

# Mara Water & Wetland Watch

# Knowledge Exchange Workshop 2019

## Materials and Report





## Dear Readers,

The Mara Knowledge Exchange Workshop was designed to progress understanding for the sustainable management of the Mara River & Wetlands, world famous for the wildlife of the Serengeti and Masai Mara, and the extensive papyrus swamp leading to discharge of the river to Lake Victoria. The basin's population of over a million people is increasing at about 3% per year. This inevitably places great pressure on the overall environment. Balancing the needs for food production with high quality habitats and increased livelihood options for an increasing population requires sound management. This can only be achieved with a strong knowledge base that recognises environmental threats to people and nature, and which can help develop integrated solutions for longer term sustainability, as outlined in the UN Sustainable Development Goals (SDGs). This workshop provides an opportunity to not only identify the potential of existing knowledge for sustainable use of the basin, but where gaps in knowledge may lie. Scientists and practitioners with a shared interest in the future sustainable use of the basin have been invited to share their experiences and identify future means to develop and share knowledge at local, national and international scales.



**Florence Mahay,**

*Basin Water Officer Mwanza (Coordinator), Lake Victoria Basin Water Board*



The Mara Basin comprises an area of immense international importance because of its varied dryland, river and wetland habitats. Integrated management of these areas is required to achieve the right balance of competing uses. The upper basin, and the areas surrounding the lower Mara wetland present different challenges for sustainable resource use but, by the nature of the catchment, are connected. This is highlighted by water resources and their management. This workshop helped identify the current and future knowledge that can play a significant part in guiding the wise use of the Mara's environment.

**Ken Irvine**

*Chair for Aquatic Ecosystems, IHE Delft Institute for Water Education*

The workshop includes a strong element of how citizen science (or community-based monitoring) can collect data for environmental monitoring, and support and affect policy. A number of international and local partners bring their expertise to lead the work for research and analysis. *Earthwatch*, an organisation with extensive citizen-science expertise, together with local partners will lead the work to establish on-the-ground citizen-science activities in conjunction with local partners. A key aspect will be providing expertise, guidance and best practice for community-engagement. The local society in the Mara basin is as important as the natural environment, and new instruments could track and monitor engagement and changing attitudes among participants, with longer term benefits on their well-being. This workshop can be a starting point to create an innovative scientific evidence for policy making within some African countries in support of the Sustainable Development Goals "Ensure availability and sustainable management of water and sanitation for all" (SDG6), "Peace, justice and stronger institutions" (SDG16), "Gender equality" (SDG5) and "Reduced inequalities" (SDG10).



**Luigi Ceccaroni**

*Innovation Lead, Earthwatch*

*Vice-Chair, European Citizen Science Association*



## About Mara Water & Wetland Watch

Reliable information is the foundation of the interrelated management of land and water, and of healthy ecosystems that support the well-being of those who depend on them. Improving catchment management in the Mara is, and has been, the goal of various policy initiatives and research projects over the past decades. While there has been extensive work to develop basin management and investment plans that have been agreed across multiple agencies, research in and about the catchment and its ecosystems is largely fragmented, geographically limited and largely disconnected from the day-to-day challenges of the local institutions tasked with catchment management.

The reasons for this are varied, including: work focussing on a particular problem for a specific discipline often remains within the knowledge base of that discipline; a large number of loosely connected research projects, often done by Masters students, remain largely within the confines of third level educational institutes; PhD level studies are typically disseminated through a large range of largely discipline-specific scientific journals; and development reports or environmental assessments, often reliant on short-term input from commercial consultancies, can be confidential or hidden deep in the so-called “grey literature”. Data from all of these sources, if not restricted, is often available only in summarised form in manuscripts and reports.



Recognising the challenges of information dissemination across the international Mara river basin prompted this Knowledge Exchange workshop, convened by Women and Water for Change in Communities project and a proposed Action group under the EU *AfriAlliance* initiative, comprising the Sustainable Water Partnership in the Mara (SWP), the Lake Victoria Basin Water Board (LVBWB), IHE Delft (The Netherlands) and the Earthwatch Institute.

The workshop created a space for collaboration and knowledge sharing among scientists, conservation bodies, decision makers and citizens, supporting locally driven water management and conservation. It aimed to contribute to the ongoing establishment of transboundary catchment management institutions, and advance ideas relevant to balancing sustainable livelihoods with the provision and maintenance of ecosystem services in support of local communities.

