AGENDA

- Welcome & Poll
  *Muttucumaru Sivakumar, University of Wollongong*

- Housekeeping Rules & Introduction
  *Fang Yenn Teo, University of Nottingham*

- Towards Nature-based Solutions for Sustainable Coastal and Estuarine Development
  *Arthur Mynett, TU Delft*

- Ecohydrology implementation for Sustainable Estuaries and Coastal Water: Towards Achieving Water Security
  *Elfithri Rahmah, UNESCO*

- Q&A Discussion
  *Fang Yenn Teo, University of Nottingham*

- Close
  *Sivakumar Muttucumaru, University of Wollongong*
The main aim of the Sustainable Coastal and Estuarine Development specialist group is to advance the application of coastal reservoirs and tidal basins technologies to the world at large, where water and energy security can be significantly enhanced while sustainability of the coastal and estuarine ecosystem is taking into account.
1ST IACRR/IWA INTERNATIONAL CONFERENCE ON COASTAL RESERVOIRS AND SUSTAINABLE WATER MANAGEMENT

ABSTRACT DEADLINE EXTENDED:
15 September 2023

Highlights:
14 world renowned keynote speakers, 10 invited lectures, one full day interactive workshop and one day technical tour to the world’s largest coastal reservoir situated at the Yangtze Estuary in Shanghai.

Conference Themes:
• Coastal infrastructures, climate change
• Sustainable water management, water security
• Ecological impacts, water quality, sediment transport
• River, Estuarine and Reservoir processes
• Water-energy-food nexus, water policy

6-9th November 2023
Hohai University, Changzhou, China

Visit: www.iacrr2023.com or
https://iwa-network.org/events/1st-iacrr-international-conference-on-coastal-reservoirs-and-sustainable-water-management/
WEBINAR INFORMATION

- This webinar will be recorded and made available “on-demand” on the IWA Connect Plus platform, with presentation slides, and other information.

- The speakers are responsible for securing copyright permissions for any work that they will present of which they are not the legal copyright holder.

- The opinions, hypothesis, conclusions or recommendations contained in the presentations and other materials are the sole responsibility of the speaker(s) and do not necessarily reflect IWA opinion.
WEBINAR INFORMATION

- **‘Chat’ box**: please use this for general requests and for interactive activities.

- **‘Q&A’ box**: please use this to send questions to the panelists. (We will answer these during the discussions)

*Please Note:* Attendees’ microphones are muted. We cannot respond to ‘Raise Hand’.
MODERATORS & SPEAKERS

Assoc. Prof. Muttucumaru Sivakumar
University of Wollongong
Australia
(Moderator)

Dr Fang Yenn Teo
University of Nottingham,
Malaysia
(Moderator)

Emeritus Professor Arthur Mynett
TU Delft
Netherlands

Dr Elfithri Rahmah
UNESCO
France
Towards Nature-based Solutions for Sustainable Coastal and Estuarine Development

A CASE STUDY FOR THE NETHERLANDS

EM/PROF ARTHUR E MYNETT
UNESCO IHE DELFT & DELFT UNIVERSITY OF TECHNOLOGY
THE NETHERLANDS

inspiring change
DAMAGES DUE TO FLOODS IN 1990’S

**Damages of Floods in 1990's**

- **Economic Losses (Million USD)**
  - Asia
  - China
  - Japan
  - Europe
  - N.Am
  - Others

- **Death Tolls (Persons)**

The chart illustrates the damages due to floods in the 1990’s with a focus on economic losses and death tolls. The data is categorized by regions including Asia, China, Japan, Europe, N.Am, and Others.
IMPACT OF FLOOD LOSSES IN % GDP

Map 10.3  Impact of flood losses (comparative losses based on national GDP)

Note: Deciles refer to the level of risk, normalized for comparing 10 categories.
Source: Based on Dilley et al. 2005.
COASTAL FLOODS (2005)

TOP 20 of most vulnerable cities 2005

1. Mumbai (Bombay) 2,387,238
2. Guangzhou 2,718,218
3. Shanghai 2,083,233
4. Hong Kong 1,326,124
5. Kolkata 1,923,212
6. New York- Newark 1,190,168
7. Jakarta 1,239,139
8. Houston 1,124,172
9. New Orleans 1,110,182
10. Lagos 1,009,108
11. Mumbai 987,988
12. Karachi 494,944
13. Calcutta 522,922
14. Shanghai 800,800
15. Amsterdam 529,529
16. Tokyo 722,722
17. Vienna 570,570
18. Lagos 596,596
19. Athens 378,378

