno Bassano
Alpine Wildlife Research Centre, Gran Paradiso National Park, Aosta, Italy
Stefano Brighenti
Alpine Wildlife Research Centre, Gran Paradiso National Park, Aosta, Italy
Rocco Iacobuzio
Alpine Wildlife Research Centre, Gran Paradiso National Park, Aosta, Italy
Matteo Rolla
DSTA-Dipartimento di Scienze della Terra e dell'Ambiente, Sezione di Zoologia, University of Pavia, Italy
Achaz von Hardenberg
Alpine Wildlife Research Centre, Gran Paradiso National Park, Aosta, Italy

KEYWORDS: INTRODUCED FISH, FISH ERADICATION , LIFE+ PROJECT BIOAQUAE

Stocking fish into once fishless high-altitude lakes is a misguided practice exacting a heavy toll on fragile alpine aquatic ecosystems. The impact of introduced brook trout (Salvelinus fontinalis) on the native communities of alpine lakes was extensively investigated from 2006 to 2014 in the Gran Paradiso National Park (Western Italian Alps) by comparing the biotic communities of stocked and un-stocked lakes. It was shown that Brook trout dramatically affected alpine lakes ecosystems causing the disappearance of many taxa and entire ecological groups, and potentially threatening some unique taxa, evolved thanks to the island-like nature of alpine lakes. The finding of two unique haplotypes of European Daphnia pulicaria in four fishless lakes is emblematic of the importance of alpine lakes as biodiversity reservoirs promoting intra-specific divergence and even speciation. Thanks to the gained awareness of the biodiversity value of alpine lakes and of the strong impact of introduced fish, the Gran Paradiso National Park has started in the summer 2013, for the first time in European high altitude lakes, an extensive eradication program of introduced fish, within the EU supported LIFE+ project project BIOAQUAE (Biodiversity Improvement of Aquatic Alpine Ecosystems). The action involves the use of intensive gill netting as an effective and non-invasive eradication technique. After the first field season, signals of the recovery of alpine lakes ecosystems are already evident.

PRESENTATION TYPE: ORAL

MS06-02

Lakes by regions (North & South America; Africa; Europe; Asia)

TOWARDS PRACTICAL MEASURES FOR IMPROVING THE ECOLOGICAL STATE OF LAKE MARKEN BY COMBINING IN DEPTH SYSTEM KNOWLEDGE WITH STAKEHOLDER ASPECTS

Ruurd Noordhuis
Deltares, Netherlands
Menno Genseberger
Deltares, Netherlands
Christophe Thiange
Deltares, Netherlands
Pascal Boderie
Deltares, Netherlands
Renier Koenraadt
Antea Group
Veronique Maronier
Antea Group
Geert Roovers
Antea Group
Anke Jellema
Antea Group
Alphons van Winden
Stroming, Netherlands
Carlein Maka
Stroming, Netherlands

KEYWORDS: SHALLOW LAKE, ECOLOGICAL STATE, STAKEHOLDERS

Lake Marken is a shallow lake with an average depth of about 4 meter and a surface of 700 square kilometer in The Netherlands. For this lake, high suspended sediment concentrations result in reduced ecological values and prevent goals and standards from being met (Water Framework Directive, Natura 2000).Mainly due to wind driven waves (fine) sediment particles on the bed are resuspended and transported by hydrodynamic flow. High concentrations of suspended sediment particles generally result in low transparency values. Light on the bottom is important for waterplants to grow, gradients between clear and turbid water are important for fish-eating waterbirds to get food.These are the main underlying physical and ecological processes and interconnections. With this knowledge, a practical measure that is currently studied is the construction of wind-sheltered areas in the North West part of Lake Marken. Construction of dams, islands, and shallow areas will influence the physical processes to improve water quality and ecological state.The study of the required size, shape, and location of the structures is being carried out. Next to the in depth knowledge of physics (via a coupled silt model for Lake Marken) and ecology, this also included an interactive approach with different stakeholders for aspects other than ecological impact (like implementation costs, engineering, recreation, and safety). In this presentation we will show how the combination of knowledge of the underlying physical and ecological processes and the interactive approach with stakeholders worked out during the study.

PRESENTATION TYPE: ORAL

WATER BALANCE MODEL FOR MANAGEMENT AND RESTORATION OF TE WAIHORA (LAKE ELLESMERE), NEW ZEALAND

Graeme Horrell

National Institute of Water and Atmospheric Research (NIWA), Christchurch, New Zealand

KEYWORDS: LAKE, DAILY WATER BALANCE MODEL, LAKE VARIABLES, BEACH BARRIER SEEPAGE, SEA INCURSIONS, ARTIFICIAL OPENING TO SEA, SEA CONDITIONS, LAKE HEIGHT AREA CURVE, ENVIRONMENTAL OPENING, LAKE VARIABLE SEASONALITY, WATER QUALITY

Te Waihora (Lake Ellesmere) is a shallow lake located on the east coast of the South Island and is the fifth largest in New Zealand. The water level has been managed by Maori and European Settlers by opening channels through the gravel bar to the sea. The lake water is currently highly enriched with nutrients and is very turbid with high levels of re-suspended sediment from the lake bed. A water balance model was developed to study lake level management options and provide predictions of consequences. The model makes use of 42 years of daily data on the variables which affect the lake level: · Inflows - tributaries, rainfall, beach barrier seepage inflow, groundwater, artificial opening sea incursion, rough weather sea incursion. · Outflows - evaporation, barrier seepage outflow, artificial opening. Additional requirements for model development included: · Knowledge of the sea conditions necessary for a successful artificial opening and closure. · Daily sea conditions. · Lake height area curve. Model applications include: · Successful National Water Conservation Order (WCO) application in 1990. · Impacts of Central Plains Irrigation Scheme. · WCO environmental amendments 2011. · Evidence to assist Canterbury Regional Council artificial opening consent. · Scientific studies into: salinity, fish habitat, trophic state, macrophyte re-establishment, flood risk and water quality. Knowledge advances for lake managers include: · Avoidance of prolonged low lake levels in summer and autumn. · Enhancement of environmental openings to improve fish recruitment in spring, and fish migration in autumn. · Reductions to the number of artificial openings and salt concentrations. · Understanding lake variable seasonality and methods to improve water quality.

PRESENTATION TYPE: ORAL

A COMPARATIVE STUDY ON THE PHYSICOCHEMICAL AND BACTERIAL ANALYSIS OF WATER SOLA LAKE, AHMEDABAD, GUJARAT, INDIA.

Sanjay D. Vediya
P.G.Center in Botany, Sir P.T.Science College, Modasa, Gujarat, India
Satish Patel
P.g.center in Botany, Sir P.T.science College, Modasa, Gujarat, India

KEYWORDS: PHYSICOCHEMICAL, BACTERIAL, LAKES OF GUJARAT

Ahmadabad is unique in the whole of India in matter of environmental neatness and flourishing conditions and it is superior to other cites in the excellence of its monuments. Ahmadabad Urban Development Authority (AUDA) proposes to undertake work for revival, development of catchments areas and beatification of few lakes under the present project .of these Sola lake waters were analysed for physicochemical and bactarrial analysis. The results values of the Physicochemical and bacterial estimated through Sola lake during monthly Analysis of the January-2009 to December -2009.The physico-chemical monthaly and microbial parameters seasonal water samples collected from various defrant sites, Sola lake, Ahmedabad, was analyzed to assess the quality of water for determining its suitability forDrinking and Agriculture purpose. The physicochemical parameter like, pH, TDS, dissolved oxygen (DO), biological oxygen demand (BOD), chemical oxygen demand (COD), total hardness (TH), calcium , magnesium and microbial Parameter like Total Coliformbacterial , Faecal Coliform and Total viable count bacterial colonies was determined. The results suggested that the lake water samples Collected from various sites in Sola, Ahmedabad was higher values of microbial parameters give clear indication of very poor water quality. The results of bacterial parameters studied, exceeds the drinking water permissible limits suggested by WHO, ICMR and ISI.

PRESENTATION TYPE: POSTER

STUDY OF PHYSICO-CHEMICAL PARAMETERS OF LAKES IN AND AROUND AHMEDABAD, GUJARAT, INDIA

Sanjay Vediya
P.G.Center in Botany, Sir P.T.Science College, Modasa, India

KEYWORDS: PHYSICO-CHEMICAL PARAMETERS, SURFACE WATER, LAKES OF GUJARAT, INDIA

Surface water samples were taken and collected from lakes samples in and around of Ahmedabad and analysed for temperature, pH, turbidity, TDS, hardness, Chloride, D.O., B.O.D and C.O.D. The surface water regime is primarily monsoon dependent, although the trunk channels receive significant contribution from ground water during lean season. This study presents a comprehensive assessment of surface water quality of the area based on analysis of nine parameters representing selected Localityes following 13th lakes will be studied; North, East, South and West side of Ahmadabad (1.Chnadlodia, 2. Gota, 3. Sola, 4.Thaltej, 5.Memnagar, 6. Vastrapur, 7.Ambli, 8. Makarba, 9. Sarkhej, 10.Ramol, 11. Vastral, 12.Singarva and 13.Nikol) and monthly Sampling during (2009). With respect to the physico – chemical Parameters, the surface water sources of the lakes catchment and adjoining area are found pH slight and Normaly Alkaline, high C.O.D, Hardness, Chloride, turbidity and Low D.O to be not suitable for drinking, domestic and agricultural use.

PRESENTATION TYPE: ORAL

MODELLING PERITO MORENO ICE-DAMMING EVENTS

Adalbert Arsen
CNES/CLS, Toulouse, France
Rodrigo Abarca del Rio
University of Concepción, Biobío, Cile
Jean-Francois Cretaux
CNES/CLS, Toulouse, France

KEYWORDS: PERITO MORENO, GLACIER, LAKE

Located in a mountainous area Lake Argentino is one of the biggest water bodies in South America. It's well-known for extreme ice damming events due to the presence of the Perito Moreno glacier splitting the southernmost branch, known as Rico branch from the main body of the Lake Argentino. In the present study our objective is to investigate if the water can be accumulated during damming not only by excess of precipitations but also by the accumulation process due to the closed passage between Rico and the main water body of Lake Argentino. This is achieved by establishing a simple model which estimates short term evolutions of Rico water balance. With our model we simulate Rico 2004, 2006, 2008 damming events for which altimetry data are available, theirs hydrological regimes and the amount of incoming and outgoing water to provide plausible explanation. Our simulations explain almost 100% of water present in the Rico system during each damming, and by doing this we can affirm that the damming of water can be driven not only by simple excess of inputs but also by closure of the passage between Rico branch and Lake Argentino. Moreover by combining different remote sensing and in situ data we establish the hypsometry of Rico branch. We prove an existence of a small permanent flux between both parts of the lake and the possibility of the damming formation detection in in situ (or altimetry) measurements. Although very narrow size of Rico branch, the altimetry data processing from Envisat mission can provide time series of lake surface heights over both parts. Coupled with optical Landsat imaging, those results give possibility to evaluate only by remote sensing approach approximate water storage during ice damming events. Until now Envisat was the only mission which gave exploitable data over Rico, but recent scientific missions such as Cryosat-2 and AltiKa give new opportunities to study lakes water balance, and upcoming missions as Jason-3, Sentinel 3A and Sentinel 3B or SWOT will help to improve again the data quality and altimetry coverage.

PRESENTATION TYPE: ORAL

ROLE OF SAMVARDHINIS IN CONSERVATION AND SUSTAINABLE MANAGEMENT OF LAKES OF INDIA

Pramod Salaskar
Naushad Ali Sarovar Samvardhini, India
E.V. Muley
Indian Association of Aquatic Biologists (IAAB), Aurangabad, India
A.D. Diwan
Foundation for Integrated Rural Development through Agri-biotech, Energy and Environment (FIRDAEE), Aurangabad, India

KEYWORDS: URBAN LAKES, ILBM, SAMVARDHINIS LAKE

After reviving current status of urban lakes in metropolitan cities in India it has been observed that number of lakes have either vanished, lost or under threatened condition due to number of reasons including industrialization, urbanization and anthropogenic intervention. Because of this situation water resources are slowly vanishing and ground water resources in particular have dried up. Now Government of India after realizing the serious problem of water scarcity is evolving and developing strategies for rejuvenation, restoration and conservation of existing lake water in the country. Ministry of Environment and Forest (MoEF) has developed National Lake Conservation Programme (NLCP) under which at present 60 lakes of the country have been included for protection of water resources. However there are number of lakes which are located in urban and semi urban areas, which need immediate attention for their protection. In view of this situation the present concept of establishment of Lake Samvardhini at each major lake will help in conservation and sustainable management of the existing water bodies. Globally in order to conserve lakes and other water bodies Integrated Lake Basin Management (ILBM) concept has been developed and similar type of concept with minor alteration suitable to our country has been drawn and mentioned in the present paper. For effective implementation of the progamme for conservation and sustainable management of lakes the role of samavardhinis and its operation mechanisms need to be understood and same is describe here.

PRESENTATION TYPE: ORAL

LAKES IN INDONESIA AT THE CROSSROAD:A HOLISTIC ECOSYSTEM-BASED AND PEOPLE ORIENTED STRATEGIES TO SUSTAIN OUR LAST FRONTIER OF FRESH WATER AND AQUATIC RESOURCES

Gadis Sri Haryani

Research Center for Limnology, Indonesian Institute of Sciences, Cibinong, Indonesia

KEYWORDS: INDONESIAN LAKES, ECOSYSTEM BASED MANAGEMENT, 8 STRATEGIES

Indonesia is the fifth largest country in the world with fresh water resources (3,221 billion m3/year), blessed with an extraordinary number of multi origin (tectonic, volcano-tectonic, oxbow, and enclosed) lakes, amounting to 840 lakes (covering 685,000 ha), 735 ponds and 162 reservoirs. Lake Toba (North Sumatra) is the largest (110,260 ha and 505 m deep), LakeMatano is the deepest (600 m) and LakeSentarum (West Kalimantan) is the most unique wetland (10 months wet and 2 months dry). The unique lake ecosystem settings, which are not always be part of any river system, are typified by their water retention time, their geologic history, the presence of thermocline layer, their depths which could be much lower than the sea level and they formed crypto depressions. A reformed management of the lakes in Indonesia is inescapable in order to comply with the sustainable use of different end users like clean and drinking water supply, transportation, fishery and agriculture, industrial use, waste disposal, energy generation, natural habitat for fauna and flora, climate regulator and cultural activities. These have resulted in critical ecosystem downgrading and their bearing capacity of the selected 15 priority lakes, suffering from pollution, siltation, fish kill, ecosystem deterioration, disturbance in biota migration pattern and other impacts on lake sustainability. By considering the lake uniqueness, 8 strategies are proposed and discussed, based on the paradigmatic shift from economic to ecosystem based management. These encompass from the holistic and integrated planning-use-evaluation, through critical assessment and public awareness, until the institutional setup.

PRESENTATION TYPE: ORAL

IBERIAN SALTSCAPES, A RICHNESS AND DIVERSITY WORTH PRESENRVING

Katia Hueso
IPAISAL, Spain
Jesús-F. Carrasco
IPAISAL, Spain

KEYWORDS: CULTURAL LANDSCAPES, HERITAGE, ENDEMISM

The Iberian Peninsula is known to be generally dry and poor in wetlands of interest. However, thanks to its geological history, its climate and is rugged topography, this region hosts an important number and diversity of saline wetlands, being unique at European scale in this respect. Many of these wetlands have been used by man as a source of minerals and wealth. As a result, they also include important intangible and tangible cultural heritage assets that transcend the wetland itself, have shaped rural and urban territories and even have influenced the course of history. Also, due to their isolation, saline wetlands often host rare and fragile halophilic species of flora, fauna and archaea, some of which have an interest for science and biotechnological applications. Some of them are endemic species, and therefore vulnerable to environmental chances. Only a few have gained a certain protection status, the majority being otherwise left to their own devices. The abandonment of traditional productive activities, especially in isolated areas, and the widespread ignorance of the values these wetlands host, threaten saltscapes with their decay and, ultimately, disappearance. IPAISAL, the Institute of Salt Heritage and Saltscapes, has recently inventoried the saltworks, saline wetlands and saline streams of the Iberian peninsula, which has resulted in over 1,000 different sites, in very different states of conservation. With this contribution, we would like to present the richness, diversity, abundance and fragility of these saline landscapes and thereby contribute to their knowledge and preservation. Ultimately, these saltscapes deserve to gain a full recognition as living cultural landscapes both from the general public as from policy makers.

PRESENTATION TYPE: ORAL

THE LAKESCAPE OF LOWER DOCE RIVER VALLEY (SOUTHEASTERN BRAZIL): PHYSIOGRAPHY AND ENVIRONMENTAL PRESSURES ON THE LACUSTRINE SYSTEM

Gilberto Fonseca Barroso
Universidade Federal do Espírito santo - UFES, Vitória, Brazil
Fábio da Cunha Garcia
Universidade Federal do Espírito santo - UFES, Vitória, Brazil
Mônica Amorim Gonçalves
Universidade Federal do Espírito santo - UFES, Vitória, Brazil
Fellipe Alcantara de Mello
Universidade Federal do Espírito santo - UFES, Vitória, Brazil
Larissa Bertoldi
Universidade Federal do Espírito santo - UFES, Vitória, Brazil
Jéssica Cruz Venturini
Universidade Federal do Espírito santo - UFES, Vitória, Brazil
Lília Rossoni
Universidade Federal do Espírito santo - UFES, Vitória, Brazil
João Guilherme Salvador Deodoro
Universidade Federal do Espírito santo - UFES, Vitória, Brazil
Alessandra Delazari-Barroso
FAESA, Vitória, Brazil

KEYWORDS: LAKE WATERSHED, LAKE ASSESSMENT, ENVIRONMENTAL CHANGES

The Lower Doce River Valley – LDRV at Southeastern coast of Brazil comprise 90 lakes (165.5 km2), with areas ranging from 0.8 ha to 62.0 km2. This lacustrine system form a valuable 'lakescape' providing several ecosystem goods and services. Unregulated land and water uses create several environmental pressures driving the system to an ecosystem shift. In order to assess ecosystem health, identify environmental pressures, and ecosystem state variables subjected to changes, an Integrated Environmental Assessment Program was launched in 2011. This Program is based on lake watershed physiography, lake basin morphometry, hydrological flows from tributary rivers, lake hydrodynamics, and trophic and pollution state indicators. Physiographic data about lakes watersheds were analyzed for basin area, drainage density, river fragmentation by damming, and land use. Four of the deepest lakes have been investigated within a limnological and hydrological approach. Lake Palmas (A = 10 km2, Zmax = 50.7 m), the deepest natural lake in Brazil, that despite anoxic bottom waters during stratification season, is an oligotrophic system with a theoretical retention time of 19.4 years. In contrast, Lake Palminhas (A = 8.8 km2, Zmax = 31.6 m) is undergoing much more rapid changes leading to an eutrophic state with cyanobacteria blooms as a consequence of a small watershed (61,7 km2) with land use dominated by pastureland (70 %), and with very low river tributary flow resulting on a retention time of 56.6 years. We hope with this findings to subsidize sound environmental management responses in order to promote sustainable uses of LDRV "lakescape".

PRESENTATION TYPE: ORAL

MULTI-STAKEHOLDER PLATFORM FOR CONTROLLING NON-POINT POLLUTION IN THE LAKE CHAPALA BASIN, MEXICO

Alejandro Juarez
Corazon de la Tierra-Institute of Environmental Development, Mexico
Rene Velazquez-Moreno
Corazon de la Tierra-Institute of Environmental Development, Mexico

KEYWORDS: MULTI-STAKEHOLDER PLATFORM, CONFLICT-COLLABORATION MATRIX, AGROCHEMICALS

A Multi-Stakeholder Platform (MSP) was constructed in order to reduce the high volumes of agro-chemicals used in the Lake Chapala basin, through the involvement of local stakeholders, specially farmers using irrigated and non-irrigated lands. All sectors related in this agricultural practice were identified (not only the farmers), being found a total of 53 institutions/groups which include government agencies, research institutions, civil organizations, councils and others. Each one of them were characterized through descriptive files (number of members, influence, territorial presence, leadership and mandates). Also they were consulted to know their position about key issues related to agrochemical control, using interviews and surveys. With this information a Matrix of Conflict/Collaboration was structured, showing that the simple issue of reducing agrochemicals generated strong disagreement between several groups, making extremely difficult to define a simple strategy. So, a set of related issues were applied to create a second level matrix, which showed that there is clear agreement about reducing risks to human health and also reducing poverty. Based in this a three-years strategy was structured, to be applied in three differentiated zones, taking into account levels of stakeholder interaction and cultural-organizative simmilarities. The MSP was structured using a Base Structure and a Negotiation Structure, taking into consideration the whole set of stakeholers' proposals and interests , defining clear responsabilities for those directly participating and communication tools to keep informed those who don't.

PRESENTATION TYPE: ORAL

NON-POINT POLLUTION AND EROSION IN THE LAKE CHAPALA BASIN, MEXICO

Alejandro Juares
Corazon de la Tierra - Institute of Environmental Development, Mexico
Teodoro SilvaTeodoro Silva
Instituto Politecnico Nacional, Mexico
Laura Davalos-Lind
Baylor University, USA
Owen Lind
Baylor University, USA
Salvador Ochoa
Instituto Politecnico Nacional, Mexico
Rodrigo Moncayo
Instituto Politecnico Nacional, Mexico
Carlos Escalera
Instituto Politecnico Nacional, Mexico
Adalberto Diaz
Corazon de la Tierra - Institute of Environmental Development, Mexico
Francisco Quintero
Corazon de la Tierra - Institute of Environmental Development, Mexico
Gustavo Cruz
Instituto Politecnico Nacional, Mexico

KEYWORDS: LAKE CHAPALA, NON-POINT POLLUTION, SILTATION

Lake Chapala is Mexico's largest inland water, a system of high priority for its biodiversity and the set of services it provides, including weather regulation, fisheries and water for irrigation, industry and human consumption. After a dyagnosis of research done in the basin (back in 2009) it was shocking to find the huge amount of lacking data. A three-years project was conducted to fill several of those gaps. Its components were: a) Inflow water analysis, b) Soil erosion/siltation, c) GIS construction, d) SWAT modelling, e) Non-point pollution monitoring, f) Stakeholder characterization and g) Multistakeholder Platform construction. As a result we found that a) More than 25000 ton/year of fertilizers are used, generating a load of nutrients than enter constantly into the lake, b) More than 340 tons/year of pesticides are used in the direct vicinity of Lake Chapala, including 22 of extreme toxicity for plankton, fishes and birds , c) From 100 to 400 thousand tons of soil are washed by rain per year; generating economic and ecosystem effects in the lake, streams and irrigation channels; d) Stakeholders lack of information about the basin functions, nevertheless there are good conditions to develop a platform to improve situation with their involvement. All information has been widely presented. Counting with such precise and validated information complemented with tools as thematic maps, GIS and a SWAT model (which present complex information in an easy-to-understand way) it's essential to move forward with the sustainable management of Lake Chapala basin.

PRESENTATION TYPE: ORAL

SOME CONSIDERATIONS ON BASE LINE INFORMATION FOR THE WATER ASSESSMENT OF A TRANSJURISDICTIONAL LAKE BASIN: THE CASE OF LAKE CHAPALA BASIN IN MEXICO

Sergio Antonio Silva Muñoz
Universidad de Guanajuato, Campus Guanajuato. Department of Civil Engineering, Mexico
Marco Antonio Ortiz Rendòn
Antares Consultores en Ingeniería, Mexico

KEYWORDS: LAKE CHAPA, TRANS-JURISDICTIONAL LAKE BASIN, BASE LINE INFORMATION

It is known that complexity of lake basin management is increased when dealing with either trans-boundary or trans-jurisdictional contexts, and that decisions on assessment issues are difficult to make if the process of integration of the base line information is carried out just by focusing on the drafting of the lake brief considerations. Thus, it is fundamental to have reliable and complete base line information for making good decisions on any lake basin issue In this paper it is considered that since information included in a lake brief is more oriented on the local context, it might not be enough for the assessment of trans-jurisdictional basins, like Lake Chapala basin in Mexico, and that information about geographical and socioeconomic context, health and the environment, (circumstance) condition state of water resources, uses of water, hydraulic infrastructure, water management tools and future scenarios on water governance in a more global perspective should be taken into account. Here, it is presented the baseline information that was developed and used in the assessment of the Lerma River – Lake Chapala – Santiago River – Pacific Ocean Hydrological System -a 199,366 km2 trans-jurisdictional lake basin in Mexico- aimed at define the basic components of its 2030 water agenda.

PRESENTATION TYPE: ORAL

MS06-03
Urban lakes

INTEGRATED LAKE MANAGEMENT OF THE URBAN LAKE "ALTE DONAU"

Thomas Ofenback
MA 45 - Wiener Gewaesser, Austria

KEYWORDS: URBAN LAKE, MANAGEMENT, WATER QUALITY

The “Alte Donau” in Vienna, Austria, with 160 ha one of Europe’s largest urban lakes, is fully embedded in the city landscape and intensely used for recreation activities and as a bathing water. The LIFE+ project „Integrated Lake Management of the Urban Lake Alte Donau" demonstrates integrated lake management as an instrument of an innovative and up-to-date environment policy with a holistic and multi-objective approach. The project measure include (1) Implementation and Demonstration of Integrated Lake Management in an intensively used urban environment in the context of the city’s governance practices, (2) Reduction of the vulnerability to climate change impacts and other anthropogenic pressures, (3) Maintaining and ensuring good ecological status (WFD) and good bathing water quality (Bathing Water Directive) through the implementation of innovative technologies and methods (4) Achieve and maintain a stable aquatic environment in an intensively used urban environment through sustainable management procedures (5) Maintaining and improving the socio-economical benefits for the population and stakeholders in connection with sustainable urban development (6) Improvement of communication with and participation of the population and other stakeholders.

PRESENTATION TYPE: POSTER

WATER SENSITIVE URBAN DESIGN

Paolo Di Giacomo
Alpha Consult, Italy

KEYWORDS: WATER SENSITIVE URBAN DESIGN, URBAN WATER CATCHMENT, LAKE MANAGEMENT UNDER ANTHROPOMORPHIC PRESSURE

The convener consider of paramount interest to stress the need of introducing the concepts of water sensitive urban design in Europe, and to draw the attention to the need of realising WSUD projects and to boost the WSUD methodology, that unites a wide range of professionals and forms a new multidisciplinary sphere of action to protect our lakes and internal waterways. WSUD involves the construction of structural storm water management measures such as constructed urban lakes, wetlands, bio retention systems, sediment basins and swales. The presentation aims to introduce water sensitive urban design principles and the challenges of managing urban lakes or natural lakes with substantial antropomorphic pressure. The author wishes to show a new set of planning tools designed to treat storm water runoff in the urban catchment prior to being released into the Wetlands or the lake basins. The objective of the contribution is to foster the stakeholders to harmonize urban planning with the related hydraulic structures and agricultural best practices to make possible a new use of urban runoff. Moreover there is the need from one side to consider the urban catchment as a new source of water for urban uses and from the other the construction of hydraulic infrastructures around the urban lakes meant to intersect polluted runoff from the catchment to safeguard the quality of lake waters. The paper provides considerations on stormwater management with an added insight into incorporating WSUD into a highly functional and well integrated public open space.