In the Mara basin, basic human needs are often compromised by land degradation and poor water quality. The knowledge gathered by formal research may not be well connected with the informal knowledge of communities, or the formal or informal institutions that affect and effect management. An important component of the workshop was to explore how to bridge this gap, and how local communities can monitor their own environment. This can support both local needs such as safe drinking water and the alignment with formal institutional mandates and reporting. Connecting the different types of knowledge fosters stewardship supporting catchment and associated water quality.

An intended output of the Knowledge Exchange Initiative was to explore the possibility to gather research inventories and integrated assessments of the Mara catchment and related ecosystems, as a foundation of the study of long-term impacts of water use and its relationships with functional transboundary water user and catchment management.

The workshop paid particular attention to research and management efforts related to the Lower Mara, but with a clear view towards development of insights relevant to the whole catchment. It was designed as a means for:

- Following up on and disseminating existing research;
- Peer input from a range of disciplines to improve catchment research for development;
- Access to more/broader data sources and sets to improve research or models;
- Strategic opportunity to developing partnerships;
- Development and testing data collection tools and apps in a real world setting

## Why an AfriAlliance Action Group

Africa requires innovative solutions for tackling water and Climate Change-related challenges. The successful interaction among relevant stakeholders from both Africa and Europe, in water management is of principal importance when trying to generate, increase and exchange knowledge and innovation that address the demands for solutions that have noticeable and high impact.

However, the lack of appropriate water-related skills and capacity in some parts of Africa and the wide-spread institutional fragmentation within Africa as well as between Africa and Europe is a major obstacle to meeting the Sustainable Development Goals and addressing water crises, many with severe Climate Change implications. In addition, the lack of effective interactions between policy, research and entrepreneurs in Africa means that current mechanisms to successfully transfer relevant EU knowledge and technologies to African economies or vice versa are not enough to accomplish market uptake and provide solutions for pressing local water problems in Africa.

The main objective of the AfriAlliance project (<https://afrialliance.org/>), funded by the European Commission's Horizon 2020 programme, is for African and European stakeholders to work together in the areas of water innovation, research, policy, and capacity development to prepare Africa for future Climate Change challenges. The project will drive Africa-EU cooperation in this field to a practical level by sharing (non) technological innovation for local challenges and thus also identifying and boosting sustainable market and investment opportunities.

The AfriAlliance project re-enforces Water and Climate Change research and (social) innovation (R&I) cooperation between Africa and Europe through a mix of forward-looking and bottom-up innovation and road mapping techniques. It help to identify demands, opportunities, and constraints at different levels and develop strategic

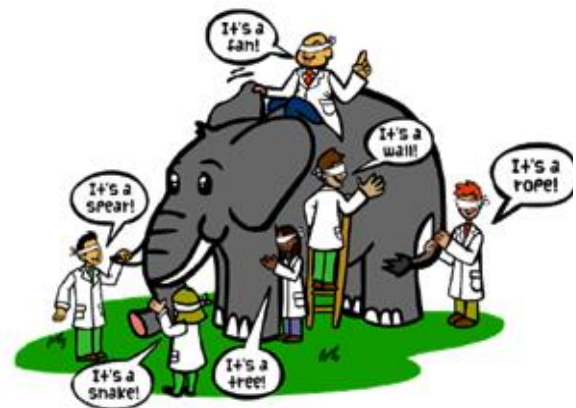
advice (short term demand-driven R&I outlook and long term R&I agenda) for improving Africa-EU collaboration. This will help policy makers to create a consistent approach to bilateral cooperation between Africa and the EU in the field of innovation for water and climate.

AfriAlliance Action Groups are selected in a highly competitive application process. They are formed around specific thematic areas and undertake activities looking to foster social innovation through knowledge co-creation helping to solve local problems, demonstration of existing (adapted) or new solutions, development and/or implementation of innovative business models, implementation of unique or innovative communication strategies, and knowledge sharing.

In line with the core challenges outlined above, the proposed Mara Water and Wetland Watch Action group is designed to contribute to the main theme “Institutional capacity development needs in water and climate actions”, specifically to “create platforms where different existing institutional agencies can work together for water preservation and climate action”.

## The Knowledge Exchange Workshop

The workshop was all about sharing knowledge and ideas. It was multidisciplinary, requiring interaction of views and seeing the world from different perspectives, identifying broader scientific interests, as well as more specific management and locally focused ones. The fable of the “blind man and the elephant”<sup>1</sup> can help visualise how each discipline, or individual study, views the world from particular perspectives. These can, on one hand, provide great detail and insight but, on the other hand, can miss the connectivity among perspective.