North-East coast USA

North-West China and Japan

Ranking of top 130 cities exposed to coastal flooding in 2005

POTENTIAL DAMAGE / PROTECTION LEVELS FOR SAMPLE COASTAL MEGA CITIES

Potential damage (US$ bln) vs Protection level

- Shanghai
- Osaka
- New York
- Tokyo
- New Orleans
- Bangkok
- Rotterdam

Potential damage (US$ bln):
- 0
- 50
- 100
- 150
- 200
- 250
- 300
- 350
- 400

Protection level:
- 10
- 100
- 1000
- 10000
- 100000
LOW LANDS OF THE RHINE-MEUSE-SCHELDT ESTUARY

Dutch Delta:
10 million people living in flood prone areas
(deepest location MSL – 6,76 m ...
## FLOODPRONE AREAS

### General statistics

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Surface area</td>
<td>33,948 km²</td>
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<tr>
<td>Population</td>
<td>16.66 million</td>
</tr>
<tr>
<td>GNP/capita</td>
<td>€ 34,661</td>
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</table>

### Main water system

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coast line</td>
<td>642 km</td>
</tr>
<tr>
<td>Dykes/dams</td>
<td>470 km (e.g. Afsluitdijk/closure dam 32 km)</td>
</tr>
<tr>
<td>Lake IJsselmeer</td>
<td>1813 km² (1500 km² polders)</td>
</tr>
<tr>
<td>Banks</td>
<td>2706 km</td>
</tr>
<tr>
<td>Weirs</td>
<td>16</td>
</tr>
<tr>
<td>Storm surge barriers</td>
<td>4</td>
</tr>
<tr>
<td>Liable to flooding</td>
<td>59%</td>
</tr>
</tbody>
</table>
NETHERLANDS: AREAS POTENTIALLY FLOODED (WITHOUT PROPER WATER MANAGEMENT)
MAJOR STORM SURGES AND FLOODS
Original DUTCH DELTA DESIGN ...

Netherlands with and without flood protection
EASTERN SCHELDT STORM SURGE BARRIER
CHANGING PERSPECTIVES ON DELTA DEVELOPMENT

- The final closure of the Eastern Scheldt deferred in 1970s
- 1986: Eastern Scheldt remained tidal with storm surge barrier
- Oyster banks, recreation, environment conserved at high costs
- 1987: New dams to separate fresh from saline
- 1987: New sluices for navigation between fresh and saline systems
- 2019: Re-opening the Haringvliet leaving a small opening for fish migration
- Reintroduction of tide in the Grevelingen because of water quality problems (future plans)
FLOOD RISK MANAGEMENT IN THE NETHERLANDS

• Long tradition
• Stringent safety standards

• Old paradigm: predict and control regime
• Emerging paradigm: integrated and adaptive regime

• Governance: the Polder model
Sealevel rise

More extreme storms

More intense rainfall

Spatial / economic development

Increased erosion

Land subsidence

Salinity intrusion

Increased river discharge

Decreased river discharge

DUTCH DELTA under pressure...
“should we LEAVE or STAY ... ?
... and at what COST... ?!”

Delta Committee 2 (Cie Veerman)

Living with water,

Working with water
RECREATING THE ESTUARY – **MORE NATURE-BASED**
Towards **sustainable** delta development
CHANGING PERSPECTIVES ON COASTAL RESERVOIRS

- Flood Control
  - From hard closures to open structures

- Land Reclamation
  - From agriculture to urbanisation and nature development

- Reservoir Development
  - Reintroduction of islands for birdlife and nature development

- Changing priorities and operating rules
  - Resalination for ecosystem health (conflict with farmers)
  - Reintroduction of tides for ecosystem health and tidal energy (conflict with farmers)
  - Opening tidal barriers for fish migration (conflict with farmers)
  - Removal of dikes for ecosystem health (conflict with farmers)
  - Raising closure dams to account for sea level rise
  - Setting up operational level to follow sea level rise (conflict with harbours and marinas)
  - Reintroduction of a natural estuary in the delta
‘Living with Water’

new concepts in spatial planning
• identify ‘tipping points’

