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**IANAS-UNESCO-IHP Workshop**  
**Water Quality in the Americas**  
**September 3-5, 2015**  
**Irvine, California**

**Report to UNESCO-IHP and IANAS**

**Workshop summary**

The Inter-American Network of Academies of Sciences (IANAS) and the United Nations Educational, Scientific and Cultural Organization (UNESCO), International Hydrological Programme (IHP) cooperated in the organization and execution of the IANAS-UNESCO-IHP Workshop: Water Quality in the Americas. The workshop was hosted by the US National Academy of Sciences and took place in the Arnold and Mabel Beckman Center in Irvine, California from September 3-5, 2015. The workshop was dedicated to one of the most important issues in water resource management, water quality. Knowledge of water quality is one of the determining factors to take into consideration in proposing important management solutions and in the development of policies to protect and conserve this resource.

The team of IANAS UNESCO-IHP and the US National Academy of Science worked closely in making possible the success of this workshop which brought together 27 water quality experts from the 21 countries represented by the Academies of Science incorporated in the Water Programme of IANAS. It is important to mention that promising undergraduate students from the Outreach Research Training and Minority Science Programs (MSP) from the Ayala School of Biological Sciences, University of California, Irvine participated in the workshop.

The representative from UNESCO-IHP, Sarantuyaa Zandaryaa, the IANAS Co-Chair, Michael Clegg and the Executive Director of IANAS, Adriana de la Cruz, participated actively in the workshop. Professor Clegg offered welcoming words to the workshop. The director of the Division of Water Sciences Secretary of the UNESCO-IHP International Hydrological Programme, Blanca Jimenez (by Skype from UNESCO headquarters in Paris) and the Co-Chair of the IANAS Water Programme, Katherine Vammen, opened the workshop emphasizing the importance of the interchange of experts specifically on water quality and the need to promote research and publications on this topic in future activities.

In coordination, IANAS and UNESCO-IHP proposed 4 different topics related to water quality in 4 sessions of the workshop programme. 1) The quality of surface and groundwater resources, 2) Water pollution effects, control and prevention, 3) Special water quality issues (natural contamination, emerging contaminants, mining and industrial pollution, contamination through oil sand mining) and 4) Institutional, economic and social aspects of water quality management. Each session was directed by Chairs to orientate the interchange and direct time limits. Please see the programme for details.

Some Highlights of the 4 sessions:

**Session 1: The quality of surface and groundwater resources.** (Chairs: José Tundisi-Brazil and Ernesto González-Venezuela)

It was noted by the specialist in microbiology from Brazil, Fernando Spilke that the presence and

evaluation for enteric viruses is one of the new aspects of water quality that needs to be emphasized in research and routine evaluations of water quality. Professor Tundisi illustrated with case studies from Brazil how Climate Change brings about deterioration of water quality – in surface waters increasing eutrophication with the consequent increase in growth of cyanobacteria severely reducing water quality due to the emission of toxins which on the other hand have influence on the costs of water treatment and affects human health. José Fábrega also demonstrated how climate change with changing precipitation patterns have affected water quality in Panama and particularly with a case study called the Purisima. Special emphasis was shown by Ernesto Gonzalez on a series of Venezuelan reservoirs undergoing eutrophication with the important conclusion that mitigation of this deterioration must be focused on the management of the surrounding watershed. The expert from Colombia, Professor Gabriel Roldan gave an impressive review of the historical development of the use of macroinvertebrates as indicators of water quality in surface waters. The focal point representative of Uruguay, Jimena Alonso focused on the reduction of the buffer capacity of lotic and lentic waterbodies in Uruguay that is leading to an increase in the occurrence and intensity of algal blooms and the emergence of new cyanobacteria species which points to the necessity of improving fertilization management practices in order to minimize the input of dissolved phosphorus on surface water.

**Session 2: Water pollution effects, control and prevention.** (Chairs: Katherine Vammen-Nicaragua and Gabriel Roldán-Colombia)

The expert from the Caribbean Academy, Martin Forde, presented a unique study of monitoring of pesticides in humans in several Caribbean islands taking into consideration the high rate of agriculture present and demonstrating the need to practice sustainable management practices and measures for the control of use of pesticides which ultimately threatens human health. The focal point expert from Canada, Banu Örmeci, focused on new sustainable systems and special technologies for wastewater treatment and concluded that there is a need for non-centralized systems for some municipalities and rural areas as well as a combination of centralized systems in urban areas. Two special cases of pollution and their effects were presented by the focal point expert from Guatemala, Manuel Basterrechea, on the impacts of massive sedimentation into Lake Amatitlán caused by intensive hydrological events and from the Dominican Republic, Osiris de Leon, on contamination of the aquifer from urban waste waters due to the lack of a sewage system. The focal point expert from El Salvador, Julio Cesar Quiñonez, proposed a system for environmentally sustainable sanitation in the city of San Salvador.