PRESENTATION TYPE: ORAL

LAZIO REGION CO FINANCED RESEARCH FOR A STRATEGIC PLANNING OF VICO LAKE FOR A PROPER TERRITORIAL ENVIRONMENTAL SUSTAINABILITY

Fabio Recanatesi
Tuscia University, Italy
Maria Nicolina Ripa
Tuscia University, Dip. DAFNE, Italy
Antonio Leone
Tuscia University, Dip. DAFNE, Italy

KEYWORDS: NON POINT SOURCE POLLUTION, LAND USE, GLEAMS MODEL

The Lakes systems are sensitive to anthropogenic activities , for this reason, they represent the "laboratories" in which it is possible to test methods of analysis for determining planning criteria to contain pollutants To this aim DAFNE Department of Tuscia University have been caring out data acquisition and monitoring network for several years The results are shown in this paper. The analysis carried out so far leads to a substantial coincidence, for the specific case of Lake Vic , including the problems of eutrophication and soil erosion control. Establishment of land use scenarios compatible, through the integration of climate projections, demographic and land cover maps in order to assess the impact of land use on these sensitive environmental systems. The definitions of mitigation measures on critical areas are shown. GLEAMS model have been prepared using over a 50 years period, with appropriate rain data from the hydrological station of Ronciglione, which has sufficiently long data recordings (started in 1919) of daily data of precipitation, integrated for the water balance , the temperature data (always Ronciglione) wind, relative humidity and solar radiation (the latter from to Viterbo Station) The results from the simulation was compared with the monitoring in the lake intake nutrients data recordings so to arrive to a validation of the model PST / CSA Strategic Planning Project for proper Territorial Environmental Sustainability thake into account Vico Lake that is a system sensitive to anthropogenic activities

PRESENTATION TYPE: ORAL

VOLCANIC LAKE BASINS INTEGRATED FRAMEWORK FOR LANDSCAPE FUNCTIONALITY ASSESSMENT

Tullia di Giacomo
Alpha Consult, Italy

KEYWORDS: LAKE BASINS, LANDSCAPE FUNCTIONALITY ASSESSMENT, GIS TECHNOLOGY

A co-research project is undergoing in cooperation with five research institute namely: University of Rome Sapienza DIAP department, University of Tuscia - DAFNE department, Italian Geographical Society, CRA-CMA National Research Unit for Climatology and Meteorology applied to agriculture and CRA-RPS National Research Centre for the Study of the Relationships between Plant and Soil. The aim of the project is to set up an integrated framework for landscape functionality assessment in land use planning for the management of urban and agricultural planning in the Lazio Region volcanic lakes hydrological basins: a model has been set up and tested with data deriving from last fifty years daily observations. The methodology ported on a web-based portal using GIS technology allows to verify in real time the implications of modification to the land use. New proposed planning projects have now an instrument allowing the stakeholders to have a quantitative method to weigh the decisions to be taken, therefore producing risk hazard maps for the different planning scenarios. The Meso scale planning includes the overlay of land use developments over the years, new geological data, slope maps, morphology, rain data, population distribution maps. The project analyses different types of ecosystem services that can be implemented and the model allows to evaluate the functionality of the landscape in ecological terms (verifying nutrient cycling, water purification gained by changing land use,biodiversity), social uses (recreational andaestheticfeaturesof the landscape to encourage local economic for instance horse trails, fishing and agricultural production).

PRESENTATION TYPE: ORAL

COLIFORM AND E. COLI LEVELS AT SEVERAL URBAN LAKES IN JAKARTA MEGACITY

Ami A. Meutia
Research Institute for Humanity and Nature (RIHN), Japan
Cynthia Henny
Research Center for Limnology - Indonesian Institute of Sciences (LIPI), Indonesia

KEYWORDS: URBAN LAKES, WATER QUALITY, PATHOGENIC BACTERIA

Urban lakes, natural or man-made lakes (situ/waduk in Indonesian) in Jakarta Megacity (Jabodetabek) have played an important role for irrigation, flood control and groundwater recharge for a long time. Many man-made lakes were believed to be built during Dutch colonial time. For decades, these urban lakes suffered from unplanned rapid development, urbanization and illegal occupancy. Also because of neglect by government and low public awareness, almost all of urban lakes have been polluted and filled with untreated sewage and solid waste. As a result, the urban lakes become breeding grounds of pathogenic bacteria especially one that causes waterborne gastroenteritis. Situation is deteriorated when the amounts of bacteria will be diffused with the flood that hit Jakarta megacity every year and elevated risk of waterborne gastroenteritis. Moreover, people around the lake are fond of fishing and eating fish from these urban lakes. Because water qualities data from Jakarta Megacity's urban lakes were quite rare, especially for Coliform and Fecal coliform/ Escherichia coli (E. coli) data, our research measured the abundance of pathogen bacteria such as coliform and E. coli at several urban lakes. The results show that population of pathogen bacteria in several urban lakes exceeded the water quality standard for irrigation and fisheries. If we use government standard [PP No. 82 (2001)] that water quality standard for coliform is 10000/100 mL and 2000/100 mL for E. coli, coliform and E. coli levels measured at these lakes has above the standard. Not only urban lakes that are surrounded by housing such as Empang Bahagia, Teluk Gong and Rawa Besar but also those are are surrounded by urban forest (Hutan Kota Srengseng), agriculture (Pamulang) and industry (Rawa Kalong) have high level of coliform and E. coli.

PRESENTATION TYPE: ORAL

ISPRA WATER RELATED ACTIVITIES

Mauro Bencivenga
Italian National Institute for Environmental Protection and Research (ISPRA), Italy

KEYWORDS: ISPRA ITALIAN NATIONAL INSTITUTE FOR ENVIRONMENTAL PROTECTION AND RESEARCH, WFD 2000/60, LAKE MONITORING PROGRAM

ISPRA - Inland and Marine Water Department performs scientific and technical activities to ensure the protection, sanitation, use and management of both Inland and Marine/Coastal Waters. Institutional national functions are in support of the Italian relevant activity as per the national legislation. In particular, the Department carries out the following activities: □ collection and management of data in connection also in relation with other national and peripheral structures and in connections with other international bodies in the field; □ functions of national importance in the field of hydrology, water resources and mareography in line with the activities of the National Hydrographic Service that is the competence center in the field of hydrology and hydraulics for the inland and marine/coastal waters; □ develops and manages the state of the seas forecasting system; and performs the analysis on the data collected; expresses official opinions and performs assessments on water protection on a national scale; □ supports the Ministry of Environment and Protection of Land and Sea for: o the implementation of the Water Framework Directive (2000/60/EC or WFD) and Floods Directive (2007/60/EC or FD) also through technical regulations drafting on the protection of water quality and quantity, o the preparation of technical reports, papers, workshops, and provides the support to the competent authorities for reporting to the European Community and ensure the participation in the Community research projects to the Competent National Authorities and Ministerial working groups and to the European Commission of the European Community; o the answer to technical questions arose during and after the bilateral meeting with the European Commission regarding the implementation in Italy of the Water Framework Directive (2000/60/EC); o the collection and processing of data for the preparation of the report of obligation for the EU with regard to EU Directives 91/271/EEC (UWWTD-municipal wastewater), 91/676/EEC (ND-nitrates from agricultural sources), (76/464/EEC - Dangerous Substances); o the predisposition, for what is its competence matters, of the schemes of the decrees or their updates on the monitoring and classification of surface and groundwater, o the preparation of reporting, the development of methodologies for the hydrometeorological monitoring and hydromorphological characterization of water resources at the national level, in accordance with the Directive 2000/60/EC and in accordance with the Directive 2007/60/EC, in coordination with the system of National Agencies and with the River Basin Authorities; o the integration of the national methods for the morphological classification of the Italian rivers with the monitoring index of morphological quality, to update the Ministerial Decree 260 / 10 on the basis of the classification of Italian surface water bodies; o the development of the national method to identify the river water bodies heavily modified, by the Ministerial Decree published on November 27th 2013; o the production of technical reports and regulatory requirements; o the coordination actions with the local authorities involved: in particular, actions of reconciliation with the System of Regional Agencies for Environmental Protection (ARPA/APPA) with the production of a guide line for the ad hoc working group on monitoring water as per the WFD approved by the Permanent Technical Committee; o the formation of ARPA/ APPA, Regions and River Basin Authorities on the method of hydro-morphological classification; o the pre-inquiry activities as experts for the component "Water Environment" for the investigations regarding the Strategic Environmental Assessment (SEA) and for investigations regarding the Environmental Impact Assessments (EIA); o the participation in the activities of the working group for matters pertaining to the department; o the activities designed to sharpen the level of knowledge about the origin of the content of nitrates in groundwater and surface water in the territories of the regions of Piedmont, Lombardy, Emilia Romagna, Veneto and Friuli Venezia Giulia. Based on the data collected and the previous experiences of the regions participating in the project; ISPRA and the ARPA involved agreed on a expeditious model applicable on a supra-regional scale for the identification of areas with different vulnerability to nitrates. The purpose of this model is to provide an index of vulnerability assessment. This indicator will be applied on a regional scale and compared with the methods applied in each region to define

the NVZ; o the management, the updating and the development of the system for the prediction and analysis of weather events at sea in the Mediterranean Bacin, through the implementation of new forecasting models, study and assessment of the improvements, development and application of innovative methods of verification and analysis of hydrological extremes, such as floods and droughts (see Drought Monthly Bulletin on the ISPRA web site) and the marine events and the intense event of the marine coastal weather, even through the combination of hydrological and hydrometric data with in situ data from radar and satellite.

PRESENTATION TYPE: ORAL

SHAMIRPET LAKE: A STUDY FOR INTROSPECTION

Vasanth Rao
Indian Association of Aquatic Biologists, Hyderabad, India
Subodh V. K.

Kulkarni S. S.

KEYWORDS: LAKE CONSERVATION, MODERNISATION, IRRIGATION

Shamirpet, near Greater Hyderabad City,is a reservoir constructed by the Erstwhile King Nizam HEH Mirusmanalikhan Bahadur to irrigate over 2000 acres of land and probably a standby lake for the city . It is situated in the coordinates(17o36l33ll N78o33l 40ll E). Due to growth, modernization and requirements of the habitants it hardly supplies water to over 200 acres of land for cultivation of rice, Kharif and Rabi crops.The Catchment area is still a ray of hope for further development and growth.This area starts from Nedchel Taluka covering many villages and forest land up to Bhongir Taluka .The Terrain of this catchment area consists forest land, fields, ditches, streams and rocks supporting vegetation, birds, human beings, animals and wild lifes. In fact this part was a collection spot for the students of hydrobiology, natural sciences, limnologists and academicians. The algal specimens and zooplanktons were available in pure form for herbarium collection and day to day practical classes to study them. They can be even today become source of fields growing algae like Nostoc, Spirulina, Chlorallae, Batrochospermum, Zooplanktons, etc. This area will generate new form of business rarely known to the populas which can be engaged in public private participations, growth of hydroponics and other branches of science. The unemployed youths, naturalists, environmentalists and others will make use of the lake like a field laboratory. The increase in water level will enhance other ventures like breeding prawns, fishes etc. This is possible only when attempts are made to interconnect the small ditches and streams in the catchment area following ICRISAT and Government of India methods of rain harvest ,preservation and conservation of water to utmost use.

PRESENTATION TYPE: ORAL

DETERMINANTS OF URBAN LAKE INHABITANTS: DISTRIBUTION MODELLING OF ANURANS AMPHIBIANS OF BANGALORE CITY

Gururaja KV
Center for infrastructure, Sustainable Transportation and Urban Planning, India

KEYWORDS: URBAN LAKES, URBANIZATION , BANGALORE CITY

Rapid urbanization currently threatens over a third of over 7200 amphibian species in the world. Presence of a good population of amphibians in a region is an indication of a healthy environment as they play a major role in ecosystem functioning. Decline in habitable water bodies, pollution and conversion of lakes to cater human settlements are considered key determinants for loss of amphibians in cities. However, scientific research on amphibians in an urban ecosystem especially in fast growing metropolitan cities of biodiversity rich tropical region are the need of the hour for better understanding of processes behind amphibian declines. The present study is carried out in the city of Bangalore, the state capital of Karnataka, India. It is one of the fastest growing and fifth largest metropolitan in India with over 741sq.km of area and 8.4 million people. Seventeen species of frogs and toads are recorded from Bangalore, with no frog or toad in the lakes of city central region to 8 species in the out skirts of the city. The key determinants of distribution included distance of the water body from the city centre, human population density, asphalted roads and built-up around the water bodies. Species distribution modelling of most frequently observed aquatic, terrestrial, semi-aquatic and terrestrial frog and toad species are carried out, based on variables of population, drainage network, lake boundaries, road network, land-use, precipitation and temperature. This helped in prioritizing regions for anuran conservation in Bangalore city.

PRESENTATION TYPE: ORAL

URBAN LAKE MANAGEMENT STRATEGY: EFFECT OF DISTINCT TYPES OF LAKE SURROUNDING AND SHORELINE LANDSCAPE DEVELOPMENT ON WATER QUALITY OF URBAN LAKES IN MEGACITY JAKARTA

Cynthia Henny
Research Center for Limnology - LIPI, Cibinong, Indonesia
Ami A. Meutia
Research Institute for Humanity and Nature (RIHN), Kyoto, Japan

KEYWORDS: URBAN LAKE, WATER QUALITY, LAKE MANAGEMENT, MEGACITY

The need to understand how the shallow urban lake responds to the broad-ranging impacts of distinct types of lake surrounding and shoreline landscape development is becoming increasingly important in maintaining the lakes water quality. This study examines what important indicators related to distinct types of lake surrounding and shoreline landscape development affect an urban lake water quality. We examined water quality of several urban lakes in megacity Jakarta associations with distinct types of lake surrounding and shoreline landscape development including littoral habitat elements. We identified 5 types of lake surrounding based on the type of inhabitant around the lakes i.e. urban village (dense irregular residential housing), rural village (agricultural area and few residential housing); planned residential area (regular residential housing); rural-urban village (mixed rural and urban village) and urban-industrial area (mixed urban village and industrial area). Shoreline landscape development in lakes included natural shoreline (with green open space), natural-artificial shoreline (lack of green open space with concrete jogging tract) and artificial shoreline (no or less vegetated cover, concrete retaining wall and concrete jogging track). Lakes in rural village with natural shoreline and various types of vegetation in lake's demarcation area, lake littoral habitats are still well maintained indicated by the presence of submerged aquatic and emergent plants and spotted several types of dragonflies and butterflies. These lakes have good water quality with less turbid water, high dissolved oxygen concentration and low COD, TN, TP, and chlorophyll-a concentration. Although still receiving sewerage, storm water and agricultural runoff the lakes in this rural village type of lake surrounding with natural shoreline landscape can maintain better water quality than those in other types of lake surrounding and shoreline landscape. Vegetation coverage in lake's demarcation area and littoral habitat elements such as the presence of submerged and emergent aquatic plants should be managed to improve water quality on urban lakes. These are the important factors for urban lake management strategy to conserve urban lakes.

PRESENTATION TYPE: ORAL

ACTUAL SITUATION OF HANOI LAKES IN VIETNAM

Phan Thi Kim Van
Institute of Geological Sciences, Vietnam Academy of Science and Technology, Vietnam
Giuseppe Arduino
UNESCO, France
Do Thi Thu
Institute of Geological Sciences, Vietnam

KEYWORDS: HANOI LAKES, RED RIVER DELTA, POLUTION

During the past few years, Hanoi has faced a rapid economic development and urbanization process as well as a population growth. Built on the Hong (Red) River Delta - a swamp land, the city environment is characterized by a large number of lakes which are not only part of the traditional natural environment of Hanoi but are also vital for the city because of their crucial roles in regulating water flows, recharging groundwater, moderating climate change effects and maintaining the biological diversity of the area. Although the economic development experienced during the last decade brought prosperity to Hanoi, the uncontrolled development has generated several negative environmental impacts on its lakes. Hanoi saw a 25 % drop in the total area of its lakes in just over a decade (1994-2005) and lost 70% of its total number of its lakes within half a century (1950-2000). The alarming level of pollution related to nutrients enrichment has caused bad impacts on the ecology and biodiversity of the lakes and has led to water quality degradation. Surface water in rivers and lakes is seriously polluted by wastewater and effluents disposal. Indeed, hundreds of restaurants and hotels located either on the lakes shore or floating on the lakes directly discharge waste and effluents into them, leading to eutrophication problems. Groundwater resources are also polluted by surface water introduced in the aquifers by heavy pumping. This paper presents the results obtained during an investigation carried out in the framework of a project aimed at enhancing the Ha Noi 1000 years.

PRESENTATION TYPE: POSTER

HYDRO-ECOLOGICAL DYNAMIC OF RECREATIONAL LAKE

Zati Sharip
National Hydraulic Research Institute of Malaysia, Malaysia
Jarina Saman
Putrajaya Corporation, Malaysia
Normaliza Noordin
Putrajaya Corporation, Malaysia
Saim Suratman
National Hydraulic Research Institute of Malaysia, Malaysia
Akashah Majizat
Putrajaya Corporation, Malaysia
Ahmad Jamalluddin Shaaban
National Hydraulic Research Institute of Malaysia, Malaysia

KEYWORDS: URBAN LAKE, ECO-HYDROLOGY, ECOSYSTEM

Putrajaya Lake, being the largest freshwater lake in the country created in year 2001, is the heart of the Malaysia's administrative city. This urban water body system not only provides sustainable biogenic environment and recreational spot for its inhabitant, but also becomes an important destination for international sports and tourism events in the country. The morphology of this urban water lake, however, is complex with water-bodies surrounding an elongated island. The increasing development within the catchment provides challenges in management of the lake ecosystem to ensure the high water quality requirement for its multi-functional uses. This paper describes the assessment of hydro-ecological dynamic of Putrajaya Lake using statistical and numerical simulations. Spatial and temporal variation of water quality varied with changing meteorological condition and hydrological cycle.The findings of the simulation provide a better understanding of the lake dynamic and become a tool to manage the lake basin system sustainably under changing environment.

PRESENTATION TYPE: ORAL

ECONOMIC VALUES OF PUTRAJAYA LAKE AND WETLANDS: THE ASSESMENT OF ITS ECOSYSTEM SERVICES

Akashah Majizat
Environment, Lake and Wetlands Division, Putrajaya Corporation (PPj), Putrajaya, Malaysia
Nurliayana Abdul Rahman
Environment, Lake and Wetlands Division, Putrajaya Corporation (PPj), Putrajaya, Malaysia
Normaliza Noordin
Environment, Lake and Wetlands Division, Putrajaya Corporation (PPj), Putrajaya, Malaysia
Awang Noor Abd. Ghani
Faculty of Forestry, Universiti Putra Malaysia (UPM), Serdang, Selangor, Malaysia

KEYWORDS: LAKE, WETLANDS, ECOSYSTEM SERVICES, ECONOMIC VALUES, ASSESSMENT

Putrajaya Lake and Wetland's catchment is located partly in Putrajaya Federal Territory and partly in the State of Selangor, within the Langat River Basin. The 400-hectare lake built in 1998, is an urban lake, created right in the middle of Putrajaya, which is the newly developed Government Administrative Center of Malaysia. In the last 15 years, the wetlands and the lake have evolved into an interesting urban ecosystem. Monitoring and surveillance conducted in this area has shown very positive signs of habitat development and biodiversity enhancement. Efforts of enhancing the ecosystem diversity and its functions must be, in a way, ensures the sustainability of the resources services that we are expecting. In this case research work must also be focus on how to measure and assess the ecosystem services available from this ecosystem. Hence, we will be able to enhance and protect its existence with the availability of funds and reasons for doing so. In other words, the ecosystem services will be better taken care off if we know and able to assess its economic values. This paper is an effort of starting off the economic assessment of the enhanced urban ecosystem as the result of the eco-hydrology management exercise. Methods of economic valuation are employed such as contingent valuation method, travel cost method and hedonic pricing method to value selected ecosystem services in this area. The basis of assessment is to display how recognizing, demonstrating, and capturing the values of ecosystem services related to lake and wetlands management can lead to a better informed, more efficient, and fairer decision making. Appreciating the values of lake and wetlands to both society and the economy as well as to decision makers can help inform and facilitate political commitment to policy solutions. It is envisage that more assessments as well as more rigorously surveys and research efforts be undertaken by researchers to ensure sustainable financing mechanisms is in place to maintain and ensure business continuity of the important lake and wetlands ecosystem in the city.

PRESENTATION TYPE: ORAL

MS06-04S
Special Session - Lake Trasimeno

THE LAKE TRASIMENE: EXPLOITMENT AND DEFENSE OF THE RESOURCES OF THE LAKE. THE BREAK UP OF AN ANCIENT BALANCE BETWEEN 18TH AND 19TH CENTURY

Ermanno Gambini
University of Perugia, Italy
Riccardo Massarelli

KEYWORDS: TRASIMENE, BALANCE, RESOURCES

Since the ancient times we know that people used to exploit Lake Trasimene for economic purposes. This is proved by the archaeological evidence, and it is witnessed by the Tabula Cortonensis , one of the longest documents written in Etruscan, which concerns a transaction dealing, among others, with certain “fields of the Lake Trasimene”. Moreover, it has been recently hypothesized that the name itself, “Trasimene”, might refer to the fact that the lake periodically drains and then fills back again with water. Since the 1279 Statute of Perugia, it is clear that the supervisors of the lake were aware of its peculiar features, because they delimited it according to the often reached maximum water expansion, in continuity with Roman Law. Thanks to a number of rules deeply connected to the habits of the country, the civic government, and after this the Papal government, managed to build and mantain a balanced relation between lake environment, fields and woods sorrounding the Trasimene, with the creation of an integrated system. Exploitment methods and conservative interventions were balanced through the ages, allowing to reach the maximum availability of the resources of the lake (fish, birds, productive fields close to the shores, vegetation of the lake). Between 18 th and 19th century people started thinking how to exploit new fields after draining the lake, and started considering lake water itself as a source for irrigation. The landowners slowly reduced their investments on permanent fishing settlements, which had long been the most important economical resource in this area. This change affected most of the choices, even the recent ones, concerning the lake, and contributed to make it more and more difficult to manage such a fragile environment.

PRESENTATION TYPE: ORAL

THE DELAYED EFFECTS OF METEOROLOGICAL CHANGES ON THE WATER FROGS IN CENTRAL ITALY: PERSPECTIVES WITHIN THE FRAMEWORK OF CLIMATE CHANGE

Roberta Rossi
Department of Chemistry, Biology and Biotechnologies, University of Perugia, Italy
Alessandro Ludovisi
Department of Chemistry, Biology and Biotechnologies, University of Perugia, Italy
Romina Paracucchi
Department of Chemistry, Biology and Biotechnologies, University of Perugia, Italy
Roberta Selvaggi
Department of Chemistry, Biology and Biotechnologies, University of Perugia, Italy
Anna Fagotti
Department of Chemistry, Biology and Biotechnologies, University of Perugia, Italy
Francesca Simoncelli
Department of Chemistry, Biology and Biotechnologies, University of Perugia, Italy
Ines Di Rosa
Department of Chemistry, Biology and Biotechnologies, University of Perugia, Italy

KEYWORDS: AMPHIBIANS, CLIMATE CHANGE, TIME-LAGGED CORRELATION

In long-lived organisms the impacts of environmental changes may become evident after time, possibly in future generations. We investigated possible delayed effects of meteorological changes on mixed populations of water frogs of peninsular Italy (B–H system) consisting of the parental species Pelophylax bergeri and the hybrid Pelophylax kl. hispanicus, breeding in small water bodies located in Lake Trasimeno and Upper Tiber River basins, by using a time-lagged correlation analysis. We found that the availability of water affects the water frog dynamics with definite time delays, corresponding to specific life-history phases. Our data suggest that the water availability in late summer-early autumn affects the survival of tadpoles and water frogs migrating from the breeding site, with no differential effect on the parental species and the hybrid, whereas the water availability during autumn has a greater impact on the fecundity and/or reproductive success of the parental species. Two potential, possibly co-occurring, effects of meteorological conditions could explain the observed population dynamics: I) a cumulative and symmetric effect on mortality, and II) a point and asymmetric effect on recruitment. The best time-lagged regression equations indicate that the water frogs are threatened for values of the annual de Martonne aridity index lower than 20 mm °C-1. A significant decline of the studied populations is also predicted in the current scenario of climate change. (Rossi R. was supported by 2007-2013 ESF “Competitiveness and Employment objective” Umbrian Regional Operational Programme (ROP), Avviso pubblico aiuti individuali per la realizzazione di progetti di ricerca)

PRESENTATION TYPE: ORAL

SURFACE SEDIMENT QUALITY IN TRASIMENO LAKE

Nicola Morgantini
Regional Agency for Environmental Protection of Umbria (ARPA Umbria), Italy
Luca Peruzzi
Regional Agency for Environmental Protection of Umbria (ARPA Umbria), Italy

KEYWORDS: SURFACE SEDIMENT, METALS, NUTRIENTS

Trasimeno lake, located in Umbria (Italy), is a shallow lake (average depth of 4.5m) and the largest lake of peninsular Italy, with a surface area of 121 Km2. The study of surface sediments was carried out in the framework of the “Osservatorio Trasimeno” project, with the aim of providing a technical support to the government institutions on the management of environmental issues in the lake basin. During the September 2008 surface sediment samples were collected at 23 locations, by using a Van Veen grab sampler. The samples were analyzed for the following parameters: dry weight (105°C), PCB, TOC, Ctot, Ntot, Ptot, IPA, metals and pesticides. Multivariate statistical analysis divides lake into four sectors based primarily on metals and nutrients. We present the spatial distribution of some metals and nutrients concentration in shallow sediments. Mapping of these parameters was performed by using sequential Gaussian simulations (sGs) algorithm (Deutsch and Journel, 1998). The evaluation of the surface sediment quality was carried out by comparison of data concentration with national and international standard quality. In particular, the comparison with LCR (Livelli Chimici di Riferimento-APAT, 2008) and SQG (Sediment Quality Guidelines), proposed by McDonalds (2000), shows critical level concentration for Ni, Cr and, to a lesser extent, for As. Moreover, the comparison with CSC (D.Lgs.152/06) shows that only Se presents a considerable proportion of data with concentration above the limit. Finally, the elevated Ctot and TOC concentration are due to the particular ecological and trophic status of the lake, characterised by elevated biological activity.