• develop logical path ways

• avoid over-investment, (only do now “no regret”)

combine with other agendas (regional socio-economic developments)
tipping point analysis

Time

Problems

Preparation time “large measure”

Critical level

Safety
Fresh Water

increasing river peak flows
longer drought periods / Sea Level Rise

Major problem requiring “Large Measure” (Tipping point)

“Major decision” (Delta Decision)

IWA
the international water association
real value options

- Precautionary approach
- Risk intervention not sensitive to climate change
- No adaptation
- Adaptive approach

Acceptable risk level

Multiple interventions

Large infrastructure investment
EU FLOOD RESEARCH: TOWARDS ADAPTIVE MANAGEMENT

(FP1 – FP5)
Assessing the problem

Managing the problem
(FP6 & FP7)

1. towards adaptive management
2. integrated & adaptive approach

flood defence
prediction & control
flood risk
... introduce *FLEXIBILITY* in the design!
... work towards
Nature-based Solutions
for Sustainable
Coastal & Estuarine
Development
Towards Nature-based Solutions for Sustainable Coastal and Estuarine Development

A CASE STUDY FOR THE NETHERLANDS

EM/PROF ARTHUR E MYNETT
UNESCO IHE DELFT & DELFT UNIVERSITY OF TECHNOLOGY
THE NETHERLANDS

inspiring change
Ecohydrology Implementation for Sustainable Estuaries & Coastal Water: Towards Achieving Water Security

WITHIN THE UNESCO-IHP IX (2022-2009)

DR. RAHMAH ELFITHRI
CHIEF OF SECTION
CAPACITY DEVELOPMENT AND WATER FAMILY COORDINATION
DIVISION OF WATER SCIENCES
UNESCO-IHP, PARIS, FRANCE
EVOLUTION OF UNESCO-IHP

IHP throughout its successive phases: shifting to a holistic and integrated approach

Science for a Water Secure World in a Changing Environment

IHP-IX

2022-2029

Transdisciplinarity

Water Dependencies: Systems under Stress and Societal Responses

Water Interactions: Systems at Risk and Social Responses

Water Security: Responses to Local, Regional, and Global Challenges

Hydrology and Water Resources Development in Vulnerable Environment

Hydrology and Water Resources Sustainable Development in a Changing Environment

International Cooperation in Hydrological Sciences

Experimental Basins, Categorization of Large Floods, World Water Balance

International Hydrological Decade (IHD)

1965

1975

1981

1984

1990

1996

2002

2008

IHP-I

IHP-II

IHP-III

IHP-IV

IHP-V

IHP-VI

IHP-VII

IHP-VIII

IHP-IX

Water Resource Management

Sectoral aspects

Holistic/system-wide

Inspiring change
EVOLUTION OF ECOHYDROLOGY WITHIN THE IHP PHASES

“IHPIX (2022-2029)
“Ecohydrology for Water Security”
Promoting the implementation of Ecohydrology in the Designated sites (BR, WHS, and GG)

“IHP-VIII (2014-2021)
“Ecohydrology as an Integrative Science from Molecular to Basin Scale”
Revitalization of Ecohydrology programme

“IHP-VII (2008-2013)
“Ecohydrology for Sustainability”
Launching of Ecohydrology Demonstration Project

“IHP-VI (2002-2007)
“Ecohydrology as an Integrative Science to Solve Issues Surrounding Water, Environment and People”

“IHP-V (1996-2001)
“Ecohydrological processes in small basins”
“Ecohydrology as a new paradigm for the sustainable use of aquatic resources”
INTERGOVERNMENTAL HYDROLOGICAL PROGRAMME (9TH PHASE – 2022-2029)

- Scientific research and innovation
- Water Governance based on Science for Mitigation, Adaptation and Resilience
- Bridging the data and knowledge gap
- Water Education in the 4th Industrial Revolution including Sustainability
- Integrated Water Resources Management under conditions of Global Change
- Hydrological Systems, Rivers, Climate Risk and Water-Food-Energy Nexus
- Ecohydrology and Water Quality
- Groundwater and Human Settlements
- Thematic open-ended working groups
UNESCO’S ECOHYDROLOGY APPROACH

- There is an urgent need to accelerate the implementation of water-related SDG through water science and education - the use of ecosystem properties as innovative management tools => Nature Based Solutions (NBS).