**Session 3: Special water quality issues.** (Chairs: Martin Forde-Grenada and Banu Örmeci-Canada)

This session covered special water quality issues such as emerging contaminants which in the majority are products earlier thought of as beneficial to health such as pharmaceuticals, special water quality problems and health, potential impacts on water resources due to a megaproject in Central America, natural contamination, and impacts from oil sand mining. The expert, José Elias Becerril Bravo, from Mexico presented the special case of monitoring data of emerging pollutants in Mexico City and although the results were not higher than reports for other urban areas in developed countries recommended the introduction of regulations based on research on potential health effects and further monitoring with improved analytical techniques. The focal point expert, Ricardo Izurieta, from Ecuador gave a summary of emerging and remerging water and wastewater pathogens in the Americas and the consequent impacts on human health. The importance of natural contamination of arsenic and boron due to special geological characteristics in two transboundary countries as Peru and Bolivia was presented by the two focal point experts, Nicole Bernex and Fernando Urquidi. Examples of rapid developing technology and the introduction of megaprojects and their effect and potential impacts on water resources of the countries of the Americas were illustrated on hand from the example of tar sand mining from the Focal Point of Canada, Banu Örmeci and the potential impact of the proposed interoceanic canal from the Focal Point expert from Nicaragua, Katherine Vammen.

**Session 4: Institutional, economic and social aspects of water quality management.** Chairs: Nicole Bernex-Peru and Henry Vaux-US)

This session combined models of management of water quality in an urban area, the city of Toronto, Canada by Michael D'Andrea and in a community driven context in a Ramsar Site in the Amazons in Peru, by Nicole Bernex, Focal Point Representative from Peru. It also showed the importance of jurisdictional management of water quality in an international watershed, the River Plate local coastal area by Raul Lopardo, Focal Point Representative of Argentina, the application of quality standards and consequent problems in Chile from James McPhee, Focal Point Representative from Chile, institutional and legal framework for management of water quality in Honduras from Marco Antonio Blair, Focal Point Representative. The social nature of water was demonstrated on hand from an analysis of the hydro-social cycle involved in access, control of water quality and water and sanitation services in Mexico from Maria Luisa Torregrosa, Focal Point Representative of Mexico. The management of coastal/marine ecosystems was illustrated on hand from the management of terrestrial and coastal waters in Cuba, presented by Daniela Mercedes Arellano-Focal Point Representative.

See Workshop Programme for more details.

### Book Presentation and Public Conference

In order to involve more students from the University of California, Irvine, on actual topics, the morning of September 4<sup>th</sup> was dedicated to special presentations to familiarize the audience with the importance and achievements of IANAS from Professor José Tundisi (Brazil) and the presentation of the recently published book from IANAS "Urban Water Challenges in the Americas. A Perspective from the Academies of Science" was provided by Katherine Vammen (IANAS, Co-Chair). The actual topic of discussion was presented by Henry Vaux (Focal Point from USA) on "Lessons from the Great California Drought". The representative from UNESCO informed about the on-going programs and activities of the International Hydrological Program.

### Field Trip to the Orange County Water District Treatment Plant

Of great interest was the visit of all participants and students to the Orange County Water District and Treatment Plant, one of the most advanced plants based on oxidation, reverse osmosis and microfiltration of secondary effluent from the Orange County Sanitation District Plant # 1 located adjacent. It was exceptionally impressive to learn about the entire water treatment complex which produces the source of water partially for reinjection to groundwater where seawater intrusion has been detected to replenish the quality and the other portion is percolated into the underlying aquifer.