PRESENTATION TYPE: POSTER

HOW TO FACE SWARMING OF PESTIFEROUS CHIRONOMIDS (DIPTERA) AT LAKE TRASIMENO

Elda Rosa Gaino
Dipartimento di Chimica, Biologia e Biotecnologie, Università degli Studi di Perugia, Italy
Bernardino Ragni
Dipartimento di Chimica, Biologia e Biotecnologie, Università degli Studi di Perugia, Italy
Alessandra Di Veroli
Dipartimento di Chimica, Biologia e Biotecnologie, Università degli Studi di Perugia, Italy
Matteo Pallottini
Dipartimento di Chimica, Biologia e Biotecnologie, Università degli Studi di Perugia, Italy
Gianluca Paggi
Provincia di Perugia, Servizio Difesa e Gestione Idraulica, Italy
Alessandro Maria Di Giulio
USL Umbria1, Italy
Elisa Chiodini
Studio Naturalistico Hyla snc, Tuoro sul Trasimeno, Italy
Cristiano Spilinga
Studio Naturalistico Hyla snc, Tuoro sul Trasimeno, Italy
Enzo Goretti
Dipartimento di Chimica, Biologia e Biotecnologie, Università degli Studi di Perugia, Italy

KEYWORDS: NUISANCE MIDGES, CHIRONOMIDS, INTEGRATED CONTROL

In recent years, Lake Trasimeno has been affected by massive chironomid swarms, particularly in 2003. Waterfront resident and touristic activities markedly suffered from this annoyance. Therefore, since 2004, Local Administrations have promoted diversified actions in order to withstand the explosion of these insects with an attempt not to damage the ecosystem: 1) Larval control: treatment with Bacillus thuringiensis var. israelensis; this choice is justified by the low toxicological impact compared to commonly used insecticides. The bacterial activity takes place 12-18 hours after treatment and lasts for some days. 2) Adult control: i) use of insecticide at low toxicity (pyrethroids), limited to the area located at least 20 m from the lake and only during periods of massive swarming; ii) installation of 200 bat boxes, uniformly distributed, has been successful and raised awareness towards the protection of the bats, thus emphasizing their ecological role; iii) diversion from inhabited areas by means of outdoor lighting, called “tofo-lamps” (no. 150), set up along the littoral zone. This technique exploits the sensitiveness of numerous insects to photoreception. In respect to the negative environmental impact owing to the spreading of insecticides, tofo-lamps and bat boxes have less impact on the environment. The use of the integrated control at Lake Trasimeno represents a remarkably innovative method for limiting the largest swarms of the chironomids in anthropic areas. This approach should be taken in due consideration in management programs aimed to protect the integrity of lacustrine ecosystems.

PRESENTATION TYPE: ORAL

LAKE TRASIMENO BETWEEN PAST AND FUTURE

Alessandro Ludovisi
Dipartimento di Chimica, Biologia e Biotecnologie, Università degli Studi di Perugia, Italy

KEYWORDS: WATER QUALITY, CLIMATE CHANGE, WATER RESOURCE MANAGEMENT

Lake Trasimeno is the largest lake of the Italian Peninsula. The strict dependence of its water balance on meteorological conditions has caused dramatic floods and droughts over the centuries, and human interventions have been made in order to regulate the lake level since Etruscan or Roman times. The outlet restructuring and progressive lowering of the artificial outlet threshold performed during the 19th century produced a rapid shift toward a shallow-lake condition, with significant changes on lake functioning and ecosystem structure. The problems related to water level changes still remains unsolved, and the current scenario of climate change raises new issues for lake conservation. The analysis of fifty-years data series of the main meteorological and water quality variables has shown that the recent meteo-climate changes have determined a continuous fluctuation in the water level and a progressive dominance of evaporative conditions, with strong effects on water quality variables (particularly water transparency, salinity and alkalinity). Predictions obtained by a hydrological model that incorporates climate forcing and current water regulation policies indicate that critical prospects emerge if the intermediate or the maximum rates of change estimated by global climate models are assumed. Under these circumstances, currently feasible mitigation measures seem effective in preventing severe water shortage in the next decades, but ineffective in preventing the drainage of the lake in the second half of the century.

PRESENTATION TYPE: ORAL

HEMPMADE WEFTS AND WEAVINGS - ETHNOGRAPHIC AND LINGUISTIC ASPECTS OF TRASIMENO LAKE'S TEXTILE TECHNIQUES

Glenda Giampaoli
The Hemp Museum, Perugia, Italy
Antonello Lamanna
Voxteca - University for Foreigners of Perugia, Italy

KEYWORDS: ETNOGRAPHIC, ETHNOLINGUISTIQUE, TEXTILE TECHNIQUES, FISHERMAN , HEMP, TECHNICAL LANGUAGE

Hemp was widely cultivated in Trasimeno Lake area until 1970s. Hemp was cultivated for textile purpose, for the creation of ropes, clothes, trusseaux. In Trasimeno Lake area hemp above all was used in order to create fishnets. According to the researches conducted by Italian Lakes Linguistic Atlas' experts in cooperation with the Hemp Museum of Sant'Anatolia di Narco, in some lacustrine villages, as for example San Feliciano and Passignano sul Trasimeno, hemp, once carded and spinned by the women, wifes and daughters of the same fishermen, was weaven and transformed into fishnets. Recently, some eighty-years-old fishnet menders have handed down their knowledge and skills to San Feliciano women who have reintroduced these techniques as the basis of their embroideries by opening the Filet Modano Lace School in San Feliciano. The school, where one of the fishnet menders teaches, represents the plot of local women's historical memories, knowledge and skills.

PRESENTATION TYPE: ORAL

IMPACT OF WATER LEVEL CHANGES ON THE SPONGE POPULATION OF LAKE TRASIMENO: A PALEOLIMNOLOGICAL PERSPECTIVE

Alessandro Ludovisi
Dipartimento di Chimica, Biologia e Biotecnologie, Università degli Studi di Perugia, Italy
Elda Gaino
Dipartimento di Chimica, Biologia e Biotecnologie, Università degli Studi di Perugia, Italy
Manuela Rebora
Dipartimento di Chimica, Biologia e Biotecnologie, Università degli Studi di Perugia, Italy
Francesca Scoccia
Dipartimento di Chimica, Biologia e Biotecnologie, Università degli Studi di Perugia, Italy
Silvana Piersanti
Dipartimento di Chimica, Biologia e Biotecnologie, Università degli Studi di Perugia, Italy
Luca Giorgio Bellucci
Istituto di Scienze Marine, U.O.S. di Bologna, CNR, Italy

KEYWORDS: BIODIVERSITY CONSERVATION, SPONGES, WATER RESOURCE MANAGEMENT

The progressive lowering of water level, mostly due to human interventions, experienced by Lake Trasimeno during the 19th century has arguably caused significant effects on the biocoenotic composition of the lake, particularly in the littoral areas. This research shows the results of an analysis of siliceous sponge remains (spicules) accumulated in the lake sediments over the last 150 years. A morphological analysis revealed that sedimentary sponge remains are attributable to Ephydatia fluviatilis, the only sponge species found in the lake in recent years. A stratigraphic analysis showed that the abundance and size of the sponge spicules have remarkably decreased, suggesting that a significant depletion of the sponge fauna occurred, particularly during the first half of the twentieth century. A correlation analysis has identified morpho-hydrological variables related to lake depth as the most significant factors explaining the change in density and size of sponge spicules. Response curves obtained by regression predict that the population is expected to survive marginally below 3 m of mean lake depth. Two ecological explanations of the sponge decline are proposed, based on the sensitivity of the sponge both to the availability of suitable hard substrata for colonization, and to the amount of wind-resuspended solids. The results suggest that the sponge population of Lake Trasimeno is increasingly endangered in the current condition and perspective of water level change. Also, the results support the use of sponge spicules as a paleohydrological and paleoecological proxy, application of which appears particularly promising for shallow-water systems.

PRESENTATION TYPE: ORAL

DRIVEN BY INVASIONS: MAIN STRUCTURAL CHANGES IN THE FOOD WEB OF THE TRASIMENO LAKE OVER THE PAST 100 YEARS

Giorgio Mancinelli

Department of Biological and Environmental Sciences and Technologies, University of Salento, Centro Ecotekne, Italy

Alessandro Ludovisi

Department of Cellular and Environmental Biology, University of Perugia, Italy

Massimo Lorenzoni

Department of Cellular and Environmental Biology, University of Perugia, Italy

KEYWORDS: ECOLOGICAL NETWORKS, INVASIVE SPECIES, FOOD WEB STRUCTURE

Food web theory is to date acknowledged as a comprehensive conceptual framework for modern ecology. In the last decade, a substantial shift has occurred in the aims of investigations focused on food webs and, in general, ecological networks. Issues and specific aspects conventionally relegated to advanced theoretical discussions, have received increasing attention within a strictly practical contextfor conservation and management applications. Here, a previously unattempted attempt has been made to analyze a considerable body of previously published information available on the Trasimeno lake food web. A preliminary, yet exceptionally detailed connectance web was produced, containing 202 species and 955 links. The topological network included 19 species of fish, 11 parasites, 88 macrobenthic taxa, 75 zooplanktonic species. Incomplete information on trophic linkages between consumers and macrophytes and phytoplankton imposed the inclusion in the network of these two taxonomic groups, notwithstanding their diversity, as single nodes. The Trasimeno network is a first example for Italy, and one of the few available for lacustrine environments in Europe. The availability of information on the introduction of alien species in the Trasimeno lake, both vertebrates (e.g., fish: Ameiurus melas, Micropterus salmoides) and invertebrates (e.g., the crayfish Procambarus clarkii), allowed a scrutiny of the structural changes progressively determined by each invasive species on the lake food web; accordingly, a number of effects on the ecosystem functions and processes (e.g., changes in primary producers biomass) have been identified, and are discussed in detail in relation to the available data.

PRESENTATION TYPE: ORAL

LAKE TRASIMENO AS A BASE FOR THE WIDESPREAD OF PROCAMBARUS CLARKII IN CENTRAL ITALY

Ambrosius Josef Martin Dörr
Università di Perugia, Dipartimento di Chimica, Biologia e Biotecnologie, Italy
Antonia Concetta Elia
Università di Perugia, Dipartimento di Chimica, Biologia e Biotecnologie, Italy

KEYWORDS: PROCAMBARUS CLARKII , INVASIVE SPECIES, LAKE TRASIMENO

In LakeTrasimeno the Non Indigenous Crayfish Species (NICS) Procambarus clarkii was recorded for the first time in 2001. This invasive species acclimated well in this shallow lake as shown by values of both condition indexes Tw/B and Hlw, and by the theoretical maximum length of cephalothorax reachable for females (73.71 mm) and males (69.35 mm).Both sexes have an elevated growth rate (k >0.6). Notable is, being P. clarkii a warm water species (Louisiana, USA), it is capable to molt at every temperature and often at very low ones, between 5°C and 12°C. Moreover, hatching pleopodal eggs and growth of juveniles takes place at temperatures between 5°C and 17°C, thus indicating that P. clarkii could potentially reproduce even in mountainous freshwater courses. The lack of challengers, the high fertility, the plasticity of the reproductive cycle and the ability to withstand environmental extremes are the best conditions for the widespread of this species. P. clarkii was the first non indigenous freshwater crayfish recorded for the Umbrian region (LakeTrasimeno) at the beginning of this century, and since then this species was illegally introduced and acclimated well in several water courses and lakes in Central Italy. Moreover, P. clarkii is able to walk up to 4 km per day on dry land, and therefore, a further expansion cannot be excluded.

PRESENTATION TYPE: ORAL

LAKE TRASIMENO IN THE FIRST HALF OF THE XX CENTURY: POLITICS, CULTURE, ECONOMIC AND SOCIAL PRACTICES

Nicoletta Stradaioli
University of Perugia, Italy

KEYWORDS: ITALIAN FASCISM, ENVIRONMENTAL MANAGEMENT, SYMBOLIC CONNOTATIONS

In the course of the traumatic transition from the Liberal State to the Fascist State, the political, economic and cultural life of the Trasimeno area underwent profound changes, affecting the distinctive relationships that the people of the region had with the “Lake of Perugia”. From the late XIX century to the first half of the XX century, the Trasimeno area witnessed different political, economic and cultural practices, showing various preliminary models for environmental management. Different social actors and different authorities played a leading role in shaping the interaction of human society and the environment. The historical period under examination highlights conflicts and contradictions, but also continuity in the management of the Trasimeno region. In this context, this paper aims at providing an analysis of the following issues: a) the competing economic, political and cultural interests characterizing the conservation and maintenance of the natural resources of the Umbrian lake; b) the symbolic and ideological connotations of the Trasimeno area; c) the idea of protecting the environment which the fascist regime supported. Local and national politics are examined to illustrate: a) the interaction between broad public interests and elite interests, b) the relationship between environmental management and conservatism, c) the influence of science and culture in the perception of nature. This kind of analysis could be the starting point for a critical rethinking of sustainable human-environment interactions and a reform of environmental sensibility about the area.

PRESENTATION TYPE: ORAL

LONG-TERM CHANGES OF PHYTOPLANKTON ASSEMBLAGES IN LAKE TRASIMENO

Antonia Concetta Elia
Dipartimento di Chimica, Biologia e Biotecnologie, Università di Perugia, Italy
Chiara Todini
Dipartimento di Chimica, Biologia e Biotecnologie, Università di Perugia, Italy
Maria Illuminata Taticchi
Dipartimento di Chimica, Biologia e Biotecnologie, Università di Perugia, Italy
Ludovisi Alessandro
Dipartimento di Chimica, Biologia e Biotecnologie, Università di Perugia, Italy

KEYWORDS: LTER-ITALY NETWORK , PHYTOPLANKTON, LAKE TRASIMENO

Long-term ecological research (LTER) plays a crucial role in tracing and predicting ecosystem trends in response to environmental changes and anthropogenic disturbances. Within the LTER-Italy network, which is part of the International LTER network, an increasing scientific effort is concentrated on freshwater environment. Lake Trasimeno has been a subject of naturalistic and ecological investigations since the beginning of the last century. Systematic studies have been conducted especially since the foundation of the Institute of Hydrobiology and Aquaculture G.B. Grassi in 1951. In this contribution, we present the results of an analysis of monthly data series of phytoplankton collected in several years in the period 1969-2012. The evaluation of the magnitude of variation among different years was performed by using a multivariate index of similarity, in order to identify the main changes in phytoplankton structure and diversity. First, monthly data series collected in subsequent years were compared in order to estimate the short term variability of phytoplankton in Lake Trasimeno. Second, the similarity among different periods was evaluated in order to identify significant long term trends or fluctuations. Overall, the results reveal a relatively low short-term variability in phytoplankton assemblages. By contrast, long term changes are significant, particularly when comparing samples collected in 1991 and 2012. A general shifts of dominance towards Cyanobacteria is observed, possibly in relation to climate-driven changes and/or biological impacts by non-indigenous species

PRESENTATION TYPE: POSTER

REED-BEDS DECLINE: NEW OCCURRENCES OF A DRAMATIC THREAT TO BIODIVERSITY IN CENTRAL ITALY

Lara Reale
Università di Perugia, Dipartimento di Scienze Agrarie Alimentari ed Ambientali, Italy
Andrea Coppi
Dipartimento di Biologia, Università di Firenze, Italy
Lorenzo Lastrucci
Dipartimento di Biologia, Università di Firenze, Italy
Bruno Foggi
Dipartimento di Biologia, Università di Firenze, Italy
Roberto Venanzoni
Dipartimento di Chimica, Biologia e Biotecnologie, Università di Perugia, Italy
Francesco Ferranti
Dipartimento di Scienze Agrarie, Alimentari ed Ambientali, Università di Perugia, Italy
Daniela Gigante
Dipartimento di Chimica, Biologia e Biotecnologie, Università di Perugia, Italy

KEYWORDS: PHRAGMITES AUSTRALIS, REED-BEDS DECLINE, CENTRAL ITALY

In Europe, wherePhragmites australis (Cav.) Trin. ex Steud.is considered a native taxon, reed-beds are extremely important for biodiversityconservation, particularly in Mediterranean areas, where the hydrologic balance of wetlands may be very fragile. After the first detection of reed die-back in N- and C-Europe in the last decades, evident signs of deterioration have been detected also in freshwater habitats of the Mediterranean Basin, first in the Po Delta and then at Lakes Trasimeno, Chiusi and Montepulciano.This decline have been referred to a complex interplay of factors and their mechanism has not been exhaustingly explained yet. The overall goal of our research, carried out within a national research project (FIRB 2013), is to compare the status of five reed populations in different freshwater ecosystems in Central Italy (Colfiorito Marsh, Lake Trasimeno, Lake Chiusi, Fucecchio Marshes, Lake Vico), in order to detect the principal ecological factors and the physiological mechanisms involved in this process. Preliminary data and first outcomes will be illustrated along with the economical and environmental impact of our research. Considering the suitable role of common reed as a good biomarker for monitoring aquatic ecosystems, our research will also supply useful tools for monitoring the conservation status of reed-dominated palustrine ecosystems, many of which are natural areas, including Natura 2000 and Ramsar sites.

PRESENTATION TYPE: ORAL

LONG-TERM DRAGONFLY COMMUNITY CHANGES AT LAKE TRASIMENO

Elda Rosa Gaino
Dept of Chemistry, Biology and Biotechnology, University of Perugia, Italy
Alessandro Dell'Otto
Dept of Chemistry, Biology and Biotechnology, University of Perugia, Italy
Enzo Goretti
Dept of Chemistry, Biology and Biotechnology, University of Perugia, Italy
Gianandrea La Porta
Dept of Chemistry, Biology and Biotechnology, University of Perugia, Italy

KEYWORDS: ODONATA, DIVERSITY ANALYSIS, LAKE TRASIMENO

Monitoring has a long history in entomology with long-term data series being used to develop forecasting systems, bioindication insights, multi-scale atlases, and trends on species conservation status. One of the key reasons for monitoring insects is to ensure protection of rare and threatened species and communities. Nonetheless insects are also informative indicators of ecosystem function and system health. As a charismatic group of taxa, dragonflies have long received the attention of researchers across the world. At Lake Trasimeno the odonatological community was investigated since the 1960s and the monitoring activities conducted in the years 2011-2013 depicted a new scenario about species inventory, distribution and conservation status. The study of the community pattern by means of the analysis of the main diversity components (similarity, species replacement and richness difference) revealed changes related to the effects of different drivers. Land use modification and habitat heterogeneity loss seem to play a prominent role. It is well known that dramatic changes affected the plant communities in the lacustrine ecosystem, with reference to the same period of observation. Locally, some restoration projects have been implemented, allowing the improvement and the reappearance of some lost or rare habitats positively affecting the dragonfly assemblage. These actions may represent models for the future in order to safeguard a rich and diverse odonatological community and a healthy ecosystem at Lake Trasimeno.

PRESENTATION TYPE: ORAL

MS07-01
ILBM

TURNING BEYOND JUST WATER SUPPLY AND SANITATION CONSERVING THE RIVERS AND LAKES OF KENYA

Ann Obae

Water Services Trust Fund, Nairobi, Kenya

KEYWORDS: INTERGRATED WATER RESOURCES MANAGEMENT, WATER RESOURCES DEVELOPMENT CYCLE, WATER SUPPLY AND SANITATION

Integrated Water Resources Management (IWRM) has emerged during the last decade to respond to diminishing planet's freshwater resources among them lakes and rivers. Thus the need to move away from sub-sector based approaches (water supply and sanitation (WATSAN), irrigation, industry, etc. to a more holistic or integrated approach to water management. Kenya is classified as a water scarce country with only 647 cubic meters of renewable freshwater per capita. Annual ground safe water abstraction is approximately 193 million cubic meters(National Water Master plan 1992). In the past our water development has been demand driven but now focus is shifting to Integrated Water Resource Management. Kenya water report, 2005. UN-WATER/WWAP/2006/12. Water Resources Development Cycle approach in Kenya is aiming at holistic integrated water resource management. Intergrating environmental, social and economic aspects as per "The Dublin conference 1992 on Integrated Water Resources Management. The Water Resource Users Association focuses on the management and conservation of the water resources of a particular area, river, lakes or aquifer for controlled, effiecient, sustainable and legal water uses. Safeguarding the reserve flows for downstream ecological demands and basic human requirements, thus reduce water use conflicts and catchment conservation measures to improve water quantity and quality. The outputs include sub catchments management plans , water allocation plans, pollution survey reports, rain water harvesting technologies, catchment protection ,rights based approaches, monitoring and information, financing and implementation, among others. Water supply,sanitation and Intergrated Water Resources Management must work together if we must keep our taps running!!!

PRESENTATION TYPE: ORAL

ILBM FRAMEWORK APPLICATION IN RESTORING AND CONSERVING A RELIGIOUS LAKE: PUSHKAR

Jagdish Kapri
Pushkar Sarovar Samvardhani, Rajasthan, India

KEYWORDS: PUSHKAR, SAROVAR, LAKES, BRAHMA, ILBM, WATER CONSERVATION, PILGRIMAGE, CAMEL FAIR

Pushkar comprises of three water bodies dedicated to the Hindu Trinity of Brahma, Vishnu and Mahesh.Pushkar where water is very manifestation of God is revered as one of the five ancient sacred lakes of Hindus. Pushkar finds mention in many scriptures. Today Madhya Pushkar (middle), a huge step well has completely dried up and Kanishtha or Budha Pushkar is at the verge of extinction. The main lake has dried up twice in last ten years and water level is being maintained by pumping in 3 million liters of fresh ground water every day. With ground water level depleting rapidly (from 3 meters 30 years ago to 30-40 meters today), population and pilgrims on rise and possibility of rains failing again (average annual rainfall 400-600 millimeters) the very existence of Pushkar is at stake. The alarming situation prompted the government to act. The lake was excavation and 3 concretized channels were built. However, the situation has not really improved. The key lake basin governance issue therefore is an immediate scientific and technical intervention to check the continuing seepage and improve water level and quality in all three water bodies and to improve the ground water situation in Pushkar. The Paper examines how the six-pillar ILEC/ILBM Framework for sustainable management and conservation of lake-basin resources can be applied to address the complex issues faced by lake basins in Pushkar reeling under the weight of outdated religious and cultural beliefs and control of an orthodox priests' lobby over the lakes and Ghats!

PRESENTATION TYPE: ORAL

CURRENT IWRM PRACTICES IN MALAWI AND THEIR IMPLICATIONS ON LAKE BASIN MANAGEMENT

Clara Chidammodzi
Nagoya University Graduate School of Engineering, Nagoya, Japan
Victor S. Muhandiki
Nagoya University Graduate School of Engineering, Nagoya, Japan
Nyasha Dumba
Nagoya University Graduate School of Engineering, Nagoya, Japan

KEYWORDS: INTEGRATED LAKE BASIN MANAGEMENT (ILBM) , INTEGRATED WATER RESOURCES MANAGEMENT (IWRM), WATER RESOURCES MANAGEMENT ASSESSMENT

Malawi is endowed with abundant water resources which include Lake Malawi, a Great African Lake hosting the greatest freshwater fish biodiversity in the world. The country's Integrated Water Resources Management/Water Efficiency (IWRM/WE) Plan for the 2008-2012 period aimed to improve the livelihoods of the people through sustainable development, use and management of water resources. In line with the National Water Policy, the plan identified five priority focal areas and 17 components forming the strategic framework for implementation. Priority projects were identified for each strategic area and they were to be implemented within the IWRM/WE Plan implementation period. This study assesses the effectiveness of the implementation of the IWRM/WE Plan, highlights achievements made and challenges encountered, and draws insights on how to incorporate Integrated Lake Basin Management (ILBM) within the IWRM framework to ensure sustainable management of lakes in the African context. Considering that the IWRM concept seeks to attain a balance between water for livelihoods and water for nature, the assessment has also focused on whether or not the projects: (1) collectively worked towards maintaining the resource base; (2) took into account all users; (3) utilized decentralized structures; (4) recognized women's role and improved their access to water; and (5) empowered poor people, helped reduce poverty, improved livelihoods and promoted economic growth. Documents review, key informant interviews, questionnaire survey and on-site observations are the methods employed. Results show that the IWRM process involved various stakeholders, the plan guided efficient investments in infrastructure, and there is some contribution to better livelihoods.

PRESENTATION TYPE: ORAL

PROMOTING INTEGRATED LAKE BASIN MANAGEMENT PLATFORM PROCESS: A CASE OF LAKE NAKURU BASIN, KENYA

Jackson Akama Raini
FlamingoNet, Nakuru, Kenya
Samuel Ngige Kimani
County Government of Nakuru, Kenya
Fred Omengo
Kenya Wildlife Service, Kenya

KEYWORDS: NAKURU, ILBM, LAKE MANAGEMENT

Lake Nakuru, located in the Lake Nakuru National Park in Kenya's Rift Valley region, is a closed and shallow lake exhibiting fluctuating water level and volume. It has a surface area of about 40-60 km2 and a catchment area of about 1,800 km2. Having no outflowing river, its water level is controlled by the balance between river, groundwater (springs) and precipitation inflows, and evaporation and infiltration outflows. In 2005, as part of the GEF-funded project, "Toward a Lake Basin Management Initiative: Sharing Lessons and Experiences from GEF and non-GEF Lake Basin Management Projects," Lake Nakuru was selected among 28 global cases to detail experiences and lessons learnt regarding Integrated Lake Basin Management (ILBM). ILBM is a comprehensive lake management approach for achieving sustainable management of lakes through gradual, continuous and holistic improvement of lake basin governance. Launched in Nakuru in December 2011, the first ILBM activity was preparation of the Lake Nakuru Lake Brief describing the current state of lake basin management. Water uses and management issues are identified and discussed. The issues, needs and challenges regarding the ILBM governance 'pillars' (Institutions; Policy; Participation; Knowledge; Technology; Finances) are discussed, followed by adoption of integrated ways and means for meeting the challenges and implementing agreed management actions. The overall significance of ILBM as applied to Lake Nakuru also is highlighted.

PRESENTATION TYPE: ORAL

SOCIOECONOMIC AND INSTITUTIONAL ISSUES OF MANAGEMENT OF TWO FRESHWATER LAKES IN WEST BENGAL, INDIA

Sourya Das
Ashoka Trust for Research in Ecology and Environment, India
Bhagirath Behera
Indian Institute of Technology, Kharagpur, India
Ashok Mishra
Indian Institute of Technology, Kharagpur, India

KEYWORDS: LAKE, MANAGEMENT , INSTITUTION

This paper deals with socioeconomic and institutional issues of managing two freshwater lakes of West Bengal, India. One is a natural oxbow lake (Chupi-char) situated in the Gangetic alluvial zone and the other is a man-made water harvesting structure (Barabundh) situated in the Red-Lateritic zone. The surrounding people, mainly the socially and economically backward section of the society depend on the two lakes immensely for different types of livelihood and economic activities. However, the ecological conditions of the two lakes have been greatly degraded by the underlying property right structure and institutional mechanisms. This in-turn affected the socioeconomic value of the two lakes. In case of Chupi-char, the existing disputes related to property right can not be addressed by the existing fishermen co-operative societies and water users associations. In case of Barabundh, the conflict between the de-facto and de-jure property right has created a void space for management of the lake. No effective measures could be taken due to the existing conflicts. In both the cases, local administration and line departments failed to bring the stakeholders under a common platform for better management of the lakes. This study argues that lack of appropriate national policy for the management of wetlands and lakes disables the capacity of the present government administration to address the underlying institutional issues of lake management. The involvement of NGOs can facilitate the process of proper management.