- The most important challenge for water management is how to increase water resources quantity and improve its quality by reducing the pressure (impacts) to ecosystems at all scales.

- The answer is by using the holistic approach based on the understanding of water-biota interplay “Dual Regulation”, which can be translated into Nature Based Solutions (NBS).

- Ecohydrology as a transdisciplinary sustainability science is promoted strategically within the UNESCO Water Family and Demosites Network towards achieving a water secure world in a changing environment.
THE UNESCO WATER “FAMILY”

Aims to advance hydrological knowledge by supporting scientific research programmes and building capacities

172 IHP National Committees and Focal Points

1 World Water Assessment Programme (WWAP)

70 Water-related Chairs & UNITWIN Networks

30 Water-specialized Centres (C2C)

17 IHP Flagship Initiatives

1 IHP Secretariat

Regional Hydrologists & Science Officers in Field Offices
THE UNESCO ECOHYDROLOGY “FAMILY”

UNESCO Water Family on Ecohydrology (Category 2 Centres under the auspices of UNESCO):

- European Regional Centre on Ecohydrology (ERCE), Poland;
- African Regional Centre for Ecohydrology (ARCE), Ethiopia;
- Asia Pacific Centre on Ecohydrology (APCE), Indonesia;
- International Centre for Hydroinformatics (CIH), Brazil & Paraguay.

UNESCO Water Family on Ecohydrology (Chairs and UNITWIN Networks)

- UNESCO Chair in Ecohydrology: Waters for Ecosystems and Societies @University of Algarve (Ualg), Portugal;
- UNESCO Chair on Ecohydrology and Applied Ecology @Lodz University, Poland;
- UNESCO Chair on Ecohydrology and Transboundary Water Management @Sokoine University of Agriculture, Tanzania.
- UNESCO Chair in Water Sciences and UNITWIN Cooperation Programme with the International Network for Ecohydrological Interfaces under Change, UK
- UNESCO Chair River Culture/ Fleuves et Patrimoine, France
- UNESCO Chair on Ecohydraulics for Sustainable Water Infrastructures for SDG 6 in the Asia and the Pacific Region, Malaysia
ECOHYDROLOGY AS AN INTEGRATIVE TRANSDISCIPLINARY SCIENCE

- **Ecohydrology (EH)** is the holistic approach of the analysis (understanding of processes) and regulation ("dual regulation") of water-biota interplay. It is a scientific field inside the sciences of ecology and hydrology which specifically studies the **interactions between water bodies and different ecosystems**.

- **Ecohydrology** by definition is a trans-disciplinary and applied science, a sub-discipline of hydrology that seeks to understand the **ecological processes** controlled by the **hydrological cycle** (Zalewski 2000, 2009).
UNESCO’S ECOHYDROLOGY APPROACH (DUAL REGULATION – WBSR + CE + LPG)

- UNESCO’s IHP developed Ecohydrology as a transdisciplinary, scientific approach to achieve water quality improvement, biodiversity enhancement and sustainable development by using the understanding of relationships between hydrological and biological processes at the scale of water catchment basins.

- Ecohydrology as an integrative transdisciplinary science providing Nature Based Solutions (NBS) not only for reduction of impacts, but also enhancement of the catchment sustainability potential.

WBSR+ CE+ LPG
WHY ECOHYDROLOGY?

- EH aims to **finding solution-oriented** methods for reducing anthropogenic impacts and **restoring aquatic ecosystems**, aiming to improve the ecosystem services they provide, as the connection with humans, and becoming sustainably managed by applying EH concept at the **catchment scale**.
Diagnosis and Key Messages

1/ **GOVERNANCE** „a radical reshaping of the water governance that moves away from the current fragmentation”

„Climate and water actions must be coordinated „ „ reduction in subsidies for water and agriculture that create overconsumption and aquifer depletion