## Conclusions and Highlights of Workshop

To finalize the workshop, all participants were invited to suggest highlights for the main conclusions after listening to the presentations of all experts on water quality issues. A brief and summarized list follows:

1. Monitoring of water quality is the basis for good resource management. This should include:
  - a. Chemical (especially for nutrients), biological and ecotoxicological indicators.
  - b. Persistent Organic pollutants
  - c. Real time monitoring is important.
  - d. Participative monitoring is sometimes recommendable.
  - e. In some cases, it is beneficial to practice low cost, but efficient techniques using innovative solutions for monitoring.
2. It is essential to practice detection of pathogen contamination that affects water quality including bacteriological, virological and microorganism's resistant to antibiotics.
3. It is very important to include in country and regional water quality norms or standards a component for enteric viruses. It is also recommended to take into account enteric viruses in monitoring and research on water quality.
4. It is fundamental when considering water quality to relate results to human health.
5. Water Quality is increasingly influenced by climate change, both droughts and extreme climate events of flooding.
6. Interdependence of Water Management with other natural resources such as energy and agriculture-food security.
7. Hydro-social Cycle: society produces the quality of water with the culture, knowledge, practices, ideas, meanings, values and potentials. "Hydro social" cycle also considers how the water is manipulated, used and concentrated by social stakeholders, struggles for access and control of the water and the mechanisms of exclusion and access expressed in the institutions, through factors such as waterworks legislation, institutions, practices and symbolic meanings (Larsimont and Grosso 2014:8)". (Presentation Focal Point Mexico)
8. All aspects of contamination of subterranean waters, such as saline intrusion, organic contaminants and pathogenic (bacterial and viral) pollution should be included in water quality evaluations.
9. Interesting case studies of contamination impairing water quality and possible impacts on potential of water resources through Megaprojects were presented: Dominican Republic,

contamination from urban wastewater to groundwater, potential impact of a megaproject on Lake Nicaragua, deterioration of water quality through mining in some countries and disposal of solid wastes, chemicals, medicines and other contaminants in municipalities of some countries.

10. The interaction of decision-makers, stakeholders, scientists and organized communities is essential to achieving adequate water management to achieve good water quality.
11. Public input is necessary to supervise regulation of water quality.
12. Water treatment for drinking water should be adapted to local conditions.
13. Environmental consideration of terrestrial and coastal services: It is necessary to consider the relationship between terrestrial and coastal waters during the maintenance of environmental services in marine ecosystems.
14. Promotion of education about water quality and quantity in both sources for water consume and water supply systems to assure that the public is aware that access to water means evaluating its quality and quantity.
15. Promote public access to information about water quality.
16. More studies should be promoted especially to emergent contaminants, impact of oil sand mining and arsenic contamination (natural and from mining).
17. The need to control and monitor water quality of recreational water.
18. Water Security needs cross sector integration considering social change and institutional integration.
19. Traditional Community Management of Terrestrial/Aquatic Environments and Maintaining Ecosystem Services.

## Workshop Documentation

IANAS has prepared a collection of the videos of UNESCO/IANAS workshop which can be found at the following link [https://www.youtube.com/channel/UCj8C\\_cCdLlvwJALrVKtYC1g/videos](https://www.youtube.com/channel/UCj8C_cCdLlvwJALrVKtYC1g/videos).

This collection is an excellent source that can readily be used for classes or reference documentation

## Most important topics and agreements of the IANAS Focal Point meeting

1. Follow up to recent publication of IANAS/UNESCO-IHP, ““Urban Water Challenges in the Americas. A Perspective from the Academies of Science”:
  - Brief reports were given on recent official Academy presentations of the Urban Water Book in Panama, Venezuela, Brazil and Nicaragua.
  - Agreements:
    - Various academies expressed the idea to publish country chapters. Updated and revised.
    - Consider publishing an edition for Policy-makers and/or managers.
    - Consider publishing papers on some of the conclusions with solutions and models.
  - Other topics for the future, suggestions:
    - Data Base of Researchers in Water
    - Data Base of Groundwater information
    - In Mexico there are groups at various Universities that have contributed to water information.
    - Health and water in the Americas.
    - New sources for water for example use of rainwater as in Pompeii.

- Civilizations show the way for better management of water. Case studies.
  - Standards for groundwater. Data base.
  - Standards for water reuse.
  - Water Plans from Municipalities as in Brazil.
2. A white paper of 2 pages per country chapter will be produced as a summary with the most important issues for policy-makers written in a more popular manner with some recommendations for each country. This will be distributed to different governmental organizations and selected policy-makers with a CD of the complete book.
  3. Two new publications will be prioritized by IANAS in the future:

- a. Based on conversations between the team of preparation for the workshop on Water Quality-UNESCO-IHP and IANAS and on suggestions from focal point representatives, a publication will be prepared especially dedicated to Water Quality in the Americas. This is becoming more important since in the last 20 years, water quality deterioration and its complexity has increased and therefore it is urgent to document the state of water quality and offer models of solutions and better management systems.