PRESENTATION TYPE: ORAL

WATERSHED COUNCILS AS AN ALTERNATIVE FORM OF PUBLIC PARTICIPATION IN IL2BM: A PROPOSAL BASED ON A DESCRIPTIVE ANALYSIS OF THEIR PLANNING PROCESSES

Sergio Antonio Silva Muñoz
Universidad de Guanajuato, Guanajuato, Mexico
Marco Antonio Ortìz Rendòn
Antares Consultores en Ingeniería, Guanajuato, Mexico

Lessons learned during fifteen years of the development and implementation of Integrated Lake Basin Management approach (ILBM) and concluding remarks of the WLC14 (Austin Declaration)provide aware that stakeholder involvement is essential for successful lake basin management and that it is needed to go beyond lentic waters to include lotic waters and evolve toward an Integrated Lentic Lotic Basin Management approach (IL2BM), if sustainable water resources management is to be achieved. In this study, a descriptive analysis carried out on the planning processes used by three watershed councils -partnerships representing the different interests in the basin by bringing together local stakeholders from private, local, state, and federal sectors- in Oregon State enabled us to know that these partnerships plan the protection and restoration strategies for lentic-lotic water systems in a holistic way. In addition, it was possible to figure out that council members collaborate to identify issues, promote cooperative solutions, focus resources, agree on goals for watershed enhancement, and foster communication among all watershed interest groups, as recommended by the ILBM pillar for stakeholders´ participation. Thus, under the premise that the IL2BM approach will need to adopt new or adapted forms of public involvement, and based on the Oregonian experience using watershed councils to plan the management of lentic-lotic systems, this work concludes that watershed councils make a feasible alternative form of public involvement in the IL2BM approach.

PRESENTATION TYPE: ORAL

ILBM AS A NECESSARY PROCESS FOR MANAGEMENT OF LAKES OHRID, PRESPA AND SHKODRA/SKADAR

Arduen Karagjozi
Ministry of Environment, Albania
Andrin Kerpaci
Drejtues Teknik, Albania
Alket Kumaraku
Polytechnic University of Tirana, Albania

KEYWORDS: ILBM PROCESS, LAKE OHRID, PRESPA AND SHKODRA/SKADAR, WATER FRAME DIRECTIVE (WFD)

Albania is an important joint in West Balkan, as regard to diversity and quantity of water resources. The watershed area is 43,305 Km2 while the territorial area is 28,748 Km2 and about 41.7 Km3/year of fresh water is discharged to the sea. Inside territorial area Albania shares with its neighbor three main lakes in the Balkans with historical and environmental values and international importance as Ohrid Lake (A=358 Km2; max.depth 289m), Prespa Lake (A=259 Km2; max.depth 54m) and Shkodra Lake (A=530 Km2; max.depth 44m). EU countries, or potential candidate countries must align their legal framework with the WFD, which is a very important document, setting strict criteria regarding to river basin management plans (including the Lakes) , but also monitoring and quality standards for surface water. However the whole process seems like a black box process which, compels EU member states, to take measures to achieve within deadlines, water quality standards. It seems that is designed specifically to be applied in developed countries of Europe which during certain stages of their industrial and economic development, have caused significant damage to the environment. Albania and Balkan countries are known for their low economic and industrial development and consequently damages to environment have been smaller. To protect those lake environmental values and to stop and prevent their degradation ILBM concept is the right one to apply in the management of the three lakes at the national level but also internationally EU WFD is the objective to be achieved while the mechanism for attaining these standards to the management of lakes, but not only is ILBM process. ILBM process should be guideline of all different Projects and policies for a sustainable management of these lakes.

PRESENTATION TYPE: POSTER

EVOLUTION OF INTEGRATED LAKE BASIN MANAGEMENT (ILBM): FROM PRINCIPLES TO PRACTICE

Walter Rast
Texas State University, USA

KEYWORDS: ILBM, GOVERNANCE, ECOSYSTEM SERVICES

Integrated Lake Basin Management (ILBM) is a comprehensive approach originally developed for managing lakes through gradual, continuous and holistic improvement of basin governance. Its genesis was spearheaded by the International Lake Environment Committee (ILEC) through a series of steps involving: (1) development of a guiding vision for managing lakes for sustainable use; (2) analyzing lessons learned from multiple lakes and reservoirs around the world to identify the efficacy of previous management experiences; and (3) identifying lake basin governance elements critical for facilitating sustainable use of lakes and reservoirs and their life-supporting ecosystem services. The first step focused on developing the World Lake Vision, with its seven management 'Principles.' The second step involved a global-scale Lake Basin Management Initiative (LBMI) to analyze lake basin management experiences from 28 lakes and reservoirs around the world to identify the strengths and limitations of previous lake management efforts. Building on these previous efforts, the culmination of this evolution was the development of the Integrated Lake Basin Management (ILBM) platform process for managing lakes, their basins and their resources for sustainable use. Having subsequently been applied in a number of countries around the world, ILBM considers not only lakes and reservoirs, but also the upstream rivers draining into them, the downstream rivers and large marine ecosystems into which they discharge, and the sub-surface aquifers underlying many of them. The Governance 'pagoda,' highlighting the major governance elements comprising ILBM, also is discussed within the context of long-term lake basin management.

PRESENTATION TYPE: ORAL

LONAR LAKE: IMPORTANCE, CURRENT SCENARIO AND CONSERVATION POLICIES.

Kshama Khobragade
S. B. College of science, Aurangabad, India

KEYWORDS: INTEGRATED LAKE BASIN MANAGEMENT, LONAR LAKE CONSERVATION, WATER POLLUTION

India is naturally blessed upon by plenty of water bodies which fulfil the various needs of multicultural communities. On this background the 'Integrated Lake Basin Management' of Lonar Lake holds an important role for its conservation. Lonar Lake, situated in Buldhana District of Maharashtra State in India is a saline water body and an excellent example of natural phenomenon of meteoritic impact occurred before 52,000 years ago. It is an epitome of scientific interest amongst world researchers. Past couple of decades had been witnessed heavy pollution to this water body due to negligence and lack of care of local public and visitors, lake authorities and their corresponding activities towards lake environment conservation. Human interventions like constructions on ejecta blanket, farming, religious practices, washing of clothes and grazing animals, deforestation, sanitation, etc degrade the quality of Lake ecosystem upto a large extent. Number of studies had been conducted in the past two decades on the hydrological, environmental, biodiversity status of the lake, which concluded the great need of adopting ILBM principals. Focused on this, efforts have been made to reduce water pollution, thereby to maintain the healthy aquatic ecosystem of the lake. Lake conservation literacy by means of stakeholders' awareness, regular scientific studies on lake water and its ecosystem, authority meetings, although showed positive changes. There is an urge to make the people aware of its precious ecosystem and to develop a sense of scientific attitude towards it.

PRESENTATION TYPE: ORAL

CONSERVATION AND MANAGEMENT NEEDS OF A RAMSAR SITE: THE ILBM APPROACH

Amit Dubey

Environmental Planning and Coordination Organization, Dept. of Housing and Environment, GoMP, Bhopal, India

Subrata Pani

Environmental Planning & Coordination Organisation, EPCO, Bhopal, India

M.R. Khan

Environmental Planning & Coordination Organisation, EPCO, Bhopal, India

KEYWORDS: RAMSAR SITE, ILBM, BHOJ WETLAND

Conservation and Management needs of a Ramsar Site: The ILBM Approach Amit Dubey, Subrata Pani and M.R Khan. Environmental Planning and Coordination Organization, Paryavaran Parisar, E-5, Arera Colony Bhopal Bhoj Wetland is an important water body of central India located in the city of Bhopal and is the maiden Ramsar site in the state. It caters to the needs of more than 35% of the population of the city for their potable needs and more importantly is a flourishing ecosystem rich in aquatic biodiversity. However like all the other urban water bodies, the wetland is under increasing environmental stress. The population pressure in the catchment of this important wetland is on a constant rise with the inevitable expansion of the city of Bhopal. A mega conservation effort was taken up aimed at environmental conservation and management of this wetland named the Bhoj Wetland project which successfully completed in the year 2004. The success of the project was reflected in overall improvement in the aesthetics in and around the wetland and remarkable improvement in the water quality. However after one decade of the end of the conservation activities, the wetland is subjected to newer environmental challenges. The present paper deals with the environmental issues being faced by the Bhoj wetland in present context and the conservation efforts required in-situ as well as in the catchment of the wetland based on the principles of ILBM. The paper also incorporates the experiences learned during the implementation of the Bhoj Wetland Project and intends the use of the same in strategising the long term management action plan for this all important water body.

PRESENTATION TYPE: ORAL

STRENGTHENING LAKE CHIVERO BASIN MANAGEMENT TECHNOLOGY PILLAR BY HARARE ILBM TEAM, ZIMBABWE

Simon Muserere
University of Zimbabwe, Mount Pleasant Harare, Zimbabwe
P.Tarusarira
ZIE, Zimbabwe

KEYWORDS: CHIVERO, HARARE ILBM TEAM, SCIENTIFIC SOLUTION

The Lake Chivero water quality is an excellent example of how wrong Lake Basin governance can negatively impact on livelihood. With an objective to address the lake's water quality challenge, since 1950s researches have been carried out, regrettably most of the studies focused on understanding the lake's complex dynamic responses. Consequently, huge resources have been sunk, only to expose the lake's uninterrupted deteriorating water quality status, while lack of clear scientific solutions to counter this problem still presents the most costly and painful obtrusive gap. Thus, the Harare ILBM team, a joint collaboration between Harare Local Authority and University of Zimbabwe academia, seeks to proffer scientific solutions to this life threatening monster. The lake being indispensable supports life of more than 2,5 million people whose significant proportion was affected by the 2008 cholera outbreak attributed to drinking contaminated water, ultimately the pandemic spread entire country. Previous studies have blamed discharge of high nutrient loads through wastewater effluents, lack of linkages between stakeholders and administrative structures, poor working partnerships and lack of public awareness in the ecological management of the reservoir. According to UNEP's recent report the management status of Lake Chivero, as a case study of institutional failure, can be defined by comparing its management to guidelines outlined in Environment and Development in Africa Tools for implementing environmentally sustainable development. Finally, four scientifically developed solutions were identified to include vermiculite effluent polishing, Solar Bee technology, methane gas power generation, simulator aided plant optimisation and ecological solutions.

PRESENTATION TYPE: ORAL

THE SOCIO-ECOLOGICAL CONTEXT AND DEVELOPMENT OF AN ILBM FRAMEWORK FOR LAKE TURKANA BASIN

Daniel Olago
Institute for Climate Change and Adaptation (ICCA) & Department of Geology, University of Nairobi, Kenya
Thomas Ballatore
Lake Basin Action Network, Shiga, Japan

KEYWORDS: SOCIO-ECOLOGICAL, DEVELOPMENT, ILBM FRAMEWORK

Lake Turkana, the largest closed-basin lake in the East African Rift, lies in the arid northwestern part of Kenya at about 3°N, 36°E. Most of the lake lies in Kenya, but part of the Omo River (which supplies about 90% of water to the lake) delta lies in southwestern Ethiopia. The rest of the influent surface water flows are from Turkwel-Kerio River and ephemeral streams. The lake's catchment area is about 148,449 km2. Lake Turkana is 250 km long and has a mean width of 30 km, with a surface area of about 6750 km2. The average depth is 35 m while the maximum depth is 115 m. The lake is a critical resource for the people who live within its catchment: agropastoralists in Ethiopia and mostly pastoralists in Kenya. The lake basin has a rich palaeontological and archaeological heritage and is world-famed as the "Cradle of Mankind" due to the early hominid remains that have been found there. It is a fragile environment that has a number of national parks and game reserves, including some endangered species. The human population is relatively sparse but rapidly growing, and poverty levels remain very high. Today, the lake is facing many challenges. Climate change has brought about more frequent and intense droughts with major impacts on the pastoral livelihoods. Changes in water quantity and quality have been observed as a result of land use changes and abstraction of water in the catchment areas. There are also now new large-scale development projects underway such as the building of large hydropower dams and planned large scale irrigation along the Omo River in Ethiopia as well as on-going survey and development of recently discovered fossil fuel resources and other minerals resource extraction in Kenya. The related infrastructure requirements, labour influx and attendant requirement for potable/industrial water and services will place demands on the natural ecosystem services. However, there is currently no established framework for the integrated management of the lake basin. This paper characterises the socio-ecological and development issues in the Lake Basin in the context of the ILBM platform process and develops a framework that can be used for the sustainable management of the lake basin.

PRESENTATION TYPE: ORAL

PROMOTING INTEGRATED LAKE BASIN MANAGEMENT (ILBM): THE INITIAL GLOBAL EXPERIENCE, 2008-2013

Masahisa Nakamura
Shiga University, Otsu, Japan
Walter Rast
Texas State University, USA

KEYWORDS: ILBM, APPLICATION, TYPOLOGY

Managing a water system (lakes, wetlands, rivers, aquifers) for sustainable use is a complex challenge involving a range of interconnected scientific, socioeconomic, political and environmental issues, sometimes even with conflicting or contradictory goals. Integrated Lake Basin Management (ILBM) is an approach for achieving sustainable management of lakes and reservoirs through gradual, continuous and holistic improvement of basin governance, including sustained efforts for integration of institutional responsibilities, policy directions, stakeholder participation, scientific and traditional knowledge, technological possibilities, and funding prospects and constraints. It has been conceptualized on the basis of a premise that achievement in managing lakes, reservoirs and their basins is pursued so that they can continue to provide their wide range of life-supporting ecosystem services that is facing a serious global challenge. To highlight the process and goals, the main purpose of this presentation is to give an overview of the experiences and outcomes of ILBM application between 2008 and 2013, mainly in Asian and African countries at the national level, with additional individual cases in other parts of the world. The typology relates to, for example, the lake/river system features, the extent of ILBM process reached so far, the temporal scope (i.e., prospective vs. retrospective), the schemes under which ILBM application cases were undertaken (e.g., a governmental initiative vs. a non-governmental initiative), and the financial arrangement for implementation. The presentation will be focused on the interpretive discussion of case application results and the challenges faced in promoting ILBM, including the need for a global mechanism for its wider application for evolutionary improvement.

PRESENTATION TYPE: ORAL

THE DEVELOPMENT OF HUMAN RESOURCES: AN ILBM APPROACH TO DESIGN TRAINING PROGRAMS

Naoya Yamamoto
International Lake Environment Committee Foundation, Shiga, Japan

KEYWORDS: INTEGRATED LAKE BASIN MANAGEMENT (ILBM), HUMAN RESOURCES, TRAINING PROGRAMS

Development of human resources is one of the most important factors to ensure sustainable management of lakes and their basins. Based on this belief, International Lake Environment Committee Foundation (ILEC), an organization established by Shiga Prefectural Government, Japan, has been conducting training programs to support capacity building efforts in developing countries since 1989, with most of them being commissioned by Japan International Cooperation Agency (JICA). One of the unique features of ILEC's training programs are that the curriculum is designed based on Integrated Lake Basin Management (ILBM), a conceptual framework for achieving sustainable management of lakes and reservoirs through gradual, continuous and holistic improvement of basin governance, including sustained efforts for integration of institutional responsibilities, policy directions, stakeholder participation, scientific and traditional knowledge, technological possibilities, and funding prospects and constraints. These elements are called "Six Pillars of Governance." Participating in the ILBM-featured programs, the trainees are expected to strengthen their capacity to apply the concept of ILBM for meeting their lake basin management challenges which originate from the products of multi-layered and complicated human activity.

PRESENTATION TYPE: POSTER

INTEGRATED LAKE BASIN MANAGEMENT EXPERIENCE & CHALLENGES EXAMPLES FROM SOUTH ASIA

Ajit Pattnaik
Chilika Development Authority, Odisha, India

KEYWORDS: ILBM, LAKE , BASIN

Integrated Lake Basin Management (ILBM) framework facilitates good governance & sustainable management of lake & it's basin. ILBM is being put to practice with various degree of success in South Asia . In the present case study, application of six principles of the ILBM framework, in 9 wetlands from India i.e. Pushkar, Udaisagar, Bhoj, Ujaini, North Sagar ,Hussain Sagar , Chilika & Powai ; a mix of natural and manmade lakes is analyzed and the following are the outcome; An enabling, adaptive institution with ability to work at multiple scales and engage with diverse stakeholders, harmonized with policy support leads to good governance & sustainability. Investment in restoration of lake & its basin can lead to enhancement of ecosystem services, amelioration of biodiversity, making the system resilient, ensuring sustainability. Participatory research helps in connecting ecosystem to the stakeholders & in translating scientific findings into practice resulting in resource efficient and inclusive management. The ecosystem health report card adopted in Chilika Lake is an excellent tool for assessment of impacts & effectiveness of ILBM and communication at regular interval, to a wide audience i.e. from policy makers to the local communities in a simple format. From the above analysis it is inferred that ILBM is in itself an effective planning and evaluation tool, however integration of the livelihood & strong embedded socio-culture elements (heart-ware) could make it an effective & sustainable in Indian context.

PRESENTATION TYPE: ORAL

DEVELOPMENT OF ILBM PLATFORM FOR NYANZA GULF-LAKE VICTORIA

Obiero Onganga
oonganga@osienala.net
Moses Owuor Oyier

Godfrey Ogonda

Collins Ongore

KEYWORDS: LVEMP II, CLIMATE CHANGE, RESILIENCE, POVERTY

Kenya, as a developing nation is facing intense pressure to industrialization and urbanization. There is struggle to create jobs for the unemployed youth which forms about 65% of the total population. As a result, there is serious impact on natural resources due to promotion of intensive agriculture as well as the urbanization process. These processes coupled with climate change have negated environmental conservation efforts. The Government of Kenya's annual budget is skewed towards development with infrastructure taking the largest share and environmental conservation taking the least. There is no budgetary allocation for lake conservation in particular. The donor funds are also released according to specific interests. The communities living within the lake basin continue to unsustainably harvest the natural resources for their immediate gain and fail to consider the long term dangers. Poor agricultural practices and land tenure system has complicated the protection of delicate habitats. OSIENALA (Friends of Lake Victoria), cognizant of the fact that lake conservation requires multi stakeholder approach, is in the process of developing an ILBM platform for Nyanza Gulf. The organization has forged alliances and partnerships with LVBC, County governments in the lake catchment, universities, KMFRI, LVEMP II, CSOs among others which are key in conservation of the gulf. This paper seeks to highlight the challenges of ILBM platform development process, showcase the efforts made so far by different stakeholders towards the development of ILBM platform for Nyanza Gulf with Community Driven Development (CDDs) sub projects under LVEMP II as the center of focus and outline the future of ILBM platform development for Nyanza Gulf.

PRESENTATION TYPE: ORAL

APPROACHES BY THE IBARAKI PREFECTURAL GOVERNMENT TO IMPROVE WATER QUALITY IN LAKE KASUMIGAURA WITH THE FOREST AND LAKE ENVIRONMENT CONSERVATION TAX

Tatsumi Kitamura

Ibaraki Prefecture, Department of Civil Affairs and the Environment, Environmental Management Division, Japan

KEYWORDS: IBARAKI PREFECTURAL GOVERNMENT, LAKE KASUMIGAURA, LOCAL TAX

The Ibaraki Prefectural Government in Japan introduced a local tax called the â€œForest and Lake Environment Conservation Taxâ€□ in 2008. It is used as a financial source to conserve forests and lakes including Lake Kasumigaura, the second largest lake in Japan. Its annual tax rate is 1,000 yen per person for individuals and 10% of the prefectural corporate tax fixed amount for corporate bodies. The annual revenue of the tax is about 1.6 billion yen. With its revenue, the Ibaraki Prefectural Government has created grants for forest management for activities such as cutting and tree thinning, along with grants for connection to sewage systems and for the introduction of high-quality septic tanks. In addition, the Ibaraki Prefectural Government supports environmental preservation activities by resident groups through this tax revenue. As a result of these efforts and other measures using different financial resources, the COD level of Lake Kasumigaura has improved from 8.8mg/L in fiscal year (FY) 2007 to 7.8mg/L in FY 2013.

PRESENTATION TYPE: POSTER

FIELD-BASE SCIENTIFIC INVENTORY OF THE HIMALAYAN LAKES IN THE EASTERN NEPAL: A CASE OF IMPORTANT CONTRIBUTION IN IMPLEMENTING INTERNATIONAL LAKE BASIN MANAGEMENT (ILBM)

Shailendra Pokharel
Conservation Development Foundation (CODEFUND), Nepal
Mana Prasad Neupane
National Lake Conservation Development Committee, Ministry of Tourism and Civil Aviation, Nepal
Madhukar Khadka
National Lake Conservation Development Committee, Ministry of Tourism and Civil Aviation, Nepal

KEYWORDS: HIMALAYAN LAKE, INVENTORY, CONSERVATION

Nepal demonstrated commitment in conserving Himalayan lakes from 2006 after the establishment of National Lake Conservation Development Committee (NLCDC)/Government of Nepal. The same year it participated in 11th World Lake Conference and became global partner in implementing ILBM both at the national and community levels in generating lake information and improving lake basin environment. NLCDC inventoried map-based 5358 natural lakes in High Mountain, Mid-Mountain, Middle-Hill and Terai regions in 2010, and verified these lakes in 16 administrative districts in east Nepal in 2011 with technical support of Conservation Development Foundation. The Foundation applied Wetlands Inventory, Assessment & Monitoring tool developed by the Ministry of Forest and Soil Conservation with modification by incorporating lake-brief guidelines developed by International Lake Environment Committee Foundation/Japan. Enumerators were trained to apply inventory tool with a focus to generate lake information below 3000 masl particularly on Institution, Policy, Participation, Information and Technology pillars of ILBM. A total of 101 lakes are field verified that have mix-value for biodiversity, livelihoods and religio-culture. District-wise distribution of lakes are reported as Bhojpur (5), Dhankuta (2), Ilam (7), Jhapa (19), Khotang (7), Morang (11), Okhaldhunga (0), Panchthar (9), Sankhuwasava (3), Saptari (8), Siraha (13), Solukhumbu (2), Sunsari (4), Taplejung (3), Tehrathum (4) and Udayapur (4). Most of the lakes are found either converted or degraded. Okhaldhunga posses no lakes but Jhapa holds maximum number of 19 lakes. Most of the lakes are below 8 ha in size; however their importance viewed critical for high altitude biodiversity and livelihoods.

PRESENTATION TYPE: ORAL

MS07-03

Water governance and cooperation for the quality of lentic-lotic-ground water systems

ASSESSMENT OF WATER GOVERNANCE FOR SUSTAINABILITY OF PASHAN LAKE, PUNE, MAHARASHTRA, INDIA

Sayali Joshi
Shrishti Eco-Research Institute (SERI), Pune, India
Bhargavi Thorve
Shrishti Eco-Research Institute (SERI), Pune, India

KEYWORDS: PASHAN LAKE, WATER GOVERNANCE, PUBLIC PARTICIPATION

In the contemporary world, lentic ecosystems are stressed by encroachment, abstraction and weighed down by enormous pollution loads. Pune's migratory avian species' winter solace – Pashan Lake is severely strained due to development in the catchment over a period for more than two decades. Residential and commercial infrastructures developed in the upstream of Pashan Lake has resulted in sewage ingress, increased flash floods, growth of non-native species and unwanted weeds, reduction in biodiversity, and gradually decreased water quality. In this paper, scenario analysis is done to evaluate the current governance in regulating the infrastructural development while protecting the naturalness of the lake on the basis of various human development scales and indices. Attempt has been made to appraise the public opinion and attitude towards the lake governance for the restoration of disturbed environmental, hydrological and social processes and harmony in the catchment of Pashan Lake. It is notable that there was expression of giving enough legroom for public participation in decision – making process for the river and lake restoration projects.

PRESENTATION TYPE: ORAL

GOVERNANCE POLICY REFORMS FOR FACILITATION OF IN-SITU TREATMENT TO RESTORE POLLUTED WATER RESOURCES ECOLOGICALLY

Avinash Akolkar
Central Pollution Control Board, New Delhi, India
Sandeep Joshi
Shrishti Environment and Sustainability Society (SESS), Pune, India

KEYWORDS: POLICY REFORMS, IN-STREAM TREATMENT, ECOLOGICAL RESTORATION

Every day, billions of litres of inadequately treated sewage, industrial and agricultural wastes laden with numerous chemogens and pathogens are discharged into the world's lentic-lotic water systems. Water resources are under stress of exploitation, encroachment and pollution due to unparalleled population growth; and passionate obsession of technology savvy comforts through changing the naturalness of waterscapes - landscapes. Water contamination of natural aquatic ecosystems is affecting humans directly by destroying self-purification capacity of water body, primary productivity causing injuries to biodiversity that affect food chain. Hygienically safe and adequate freshwater is crucial for the continued existence of all living organisms and the smooth functioning of ecosystems, communities, and economies. Given the perception of threat to water resources, local, regional hydrologic cycles and their natural life forms, there is a need to re-instate the wholesomeness, purity, integrity of the water cycle considering the micro-watershed as basic unit of human-water relationship. Its qualitative connection with human health and economic development having community - governance links and responses for effective protection and conservation needs to be ascertained through wide spectrum of right to water security. In this paper, various factors are discussed to enable to evolve basin specific policy for the ecological restoration of polluted water resources for the sustained economic growth of the region and securing the health of the population.

PRESENTATION TYPE: ORAL

INSTITUTIONALIZATION OF INTER-GENERATIONAL PARTICIPATORY GOVERNANCE FOR CONSOLIDATION OF CATCHMENT REFORMS IN THE BASIN OF WLV LAKE YESHWANTSAGAR, UJJANI, MAHARASHTRA, INDIA

Sandeep Joshi
Shrishti Environment & Sustainability Society, Pune, India
Vinod Bodhankar
SETU, Pune, India
Shailendra Patel
Gayatri Pariwar, Pune, India

KEYWORDS: INTER-GENERATION, INCLUSIVE, ENVIRONMENT GOVERNANCE

World Lake Vision (WLV) reservoir Yeshwantsagar, Ujjani, South Maharashtra, India is a classic case of downstream rural water human and constitutional rights trampled by lacunae in upstream urban planning of entire catchment. Inclusion of this Ujjani Lake in World Lake Vision in 2007 has synergized its regional network partners and stakeholders to crystallize and integrate multiple functional rural and urban green initiatives towards sustainability. Basin sustainability approach has led to synergize threads of numerous participatory programmes of rural–rural (water rights initiative); urban–rural (water friendship and culture); and urban–urban (Ramnadi-river basin governance for eco-restoration involving government institutions). In this paper the reform policies are derived through studies of intensified educational, cultural, professional, corporate, social, scientific, technological, spiritual, legislative and governance actions, for example, Bhukum Village-Wells Revival programme, Sagarmitra Recycling Initiative, Devnadi Legislative Initiative and the Rajiv Gandhi Park Green-Bridge Initiative have together forged the most basic levels of participatory governance designed to create a comprehensive foundation of lifestyle transformations across all dimensions of a lake basin population. In this paper, the need of inter-generational strategies of participatory governance is discussed elaborating the deliberate merger of representative-governance and accidental-governance towards inclusive-environmental-governance.