Source: [www.theblindelephant.com](http://www.theblindelephant.com)

In the picture we might ask how much of the elephant is being investigated? If we aggregate our views, do we have an understanding of the Mara “elephant” as a holistic entity (or is the researcher of the “rope” merely aware that others investigate “spears” and “trees”?). Are there overlaps across initiatives, with people doing the same thing, planning things that have already been done, or people who want to do the same thing, perhaps with different methods? Awareness of these is meant to help with coordinating approaches, identifying synergies and building partnerships.

Reflecting the different interests of the stakeholders involved, the workshop agenda consisted of three separate parts. The first day focussed on **scientific knowledge exchange**, investigating connections, overlaps and gaps from a conceptual perspective to provide a synthesis of the state of multidisciplinary knowledge. Day One had a series of short presentations that provided a foundation of scientific knowledge important for sound water supply and management for competing needs, a healthy Mara river, the change in the morphology of the river within the wetland, the conservation and management of the Mara wetland and surrounding landscape to support communities, and the policy dimension that connects activities within the catchment. Presentations were accompanied by an invitation for participants to consider the issues presented from a different perspective or discipline, stimulating a broader discussion on the sustainable management for people and ecosystems.

<sup>1</sup> Image and summary of the original [http://www.theblindelephant.com/the\\_blind\\_elephant\\_fable.html](http://www.theblindelephant.com/the_blind_elephant_fable.html)

The second day focused on possibilities to improve access, integration and use of existing data, and the potential of **community-based monitoring** as a contribution to monitoring and stewardship of the catchment. A series of short presentations provided the state of the art in current citizen science methodologies, as examples of applications in Tanzania and beyond, and their role in better measurement of river and wetland ecosystems and the services they provide. The discussion explored possibilities to improve the integration and use of Mara databases and data collection apps, and identified challenges that need to be addressed to make the use of technologies viable as an integrated part of catchment management. This includes opportunities to expand the available datasets for catchment and SDG monitoring, but also long-standing questions of the value and use of data collected by local communities.

Formal presentations comprised short overviews of the state of knowledge, information gaps and suggestions of where combined approaches can be most effective. These aspects formed part of the final discussion with key points gathered.

## The Demand Challenge

To increase relevance of the workshop to local communities and institutions involved in management of the catchment and its natural resources, preparatory meetings with local stakeholders were held, aimed to identify data needs and questions. Key issues and challenges raised provided an important context for the workshop.

The key questions included:

- How useful is the research conducted in the catchment to end users with institutional mandates?
- What do end users need from science?
- How can knowledge generated by research be better be linked to day-to day decision making to support local institutions and citizens?



*Stakeholder consultation on water related challenges in the Mara Basin*

# Supporting sustainable management of the Mara River & Wetlands

## Workshop Report

### Overview

The Knowledge Exchange workshop took place on 24<sup>th</sup> and 25<sup>th</sup> of July 2019 in the Victoria Palace Hotel in Mwanza, Tanzania, followed by a local stakeholder meeting for a demonstration and training in citizen science tools on 26<sup>th</sup> of July. The programme of the workshop (Annex 1) was outlined in a handbook for participants, here provided with some minor updated corrections and links to the presentations. The workshop was designed to bring together a number of regional and international researchers and water managers to share their knowledge and experience on the Mara River and Lower Mara wetlands. While there has been decades of research efforts that can help inform catchment and river management, and associated policy discussion in both Kenya and Tanzania, only comparatively recently has there been formal agreement on transboundary management (Lake Victoria Commission, 2016), and a more recent draft management plan for the Lower Mara (The United Republic of Tanzania, 2018). These plans have potential importance for linking with the regional strategic planning for water resources, and wider government and donor led investment plans in the basin (e.g. USAID, 2017). Nevertheless, data and information to guide management remain fragmented, geographically limited and disconnected from the day-to-day challenges of local institutions tasked with catchment management. The water and land resources in the Mara catchment are under increasing stress from a pollution increase of about 3% per year, and development in the catchment. Coordination of research in the basin is done by different institutions. But projects come and go with little consolidation of results for future accessibility, and that can build on findings of projects rather than always having to recreate project plans and processes.

The Knowledge Exchange Workshop provided the opportunity to connect local institutions and international researchers to share experience and expertise, and discuss the challenges of past and future information dissemination, and research needs to support integrated assessments and management of the Mara catchment and related ecosystems.