Two forms of organizations were discussed: i. One by country as in the past but it was suggested to include special chapters such as economy, social aspects (hydro-social structure, linkage between people and water), water and health, water quality in rural areas, biological invasions, acidification process present in water resources (air and water), bioindicators and monitoring and measuring for early warning systems of water quality deterioration.

ii. The second form proposed would be the organization per topics.

Agreement: It was agreed to form a group responsible for the design of the water quality publication composed of Prof. Tundisi (Brazil), Katherine Vammen (Nicaragua), Ernesto Gonzalez (Venezuela), Nicole Bernex (Peru), Banu Örmeci (Canada) to prepare a proposal for Co-Chairs and Executive Director of IANAS, UNESCO-IHP and Focal Points of IANAS.

- b. The focal point representative from Colombia, Prof. Gabriel Roldan proposed a new publication dedicated to Eutrophication. This publication should consider more than just diagnosis but also include success stories, land uses, indicators of the process, social impact, and more. There was an agreement by the focal point representatives to promote this publication and it was suggested that Prof. Roldan with others should prepare the design.

#### 4. Planning of Future Workshops.

Progress Reports and agreements for the three proposed workshops:

- Eutrophication of Lakes and Reservoirs in Central America and the Caribe, Gabriel Roldan and Manuel Basterrechea.

##### *Financing possibilities:*

This workshop has various possibilities of financial support and possible locations (Cuba, Panama, Guatemala). The first possibility would be Panama as the Focal Point, José Fábrega, has knowledge of a concrete financing possibility and Prof. Roldan has proceeded to elaborate the proposal in October for the Panama workshop.

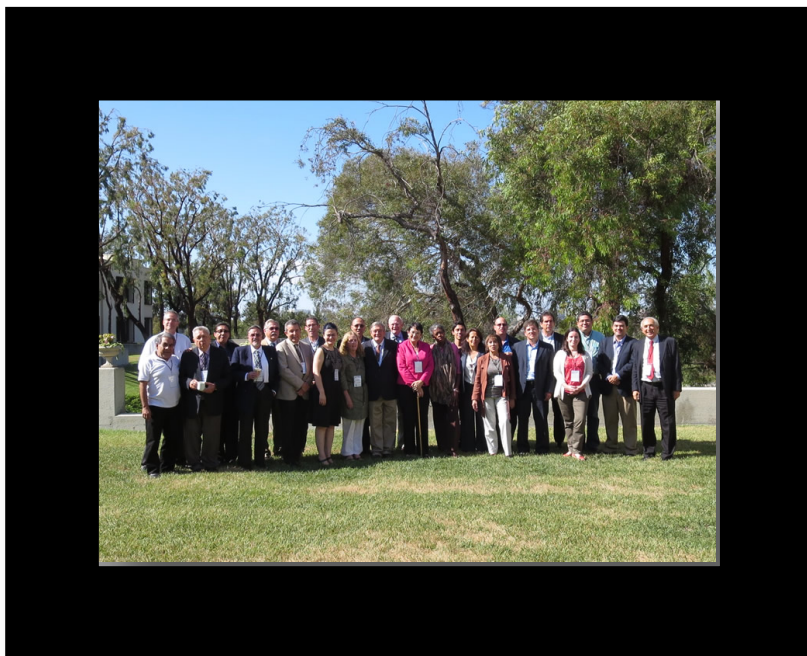
##### *Output:*

The workshop would be directed to managers. Managers need to know how aquatic ecosystems work. It is important that managers know why

and what steps should be taken to avoid eutrophication and restoration possibilities of affected surface waterbodies. What is the cost or consequences if they don't take these steps? Positive experiences in avoiding eutrophication and restoration successes. Lessons learned and done.

Along with the workshop a practical manual for managers would be produced.

- Water and Energy, Marcos Cortesão  
Agreement: This workshop will accompany the next IANAS Focal Point meeting to be held in Foz do Iguaçu and will be planned from the Brazilian Academy. Should include the aspects of how to deal with the Water-Energy Nexus under the pressure of Climate Change. IANAS Focal Points will participate with other specialists on the topic in the workshop.
- Climate Change and extreme hydrometeorological events: a workshop for scientists and managers. Hugo Hidalgo. There are open opportunities to organize this workshop in association with other academic institutions of the University of Costa Rica which are being presently explored. This includes the participation of the Costa Rican Academy of Sciences in the organization of the workshop as well as several academic units from the University of Costa Rica. The idea is to organize the Climate Change workshop jointly with the international RELAB symposium that is hosted by the School of Biology at the University of Costa Rica.



Katherine Vammen  
IANAS Water Programme, Co-Chair  
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