PRESENTATION TYPE: ORAL

SOCIO-ECONOMIC ANALYSIS TO EVOLVE GOVERNANCE POLICY FOR ECOLOGICAL RESTORATION OF POLLUTED WATER BODIES WITH REFERENCE TO STUDY OF POLLUTED RIVER IN LUDHIANA CITY, INDIA

Mangesh Kashyap
Society For Environmental Education Research (SEERAM), India
Pramod Salaskar
Naushadali sarovar sanvardhini Mumbai, India
Shirish Ambegaonkar
Society For Environmental Education Research SEERAM, Pune, India.
Pradnyesh Agre
Ses society Pune, India

KEYWORDS: POLLUTION STRESS, ECONOMY, ENVIRONMENTAL HEALTH

Pollution of inland freshwater systems is a global challenge having very complex reflection in socio-economic structure of the upstream-downstream societies. Discharges from the upstream urban and industrial growth not only pollute the surface waters but ground waters also get polluted severely. In era of global warming, changing climatic trends affecting the water availability in the water basins all over the world, it is essential to reform the socio-economic paradigms of development. In this paper, the studies of socio-economic impacts of constant, uninterrupted dispersal of pollution from point and non-points sources on health and agro-economics is presented with respect to the case study of Ludhiana – the industrial city in Punjab State of India. Pollution control measures are insufficient to tackle the ever-increasing industries and subsequently the population leading to sever contamination of surface water bodies finally ending into Lake Harike – a tail end Ramsar Wetland. Enroute from Ludhiana city to Lake Harike the population and agriculture on the banks of stream receive contaminated water affecting their health and economy. It can be stated that the spreading of contamination through the surface-ground water exchanges has led to various water borne diseases. About 10% of the 40,000 population is suffering from dysentery and various alimentary ailments and 1% of the population is distressed due to cancers. Economically, the downstream rural population is severely facing pollution stress due to degraded quality of crops resulting from use of dirty water. It is recommended that the development policy needs to integrate with goals of attaining regional economic stability commensurate with environmental health and population health.

PRESENTATION TYPE: ORAL

PAYMENTS FOR IMPROVING ECOSYSTEM SERVICES ON THE WATERSHED SCALE: A PUBLIC POLICY INSTRUMENT FOR DEVELOPING COUNTRIES

Hebin Lin
International Lake Environment Committee Foundation (ILEC), Japan

KEYWORDS: ECOSYSTEM SERVICE, POLICY, DEVELOPING COUNTRIES

Developing countries are facing a more and more severe dilemma between economic development and ecosystem protection, especially in designing and implementing effective policies. This study proposes a methodology of Payments for Improving Ecosystem Services on the Watershed Scale (PIES-W) as a solution. PIES-W is founded on institutional and behavioral economic theories. It results in economic-ecological-social win-win-win scenarios for collective actions implementable by diverse stakeholders residing within a watershed. PIES-W will be a powerful public policy instrument for a fundamental transition to sustainable development. A case study is presented to illustrate how to develop and compare different scenarios in the watershed composed of northern Lake Laguna, Pasig River, and Manila Bay in The Philippines. This study intends to draw the attention of natural and social scientists as well as practitioners to a transdisciplinary approach of ecosystem management in the new era of development under the impact of global climate change.

PRESENTATION TYPE: ORAL

GOVERNANCE AND MANAGEMENT STRATEGIES FOR REVIVAL OF SEVEN SACRED LAKES OF HOLY CITY OF UJJAIN, MADHYA PRADESH, INDIA

Anoop Shrivastava
Environmental Planning and Coordination Organization, Bhopal, India
Lokendrta Thakkar
Environmental Planning and Coordination Organization, Bhopal, India

KEYWORDS: SACRED LAKES, WATER GOVERNANCE, INTEGRATED MEASURES

Reverence for Earth, Water, Air, Fire, and Sky, the five constituents of nature and human existence is interwoven in ethos of water governance for living in harmony with nature – a way of life in Indian culture. Decline in the nature-human relationship in technologically modern world has reflected in the deterioration of natural resources. In this paper, the strategies for evolving governance and management plan for seven sacred lakes located at the world famous temple town at an Ujjain has been discussed in the milieu of Indian water culture. These seven lakes namely Rudra Sagar, Vishnu Sagar, Kshir Sagar, Goverdhan Sagar, Purshottam Sagar, Ratnakar Sagar and Puskar Sagar collectively known as Sapta Sagars or Seven Sacred Lakes are struggling for their survival as the water quality is deteriorating and quantity is depleting very fast due to variety of anthropogenic factors. Heavy siltation, pollution load from point are non point sources, hydrology of the catchment, solid Waste intrusion, weed infestation human intervention in the form of religious activities and encroachment in the catchment area are some of the obvious causes of the degradation of these lake systems resulting in reduction in storage capacity, deterioration of water quality, human health, loss of livelihood opportunities. Water governance and management framework for effective implementation of integrated intervention mitigation measures for revival of these environmentally important and religiously significant sacred lakes of Ujjain has been proposed on the basis of on-site scientific and engineering studies of the loss of environmental quality of lake system.

PRESENTATION TYPE: ORAL

THE NEED FOR INTEGRATED AND ECOSYSTEM APPROACH/LENTIC-LOTIC-AQUIFERS SYSTEMS FOR SUSTAINABLE MANAGEMENT OF LAKE AND RIVER BASINS. CASE-STUDIES OF LAKE TURKANA/EAST AFRICA AND LAKE VOLTA/WEST AFRICA

Salif Diop
ILEC Scientific Committee, Senegal

KEYWORDS: INTEGRATED APPROACH, LENTIC-LOTIC-GROUNDWATER SYSTEMS, SUSTAINABLE MANAGEMENT OF LAKE AND RIVER BASINS

Lake Turkana and Lake Volta (and their river basins at large) are transboundary basins as they are both shared by several countries. As Lake Turkana is the largest permanent arid zone lake in the world, Lake Volta created by Akosombo dam originates from a number of small rivers which flow directly into the lake basin. In a changing environment exacerbated by constant climate modifications and increasing competition for water uses due to population increase and economical activities (water for domestic use, for agriculture and for energy), it is crucial for sustainable management of such river and lake basins to carefully consider their intricated and interlinked lentic/lotic/aquifers systems. Future solutions should be to know how to exploit surface and groundwater resources to alleviate domestic water shortage and address economic challenges in such transboundary rivers/lakes systems without using fragmented approaches with each riparian country having its own water management policies. Therefore, it is important to adopt integrated approach for the long term conservation of natural resources by involving local populations and through the application of scientific methods for improving management of both lake basins. While Lake Turkana and Lake Volta basins have high potential for their development, some of the key challenges for their sustainable management are the important degradation of land, water and biodiversity resources as well as the freshwater resources over abstraction for irrigation, the dam construction effects and the impacts of climate change…The options for future solutions with regard to such challenges have to consider the development of common strategies for sustainable management of the basins integrating human well-being with natural resources management. Furthermore, achieving eco-efficient and effective water use, especially given the potential effects and impacts of climate change and the ability to meet the growing demand of many economic activities for water is a necessity; the same for creating an atmosphere of peace, harmony and security by avoiding or alleviating both local communities' water and transboundary related conflicts.

PRESENTATION TYPE: ORAL

SOME THOUGHTS ABOUT STRESS-RESPONSE BEHAVIOR IN LAKES

Satoru Matsumoto
International Lake Environment Committee (ILEC), Japan

KEYWORDS: ECOYSTEM HEALTH, STRESS, CARRYING CAPACITY

Lakes are more vulnerable to stress than rivers because of the three lentic features - Integrating nature, Long retention time, and Complex response dynamics. A lot has been said about this vulnerability of lakes and other lentic water systems, but its management implication is often neglected in global water discussion. In this paper, the author tries to discuss the vulnerability of lake system by comparing basic features of lakes and rivers and by categorizing the stresses put on lakes into three types - Natural stress, Human-induced stress, and Responsive stress. This third stress is a response of a lake system that comes to take effect sometime after accumulation of Human-induced stress within the lake and is the main reason that action does not give the desired effect. It will be illustrated how these three stresses affect the ecosystem health of lakes and their ecosystem service provision overtime on the assumption that impairment of ecosystem health becomes serious when the stress level exceeds the carrying capacity – some stress tolerance level - of lake system. It will also be discussed that action should be taken as early as possible and that action should continue to see the stress level does not go beyond the carrying capacity. This preventive approach requires a constant and careful monitoring of lakes and their environment because lakes usually do not show visible changes until stress level does not exceed their carrying capacity. It also requires scientific knowledge and understanding about various processes taking place in lakes and their effects.

PRESENTATION TYPE: ORAL

MS07-04
Citizen participation in lake basin management

THE YAMAN NG LAWA (BLESSINGS OF THE LAKE) INITIATIVE IN SANTA ROSA CITY, LAGUNA, PHILIPPINES: AN INCLUSIVE, PARTICIPATORY APPROACH TO PUBLIC POLICY DEVELOPMENT

Ramon Pedro P. Paterno
rpppaterno@gmail.com
Jaime Z. Galvez Tan

Leah Adrid Palapar

Amiel Nazer C. Bermudez

April Joy B. Guiang

KEYWORDS: POLICY DEVELOPMENT, PARTICIPATORY ACTION RESEARCH, SUB-WATERSHED AREA, STAKEHOLDER PARTICIPATION

Inclusive, participatory approaches to public policy development are emerging as a means to address challenges arising from traditional, top-down mechanisms. In Santa Rosa City, Laguna in the Philippines, Yaman ng Lawa is an initiative that encourages policy ‘recipients’ in meaningfully contributing to the development of policy recommendations for managing environmental risks to food and human health security. The Santa Rosa City Yaman ng Lawa Initiative recognizes that (1) scientific and local knowledge are equally valuable in policy development; (2) socially disadvantaged people and communities themselves are capable of assessing, planning and decision making; (3) the scientific community can be a catalyst for change; and (4) local and national offices should strive to promote 'voice' over 'control' in policy decision making. This paper describes the various activities of the Santa Rosa City Yaman ng Lawa Initiative. Residents of lakeshore villages and officials from all levels of government were engaged in various types of activities, namely, public consultations, community assemblies, dialogues with policy decision makers, and stakeholders’ forum. Representatives of various sectors of the community took part in the activities including fisherfolk, farmers, women leaders, village health workers, among others. Eight interrelated issues were identified during public consultations, which were ranked in terms of relevance and severity during community assemblies. In the stakeholders’ forum, community representatives described priority issues in the lakeshore: (1) changes in livelihood, (2) persistent flooding, (3) solid waste management, and (4) hunger and malnutrition. Government officials discussed current interventions and available resources to address community-prioritized issues. The participatory approach empowered communities with information for healthy settings, healthy lifestyles, and healthy populations; encouraged community initiatives; and enhanced community ownership of solutions to environmental issues, particularly those related to Laguna Lake. With this mechanism in place, stakeholders from grassroots to top-level officials were represented in discussions relevant to public policy development. Replication of the participatory mechanism in other areas in the Silang-Santa Rosa sub-watersheds and, ultimately, in all sub-watershed areas, and its institutionalization in the city, regional, or national levels are recommended.

PRESENTATION TYPE: ORAL

FACILITATING STAKEHOLDER PARTICIPATION IN EVALUATING WATERSHED MANAGEMENT OPTIONS USING INTEGRATED LAKE BASIN MANAGEMENT PRINCIPLES: A PRACTICAL EXAMPLE

Walter Rast
ILEC Scientific Committee; Texas State University, USA
Beverly A. Saunders
Southeastern Wisconsin Regional Planning Commission, Waukesha, Wisconsin, USA

KEYWORDS: MANAGEMENT, PUBLIC PARTICIPATION, STAKEHOLDERS

Containing more than 90% of the liquid freshwater on our planet's surface, lakes (are used to meet a wider range of human needs than any other type of freshwater system. Thus, managing lakes and their basins for sustainable use requires consideration of a multitude of scientific, socioeconomic and governance issues. To this end, Integrated Lake Basin Management (ILBM) is a comprehensive approach originally developed for managing lakes and reservoirs through gradual, continuous and holistic improvement of basin governance. It encompasses sustained efforts aimed at improving six governance 'pillars' (Policy; Institutions: Stakeholders; Knowledge; Technology; Finances). The present study demonstrates that ILBM is applicable not only to lentic water systems (lakes and reservoirs), but also to the upstream and downstream lotic water systems (rivers and streams) of which they are a part. Two "Critical Water Planning Area" watersheds in Pennsylvania (USA) are used to demonstrate this application, focusing on public participation within the context of the ILBM Stakeholder pillar. The feasibility of alternative management options for these watersheds are identified and ranked on the basis of watershed stakeholder perceptions, and the lessons learned in the evaluation process are discussed.

PRESENTATION TYPE: ORAL

CITIZEN`S ACTIVITIES AIMING AT SWIMMABLE LAKE KASUMIGAURA

Toshio Takishita
Kasumigaura Citizens' Association, Japan
Tetsuo Awano
Kasumigaura Citizens' Association, Japan
Yuichi Ikeda
Kasumigaura Citizens' Association, Japan
Noboru Hakata
Kasumigaura Citizens' Association, Japan
Tetsuo Wada
Kasumigaura Citizens' Association, Japan
Kazuo Okubo
Kasumigaura Citizens' Association, Japan

KEYWORDS: CITIZEN ACTIVITY, IMPROVING WATER QUALITY, ENVIRONMENTAL LEARNING

People who live in the drainage basin have been worried about the water quality deterioration of Lake Kasumigaura over the last four decades. The main reasons of deterioration are wastewater discharged from households, livestock, agricultural lands, factories, business and urban area. These waters are accounted more than 75 % of total sources and are all generated as the results of each human activity. Since the Kasumigaura Citizens' Association has been established in 1996, we have performed various activities that raise public awareness for improving water quality aiming to swimmable lake water such as foul water reduction from households. Every year we take place summer-school for children's environmental learning through experience at Lake Kasumigaura, Kasumigaura Approval Test that leads to the chance for understanding Kasumigaura's environmental problems including nature, geography, history and culture etc., and water festival aiming to restore a swimmable Lake Kasumigaura cooperated with local citizens, researchers, industries, associations and administrations and so on. Through these events we are making effort to raise public awareness to feel Lake Kasumigaura important and to bring up children to successor who will preserve water environment.

PRESENTATION TYPE: ORAL

THE COLLABORATION WITH LOCAL GOVERNMENT TO RESTORE THE LAKE BIWA IN JAPAN

Michio Furukawa
Akanoi biwako environmental citizen's initiatives. Shiga, Japan

We are one of several non-governmental citizen's groups seeking to improve and maintain the water quality of Lake Biwa. Members are from all walks of life, and range in age from high school students to retired persons. Most of our 429 member groups are citizens of Moriyama City. Our main areas of activity are in Moriyama city in Shiga prefecture. Therefore we have various kinds of collaboration with Moriyama City Government to restore the water quality of Akanoi Bay in the Lake biwa.

PRESENTATION TYPE: POSTER

TRANSSALINAS, A COMMUNITY ART AND CONSERVATION PROJECT FOR SALINE WETLANDS

Katia Hueso
IPAISAL, Madrid, Spain
Marta Gil
IPAISAL, Madrid, Spain

KEYWORDS: SPAIN, CENTRAL ASIA, PARTICIPATION

Nature conservation efforts are usually steered by the authorities, who present facts and figures to the public in a rather distant manner. NGOs may contribute to these efforts by bridging the gap between the official policies and the real perception and needs of the local communities. IPAISAL, the Institute of Salt Heritage and Saltscapes (Spain), has tried to disseminate the values of saline wetlands for over a decade by traditional methods (presentations, publications, panels, exhibits…), with different results. We are now proud to present Transsalinas, an ambitious project that offers an innovative approach to enhance the chances of success of long-term saline wetland conservation efforts. The project will use community art as a means to engage with the local communities and to motivate them to preserve their saline wetlands of reference. Transsalinas will visit four sites in Spain and Central Asia, chosen on the grounds of their common biogeographical origin, as well as their similitudes of the threats and challenges they face. The project will then record the sounds of the hearts of the local residents in each site –symbolising their emotions– and the sounds of the trains that will move the project from one site to the next –symbolising the vessels that join the hearts of each community. The sounds will then be transformed into a visual installation, based on the science of cymatics. As a result, the public will see their heartbeats vibrating on the surface of the water and hopefully feel linked to the wetland in a very basic but deep running manner. The installation is visually strong but ephemeral, leaving no impact or traces behind, except for the audiovisual registration of the event. The project is strongly based on community participation and hopes to engage them both with the conservation of their wetlands, as well as with each other. The ultimate aim of the project is to strengthen the sense of belonging to the sites and raise awareness of the importance of taking the communities' feelings into account when preserving nature.

PRESENTATION TYPE: ORAL

COMPARATIVE RESEARCH ON THE VIEWS AND KNOWLEDGE OF LOCAL RESIDENTS OF CENTRAL GREECE IN TWO WETLANDS. SMOKOVOS LAKE CASE AND METAMORPHOSIS MARSCH IN KARDITSA'S PREFECTURE

Georgios Efthimiou
T.E.I. of Sterea Hellas. Karpenissi, Greece
Konstantinos Ntouras
T.E.I. of Sterea Hellas. Karpenissi, Greece
Aristides Mertzanis
Assosiate Professor

KEYWORDS: VIEWS, LAKE OF SMOKOVOS, METAMORPHOSIS MARSH, KNOWLENDGE

A very rich biodiversity is insured by the wetlands and also satisfy a big number of human requirements in the wider area. The main instrument for the preservation and the biggest benefit of wetland ecosystems is the proper administration of them. Greece as country has a big number of wetlands and is member of Ramsar agreement. Purpose of this research is the inventory and development of the local residents knowledge in two wetlands of the wider area in region of Karditsa, in central Greece, artificial lake of Smokovos and Metamorphosis marsh. Through ecological and socialeconomical view it is about two significant wetlands in central Greece. For the achievement of this purpose it was realized research with the use of structured questionnaires in the period of autumn 2011 to spring 2013 and sample of 428 teenager residents in the wider area of the above wetlands ecosystems. It was examined the existence of differences at the level of the knowledge of the sample for artificial lakes generally and for artificial lake of their area as a race. Teenagers of the wider area of Metamorphosis marsh had higher average in connection with teenagers of Smokovos lake. Also girls who live at the wider area of Metamorphosis marsh have higher averages in connection with boys of the area. Just the opposite happens at the area of Smokovos lake. But these findings hasn't confirmed statistically

PRESENTATION TYPE: POSTER

KABATA

Satoru Yamakawa

KEYWORDS: KABATA, COMMUNITY-BASED ORGANIZATIONS, ECOTURISM

Harie District, Takashima City, is located on the northwestern shore of Lake Biwa. This district is well endowed with clean water, which is flowing from springs on the very grounds of households. Many of the approximately 160 houses there have a feature unique to the area known as “kabata” (literally, edge of a river) whereby residents make use of these springs in their daily lives. Being aware of the importance of the water being as the common property of the entire area, the Committee of Harie Shozu Village, a community-based organization which local residents form, conducts activities to preserve the water environment and provides visitors with guided tours which create profits. The District annually accepts almost 10,000 visitors. Being highly recognized as one of the most successful cases of ecotourism in Japan, the Committee recently won Grand Prize at 9th Ecotourism Awards co-organized by Ministry of the Environment, Japan, and the Japan Ecotourism Society.

PRESENTATION TYPE: ORAL

REJUVENATION OF RESERVOIR THROUGH VILLAGERS' PARTICIPATION FOR CONSUMPTIVE AND NON-CONSUMPTIVE PURPOSES WITH RESTORATION OF HYDROLOGIC CYCLE: CASE STUDY OF ASTITVA BUND, WESTERN MAHARASHTRA, INDIA

Sunil Suryavanshi
Astitva Foundation, Bhandwali District Satara, Maharashtra State, India
Sandeep Joshi
Shrishti Environment and Sustainability Society (SESS), Pune, India.

KEYWORDS: REJUVENATION, ARTIFICIAL LAKE, PUBLIC PARTICIPATION

Villagers at Bhandwali district Satara in Maharashtra has successfully revived an artificial lake having spread about 70 ha in one monsoon (rainy season) cycle. It was developed in 1986 but never filled with water since inception. About 1000 rural population with guidance from water conservationists joined hands in this effort to protect and conserve their water body in order to make water available for village, irrigation and aquatic ecosystem June 2013. Villagers desilted the basin about 1 km and reconstructed 64 m long bund again. In the end of first rainy season in September, the water collected to the tune of 490 million liters at the cost less than $0.06 per cu m. These social efforts revived about 40 wells in 2.5 kilometer distance longitudinally and downstream bund remained full of water till the summer. This lakewater was used to irrigate about 125 ha thereby alleviating the impact of 4 years' drought condition and improved agricultural profits by 20 times. Therefore, this social – lake relationship with traditional knowledge of water body revival has improved livelihood of the poor villagers in just one year which will be replicated in near future.

PRESENTATION TYPE: ORAL

PUBLIC PARTICIPATION IN SOCIAL AUDITING AND ECO-POLITICS OF WATER QUALITY AND ECOLOGICAL HEALTH OF THE FRESHWATER LAKE UJJANI, MAHARASHTRA, INDIA

Sandeep Joshi
Shrishti Environment & Sustainability Society. Pune, India
Anil Patil
Maharashtra Vikas Kendra, Pune, Maharashtra, India

KEYWORDS: WATER QUALITY, ECO-POLITICS, SAFE WATER

Deterioration of water quality of Ujjani Lake, the tail end reservoir on Bhima river – a known World Lake Vision water body – is the result of upstream unmatched, rapid urbanization and industrial growth in last two decades. This huge water body in South Maharashtra is under pollution stress which is affecting its quality and ecology. Constant efforts for wide spread awareness from a decade have consolidated the participatory action plan by involving students of schools and colleges in the region for social auditing and biomonitoring of water quality and ecological status of the Ujjani Lake. The feedback of public participation has led to raising the issues of water quality improvement in Ujjani catchment leading to eco-politics of impact of pollution on community health. A careful assessment of socioeconomic and health issues among the population along the shoreline downstream of urban development has documented that the people have become attentive and responsive of their natural and human right of safe drinking water. People's movement for water security has outlined the political agenda in the region leading to planning and investments for urban and industrial wastewater treatment plants in upstream cities. In this paper, the outcomes of surveys have been discussed articulating the demands of villagers for sustainable, protected and pollution – free water source for agriculture, pisciculture and secured life.

PRESENTATION TYPE: ORAL

CONTRIBUTION OF NGOS TO LAKE BASIN MANAGEMENT

Tatyana Fedorova
NGO "Baikal Information Centre "GRAN". Buryatia, Russia

KEYWORDS: LAKE BAIKAL, NGO, ENVIRONMENTAL

Role of environmental NGOs in lake basin management can't be overestimated. Range of activities fulfilled by NGOs is quite wide: starting from implementing environmental projects aimed at solving various ecological problems of lakes and their ecosystems; organizing environmental education of local population (children and adults) by means of seminars, eco-camps, etc; public awareness raising campaigns and waste cleaning campaigns. NGO “Baikal Information Centre “GRAN” realized all of the above-mentioned activities during 15 years of work. We collected information about Lake Baikal and ecological problems it faces, presented the information at numerous meetings (conferences, workshops, seminars, etc) in Russia and abroad. “GRAN” implemented a number of joint international eco-projects with Global Nature Fund and other partners. During 5 years we fulfilled a municipal environmental programme on environmental education and raising awareness of the local population. In 2012 NGO “Baikal Information Centre “GRAN” published a toolkit for Primary and Middle Grade Students “Baikal Box”. The toolkit was recommended by the Ministry of Education and Science of the Republic of Buryatia for use in schools as part of the standard educational programme and supplementary programmes. The last 4 years “GRAN” functions as the Operator and Organizer of the Grant Programme “Every drop Matters – Lake Baikal” in Russia, with financial support from United Nations Development Programme and the Coca-Cola Company. The Programme supports local initiatives aimed at reducing water contamination, ecotourism development, providing access to clean drinking water, etc. Thus, local NGOs get a chance to influence lake basin management through improving the existing conditions at Baikal.

PRESENTATION TYPE: POSTER

LAKE CHAPALA BIRDS FESTIVAL: AN ENVIRONMENTAL EDUCATION STRATEGY.

Claudia Figueroa
Corazon de la Tierra-Institute of Environmental Development (Mexico)
Camilo Cote
Corazon de la Tierra-Institute of Environmental Development

KEYWORDS: LAKE CHAPALA, ENVIRONMENTAL EDUCATION, BIRDS

Lake Chapala, Mexico's largest natural lake has been object of public attention during different hystorical moments, mostly related to water storage crisis. There is a wide perception that the only important issue regarding lake's environmental health is its volume, despite the extense variety of environmental services provided both by the waterbody and its basin. In order to raise awareness about its functions and importance, birds biodiversity was selected as the core issue of an environmental education program, being the Lake Chapala Birds Festival the most visible activity, which is held each November, to celebrate the arrival of waterfowl coming from USA, Canada and Central America. This festival includes a set of activities, including academic, sports, cultural and educative ones, which are conducted both in schools and open spaces, along 10 days. It had A small effect at first edition (back in 2010) but it quickly became a reference for lakeshore dwellers and visitors. During 2013 more than 4200 people attented the festival and close to 350 thousand received information about the lake-ecosystem, birds characteristics and related themes through mass-media and social networks. Activities are designed to be enjoyable and to include clear references about birds' features, habitat, ecological roles, cultural importance and current sityuation, all directed to engage public in conservation activities being conducted by several institutions, including ours.

PRESENTATION TYPE: POSTER

RURAL DEVELOPMENT PERSPECTIVES, BASED ON THE RURAL POPULATION'S PERCEPTIONS OF THE CROSS BORDER LAKE PRESPA (NORTH GREECE)

Anna Latsiou
University of Thessaly. Greece
Olga Christopoulou
University of Thessaly. Greece

KEYWORDS: CROSS BORDER, RURAL DEVELOPMENT, LAKE

The development of agricultural areas, characterizes the sectors of the economy, ecology and management.Agricultural development is anthropocentric, and every society has its own needs and through the participation of the involved groups, can achieve substantial cooperation with the decision-making centers. From the other hand, mountain Lake areas, are an important part of Greece and require special design and development policies, as they face due to geomorphological characteristics, a series of inhibitors. One of them is, the geographical isolation.Cross border regions are even more multi actor and multi level spaces than institutionalized regions in decentralized states. Without any formal competencies, cross border regions are fully depending on successful governance – processes to co-ordinate and develop common activities. In Lake Prespa (Natura 2000) other inhibitory factors, is the cross bordering , the absence of spatial planning, while sharp is the cultural diversity. In General, the sectors of agriculture and tourism are the main microfinance development model. The purpose of the promotion of rural development and prospects based on perceptions of the rural population of the region of Prespa .Usually, cross border environmental policy, characterized by a very high degree of complexity. Questionnaires completed by the rural population of the region and analyzed through SPSS 15.0.0. Some first results showing that the rural population in 3 regions(Greece,Albania,F.Y.R.O.M) characterizes as a positive relationship with the ecosystem, while features and environmental consciousness. The farmers believe that the region is on track of growth but needs improvement. The processing of the results continues.