2/ **ECOHYDROLOGY** „...it is essential better understand and use the relationships between hydrological and ecological processes... „Ecohydrological Nature-Based Solutions, which use or mimic these processes, play a key role in enhancing biodiversity, reducing risks associated with hydroclimatic extremes, and ensuring water-food-energy security and carbon cycling”

3/ **SOCIETY** „...necessity of involving in the decision-making processes those groups that can potentially be most affected by the water crisis.„
ECOHYDROLOGY METHODOLOGY

“Dual regulation” (regulation of water-biota and/or biota-water interplay)
IMPLEMENTATION AT THE CATCHMENT SCALE

Basins/City/Urban

Inland Wetlands

Estuaries/Coastal Water

Rivers/Lakes
ECOHYDROLOGY KEY STAKEHOLDERS

Key Players/Stakeholders

- Demosite Manager/Coordinator
- Local Stakeholder & Community – at the Catchment Level
- State & National Water Related Agencies/Ministries
- Various Researchers – for conducting multi & transdisciplinary research
- Various Partners/Networks – for sustaining EH initiative (including regional & international partners)
- Donors/Funding Provider – to support program and various initiatives
- Other supporter – for providing various supports & in-kind contribution
- Various Partners/Networks – for conducting multi & transdisciplinary research
- Donors/Funding Provider – to support program and various initiatives
- Other supporter – for providing various supports & in-kind contribution
Enhancement of the Catchment Sustainability Potential @Putrajaya UNESCO Ecohydrology Demosite, Malaysia

- The Use of Wetland for Improving Water Quality
- Biodiversity Enhancement in Putrajaya
- Ecosystem Services Enhancement
- Law, Policy & Governance - Local Agenda 21 Putrajaya (LA21), Towards Low Carbon Green City
- Culture & Education - Series of Community Participation & Awareness Programmes
- Putrajaya Lake - Resilient to Climate and Impact

Enhancement of ecosystem resilience and catchment sustainability potential

Improving “WBSR+CE+LPG” in Putrajaya for Sustainable Water Management
UNESCO’s Ecohydrology Approach

- UNESCO-IHP promotes the establishment of Ecohydrology Demonstration Sites around the world since 2010 to apply ecohydrology solutions in various catchments at all scales.

- UNESCO launched the Call for New Ecohydrology Demonstration Sites in 2022 – in order to promote Ecohydrology approach, stimulate action to implement NBS and disseminate the acquired information to UNESCO’s Member States and the general public, globally to all countries and regions in the world.

- The demonstration sites include the concept of enhanced ecosystem potential through the application of ecohydrological strategies to achieve sustainability of ecosystems closely related to water to improve IWRM in specific areas.

- The UNESCO Ecohydrology Demonstration Sites currently consist of 37 Demosites in 26 countries (including 11 in Asia-Oceania, 12 in Europe, 9 in Latin America and the Caribbean and 5 in Africa.)
The current composition of UNESCO Ecohydrology Demonstration Sites consist of 37 Demonstration Sites in 26 countries around the world.
# UNESCO Ecohydrology Demonstration Sites 2023 (Total 37 in 26 Countries)

<table>
<thead>
<tr>
<th>Region</th>
<th>Country</th>
<th>Site</th>
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<td>Latin America and the Caribbean (9)</td>
<td>Argentina</td>
<td>Lacar Lake Basin</td>
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<tr>
<td></td>
<td>Bahamas</td>
<td>Victoria Reservoir Watersheds</td>
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<tr>
<td></td>
<td>Brazil</td>
<td>Santo Antonio River</td>
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<td></td>
<td>Chile</td>
<td>Quebrada Parque</td>
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<td>Colombia</td>
<td>Teusaca River Basin</td>
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<td></td>
<td>Colombia</td>
<td>Zapatosa Wetland Complex</td>
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<td></td>
<td>Costa Rica</td>
<td>Rana-Ice study</td>
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<td></td>
<td>Ecuador</td>
<td>Pelican Bay Watershed, Santa Cruz, Galapagos</td>
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<td>Ecuador</td>
<td>City of Catacocha, Southern Ecuador</td>
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<td>Asia and the Pacific (11)</td>
<td>Australia</td>
<td>Murray-Darling Basin</td>
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<td>Australia</td>
<td>Peri Urban Landscapes (Western Sydney)</td>
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<td>China</td>
<td>Hongfeng Lake Area in Guizhou Province</td>
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<td>China</td>
<td>Sub Urban Area of Metropolitan Beijing</td>
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<td>China</td>
<td>Sanjiang Plain (Northeast China)</td>
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<td>China</td>
<td>Fengxi Sponge City</td>
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<td>China</td>
<td>The Three Gorges Reservoir (TGR)</td>
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<td>Indonesia</td>
<td>Saguling Reservoir in the Upper Citarum River Basin</td>
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<td>Malaysia</td>
<td>Putrajaya Lake and Wetland</td>
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<td>Pakistan</td>
<td>Sustainable Eco-technologies of NUST Main Campus</td>
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<td>Davao City</td>
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<td>Europe and North America (12)</td>
<td>Croatia</td>
<td>Ribb Watershed &amp; Lake Tana Shore</td>
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<td>Germany</td>
<td>Kielstau Lowland River Catchment</td>
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<td>Africa and Arab States (5)</td>
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<td>Sierra Leone</td>
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<td>Tunisia</td>
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Inspiring change
ECOHYDROLOGY @GUADIANA ESTUARY, PORTUGAL