PRESENTATION TYPE: POSTER

WATER ANALYSIS OF GODAWARI RIVER (DHANGAR TAKALI TO VISHNUPURI DAM), MAHARASHTRA, INDIA

Pradip Wesanekar
Department of Geology, N.E.S.Science College, Nanded, India
Upendra Dattatraya Kulkarni
Department of Civil and Water Management, S.G.G.S. Institute of Engi. & Tech. Nanded, India
kanagala Sakshi
Department of Civil and Water Management, S.G.G.S. Institute of Engi. & Tech. Nanded, India
Nitin Shelak
Department of Geology, N.E.S.Science College, Nanded, India

KEYWORDS: JAL DINDI(RIVER TRAIL), GODAWARI RIVER, WATER ANALYSIS

The Godawari river is one of the major rivers of India. It originates at Nashik in Sahyadri (Western Ghats) ranges of Maharashtra , India and goes to Bay of Bengal at Rajmundri of Andhra Pradesh. It travels over thousands of kilometres before it forms delta at Rajmundri. It feds agriculture, Industries and major drinking water requirements ofMaharashtra and Andhra Pradesh states. It has main impact on culture, religion and progress of this region. The holy Godawari River is shrinking due to sand mining, dam silting, water pollution and urban waste. There is not even minimum river flow over major part of this river The urban waste, Industrial waste, fertilisers used for agriculture is polluting the river water and groundwater of this region. The three days Goda Jaldindi (River Trail) is organized to generate awareness about this river , among the people living on the river banks; specially with reference to water quality, pollution status, impact on health and ecology of this region. The River trail is new concept based on the cultural or spiritual trails in the India. Lakhs of people participate in such trails. The trails run over 100s of kilometers. The routeis in the back water of Vishnupuri Dam. The water analysis is presented in this paper. The study area is part of Nanded and Parbhani districts. The area is of backwater region of Vishnupuri Irrigation Dam, Nanded. It is almost central part of Godawari River. The Nanded is known as Nabhi Sthan (Navel or umbilical place) of Godawari river. Purna river meet to Goadawari near Dhanagar Takali . The sampling is done all along the river. Route of the Goda Jaldindi : Dhanagar Takali -Gangabapu - Anteswar -Pennur - Gangabet -Wahegaon- Markandya - Thugaon -Vishnupuri .(Fig.- 1) The total distance of the route is 42 kms . The water samples are analyzed for pH, Dissolved oxygen(D.O.), Conductivity, Turbidity, Total Dissolved Solids(TDS), Total Hardness(TH), Calcium, Magnesium, Chlorine and Total alkalinity. The analysis is given in Table -1 The pH varies from 8.21 - 8.88 with average of 8.534. The pH range at river bank is from 8.31 to 8.74 and middle of the river flow is from 8.21 to 8.88; both values are very close . The pH of the river water is within the range of BIS for drinking water (pH : 7.5 - 8.5), but relatively high. The Godawari river water show low turbidity with range of 1.02 to 2.6 N.T.U., with average turbidity is1.42 N.T.U. The TDS varies from 320 to 720 ppm with average of 362.8 ppm and it is within the range of drinking water (BIS TDS :). The Total Alkalinity(TA) of river water varies from 120 to 250 ppm with average TA of 209.11ppm . The conductivity varies from 200 to 519 with average of 379.6. The calcium content range from 20.048 to 264.52 ppm with average of 98.65 ppm . The magnesium varies from 0.86 to 62.69ppm with average of 29.22 ppm . The chlorine varies from 29.75 to 209.5 ppm with average of 90.81 ppm. The dissolved oxygen varies from 8.9 to 10.8 with average of 10.02. the total hardness (TH) varies from 120 to 300 ppm with average of 218.04 ppm . The total hardness (TH) is less than the BIS range for drinking water.

PRESENTATION TYPE: ORAL

MS07-05

Research, sustainability and governance - How to practice on ILBM

COMMUNITY-BASED MANAGEMENT OF ECOLOGICAL RISKS TO HEALTH AND FOOD SECURITY IN THE SILANG-SANTA ROSA SUB-WATERSHED AREA, LAGUNA LAKE WATERSHED, PHILIPPINES

Jaime Z Galvez Tan, MD, MPH
Health Futures Foundation, Inc., University of the Philippine, Manila, Philippines
Amiel Nazer C Bermudez, MD, MPH(c)
Health Futures Foundation, Inc., University of the Philippine, Manila, Philippines
Leah A Palapar, MD, MPH
Health Futures Foundation, Inc., University of the Philippine, Manila, Philippines
Gary T Pagtiilan, RN
Health Futures Foundation, Inc., University of the Philippine, Manila, Philippines

KEYWORDS: COMMUNITY-BASED MANAGEMENT, ECOLOGICAL DISEASE, LAGUNA LAKE

Ecological diseases are conditions that are unique to a particular population resulting from distinctive behavioural, socio-cultural, demographic, and environmental factors. This paper discusses community-based management strategies to address ecological risks to health and food security in communities in the Silang-Santa Rosa subwatershed. Health status and food insecurity were determined on 363 households in the sub-watershed, while the health effects of environmental lead exposure were assessed in 108 mother-child pairs from four barangays in Santa Rosa City. Health risks identified such as differences in mean IQ scores of children according to blood lead levels were presented to residents of lakeshore villages and officials from all levels of government through various types of activities including focus group discussions, prioritization of community-identified issues, and stakeholder meetings. Refinement of current national, regional and local efforts to prevent and mitigate ecological risks to health and food security can be promoted through the recognition of the concept of ecological diseases, which underlines the need to tailor-fit interventions to address not only the illness itself, but also the specific contextual factors that contribute to their emergence. This outlook places communities at the center of identifying and acting on issues that affect their health and well-being. This may include community-based surveillance and services for common illnesses; risk communication on exposure to heavy metals, particularly, lead; and community initiatives that address contextual factors such as livelihood projects and environmental conservation.

PRESENTATION TYPE: ORAL

RESEARCH, SUSTAINABILITY AND GOVERNANCE: HOW TO PRACTICE ON ILBM

Francesca Alvisi
CNR-ISMAR, Bologna, Italy

KEYWORDS: SUSTAINABLE DEVELOPMENT, INTEGRATED MANAGEMENT, LAKE BASIN

ILBM is a way of thinking about water management that is based on six pillars. Two of these are the Participation (of stakeholders but also of citizenship as stakeholders) and the Information (to stakeholders and thus to citizens). These concepts are strongly present in the approach we want to pursue to bring together scientific research approach, strategy and results, and public opinion and stakeholders participation through a governance exercise on sustainability issues. We like to discuss the importance of information and knowledge for a qualified and pro-active participation as well as reflect on our individual and collective responsibility as citizens in ILBM projects. To achieve these goals, three working groups will be organised: 1. Active vs. Scientific citizenship - This working group will discuss and share experience about topics like: Why Scientific Information is important?What kind of Information Needs for Lake Basin Management? Which consequences of a “Non-use” of Science? How and where can we share information? How much information is “enough”? 2. Participative democracy - We plan to work on the responsibility/action axis mediated by the contribution of scientific approach: evaluate the individual vs. collective responsibilities, allowing to assess the impact of actions and possible solutions in terms of cost/benefit, promotes the critical analysis of the information available today. 3. Participatory planning - This working group will experience a process of participatory planning in order to practice on the ILBM issues by analysing case studies taken from the past and possibly practising on present situations.

PRESENTATION TYPE: ORAL

MS08-01

Converting Policy into Action for Successful Lake Management

30 YEARS OF WORLD LAKE CONFERENCES AND THE APPROACHES FOR THE CONSERVATION OF THE LAKE BIWA BY SHIGA PREFECTURE

Yasuhisa Ishikawa
Shiga Prefecture, Japan

KEYWORDS: LAKE BIWA, LAKE BIWA COMPREHENSIVE DEVELOPMENT PROJECT, MOTHER LAKE 21 PLAN

It has been 30 years this year since the first World Lake Conference was held by Shiga Prefecture in Shiga, Japan in 1984. I would like to review the measures for the conservation and development of Lake Biwa during this period, and explain the current issues and directions of the measures.The Lake Biwa Comprehensive Development Project (LBCDP) was implemented in 1972 as a national project for a 10 year plan, and was extended in 1982 for another 10 years. The LBCDP consisted of three principles; conservation, flood control, and the various use of lake water. During that project, Shiga banned the use of synthetic detergents containing phosphorus by enacting an ordinance in 1979. In 1984, Shiga made the Lake Water Quality Conservation Plan assisted by national law, and worked to reduce the inflowing load to Lake Biwa. The construction of sewerage facilities and efforts by citizens and government helped significantly to reduce the load, however, construction of levees along the lake shore, lowering the lake water level during the summer time to reduce the risk of flooding, had great effects on the ecosystem of Lake Biwa. In 2000, Shiga made the Mother Lake 21 Plan which was a 10 year plan to improve water quality, to foster water source, to preserve the natural environment and scenic landscape as its three principles. In 2011, Shiga reviewed the plan and revised it for another 10 years, adding an aspect of "restoring the relationship between our daily lives and the lake". The Lake Biwa is gradually losing its natural ecosystem which has been recognized by the reduction of the fish catch as a vivid example. There are currently major issues such as overgrowth of water weeds, the increase of foreign fish, and the separation of the water channels among the lake, paddy field, and forest.To take measures against those issues, "connection" is the key word. It is important to see all of the issues not in a small separated area, but to see them as a whole and take comprehensive measures. Shiga has started to work together with many stakeholders. Citizens, NPOs, researchers, companies and government, formed a group called "Mother Lake Forum", sharing thoughts and isssues, and think about the future of Lake Biwa together.In the presentation, the experiences of Lake Biwa from a historical point of view and the present measures for the conservation of Lake Biwa are to be discussed.

PRESENTATION TYPE: ORAL

LAKE CONTRACTS FOR PROTECTION AND MANAGEMENT OF LAKES IN PIEDMONT (NORTH-WEST ITALY): EXPERIENCES, PROBLEMS, PERSPECTIVES

Vincenzo Pellegrino
Piedmont Region, Environmental Department, Italy
Annamaria Baldassi
Province of Biella, Agriculture and Environment Department, Italy
Gianna Betta
Province of Torino, Water Resource Service, Italy
Paolo Mancin
Piedmont Region, Environmental Department, Italy

KEYWORDS: LAKE CONTRACT, BASIN MANAGEMENT, LAKE RESTORATION

"Lake contracts", analogous of "river contracts", are voluntary, participative and inclusive governance instruments provided for by Piedmont's (North-West Italy) regional law (Water Protection Plan, 2007), in order to attain an integrated policy for protection and restoration of lakes. Currently, two Lake contract processes are in progress: the one concerning the "Catchment basin of Avigliana lakes", a system of lakes, marshes and peat bogs in Avigliana town, nearby Torino city; the other concerns "Viverone lake", a suggestive ecosystem in the morainic amphitheatre of Ivrea, near Biella town. Both lakes, despite they are protected areas of EU "Natura 2000 Network" (Dir. 92/43/EEC "Habitats" and Directive 2009/147/EC "Birds"), result eutrophicated and partially degraded, owing to the plethora of anthropic pressures and impacts that affects water bodies and their catchment basins, such as urbanization, riparian alteration, sewage system bad performances, intensive cultivation or manure spreading, water abstraction, massive tourism and recreational activities (carp fishing, waterskiing…). Some expensive in-lake measures were carried out in the past to restore the lacustrine water quality but their partial failures denoted absence of proper basin management strategies: now, the "contract processes", following many meetings and public debates, reached the challenging phase of comprehensive Action Plans definition and implementation, requiring a "voluntary obligation" of administrators, stakeholders, common people to get a real environmental awareness, sustainable agreements, human and financial resources in order to fulfil nutrient input reductions, limitations in uses and behaviours, coordination and coherence of policies, best practices adoption, mitigation of unavoidable impacts.

PRESENTATION TYPE: ORAL

COLLABORATIVE GOVERNANCE APPROACH FOR TRASIMENO LAKE (ITALY) SEDIMENT MANAGEMENT: METHODOLOGICAL BASIS AND GUIDELINES FOR A NEGOTIATED AGREEMENT (LAKE CONTRACT)

Giancarlo Gusmaroli
Studio Ecoingegno, Venice, Italy
Maurizio Bacci
IRIS Ambiente, Florence, Italy
Antonio Boggia
Department of agronomic sciences, food supply and environment, University of Perugia, Perugia, Italy

KEYWORDS: LAKE GOVERNANCE, MULTICRITERIA APPROACH, LAKE CONTRACT

Trasimeno Lake is the largest lake on the Italian peninsula, with a surface area of approximately 125 km2 and a basin of about 380 km2. No major watercourses flows directly into or out of the lake and the water level fluctuates significantly according to rainfall rate and seasonal water abstractions. This features, together with land uses at catchment scale, have a close connection with geomorphic behavior of the lake system and in turn sediment management is a key issue for pollution dynamics, bathymetric trends and biodiversity conservation. Many socioeconomic interests are involved around this topic and related decision making processes face tangle challenges. Since at least three decades Trasimene Lake has been deeply studied and several measures have been identified for a sustainable sediment management. But just a few initiatives have been launched and known problems are currently not solved. Thus a need for cooperative planning, effective strategies and viable solutions is felt as compelling by local communities and public bodies. Given this complex background, in 2013 Perugia Province has appointed Perugia University to develop a methodological approach for lake governance and sustainable sediment management. In this paper the authors of the research present the outputs of this task, with emphasis to the multicriteria approach that has been proposed. Hereby assessment approaches and tools to be integrated within participative decision making processes are described. Finally a set of guidelines for inclusive decision making processes is illustrated, aimed at stipulating a negotiated agreement (Lake Contract) for Trasimene lake.

PRESENTATION TYPE: ORAL

PERFORMANCE EVALUATION OF CONSERVATION PLAN FOR LAKES IN INDIA

Prashant Sing
Indian Institute of Technology Roorkee, Haridwar, India
Arun Kumar
Indian Institute of Technology Roorkee, Haridwar, India

KEYWORDS: ISRO- INDIAN SPACE RESEARCH ORGANISATION, BHUVAN- A GEOPORTAL OF INDIAN SPACE RESEARCH ORGANISATION, GIVES A GATEWAY TO EXPLORE AND DISCOVER VIRTUAL EARTH IN 3D SPACE WITH SPECIFIC EMPHASIS ON INDIAN REGION., GIS/SWAT- GEOGRAPHIC INFORMATION SYATEM / SOIL AND WATER ASSESSMENT TOOL

A review of present lake programme in India is being carried out under this study. A range of parameter are needed to evaluate a Lake and its conservation Plan due to diversity in term of size, biodiversity, geography, origin, ownership and management policies of Lakes in India. Here a scoring method is developed taking various parameter and then ranked them based on their score. Scoring is divided in four broader parameter i.e. Lake's Properties, Lake's catchment properties, Vulnerability to Lakes and Conservation and management policies. These are further divided into more parameter. In this scoring method Lakes which are highly bio diversified, Vulnerable and best conserved get highest score. Ten Lakes are selected from all over India and scores are given by analyzing and interpretation of data collected/ gathered/ generated by contacting different sources, Land Use Land Cover Map, Biological Richness Map, Disturbance Index Map and Erosion Map, obtained by projecting catchment area, delineated with the help of topological sheet or GIS/SWAT tool, over Water Resource Information System, Biodiversity Information System and Bhuvan site developed by ISRO, where conservation plan have been completed/underway. Lakes and their conservation plans can be seen and analyzed from various perspective and appropriate measures can be taken for better conservation and management.

PRESENTATION TYPE: POSTER

SHKODRA LAKE: BETWEEN MULTICRITERIAL COMPLEXITY AND INNOVATION

Adriano Ciani
Department of Agriculture, Food and Environmental Sciences, University of Perugia, Italy
Luisa Paolotti
Department of Agriculture, Food and Environmental Sciences, University of Perugia, Italy
Lucia Rocchi
Department of Agriculture, Food and Environmental Sciences, University of Perugia, Italy
Giordano Stella
Department of Agriculture, Food and Environmental Sciences, University of Perugia, Italy
Antonio Boggia
Department of Agriculture, Food and Environmental Sciences, University of Perugia, Italy
Jozef Bushati
University of Shkodra, Albania

KEYWORDS: COMPLEXITY, MULTICRITERIA APPROACH, TERRITORIAL CONTRACT MANAGEMENT

The Shkodra Lake is a basin located in the boundary between North Albania and South East Montenegro, having a surface variable from 370 to 530 km2. Lake is very rich in biodiversity and includes extensive wetlands. Some parts of the lake are classified as Ramsar areas (Wetlands of International Importance), World Heritage sites, national parks and biosphere reserves.More than 160 aquatic and wetland plant species, 52 fish species and 270 bird species live in the ecosystem of the Lake. The Lake is very relevant for the multifunctionality of its use, being used for several different purposes, like irrigation, drinking water, bathing and fishing. Especially in the Albanian part of the lake there is a very deep pressure caused by different human activities, as intensive fishing, agriculture, urbanization, tourism, with problematic pollution of water and lake shores. The ecosystem is very complex and the criteria composing the conflict of interests derive from a large historical period. After the fall of the communist regime in the Montenegro part and especially in the Albanian part, the management of the lake didn't achieve normally the sufficient equilibrium among the different social, economic, environmental, cultural and managerial aspects. For all these reasons, the lake needs an innovative strategy of management that must be smart, sustainable and inclusive. The authors after a deep analysis of the context present a possible innovative model based on the idea of the Territorial Contract Management (TCM). They present a simulation with the multi-criteria approach for the proposed model.

PRESENTATION TYPE: ORAL

TITICACA: A SUPRANATIONAL EXPERIENCE OF GOOD GOVERNANCE PRACTICES FOR LAKE WATER RESOURCES

Adriano Ciani
Department of Agriculture, Food and Environmental Sciences, University of Perugia, Italy
Filippo Fiume Fagioli
Department of Agriculture, Food and Environmental Sciences, University of Perugia, Italy
Luisa Paolotti
Department of Agriculture, Food and Environmental Sciences, University of Perugia, Italy
Lucia Rocchi
Department of Agriculture, Food and Environmental Sciences, University of Perugia, Italy
Giordano Stella
Department of Agriculture, Food and Environmental Sciences, University of Perugia, Italy
Antonio Boggia
Department of Agriculture, Food and Environmental Sciences, University of Perugia, Italy

KEYWORDS: TITICACA LAKE, MULTICRITERIA APPROACH, GOVERNANCE MODEL

Lake Titicaca is part of a hydrographic basin known as TDPS system, composed by lake Titicaca, Desaguadero river, Poopo lake, Coipasa basin. It is known as the highest navigable lake in the world and the second largest lake in South America. In 1990s Peruvian and Bolivian governments worked in cooperation with European Community to develop a Binational Master Plan for the development of Lake Titicaca and in 1996 the Autonomous Binational Authority of Lake Titicaca (ALT) was created. The aim of this authority is to implement and to enforce the management, the control and the protection of the Lake Titicaca system's water resources, developing and improving the living conditions of the populations who live in the Titicaca basin. The management of the Titicaca lake is very complex, as several environmental, economic and social factors are involved, like environmental degradation, extreme weather events, insufficient regulatory works, disadvantaged economic context. Under the main conditions of stakeholders participation and equal sharing of resources, we intend to follow some main topics as the sustainable use of water resources, the development of models for sustainable and equal exploitation of fish, the development of existing environmental systems and landscape from a touristic perspective, the sustainable development of the territory. The authors, in agreement with the Peruvian and Bolivian authorities and after a deep analysis of the Titicaca's governance practices implemented by ALT, propose a Multicriteria Approach to study an innovative governance model of lake water resources within the framework of Sustainable and Development Goals (2015-2030).

PRESENTATION TYPE: ORAL

PARTICIPATIVE PROCESSES FOR THE MANAGEMENT OF THE RESOURCES AND THE PROBLEMS OF THE AREA OF THE LOWER PATH OF THE NERA RIVER: THE EXPERIENCE OF THE SAN LIBERATO LAKE

Maria Paola La Pegna
Province of Terni, Italy
Donatella Venti
Province of Terni, Italy
Chiara Bagnetti
Province of Terni, Italy

KEYWORDS: LANDSCAPE, PARTICIPATION, LAND DEVELOPMENT AND PROTECTION

In order to implement the policies of the PTCP (Provincial Territorial Coordination Plan, 2000 now in review), whose constitutive strategy was a "bottom up" approach and the centrality of the landscape, the Province of Terni (Umbria, Italy) launched in the year 2010, in collaboration with some local governments, two participative processes for the preparation of a River Contract for the Lower Nera River and a Landscape Contract, which lasted up to 2013. These processes actually experienced the active participation of a broad panel of public and private stakeholders, associations, citizens, and schools to promote innovative forms of environmental, cultural and economic protection and development of the territory, in agreement with the guidelines of the European Convention Landscape. Thanks to the many engagement tools used, which considered a large variety of stakeholders (participatory design workshops , seminars , events, educational tours , etc.), these processes have now allowed the realization concrete actions intended toward the protection and enhancement of the environment. The "S.Liberato Lake" which is a storage basin for hydroelectric power production included in the territory of the Contract of the Nera River, partially re-natured and now included in an area ZSC (Special Areas of Conservation), has been the subject of particularly intense participation. This was due to the complexity and conflict of uses and "identity" that characterize it (presence of productive sites, pollution, environmental values, identity values, etc.). The synergies created between different actors during the process of participation and involvement, have allowed the realization of a series of management and enhancement proposals which are now being implemented.

PRESENTATION TYPE: ORAL

FRASSINO LAKE: TOWARDS PARTICIPATIVE MANAGEMENT

Michele Cassol
Studio Dottori forestali Cassol e Scariot, Italy
Paola Modena
Studio progettazione ambientale, Italy
Alberto Scariot
Studio Dottori forestali Cassol e Scariot, Italy
Cesare Lasen
Parco Nazionale Dolomiti Bellunesi, Italy
Stefano Salviati
Aquaprogram srl, italy
Giuseppe Maio
Aquaprogram srl, Italy

KEYWORDS: FRASSINO LAKE, MANAGEMENT PLAN, LAKE CONTRACT

Frassino Lake is a small glacial lake witha a surface of 78 ha; it is located in the province of Verona (Veneto Region-North Italy). It's a natural biotope protected for its unique animal and plant species. It is a natural park of local interest. It is identified as Community Interest Site and as a Special Protection Area (IT3210003). In 2013-14 surveys were conducted for ecosystem characterization. Were identified tipical conservationistic interest habitat, 14 fish species, 6 species of amphibian, 8 species of reptiles, 130 specie of birds and few species of mammals. The main pressure factors are: water pollution, anthropogenic pressure, water abstraction, non-native species (animals and plants). The most important threat of Frassino Lake is the replacement of species and habitat from original situation. It was drawn up the management plan of the regional natural park with sistems of rules , active management actions, a monitoring plan and educational programs. The "Lake contract" will be implemented as soon as possible to define the strategies for the conservation and for the partecipative environmental management

PRESENTATION TYPE: POSTER

MS08-02

Workshop - Water Framework Directive environmental quality assessment of lake water bodies in Europe

FIRST APPLICATION OF THE EPIPHYTIC AND EPILITHIC DIATOMS INDEX (EPI-L) FOR THE EVALUATION OF LAKE ECOLOGICAL QUALITY IN ITALY: A CASE STUDY FROM UMBRIA (CENTRAL ITALY)

Margherita Di Brizio
ARPA Umbria. Italy
Rosalba Padula
ARPA Umbria. Italy
Valentina Della Bella
ARPA Umbria
Isa Crescentini
ARPA Umbria
Luca Galli
ARPA Umbria
Stefania Bracchi
ARPA Umbria
Egiziana Rinaldi
ARPA Umbria

KEYWORDS: INDICATOR SPECIES, MEDITERRANEAN ECOREGION, WATER FRAMEWORK DIRECTIVE

The European Directive 2000/60/EC requires monitoring of macrophytes and phytobenthos – including diatoms – for the assessment of the ecological quality of lakes. In response to a call from the European Commission to Member States, the Italian Ministry of Environment invited Regions to join a “Program on Lake Diatoms", with the aim to design a national method for the evaluation of lake ecological quality. The Institute for Ecosystem Studies of the National Research Council (ISE-CNR) provided guidelines for sampling and analysing benthic diatoms, and a new index (EPI-L) was developed on the basis of data collected by Environmental Agencies and Research Institutes in 2012. Environmental Protection Agency of Umbria (ARPA Umbria) participated to the Program, collecting and analyzing data from two sampling sites for each of the two main lakes in Umbria (Lakes Trasimeno and Piediluco). We recorded ca.70 diatom species. Our preliminary results were used for a first application of EPI-L and the present work illustrates the challenges to be tackled for a correct application of EPI-L in Mediterranean ecoregion lakes: 1) some diatom taxa characteristic of lentic habitat are poorly known and difficult to identify, therefore training courses on identification and intercomparison exercises are needed; 2) several species recorded in the two lakes are not currently incorporated in the index, therefore the lakes' evaluation is incomplete; 3) the reference lakes in the Mediterranean ecoregion have not yet been identified, and this has to be done to enable biologically meaningful assessments of the ecological quality of Mediterranean lakes.

PRESENTATION TYPE: POSTER

A METHOD BASED ON BENTHIC DIATOMS FOR THE EVALUATION OF LAKE ECOLOGICAL QUALITY IN ITALY

Aldo Marchetto, Simona Musazzi
National Research Country, Institute of Ecosystem Study (CNR-ISE), Verbania Pallanza, Italy
Chiara Agostinelli, Andrea Beghi, Cristina Borlandelli, Fabio Buzzi, Elisa Carena, Francesco Elvio, Marco Fioravanti, Riccardo Formenti, Matteo Galbiati, Filippo Galimberti, Stefano Gomarasca, Frances
ARPA Lombardia, Italy
Renate Alber, Berta Thaler
APPA Bolzano, Italy
Stefania Balzamo, Serena Bernabei
Italian National Institute for Environmental Protection and Research (ISPRA), Italy
Stefania Bracchi, Isa Crescentini, Valentina Della Bella, Margherita Di Brizio, Rosalba Padula, Egiziana Rinaldi
ARPA Umbria, Italy
Susanna Cavalieri, Federica Cimoli, Giovanna Marchi, Chiara Rustighi
ARPA Toscana, Italy
Silvia Costaraoss, Sabrina Pozzi, Paola Testa
APPA Trento, Italy
Pierluigi Fogliati, Arianna Nicola
ARPA Piemonte, Italy
Arianna Macor, Raffaella Zorza
ARPA Friuli Venezia Giulia, Italy
Laura Mancini, Stefania Marcheggiani, Camilla Puccinelli, Claudia Vendetti
Nationa Institute of Health (ISS), Italy

KEYWORDS: LAKES, EPILITHIC DIATOMS, PERIPHYTIC DIATOMS

Benthic diatoms are routinely used in river monitoring for evaluating general or organic pollution and trophic status, but their use in lake monitoring is less common. In Italian deep lakes, existing indices generally resulted significantly correlated to the mean epilimnetic total phosphorus concentration (TP), but they were not able to clearly distinguish reference lakes from the water bodies with higher trophic status. For this reason, we designed a specific index aimed to the evaluation of the trophic status of Italian lakes (EPI-L), using a weighted averaging formula calibrated on logTP, as a proxy for lake eutrophication. The calibration data set cover both Alpine and Mediterranean ecoregions and includes 110 samples from 75 lakes. Among them, 36 lakes have mean depth larger than 15 m, such as the deep lakes South of the Alps and the volcanic lakes in Central Italy. Cross-validation was used to compare the performance of EPI-L with other existing indices. The correlation between EPI-L and logTP is only marginally influenced by lake depth and the difference between the EPI-L values for oligotrophic and eutrophic lakes resulted statistically significant. Benthic diatoms resulted to be useful indicator of the trophic status of both deep and shallow lakes, but the lists of trophic scores and indicator values must be adapted to the trophic niches of benthic diatoms in lakes. Finally, the use of a multivariate regression tree and the inclusion of our data into an international intercalibration exercise allowed us to define the EPI-L boundaries for lake quality classes.

PRESENTATION TYPE: ORAL

UNCERTAINTIES IN RESTORATION PROJECTS IN EUTROPHIC WARM MEDITERRANEAN LAKES: THE NEED OF A NEW APPROACH WITH RELIABLE TOOLS

Dionysis Latinopoulos
Democritus University of Thrace. Xanthi, Greece
Ifigeneia Kagalou
Civil Engineering Department, Democritus University of Thrace. Xanthi, Greece

KEYWORDS: MEDITERRANEAN LAKES, RESTORATION, MANAGEMENT

Lake Eutrophication is a “scourge” for lakes around the world. The process of eutrophication and (re-) oligotrophication has manifold facets including many moderate and continuous disturbances originating in the lake and its watershed. Over the past centuries surface freshwaters, lentic ecosystems included, subjected to extensive alterations in their morphology, hydrology, nutrients’ biogeochemistry, ecosystem metabolism and biodiversity. Specifically for the Mediterranean region, this stress has been maximized due to climatic particularities and variability, along with the topography characteristics. Many lakes retain their eutrophic status for extended periods of time. Time lapse in remediation occurs frequently. This could happen due to many factors since the process of recovery from eutrophication is not entirely understood, can be slow, or do not succeed mostly due to internal (in-lake) procedures. Literature knowledge highlighting lake responses to environmental conditions is focused on northern temperate lakes, thus providing valuable tools for their management. Comparable information on the warmer Mediterranean watersheds is extremely limited. The objective of the present paper is to describe the eutrophication status of several Greek lakes, some in-lake biotic interactions, and to highlight their functions and uses, using hydro-morphometric, physicochemical and biological data, along with functions’ indexes. Issues of existing management practices and the need for new effective tools are also addressed. Our results demonstrate the long eutrophication history of the Greek lakes and the severe impact of certain anthropogenic pressures. Traditional restoration methods poorly contribute to the elimination of eutrophication while new practices, mainly focused on “out of the lake” measures, are discussed.

PRESENTATION TYPE: POSTER

ENVIRONMENTAL IMPACTS ON RESIDUAL LAKES OF RIETI PLAIN (CENTRAL ITALY)

Luana Colacicchi
ARPA Lazio. Italy
Donatella Franchi
ARPA Lazio. Italy
Laura Mancini
Italian Superior Health Institute. Italy
Malgorzata Owczarek
ARPA Lazio. Italy
Valentina Stufara
ARPA Umbria. Italy
Simona Teodori
ARPA Lazio. Italy
Lucilla Pssacantando
ARPA Lazio. Italy
Wanda Chinzari
ARPA Lazio. Italy
Clara Di Felice, Erminia Lucarelli
ARPA Lazio. Italy
Angiolo Martinelli, Carlo Porretta, Adriana Vecchi
ARPA Lazio. Italy

KEYWORDS: SHALLOW LAKES, ENVIRONMENTAL STATUS, RESTORATION

The lower Velino valley was occupied, in the history, by a wide lake, the “Lacus Velinus”, extended some tens of square kilometres. Drainage and reclamation works, from Roman age to early 20th century, reduced lacustrine surface to some ponds and four shallow residual lakes: (Piediluco, 1,5 km2 and 22 m of maximum depth; Ripasottile, 0,8 km2 and 4 m; Lungo, 0,6 km2 and 4 m; Ventina, 0,1 km2 and 3,5 m of depth). Piediluco actually is acting as hydro-electric reservoir, receiving daily more than one million of cold water from upper Nera river. Ventina has a small rain-feed basin (less than 3 km2). Ripasottile and Lungo are still partially recharged by calcareous springs. Both are included into Bird and Habitat protected areas and in a larger Regional Park, jointly with S.Susanna spring, mainly diverted to Velino river by way of an artificial water body (S.Susanna channel). Pumping station at Ripasottile maintains lakes level two meters below actual outlet elevation, the land use outside lakes reed belt is agriculture. Two fish farms sewers, discharging few m3/s on hydrographic network, and three urban wastewater treatment plants represent the most consistent pressures. Environmental status of the lakes water and ecosystems reflects these modified conditions. Transparency and particulate matter, chlorophyll, nutrients loads, oxygen balance, biotic indicators, algal growth, sediments accumulation, varying significantly lake by lake, even if eutrophic conditions are widely detected. Data evaluation and ecological assessment can support the process of environment restoring and protected areas valorisation, according to an ideal objective of unique ecological network.

PRESENTATION TYPE: POSTER

ENHANCED LAND-WATER BUFFER ZONES AS MITIGATION MEASURE FOR NON-POINT SOURCES POLLUTANTS IN GROUNDWATER

Katarzyna Izydorczyk
European Regional Centre for Ecohydrology PAS
Wojciech Frątczak
Regional Water Management Authority in Warsaw
Edyta Cichowicz
European Regional Centre for Ecohydrology PAS
Radosław Gross
European Regional Centre for Ecohydrology PAS
Maciej Zalewski
European Regional Centre for Ecohydrology PAS

KEYWORDS: BUFFER ZONE, DIFFUSE POLLUTION, ECOHYDROLOGY

The riparian buffer zone (ecotones) is a widely recommended measure for reduction of agricultural impacts on freshwater ecosystems caused by nutrients from the landscape. However, due to a limited space in the shoreline zones and/or high initial loads, the efficiency of a buffer zone is frequently not sufficient. That is why, ecohydrological measures can be developed to enhance the buffer zones by regulation and intensification of naturally occurring processes responsible for water quality control, e.g. denitrification and phosphorus sorption. Two enhanced ecotones as demosites of LIFE+ EKOROB project: (Ecotones for reduction of diffuse pollutions. LIFE08 ENV/PL/000519, www.ekorob.pl) was constructed in the shoreline of the Sulejow Reservoir (Central Poland). The first demosite is surrounded by agriculture land. Nitrate concentration (ab. 100 mgNO3/l) in groundwater classified it as polluted, according to the Nitrates Directive (>50 mg NO3/l). The solution tested in the area is vegetation buffer zone enhanced by denitrification barrier. The pilot results show that the effectiveness of denitrification wall in buffer zone is about 86%. The second demosite is located in recreational area, where shoreline is surrounded by cottages. The seepages of groundwater heavily contaminated with phosphorus (ab. 3,1 mg PO4/l) was observed below the water level in the reservoir shoreline. In this case, geochemical barrier based on limestone was tested as additional element of a vegetation buffer zone, which enhance the phosphorus adsorption capacity.The mean reduction in phosphate concentration achieved as a result of water flow through the barrier reached 58%.

PRESENTATION TYPE: POSTER

QUANTIFICATION OF DIFFUSE POLLUTION SOURCES IN THE PILICA RIVER CATCHMENT AS A BASIS FOR THE DEVELOPMENT OF ACTION PLAN

Wojciech Frątczak
Regional Water Management Authority in Warsaw. Poland
Mikołaj Piniewski
Department of Hydraulic Engineering, Warsaw University of Life Sciences. Poland
Tomasz Kowalkowski
Department of Environmental Chemistry and Bioanalytics, Faculty of Chemistry Nicolaus Copernicus University. Poland
Louis Courseau
Regional Water Management Authority in Warsaw. Poland
Ignacy Kardel
Department of Hydraulic Engineering, Warsaw University of Life Sciences. Poland
Marek Giełczewski
Department of Hydraulic Engineering, Warsaw University of Life Sciences. Poland
Katarzyna Izydorczyk
European Regional Centre for Ecohydrology PAS. Poland

KEYWORDS: NON-POINT SOURCES, MODELING, ECOHYDROLOGY

According to the requirements of the Water Framework Directive (WFD) and the provisions of the Polish Water Law, work is continuing on the updating of the Water Basin Management Plans and the program of measures included in the National Water and Environmental Programme. The implementation of the mentioned documents is aimed at achieving the good status of waters required by the WFD. The analyses presented here pertain to a part of the Pilica River catchment (approximately 4900 km2) and were conducted as the starting point for the development of an Action Plan aimed at reducing non-point (diffuse) pollution in the Pilica River catchment in order to improve the environmental potential of the Sulejów Reservoir. The GIS-oriented models: MONERIS (Modeling Nutrient Emissions in River Systems, IGB German) and SWAT (Soil & Water Assessment Tool) were applied to identify sources and pathways of nutrient emissions in the Pilica River catchment. The MONERIS model results showed that only about 7% of the nitrogen and phosphorus loads were from point sources in the Pilica River catchment and >90% were from diffuse sources. The spatial analysis of emissions of nitrogen and phosphorus were made by the SWAT model, which allowed for quantification of the water balance and nutrient emission divided into 273 sub-basins, indicating precisely the 'hot-spots' of generating diffused pollution in the sub-basins. The modeling results will be used as a basis to develop 'Action Plan to reduce diffuse pollution in the Pilica River catchment'.

PRESENTATION TYPE: POSTER

FIRST RESULTS ABOUT UNCERTAINTY EVALUATION IN ECOLOGICAL STATUS ASSESSMENT OF LAKES USING PHYTOPLANKTON

Giuseppe Morabito
CNR, Institute for Ecosystem Study, Pallanza, Italy
Fabio Buzzi
ARPA Lombardia, Italy
Giuseppe Morabito
CNR, Institute for Ecosystem Study, Pallanza, Italy

KEYWORDS: LAKES ASSESSMENT, PHYTOPLANKTON , UNCERTAINTY

The classification of ecological status according to the WFD requires to assign a water body to one of five quality classes: High, Good, Moderate, Poor or Bad. Associated with this classification is a risk of uncertainty. The question is how confident we are that a lake is really in the assigned status class and whether it might be in another class. In order to quantify this likelihood we must statistically estimate the uncertainty for our classification results. We estimated the uncertainty associated with the multimetric index ICF, adopted in Italy for lakes assessment using phytoplankton. The analysis was carried out on data from 58 lakes, sampled at least three times per year, some of them included in the database used for the Alpine GIG intercalibration exercise, some coming from the Italian monitoring programme. Only lakes with a stable trophic condition were chosen, in order to avoid the error due to a change in the trophic status. The approach suggested by Ellis and Adriaenssens (2006) was followed, calculating the confidence curves for each quality class as well as the risk of misclassification across the scale of the normalized EQR for ICF. Our results show that this risk is close to 50% at the border between the critical classes Good and Moderate, although decreasing to less than 20% in the middle of the ICF range corresponding to the Good class. The estimation of uncertainty used here included many sources of error such as seasonal, inter-annual and measurement error.

PRESENTATION TYPE: ORAL

FIRST EVALUATION OF THE ECOLOGICAL STATUS OF THE MEDITERRANEAN LAKES OF UMBRIA IN ACCORDANCE WITH WFD 2000/60/EC: THE CASE OF POLYMICTIC AND SHALLOW LAKE WATER BODIES

Alessandra Santucci
ARPA Umbria, Italy
Alessandra Cingolani
ARPA Umbria, Italy
Fedra Charavgis
ARPA Umbria, Italy

KEYWORDS: WFD DIRECTIVE, MEDITERRANEAN LAKES, CLASSIFICATION SYSTEM

This work describes lake water bodies first classification results in accordance with Directive 2000/60/EC, highlighting the main steps of the new complex environmental quality assessment system and the problems related to the application of sampling and evaluation methods in the Umbria region areas. The application of new European and national regulations led to a thorough review of the monitoring activities applied so far. Besides, it made possible, for the first time, to collect informations on Umbrian Mediterranean lakes ecological aspects through a standardized and systematic monitoring of faunistic and floristic communities. The aim of the study is to present, for each lake and for each biological quality element, the main topics of the application of the different indices involved in the ecological status assessment, specially referred to Trasimeno lake and Piediluco lake, which represent ecosystems of significant importance from a naturalistic and an environmental point of view. The work may give an important contribution in the biological methods validation process as it also points out the new classification system limits and problems related to the reference conditions established for Mediterranean lakes. National reference values, infact, don't seem to be adequate to describe some ecosystems, like polymictic and shallow lake water bodies.

PRESENTATION TYPE: POSTER

MACROIMMI INDEX, APPLICABILITY TO MEDITERRANEAN LAKES: WORK IN PROGRESS

Alessandra Cingolani
ARPA Umbria, Italy
Elisabetta Ciccarelli
ARPA Umbria, Italy
Tisza Lancioni
ARPA Umbria, Italy
Barbara Todini
ARPA Umbria, Italy

KEYWORDS: MACROPHYTE, WFD DIRECTIVE, CLASSIFICATION SYSTEM

Aquatic flora represents an essential biological element in evaluating the ecological quality of water bodies. According to Water Framework Directive, local Environmental Protection Agency monitored the taxonomic composition and abundance of aquatic vegetation (APAT, 2007) on two Mediterranean Lakes (Central Italy): Lake Piediluco (shallow lake, calcareous, macrotype L3) and Lake Trasimeno (polymictic lake, macrotype L4). Data collected in June-July 2010 have been used to evaluate the applicability of the Macrophytes Italian MultiMetrics Index, MacroIMMI, developed by a specific working group (Intercalibration, IC; CIS 2004) to assess aquatic macrophyte community quality and, only within the Alpine GIG, exposed to intercalibration process (CNR-ISE,02.13, 2013). The components of the MacroIMMI are: the maximum depth of aquatic plant growth, the trophic score and the Bray Curtis dissimilarity index. The rate between the reference conditions and the Index numerical value, calculated for each water body, identifies the Ecological Quality Ratio (EQR) and is associated with the ecological status class (high, good, moderate, poor, bad). The hydrophytes data collected on the two lakes investigated allowed us to assess the MacroIMMI reliability to detect the trophic status of lacustrine types of Mediterranean Ecoregion. The MacroIMMI classified the Lake Trasimeno in good ecological status and the two water bodies of Lake Piediluco in moderate ecological status. The quality achieved with the macrophytic index was compared with the status registered through the Phytoplankton Index (ICF) and that obtained with the Lakes Trophic Level for ecological status (LTLeco), based on physico-chemical parameters (total phosphorus, transparency, dissolved oxygen).

PRESENTATION TYPE: POSTER

ECOLOGICAL STATUS ASSESSMENT OF LAKES IN LOMBARDY

Agostinelli Chiara
Arpa Lombardia, Italy
Beghi Andrea
Arpa Lombardia, Italy
Bellinzona Silvia
Arpa Lombardia, Italy
Bettoni Eugenia
Arpa Lombardia, Italy
Bonomi Francesco
Arpa Lombardia, Italy
Borlandelli Cristina
Arpa Lombardia, Italy
Caraffini Ketty
Arpa Lombardia, Italy
Carena Elisa
Arpa Lombardia, Italy
Dotti Nicoletta
Arpa Lombardia, Italy
Elvio Francesco
Arpa Lombardia, Italy

KEYWORDS: ECOLOGICAL CLASSIFICATION, LARGE DEEP LAKES, HIGH ALTITUDE LAKES

In northern Italy there is an important lake district that includes the deep subalpine lakes, some small medium insubrian lakes and many high altitude lakes. The ecological status assessment of the Water Framework Directive combines information of several hydromorphological, chemical and biological parameters to define the overall status of functioning and structure of the ecosystem. ARPA Lombardy started to study biological quality elements and chemical parameters of lakes belonging to the different typologies, since 2000. Biological Quality Elements have been described, first using sampling and analytical methods adopted by the research institutes and subsequently following official methods implemented by Italian national EPA (ISPRA). The main difficulties have been found in the ecological assessment of large and deep lakes such as Garda, Maggiore, Como, Lugano, Iseo and for high altitude lakes. Data on biological, chemical and hydromorphological features of 30 lakes were collected and used for the implementation of biological indices and, subsequently, for the ecological classification of all water bodies of the entire sampling network. 270 phytoplankton communities have been characterized; 788 transect have been investigated to define macrophytes communities; 229 macroinvertebrates samples were processed with the identification of the specimens to the lowest taxonomic level; 30 benthic and 5 pelagial multi-mesh gillnets have been used to apply Lake Fish Index on 2 small lakes; hydromorphological parameters have been collected from 70 Hab plots according to LHS method. In this work the results of ecological classification of all lacustrine water bodies focusing on large deep and high altitude lakes are shown.

PRESENTATION TYPE: POSTER

CRITICAL ASPECTS OF APPLICATION OF WFD ASSESSMENT METHODS TO THE LAKES OF LOMBARDY

Fabio Buzzi
Arpa Lombardia, Italy
Chiara Agostinelli
Arpa Lombardia, Italy
Andrea Beghi
Arpa Lombardia, Italy
Silvia Bellinzona
Arpa Lombardia, Italy
Eugenia Bettoni
Arpa Lombardia, Italy
Francesco Bonomi
Arpa Lombardia, Italy
Cristina Borlandelli
Arpa Lombardia, Italy
Ketty Caraffini
Arpa Lombardia, Italy
Elisa Carena
Arpa Lombardia, Italy
Nicoletta Dotti
Arpa Lombardia, Italy

KEYWORDS: BIOLOGICAL QUALITY ELEMENTS, IDENTIFICATION LEVEL, UNCERTAINTY

The Ecological classification of water bodies, introduced by WFD in 2000, was adopted in Italy in 2006 and 2010 by 2 legislative decrees. ARPA Lombardy started to study lacustrine ecosytems since 2000, at first monitoring phytoplankton communities and chemical parameters. Since 2003 at now all the Biological Quality Elements and hydromorphological aspects have been investigated. Data produced by thisAgency have been used for the implementation of the metrics of phytoplankton, macrophytes, macroinvertebrates and for the intercalibration exercises of Alpine GIG Lakes . Some difficulties have been found in all the phases of the application of the assessment methods, at field survey level especially for macrophytes, macroinvertabrates, fish fauna and hydromorphological parameters. They were particularly conspicuous for subalpine lakes, because oftheir great surfaces, depths and strong waves; besides, high altitude lakes were difficult to reach with the suitable sampling equipment. About the analytical phase a critical aspect was the identification of the specimens of phytoplankton and, in particular, of chironomids larvae to the suitable taxonomic level. Not all the BQEs metrics were finalized. The application of fish fauna assessment method to large deep lakes involves the use of great economic and human resources. Assessment methods need to be better calibrated to Italian lakes typologies and almost all of them respond only to eutrophication pressure factor. There is the need to evaluate the uncertainty associated to every single metric. The One out all out approach is not always the better combination rule to classify water bodies using multiple BQEs.

PRESENTATION TYPE: ORAL

BIODIVERSITY MONITORING OF A NEWLY-ESTABLISHED WETLAND IN THE REGIONAL PARK OF APPIA ANTICA (ROME, ITALY)

Della Bella Valentina
Italian National Institute of Health, Rome, and Environmental Protection Agency of Umbria Region. Italy
Ciadamidaro Simone
Italian National Institute of Health, Rome, and ENEA Saluggia Research Centre, Saluggia.Italy
Puccinelli Camilla
Italian National Institute of Health, Rome, taly
Marcheggiani Stefania
Italian National Institute of Health, Rome, Italy
Rossi Alma
Regional Park of Appia Antica Rome, Italy
Piccari Fabrizio
Regional Park of Appia Antica, Rome, Italy
Mancini Laura
Italian National Institute of Health, Rome, Italy

KEYWORDS: MEDITERRANEAN POND, MACROINVERTEBRATES, DIATOMS

Small wetlands are widely recognised to contribute to freshwater biodiversity at regional level, and to deliver valuable ecosystem services. Notwithstanding their value, they are seriously threatened by human activities, which has resulted in a sharp decline in numbers and ecological quality, especially in metropolitan areas of big cities. The Regional Park of Appia Antica is a protected area embedded within the city of Rome and connected with surrounding rural areas at the outskirts of the city. The aquatic habitats of the Park include small watercourses, ponds and a small artificial wetland (Caffarella Pond) built in 2004. A monitoring program was set up to study the seasonal variation of physico-chemical characteristic in the Caffarella Pond, and to analyse the spatio-temporal patterns in macroinvertebrate colonization and the benthic diatom community during the first four years. The results of our analyses show two main effects of the new pond: 1) a mitigation action of nutrient load on the small stream forming the pond; 2) an increased biodiversity of aquatic ecosystems inside the Park. In fact, the pond hosted a macroinvertebrate community more diverse than the other aquatic habitats, playing a role as “reservoir” of species for neighbouring aquatic biotopes impacted by anthropogenic activities. Our study supports the recommendation of the European Directive (WFD 2000/60/EC) that the management of river basins includes small wetlands. Caffarella Pond, in fact, could play an important role in the biodiversity restoration and, more in general, in the management of the aquatic urban ecosystem.

PRESENTATION TYPE: POSTER

IDENTIFICATION AND CLASSIFICATION OF HEAVILY MODIFIED AND ARTIFICIAL WATER BODIES, LAKES AND RIVERS

Maria Camilla Mignuoli
Ministry of Environment, Land and Sea. Italy
Mariachiara Barile
Ministry of Environment, Land and Sea. Italy
Claudia Vendetti
Ministry of Environment, Land and Sea, Italy
Gabriela Scanu
Ministry of Environment, Land and Sea, Italy

KEYWORDS: WATER USES, DESIGNATION OF HMWB OR AWB, MITIGATION MEASURES

The Water Framework Directive 2000/60/EC has establishes a framework for the protection of all surface and ground waters and aims to achieve the “good ecological and chemical status” for all Community waters by 2015. The WFD provides that for certain water bodies (w.b.), under specific circumstances, the environmental objective is to achieve the “good ecological potential” (GEP) rather than the “good ecological status”. This is the case of the artificial w.b. and of those w.b. which have been physically altered by human activities (i.e. “specified uses” such as, e.g., water supply of lakes/reservoirs), that may be designated as “artificial” (AWB) or “heavily modified” (HMWB), reconciling thus the socio-economic activities and the environmental objectives. The assumption is that the “ecological status” (based on structure and functioning of biological communities of the aquatic ecosystem) of HMWB and AWB is different from that of “natural” w.b.. The Ministerial Decree 27.11.2013, n.156, indicates the identification/designation methodologies, for rivers and lakes, as heavily modified or artificial. Next is define the criteria to establish the GEP for these lakes/reservoirs and rivers. One possible approach is to identify a list of national mitigation measures dependent on HMWB’s or AWB’s use. The “maximum ecological potential” (MEP) of HMWB or AWB represents the reference conditions i.e. the state that could be achieved once all possible mitigation measures have been applied. The GEP is defined, however, as the state that could be achieved when you take all possible mitigation measures, excepting those that improve w.b. to slight deviation of MEP.

PRESENTATION TYPE: POSTER

ECOLOGICAL ASSESSMENT METHODS OF LAKES IN EUROPE

Sandra Poikane
European Commission, Joint Research Centre, Institute for Environment and Sustainability, Ispra, Italy
Wouter van de Bund
European Commission, Joint Research Centre, Institute for Environment and Sustainability, Ispra, Italy

KEYWORDS: WATER FRAMEWORK DIRECTIVE, EUROPEAN LAKES, ECOLOGICAL ASSESSMENT

The Water Framework Directive (EC 2000; WFD) is the first piece of international legislation to require European countries to establish comparable ecological assessment schemes of their freshwaters. A key element in harmonising quality classification within and between Europe's river basins is an "Intercalibration" exercise, stipulated by the WFD, to ensure that the good status boundaries in all of the biological assessment methods correspond to similar levels of anthropogenic pressure. In this paper, we provide a comprehensive overview of this international comparison, focusing on the assessment schemes developed for freshwater lakes. Out of 82 lake ecological assessment methods submitted for the comparison, 62 were successfully intercalibrated and included in the EC Decision on Intercalibration, with a high proportion of phytoplankton (18), macrophyte (17) and benthic fauna (13) assessment methods. Consequently, we (1) review all the assessment methods developed for lakes focusing on the metrics included and the pressures addressed; (2) summarize the process and the results of intercalibration of lake assessment methods, and (3) discuss the current gaps and the way forward to common management objectives for European lakes.

PRESENTATION TYPE: ORAL

MS08-03S

Special Session - Ecotechnology and Ecohydrology for remediation and restoring the quality of contaminated lentic-lotic water systems

STANDARD PROTOCOL FOR TIME-WEIGHTED PERFORMANCE MONITORING OF ECOLOGICAL RESTORATION OF POLLUTED LENTIC-LOTIC AQUATIC SYSTEMS

Sandeep Joshi

Shrishti Environment & Sustainability Society, Pune, India

KEYWORDS: ECOLOGICAL RESTORATION, AQUATIC SYSTEMS, EVALUATION PROTOCOLS

Lentic-lotic aquatic ecosystems including rivers and streams, ponds and lakes, oceans and bays, wetlands, swamps and marshes, are characterized by their biotic components creating niche of the adequate space, shelter, water, and food. Debasement of lentic (Lakes) – lotic aquatic systems by discharge of sewage, effluents and solid wastes has affected the ecological processes and productivity essential for the economic gains. These effects can be categorized into three – stress of pollution loads, swing in processes and alteration in status factors. Ecological restoration of aquatic systems is typified by attaining the original status of ecological equilibrium of communities, carbon-nutrient cycling and energy transfers. These parameters can be classified into “System’s Operational Evaluation Protocol”. The second group of parameters inclusive of infrastructure engineering can be termed as “System’s Structural Evaluation Protocol” and thirdly the group of parameters comprising systemic adaptations, financial returns, competency of human resources, and governance policy formulations can be termed as “Management Excellence Evaluation Protocol”. All these three protocols are to be monitored for project performance of ecological restoration of polluted lentic-lotic aquatic systems and its sustainability.

PRESENTATION TYPE: ORAL

ECOLOGICAL QUALITY INDEX OF RAIN WATER HARVESTING POND, BHAVAN'S POND AND VIHAR LAKE, MUMBAI, INDIA

Pramod Salaskar

Naushad Ali Sarovar Samvardhini, Maharashtra State, India

Rain Water Harvesting Pond of about 4184.0675 sq.m created in the abandoned solid waste dumping site was assessed for its ecological health status, water quality and biodiversity. The Pond has been catering the need of the water for plantation in the premises of Maharashtra Nature Park, Mumbai admeasuring about 37acres. This emphasized the need of assessing the impact of stabilizing solid waste on the water quality of pond. Methodology's replicability was also verified by applying it for the simultaneous assessment of Bhavan's Pond and Vihar lake. In the present assessment programme all the three lakes were thoroughly studied during period for their Ecological Quality Index (EQI) calculated from Carlson's Trophic State Index (C.TSI), Simpson's Diversity Index (SDI), and Water Quality Index (WQI). All these indices were estimated using the observations of 2 years. It was observed that the Rain Water Harvesting Pond (RWH Pond), MNP and Bhavan's Ponds were somewhat similar in showing eutrophic conditions and Vihar lake was in mesotrophic condition. By comparing Rain Water Harvesting Pond and Bhavan's Pond, it was further concluded that there was no serious impact on water quality of RWH Pond due to fully or partially stabilized solid waste dumping site. This might be due to clustered scientific plantation. So, based on all the observations and conclusions it can be recommended that such low cost RWH pond can be effectively used for watering the plantation and controlling the dust in abandoned waste dumping sites. It is desirable to develop a layout of green capping of abandoned sites with Rain Water Harvesting Pond.