SUSTAINABLE ESTUARINE ZONE MANAGEMENT FOR CONTROL OF EUTROPHICATION, TOXIC BLOOMS, INVASIVE SPECIES AND CONSERVATION OF BIODIVERSITY (GUADIANA ESTUARY, PORTUGAL)

- Guadiana River Basin is the 4th largest basin in the Iberian Peninsula: 83% in Spain and 17% in Portugal.
- There exists 1824 dams in the basin. The Guadiana estuary and the coastal areas are affected by the biggest one called the Alqueva dam. It modified the hydrological regime of the estuary and also its ecological functions reducing the ecosystem service of water regulation.
- There are three main protected areas in Guadiana estuary and its floodplains: RAMSAR site, National Reserve, Special Protection Zone (ZPE), Important Bird Area.

**Demosite Location**

**Country:** Portugal

**Name:** Luis Chicharo

**Email:** luis.chicharo@icco-unesco.org

**Organization:** International Centre for Coastal Ecohydrology

**Website:**

**Contact**

**CLICK HERE TO SEE COMPLETE DEMOSITE INFORMATION**

Updated in: 23/06/2021

4th largest river basin at the Iberian Peninsula 67,500 km²
83% in Spain +17% in Portugal
1824 small-medium reservoirs
Mediterranean climate – dry years
ECOHYDROLOGY @GUADIANA ESTUARY, PORTUGAL

Hydroelectric production

Agriculture irrigation

Strategic water reserve

Areas (ha) of irrigated cultures in the Portuguese part of the Guadiana basin (MA, 2014)

Nutrients Sediments

Hydroelectric power 530 MW

Before 2000 2006 2011

Area of irrigated cultures (ha):

2000

2006

2011

23.3%

Before After

Average river flow (m³/s):


Before After

Volunteer

Inspiring change
ECOHYDROLOGY @GUADIANA ESTUARY, PORTUGAL

A – Establish the flood pulses values required to promote planktonic diversity and productivity (reduce HABs and eutrophication risks)

B – Establish minimum bivalve density to filtrate microalgae (reduce HABs and eutrophication risks)

C – Determine the required residence time (reduce coastal eutrophication and HABs risks)

D – Restore wetlands to: (1) sustain nursery functions and; 2) reduce HABs and eutrophication risk

E – Establish volume and timing for dam discharge to restore river plume and anchovy nursery functions

Biota to control hydrological processes and hydrology to regulate biota
This project on Sustainable estuarine zone management for control of eutrophication, toxic blooms and conservation of biodiversity in the Kaštela Bay foresees comprehensive solution to assure unhindered development of the tourism and general economy, through realization of main project objectives: the protection and preservation of water quality; the creation of conditions for safe development of economy; and the maintenance and improvement of achieved level of environment protection.
RESTORATION OF VICTORIA POND WETLAND HABITAT IN HISTORIC GEORGE TOWN, GREAT EXUMA FOR SUSTAINABLE MANAGEMENT TO CONTROL POLLUTION AND ENHANCE NEAR SHORE FISH HABITAT (BAHAMAS)

- Great Exuma is the largest island in the Exuma Island chain, with just fewer than 8,000 people living on the island in six major settlements. George Town is the largest and oldest settlement, located at the southwestern shore of Elizabeth Harbour. Victoria Pond is the largest wetland complex in Elizabeth Harbour;
- Ecosystem services are linked to coastal ecology – protection of near-shore environment to support fish production and reduce flooding in George Town – degraded by the destruction of coastal wetlands (mangrove habitats);
- There is one on-going program involving the restoration of Victoria Pond called Ramsar Caribbean Wetlands Initiative.

Demosite Location

<table>
<thead>
<tr>
<th>Name: John A. Bowleg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Email: <a href="mailto:wcibowleg@wsc.com.bs">wcibowleg@wsc.com.bs</a></td>
</tr>
<tr>
<td>Organization: The Water and Sewerage Corporation of the Bahamas</td>
</tr>
<tr>
<td>Website: <a href="http://www.wsc.com.bs/">http://www.wsc.com.bs/</a></td>
</tr>
</tbody>
</table>

Contact

Country: Bahamas

Updated in: 23/05/2021
The ecohydrological approach reveals

- Extreme vulnerability of coastal zone in arid regions
- Mediterranean lagoons are undergoing severe biodiversity degradation.
- Degradations are driven by changes in sea surface salinity (SSS) and sediments grain sizes.
DEVELOPMENT OF ECOHYDROLOGY APPROACH WITHIN UNESCO DESIGNATED SITES

- UNESCO Designated sites constitute a network of living laboratories.
  - UNESCO Biosphere Reserves
  - UNESCO World Heritage Sites
  - UNESCO Global Geoparks

- As such these sites can also be used to demonstrate the application of the ecohydrology solution in addressing of issues surrounding water, environment, and people - this is among the main focus on UNESCO Ecohydrology Programme within IHP IX.
# BUILDING CAPACITY FOR IMPROVED WATER MANAGEMENT

<table>
<thead>
<tr>
<th>26 Ecohydrology Workshops</th>
<th>7 in Africa (Tanzania (2), Nigeria, Tunisia, Senegal (2) and Cabo Verde), 7 in Europe (Poland, Spain, Germany, Italy, Romania, Portugal, and France), 2 in Latin America and the Caribbean (Brasil and Uruguay), 6 in Asia Pacific [Indonesia (2), Malaysia (2) and China (2)].</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 UNESCO designated sites</td>
<td>Tanzania (2), Madagascar (2), Ghana, Indonesia, Malaysia (2), Cape Verde, Guinea Bissau &amp; Sao Tome and Principe</td>
</tr>
<tr>
<td>45 MS involved/benefited</td>
<td>Tanzania, Austria, Nigeria, Benin, Côte d'Ivoire, Gambia, Ghana, Guinea, Liberia, Niger, Senegal, Sierra Leone, Togo, Kenya, Ecuador, Portugal, Poland, UK, Tunisia, Morocco, Cameroon, Egypt, Gabon, Algeria, Cabo Verde, France, Tunisia, Uganda, Nairobi, Madagascar, Indonesia, Malaysia, Guinea Bissau, Sao Tome and Principe, China, Brasil, Uruguay, Bahamas, Costa Rica, Ethiopia, Chile, The Netherlands, Italy, Romania, Germany</td>
</tr>
<tr>
<td>More than 1000 experts</td>
<td>Capacity of around 1000 experts of member states enhanced on ecohydrology through various organized workshops.</td>
</tr>
</tbody>
</table>
PROMOTING ECOHYDROLOGY IN ALL REGIONS

UN/2023 WATER CONFERENCE SIDE EVENT
TRANSDISCIPLINARY ECOHYDROLOGY FOR ACCELERATION OF SDGs – METHODOLOGY OF SCIENCE AND PATTERNS OF IMPLEMENTATION
Enhancement of sustainability potential by transdisciplinary Ecological and Advanced Nature-Based Solutions.