PRESENTATION TYPE: ORAL

COMPARISON OF VARIOUS MICROBIAL TECHNIQUES FOR TREATMENT OF RIVER AND LAKE POLLUTION

Sayali Joshi
Shrishti Eco-Research Institute (SERI), Pune, India.
Amar Supate
Maharashtra Pollution Control Board, Mumbai, India
Sandeep Joshi
Shrishti Environment and Sustainability Society (SESS), Pune, India

KEYWORDS: RIVERS AND LAKES, MICROBIAL TECHNIQUES, BIO-ELIMINATION

Microbial diversity and ecology is a foundation of diagnostic analysis and treatment of contamination surface water bodies such as streams, rivers and lakes which receive high amounts of pollution loads. Substrate and habitat specificity of various microbial communities provides range of techniques such as aerobic, facultative, anaerobic stand alone and combination methods to degrade the pollution to acceptable limits. If bioremediation is combined with suitable naturally growing native plant species the effect of decontamination is pronounced. It is noticed that the rate of degradation is comparatively better in the moderate climatic conditions, ambient temperature ranging from 25 – 40oC as observed in various case studies. Augmentation of Contaminated water bodies' normal microflora can be achieved through addition of some pure or mixed cultures with stock release or continual dosing. Effectiveness of the addition can be monitored using selective process parameters such as autotrophic, organotrophic and lithotrophic actions and numerical assessments, in addition to presence of extra-cellular enzymes. Polymer Chain Reaction (PCR) techniques can be used for effective monitoring of pathogens in the polluted water bodies. In this paper, abovementioned techniques for measurement of microbial activity are discussed with their effectiveness in biomonitoring and bio-elimination of pollution from the vital freshwater resources – rivers and lakes.

PRESENTATION TYPE: ORAL

ECO-RESTORATION OF LENTIC-LOTIC SYSTEM DOWNSTREAM OF UDAIPUR CITY, RAJASTHAN USING ECOTECHNOLOGICAL AND ECOHYDROLOGICAL SOLUTIONS WITH PEOPLE'S ENDORSEMENT

Sayali Joshi
Shrishti Eco-Research Institute (SERI), Pune, India

Tej Razdan
Jheel Sanrakshan Samiti, Udaipur, India

Arvind Singhal
Udaipur Chamber of Commerce and Industry, India

Gaurang Sinha
Green Infrastructure, Pune, India

Anil Mehta
Vidya Bhawan Polytechnic, Udaipur & Joint Secretary, Jheel Sanraklshan Samiti, India

KEYWORDS: ECO-RESTORATION, GREEN BRIDGE, PEOPLE'S ENDORSEMENT

River Ahar and associated lake system, in Udaipur, Rajasthan is severely contaminated due to wastewater from urban sprawl of nearly 0.7 million people which is a fifth order drainage system of holy river Ganges of India. In the flow regime of the river, in-stream ecological operation was carried out in 2010 using microbial consortia and plants. Stretch of the river where this horizontal eco-filtration system was installed got revived in a quarter year; and the system is functional as on date on its own from last 4 years. In this restoration project, stakeholders' community of the river basin was dynamically engaged in all activities of eco-restoration mechanism known as 'green bridge system'. Continual people's involvement on eco-revival of Ahar river proves that theconceptsof eco-hydrology, eco-technology and people's concerned wisdom of conservation of water resources can coexist. Mechanized treatment processes do not count for ecological restoration and greatly rely on empirical data for treatment design as well as on verification of very broad physico-chemical parameters of treated wastewater. These treatment plants cannot perform because of both non-ecological approach as well as lack of ownership of stakeholders. The need is, therefore, to explore the wisdom of people and blend it with scientific interventions in order to solve the problems of industrial and domestic sewage of entire world. This paper is a case study of people's ecotechnological initiative of application of principles of eco-hydrological principles to convert dead-river and associated lake system into living water bodies.

PRESENTATION TYPE: ORAL

PIT LAKES – SPECIAL LIMNOLOGICAL FEATURES AND OPTIONS FOR MANAGEMENT

Martin Schultze

Helmholtz-Centre for Environmental Research - UFZ, Department Lake Research, Magdeburg, Germany

Walter Geller

Helmholtz-Centre for Environmental Research - UFZ, Freiburg, Germany

KEYWORDS: PIT LAKE, ACIDIFICATON, MANAGEMENT

Pit lakes are artificial lakes resulting from surface mining for various raw materials. Their number and, thus, their relevance are increasing worldwide due to increasing application of surface mining in the last decades. When resulting from mining for lignite, coal or metals, pit lakes are often acidic (pH3) and show high concentrations of sulfate, metals and trace elements (up to grams per liter). They may cause serious risks for downstream water systems, local population and wildlife. However, pit lakes also provide many options of beneficial end use and may constitute valuable water resources. Research ad management practice in the last 20 years have provided basic understanding of the limnology of pit lakes and tested management options. This knowledge is needed by mining industry for developing appropriate mine closure plans, by responsible authorities for decision making and by lake managers for handling already existing pit lakes but not widely recognized yet. The presentation summarizes the available knowledge on limnological characteristics and management options for pit lakes with emphasis on acidification and lakes resulting from lignite, coal and metal mining. Special features of pit lakes will be presented regarding hydrology (e.g. interaction with groundwater under post-mining conditions), physics (e.g. influence of high concentrations on stratification and light), chemistry (e.g. unusual relevance of iron), and biology (e.g. reduced food webs at low pH). Available approaches of management comprise avoidance and source treatment, hydrological management, chemical and biological in-lake treatment, and treatment of inflowing and outflowing water.

PRESENTATION TYPE: ORAL

TECHNOLOGICAL APPLICATION OF MICROBIAL CONSORTIA, NANO FORMS AND BACTERIOPHAGES FOR REVIVING SELF – PURIFICATION OF LENTIC – LOTIC AQUATIC SYSTEMS

Sandeep Joshi
Shrishti Environment & Sustainability Society, Pune, India
S. P. Gautam
Ex-Chairman CPCB, Delhi, India

KEYWORDS: AQUATIC SYSTEM, SELF-PURIFICATION, MICROBIAL MECHANISM

Ecological restoration of any river or lake largely depends on the re-establishment of food chain. Detritus food chain comprising microbial flora and fauna is fundamentally instrumental in biochemical cycle from residuals into resources like sources of carbon, nitrogen, phosphorus along with other essential nutrients and energy. The interaction of microbes with green plants in microcosm for the targeted task of reducing pollution stress is the key to attain self-purification capacity of lentic - lotic systems. This paper enlists application of various technologies employing microbial consortia, nano forms and bacteriophages with their their efficacy in achieving the pristine nature of water body. These technologies support the indigenous micro flora responsible for in situ purification of water by optimal concentration of microbial release in the water body at a regular interval at bio-augmented banks. Technological efficiency in terms of bio-kinetics of aerobic - anaerobic microbial mechanisms of pollution reduction in the aquatic systems with use of certain reported nanoforms and bacteriophages is discussed in detail.

PRESENTATION TYPE: ORAL

LAKE MANAGEMENT CHOICES USING AERATION TO IMPROVE WATER QUALITY

Robert Robinson
Kasco Marine, Prescott, USA

KEYWORDS: REDOX POTENTIAL, WATER QUALITY, AERATION TECHNIQUE

As nations develop it is critical to their overall success to partly focus on managing the overall water quality of their lakes which command focus from the rest of the world. Lakes can and should be the showcase of natural beauty and pride. The goal of lake management professionals is to maintain or improve water quality of the aquatic environment they are tasked with managing. Aeration is one of the most widely used, and in some cases misunderstood, lake management techniques. The most important water quality parameter for lakes is dissolved oxygen which can be paired with redox potential. When the appropriate aeration technique is properly designed and employed the self polluting effect of aquatic systems are greatly reduced and the assimilation capacity increases. Within the United States the Clean Water Act of 1972 states all bodies of water must maintain dissolved oxygen levels of 5 ppm or greater. It is known that many bodies of water do not meet those criteria both in the United States and world-wide. A review of known aeration/circulation/oxygenation/ destratification approaches will be discussed to include advantages and disadvantages and economics with these management techniques. Case studies will indicate oxygen to the sediment water interface as well as elimination of thermal/chemical stratification positively impacts overall water quality and fish habitat. When used appropriately, aeration can be a very effective lake management tool.

PRESENTATION TYPE: ORAL

MS08-04S

Special Session - Lake Habitat Preservation and New Opportunities for Sustainable Development

WATER CONSUMPTION IN BUILDINGS: INSIGHT FROM A STUDY ACROSS THE UNITED STATES

Umberto Berardi
Worcester Polytechnic Institute. Worcester. USA

KEYWORDS: DORMITORIES, SUSTAINABLE BUILDINGS, WATER CONSUMPTION

Worldwide depletion of resources has brought many sustainability issues of buildings to the forefront, including the consumption of water-use for indoor purposes. The third largest consumption of water occurs in buildings, mainly for flushing and personal hygiene. The United States Department of Energy and the European Commission place domestic water use at more than 250 liters per person per day. This paper examines two related aspects: the temperature and quantity of water consumption in buildings with different levels of sustainability. First, the paper presents the results of a showerheads and faucet aerators metering study, and their impacts on the energy consumption. Then, the water consumption in Leadership in Energy and Environmental Design (LEED) and non-LEED dormitories over several years is compared. Three LEED and six non-LEED dormitories, serving over 2000 students, were selected for this analysis. The perception of water consumption behavior of occupants has also been investigated through online users' surveys. A comparison among the design evaluation, actual water consumption, and subjectively evaluated consumption allows highlighting water consumption in dormitories. In particular, the water filtration system used in a building aiming to zero water consumption is described. Technologies for using rain water in buildings are hence compared. Finally, this paper discusses several key variables that impact water use of buildings and aims to stress the importance of this resource for sustainability.

PRESENTATION TYPE: ORAL

SIMULTANEOUS SACCHARIFICATION AND FERMENTATION OF COMMON REED (PHRAGMITES AUSTRALIS) AT HIGH SOLID LOADING

Franco Cotana
CIRIAF - Biomass Research Centre, University of Perugia, Italy
Gianluca Cavalaglio
CIRIAF - Biomass Research Centre, University of Perugia, Italy
Valentina Coccia
CIRIAF - Biomass Research Centre, University of Perugia, Italy
Anna Laura Pisello
CIRIAF - Biomass Research Centre, University of Perugia, Italy
Alessandro Petrozzi
CIRIAF - Biomass Research Centre, University of Perugia, Italy
Mattia Gelosia
CIRIAF - Biomass Research Centre, University of Perugia, Italy

KEYWORDS: ETHANOL, COMMON REED, SIMULTANEOUS SACCHARIFICATION AND FERMENTATION

Trasimeno lake's environment offers a good availability of residual biomass such as common reed (Phragmites Australis). Thanks to recent advancement in conversion technologies this feedstock can be used for the production of cellulosic ethanol as a substitute for traditional fossil fuels using local resources. Second generation bioethanol obtained from ligno-cellulosic matter avoids the food/energy competition making this fuel highly sustainable. The study will carry out an optimization of the process using steam explosion pre-treatment at different severity parameter (R0) values. Steam explosion prototype has a range of temperature between 180 and 240 °C; the maximum system size is around 2 kg input biomass each cycle. The pretreated material is separated by a sieve in order to obtain WIS (water insoluble substrate) and liquid fraction. WIS is washed and pressed to remove inhibitors and remaining hemicellulose. Enzymatic hydrolysis is carried out in a 5-L reactor using Cellic™Ctec2 provided by Novozymes, which consists of a blend of aggressive cellulases (endocellulase and exocellulase), β-glucosidases and hemicellulose. Fermentation is carried out in the same 5-L reactor using Saccharomyces cerevisiae yeast ("red ethanol") provided by Fermentis. The characterization of raw material, intermediate product (solid and liquid pretreated material, samples during hydrolysis and fermentation, final products) is carried out by HPLC (High Performance Liquid Chromatography). Moreover the ethanol yield will be investigated using different values of solid loading and enzyme dosage with a simultaneous saccharification fermentation (SSF) process, investigating the possibility to co-ferment solid and liquid fractions obtained from pre-treatment.

PRESENTATION TYPE: ORAL

THE EFFECT OF LAKE MICROCLIMATE ON THERMAL-ENERGY BEHAVIOR OF BUILDINGS

Anna Laura Pisello
CIRIAF - Biomass Research Centre, University of Perugia, Italy
Veronica Lucia Castaldo
CIRIAF - Biomass Research Centre, University of Perugia, Italy
Gloria Pignatta
CIRIAF - Biomass Research Centre, University of Perugia, Italy
Franco Cotana
CIRIAF - Biomass Research Centre, University of Perugia, Italy

KEYWORDS: ENERGY EFFICIENCY IN BUILDINGS, LAKE MICROCLIMATE MONITORING, DYNAMIC THERMAL-ENERGY SIMULATION

Lakes play an important role in determining both global and local boundary climate conditions, and can significantly contribute to sustainable development, given their high carbon sequestration potential and inner energy source. Additionally, they are excellent memory custodians of global climate change, thanks to the ability to store heat in their hypolimnetic water and through the traces left in sediments during the course of the centuries. In particular, the presence of masses of water produces important damping effect for the oscillations of daily and annual air temperature. In this scenario, the purpose of the research work is to investigate how micro-climate and meso-climate boundary conditions are influenced by the presence of lakes. In particular, the Trasimeno lake (128 km2) situated in Perugia (Central Italy) is selected as case study, and the climatological assessment of four different areas located around its basin is carried out to evaluate microclimate singularities determined by the lake's presence. To this aim, four microclimate monitoring sensors have been installed in January 2014 with the purpose to elaborate new specific local weather profiles and to characterize environmental boundary conditions around the lake, in terms of air temperature and relative humidity. . These continuously monitored data are therefore used to investigate the effect of the lake's presence in the thermal-energy behavior of buildings and energy plants' efficiency,in comparison with both urban and suburban monitoring stations. Therefore, the variation of the thermal-energy performance of the buildings situated in the proximity of the lake is assessed through dynamic thermal-energy simulation, in order to investigate the extent to which the built environment is affected by the lake's presence. The final objective is to investigate the variation of the external climate boundary with reference to (i) lake environment, (ii) urban environment, and (iii) suburban environment, and to determine their interactions with buildings' thermal-energy performance.

PRESENTATION TYPE: ORAL

AN EFFECTIVE COMPARISON OF THE PRODUCTION METHODOLOGIES OF NANOCRYSTALLINE CELLULOSE (NCC) OBTAINED FROM PHRAGMITES AUSTRALIS

Valentina Coccia
CIRIAF - Biomass Research Centre, University of Perugia, Italy
Gianluca Cavalaglio
CIRIAF - Biomass Research Centre, University of Perugia, Italy
Mattia Gelosia
CIRIAF - Biomass Research Centre, University of Perugia, Italy
Enrico Pompili
CIRIAF - Biomass Research Centre, University of Perugia, Italy
Franco Cotana
CIRIAF - Biomass Research Centre, University of Perugia, Italy

KEYWORDS: BIO-BASED PRODUCT, NANOCRYSTALLINE CELLULOSE, IONIC LIQUIDS

Nanocrystalline cellulose (NCC) is an high quality bio-based product, obtainable from cellulosic matrix (e.g. residual biomass) and its relevant cross-sector properties have been scientifically demonstrated. Currently, a major barrier to be overcome is the sustainability of the production process, looking forward for industrial scaling up purposes. A promising production method consists in the use of ionic liquid technique, allowing the deconstruction of cellulose and the reclaiming of its crystalline content, using alternative sustainable components. The present work will present the main results coming from the production of cellulose nanocrystals from phragmites australis that is a very common arboreal variety widespread along lake rivers. The exploitation of such a resource can be contributory for both to the waste management task and to the biorefinery vision, achieving the combined production of energy (biofuels) and materials (biobased products). In this context, and parallel to an intensive bioethanol production campaign at CRB Labs, two different methods were applied (and compared in terms of production efficiency) to obtain NCC: the method including an acid hydrolysis step (using 70 vol. w/w H2SO4) and the procedure exploiting the green ionic liquids. The SEM characterization analyses for the obtained NCC samples are also presented, together with the main future prospects of the research.

PRESENTATION TYPE: ORAL

ENHANCEMENT OF QUALITY OF FISH PRODUCT OF TRASIMENO LAKE: PSR UMBRIA PROJECT

Francesco Asdrubali
CIRIAF - Biomass Research Centre, University of Perugia, Italy
Raffaella Branciari
Veterinary Medicine. University of Perugia
Raffaella Franceschini
University Guglielmo Marconi, Roma, Italy
Samuele Schiavoni
CIRIAF - Biomass Research Centre, University of Perugia, Italy

KEYWORDS: BIODIVERSITY, FISH PRODUCTS, FOOD QUALITY

Trasimeno Lake is considered a high value ecosystem due to its wide biodiversity. Today, fishing is still one of the main commercial activities of the area. Owing to the introduction of exotic species, profound changes have occurred in the composition of the fish community. The new species such as Procambarus clarkii and Carassius auratus (Gold fish) have adapted well, while the indigenous species such as tench, carp, pike and eel, have declined over the years in abundance. Since the 1990s the goldfish has been found in Lake Trasimeno and, it gradually increased in number and is currently the dominant species caught by professional fishermen. The Regional Fund PSR Umbria 2007-2013 (Cooperation for the development of innovative products, processes and technologies for agricultural, food and forest service) is supporting a R&D project related to the Lake Trasimeno in order to: enhance the knowledge of its fish fauna, prepare plans for the control of the foreign species and for the preservation of the ecosystem and modernize professional fishing activity. Another aim of the project is to study a new process for take in advantage of the abundance of this species to obtain a new fish product with high nutritional quality appreciate to the consumer using local aromatic herb and high quality olive oil is useful to enhance the quality of the fishing products of Lake Trasimeno and to create a high quality brand of the area. But informed consumers wants to be reassured about food origin and also about quality and the project, in addiction, allow innovative tests to monitor the cold chain such as time temperature indicator labels. These systems are user friendly and allow to verify if the temperature of the product has exceeded the correct storage value.

PRESENTATION TYPE: ORAL

ENERGY USE AND ENHANCEMENT OF BIOMASSES AROUND WATER RESOURCES

Franco Cotana

Anna Laura Pisello
pisello@crbnet.it
Stefano Cotana

Alessandro Petrozzi

Giorgio Cesari

Emilia Coiauta

Gloria Pignatta

KEYWORDS: ENERGY ENHANCEMENT OF BIOMASSES, WATER RESOURCE, COGENERATION PLANT

CIRIAF group has been researching around renewable sources for energy production since years. The FACEB project was aimed at developing new prototype models in order to use and valorize the energy applications of local wasted biomasses to be picked up from the areas around streets and other non-valuated sources. The program CIRIAF FOR UNESCO is aimed at valorizing from a both energy and economic point of views the possible use of wasted natural biomasses located in close proximity to water resources. This practice could contribute to important local energy supply solutions but also to the general socio-economical benefit deriving from the useful and profitable maintenance of water resources' pertinence. Starting from previous considearations, this analysis concerns preliminar studies around the design and construction of a new cogeneration energy plant, with local biomass from Umbrian rivers' pertinence are collected and supplied in order to produce 1 MWel.

PRESENTATION TYPE: POSTER

ENERGY CONVERSION OF FEEDSTOCK FROM RIVER MAINTENANCE OPERATIONS: DEVELOPMENT OF A MICRO-SCALE GASIFIER

Giulio Allesina
Univ. Modena & Reggio Emilia, Italy
Simone Pedrazzi
Univ. Modena & Reggio Emilia, Italy
Alberto Muscio
Univ. Modena & Reggio Emilia, Italy
Stefano Orlandini
Univ. Modena & Reggio Emilia, Italy
Paolo Tartarini
Univ. Modena & Reggio Emilia, Italy

KEYWORDS: MAINTENANCE, BIOMASSES, GASIFICATION

River maintenance operations are preventative measures aimed at reducing the impact of floods. The thicker or denser the vegetation in the river bank, the slower and the higher the overflow wave. Furthermore the river banks are a suitable environment for the growth of several species that collect high amounts of biomasses. On the other hand, no gasifier on the market is suitable for this kind of feedstock. In several cases the ash content is too high and, besides, the dimensions are far away from woodchip gasifiers standards. This work is primary aimed at developing a coupled model for the prediction of the exploitable biomass amount from the rivers maintenance. These data are then used in a second model, together with the chemical and physical characteristics of the typical biomasses collected. The second model predicts the energy conversion efficiency and the total electrical energy extractable from a zone maintenance. Finally, the design specs of a innovative gasifier for raw feedstock conversion are proposed.

PRESENTATION TYPE: ORAL

THE BIO-LAKE, A NATURAL SWIMMING POOL

Vera Luciani
Vera Luciani Giardini, Italy
Silvia Bizzarri
Vera Luciani Giardini, Italy

KEYWORDS: BIO-LAKE, LANDSCAPE, WATER OXYGENATION

The bio-lake located nearby Lucignano (Arezzo) is one of the most interestingfortified village ever built in Tuscany in the 16th century. It represents a greatvaluable element of an homestead which has been totally refurbished by usingoriginal and recovered stones and material. The extraordinary richness in flora andfauna typical of the bio-lake habitat contributes to perfectly integrate the pool withinthe surrounding hill landscape and makes it an ideal place for relaxing and bathing.The bio-lake is South East oriented and consists of a bathing pool of about 120 m2, from 120 to 200 cm deep, lined with a waterproof fabric made ofrecyclable EPDM (no concrete). The water oxygenation is naturally granted thanks to specific plants able to absorb heavy metals and to filter the nutrients andthe eventually toxic organics components. These plants are placed in thedepuration pool built on top of the bathing area (150 cm higher) and linked to itvia a small streamlet. Around and aside the bathing pool the bank areas ensurewater regeneration. These areas are built with local stones and gravel, andbordered with a stringcourse built by using the ancient technique of the dry wall,without chemicals glue and/or cement.

PRESENTATION TYPE: ORAL

ENERGY ENHANCEMENT OF MARSH REED AS BIOFUEL FOR THERMAL BOILER

Alessandro Petrozzi
CIRIAF - University of Perugia, Italy
Anna Laura Pisello
CIRIAF - University of Perugia, Italy
Gianluca Cavalaglio
CIRIAF - University of Perugia, Italy
Valentina Coccia
CIRIAF - University of Perugia, Italy
Mattia Gelosia
CIRIAF - University of Perugia, Italy
Veronica Lucia Castaldo
CIRIAF - University of Perugia, Italy
Mario Pertosa
CIRIAF - University of Perugia, Italy

KEYWORDS: MARSH REED, THERMAL BIOMASS BOILER, NATURAL BIOMASS FROM LAKE

The lake shores can offer the abundance of a particular spontaneous biomass as the marsh reed (Arundo donax) growing at very high speed, very resistant to extreme weather events. The need for maintenance of the lake shores offers the possibility of collecting and store this biomass in large quantities. The reed can be harvested and processed for the production of a low-cost biofuel with a low moisture content, to be stored and transported in the form of briquettes to supply a biomass boiler for thermal energy production. In this work a case study such as an application to a school is analyzed: an economic and environmental analysis is provided, referring to the whole chain of the biomass collection, treatments and energy enhancement for the thermal energy production, replacing the current fossil fuel boiler

PRESENTATION TYPE: ORAL

WATER HEAT PUMPS USING WATER FROM LAKES. STATE OF THE ART AND CASE STUDY

Anna Laura Pisello
CIRIAF - Biomass Research Centre, University of Perugia, Italy
Valentina Coccia
CIRIAF - Biomass Research Centre, University of Perugia, Italy
Gianluca Cavalaglio
CIRIAF - Biomass Research Centre, University of Perugia, Italy
Silvia Di Francesco
Cusano University, Rome, Italy
Andrea Aquino
CIRIAF - Biomass Research Centre, University of Perugia, Italy
Alessandro Petrozzi
CIRIAF - Biomass Research Centre, University of Perugia, Italy

KEYWORDS: GEOTHERMAL HEAT PUMP, LAKE WATER

The low enthalpy geothermal heat pumps exploit the presence of a thermal source at a fixed temperature, which ensures a thermal head useful to reduce the energy costs necessary for indoor heating and cooling. A heat pump plant consists of three components: heat exchangers interacting with the external source; heat pump and the piping system through terminal elements for indoor conditioning. Geothermal power is a renewable energy source characterized by a huge potential but presenting high costs and significant environmental impacts and risks during the realization and the conduction of the plant. The idea is to overcome these restraints using water heat pumps. This work aims at reviewing the state of the art of mentioned technologies showing how the water heat pump systems are characterized by the highest efficiency, for the direct heat exchange between heat pump and thermal source, and the lowest economic costs, with particular attention to the integration of this technology in lakes' environment. A case of study applied to the water from the Lake Trasimeno is shown.

PRESENTATION TYPE: ORAL

A NEW MODEL FOR PHOTOVOLTAICS INTEGRATION WITH HYDROPOWER: A CASE STUDY

Alessandro Petrozzi
CIRIAF - Biomass Research Centre, University of Perugia, Italy
Silvia Di Francesco
Cusano University, Rome, Italy
Anna Laura Pisello
CIRIAF - Biomass Research Centre, University of Perugia, Italy
Andrea Aquino
CIRIAF - University of Perugia, Italy

KEYWORDS: PHOTOVOLTAICS, HYDROPOWER, RURAL TOWER

The imbalances in the electricity grid produced by not programmable renewable energy sources as wind and solar ones, can be solved integrating the energy production plants with distribution net, via a storage systems. An example of energy storage, different from the electric battery, is represented by a gravity water tank to produce hydropower provided with a pumping system to reload water fed by the unused energy. Similarly, the artificial reservoirs for hydropower production are recharged during the night to take advantage of the water during the day after. The presented system of integration of photovoltaics power with hydropower, aims at create a system for continuous energy production avoiding the energy lacks typical in solar plants applications. The presented study shows the elaboration of the numerical model of a configuration of the integrated energy plants in a rural tower getting a new function, i.e. providing energy for the local buildings.

PRESENTATION TYPE: ORAL

With the contribution of

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Honors Center of Italian Universities

Italian Association of Oceanography and Limnology

Lakes, both natural and artificial are vital and strategic resources for life on our planet. At the same time, they are also highly vulnerable to human activities, especially if they are not properly preserved and used in a sustainable manner. These natural resources and their ecosystems have defined borders, while at the same time also strongly influenced by where they are located. Although there is a geographic limit between a lake ecosystem and neighboring ecosystems, lakes are heavily influenced by the substances entering them in their incoming waters. Moreover, lakes are very complex systems influenced by many different factors, major ones being the materials dissolved in their waters, the climate of the region, energy exchanges with the atmosphere, the soil and the variety of organisms inhabit them, all of which are influenced by, and also influence, the lake system itself. This complexity means that when a lake is studied on the basis of a single discipline, it can often lead to misleading conclusions, or even incorrect results. Multidisciplinary is a keyword in regard to this conference, different approaches and point of views also must be taken into account to address complex lake issues. Therefore, we are inviting not only scientists, but also resource managers, politicians, and lake basin stakeholders and users to the conference. The interactions among this diverse audience will result in a wider discussion, with the goal of connect a top-down approach to a bottom-up perspective to solving complex lake basin issues.

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