Webinar
Promotion of ecohydrology for a better management of water in Africa
April 17, 2023 - 2:00 PM (UTC)

To participate, please register via the link: https://bit.ly/4WA1Cmr

Ecohydrology Demonstration Sites in Latin America and the Caribbean
We invite you to learn more about these initiatives through these cycles of webinars

May 24 - June 14 – July 12

REGISTRATION: https://bit.ly/4Cv3sD
PROMOTING ECOHYDROLOGY FOR YOUTH

- Support to young water leaders and facilitation of spaces for their exchange processes and discussions.
ERASMUS MUNDUS MASTER IN APPLIED ECOHYDROLOGY (MAEH)

Erasmus Mundus Master in Applied Ecohydrology (MAEH)

- Started in 2021 – supported by UNESCO.

- UNESCO participated in the opening of the 2nd intake of the students, held on 6-7 October 2022, at University of Algarve (UAlg), Faro, Portugal.

- The technical visit to UNESCO HQ in Paris, France was conducted on 9 November 2022 to learn Ecohydrology and other water sciences related activities directly from experts in UNESCO.

- Total 44 students from 29 countries are part of MAEH.
CALL FOR NEW ECOHYDROLOGY DEMONSTRATION SITES – DEADLINE 31 AUGUST (ANNUALLY)

TIMELINE AND STEPS FOR APPLICATIONS

Submission Starts
1

The applicants can start submission from 1st June each year through UNESCO’s Ecohdyrology Web Platform available at: ecohydrology-ihp.org

The deadline for submission of applications to establish new UNESCO Ecohdyrology Demonstration Sites is 31st August each year.

Evaluation Ends
31

The UNESCO’s Ecohdyrology Scientific Advisory Committee (SAC) will evaluate the applications received in the platform. During this time a meeting with applicants could be made to present the proposal to the SAC and clarify some informations.

Final decision will be announced by UNESCO-HP Ecohdyrology Programme

Submission Deadline
31

Announcement
31

New UNESCO Ecohdyrology Demonstration Sites

Official Application form
WAY FORWARDS & FUTURE OPPORTUNITIES

✓ Establishing the New Ecohydrology Demonstration Sites / promoting Nature-based Solutions (NBS) Approach at the designated sites of UNESCO (Biosphere Reserved, Natural World Heritage Sites, Global Geopark).

✓ Exploring new UNESCO water-related Chairs and Category 2 Centres.

✓ Strengthening the Youth Ecohydrology Network!

✓ Welcome for further collaborations and partnerships in water related activities.
THANK YOU! MERCI 😊

R.ELFITHRI@UNESCO.ORG

DR. RAHMAH ELFITHRI
CHIEF OF SECTION
CAPACITY DEVELOPMENT AND WATER FAMILY COORDINATION DIVISION OF WATER SCIENCES UNESCO-IHP, PARIS, FRANCE
Q&A Discussion

MODERATOR: FANG YENN TEO
UPCOMING IWA WEBINARS & EVENTS

WEBINAR
Climate Smart Futures: from Process Emissions to Planetary Boundaries
Climate Smart Utilities Webinar Series

3 OCTOBER 2023
12:00-14:30 BST

REGISTER NOW
www.iwa-network.org/webinars

In partnership with:
DANVA

REGIONAL CALL
Connecting Young Water Professionals in Africa

5 OCTOBER 2023
16:30 BST

REGISTER NOW
www.iwa-network.org

Learn more about future online events at http://www.iwa-network.org/iwa-learn/
UPCOMING IWA WEBINARS & EVENTS

Learn more at https://nssconference.org/
ABSTRACT DEADLINE EXTENDED: 15 September 2023

Highlights:
14 world renowned keynote speakers, 10 invited lectures, one full day interactive workshop and one day technical tour to the world’s largest coastal reservoir situated at the Yangtze Estuary in Shanghai.

Conference Themes:
• Coastal infrastructures, climate change
• Sustainable water management, water security
• Ecological impacts, water quality, sediment transport
• River, Estuarine and Reservoir processes
• Water-energy-food nexus, water policy

6-9th November 2023
Hohai University, Changzhou, China
UPCOMING IWA WEBINARS & EVENTS

IWA Digital Water Summit

BILBAO SPAIN
14-16 November 2023

The Latest in Digital Developments

www.digitalwatersummit.org

Find out more at:

https://digitalwatersummit.org/
UPCOMING IWA WEBINARS & EVENTS

Find out more at:

https://waterdevelopmentcongress.org/
JOIN OUR NETWORK OF WATER PROFESSIONALS!

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