The overall objectives of the workshop over the two days were to:

- Consolidate existing work on the Mara Catchment towards a shared understanding of the catchment, with particular focus on connecting river and wetland dynamics;
- Identify gaps, overlaps and redundancies in existing and ongoing research;
- Consider how research insights effectively advance strategies of catchment management and support the function of effective catchment institutions; and
- Improve the availability, further use and development of data and models after the end of individual projects.

### Report on Day One (24th July)

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The workshop was opened by Majura Maingu (Chairman of “Mara Mori Catchment Forum” MAMO-CAF), who outlined the importance of the workshop in connecting local, regional and international knowledge for common purpose, and the importance of working with communities of the Mara to move towards greater sustainable use of water and other resources so as to achieve lasting growth



and value creation. This requires choosing the correct instruments for measuring sustainable resources and human benefits in the face of increasing growth in population, increasing demand for energy and economic aspirations all of which place pressures on natural resources. The invigoration through the transboundary MAMOCFAF provides a mechanism to connect local stakeholders and a platform for the development of local Water Users Associations (WUAs) that can support the mission of local and regional catchment management.

Twenty-four people participated in the workshop on 24<sup>th</sup> and 25<sup>th</sup> of July, representing local institutions such as Lake Victoria Basin Water Board and Regional Water Quality Laboratory in Mwanza, NGOs and researchers from five different countries: Tanzania, Kenya, United Kingdom, The Netherlands and South Africa. The variety of perspectives helped form important questions: What are the services the wetland provides? What is the desired wetland extent? If you are measuring change, what is the baseline? The knowledge exchange workshop was followed by a workshop and field activities for citizen science for water quality assessment in the Lower Mara. This involved about 30 participants from both Mara North and South, including WUA officials, teachers and pupils and community representatives who had previously expressed an interest in citizen science, as well as representatives of WUAs from neighbouring catchments.



*Participants of the Knowledge Exchange Workshop at the Victoria Palace Hotel in Mwanza, Tanzania*

The first day focused on scientific knowledge exchange, investigating connections, overlaps and gaps from a conceptual perspective. An introductory exercise set the scene for the workshop. Groups of participants shared their specific views and perspectives about the Mara catchment, by describing their own work based on a series of guiding questions:

- What do you UNDERSTAND?
- What do you LOOK at?
- Who do you LISTEN to?
- What do you DO when you study a catchment?
- What do you SAY to describe the catchment?
- WHY (for what purpose) do you study the catchment?

Together, the participants in the room represented knowledge of the following aspects of the Mara catchment.

**Understanding** – community motivation and analysis, ecosystem services provisioning; area with hydrological boundaries; how the system is working; effects in livelihoods

**Looking at** – water, people, land use, animals; water quantity and quality, sediment, land use, morphology, pollution; community dynamic, quantity and quality of water; water quality variables as a measure of water ecosystems; demand and supply side (demand is increasing for livestock, fishery), the effect of population increase on the quantity and quality of water

**Listen to** – leaders, communities, institutions, NGOs, CBOs, government; communities, institutions, NGOs, CBOs, government; policy, stakeholders, politicians; data, birds, water quality data, organisms of the river, input from people about river; citizen based on the “complaint”, institutions of standards of Ministry, guidelines; all value chain practitioners (stakeholders) – goes to different hands in the market.

**Doing** – capacity building (training), awareness creation, advocating; water resources assessment and monitoring, modelling and forecasting; monitoring, measurement, community engagement; measure change; capacity to improve water quality; engage practitioners and personnel to take care of water resources, to make sure the balance is achieved.

**Saying** – water resources, usage, management of the water for people’s needs; health and ecological issues around it; catchment suitability, good practice, describing the catchment;

**Why (purpose)**- empower the community to better manage resources; good connection point for water resource management, without information empowering is impossible, we are all stakeholders; what affects the river; increasing conflict among end users due to scarcity of the resources

After the introduction, four stimulus talks, on water management, ecosystem processes, river and wetland assessment (see Annex 1 for links to presentations), led to immediate discussions focussed on specific details and clarifications that were used as inputs to the group work. The talks outlined the challenges within the catchment, and areas where understanding needs improving and development. Water management requirements and challenges were outlined by Batuli Seif on behalf of the Lake Victoria Basin Water Board (LVBWB), Mwanza, and as provided in their 2019-2021 Strategic Action Plan (LVBWB, 2019). Capacity needs are high with, for example, it is unclear how much water is allocated to different end users. Identified water users in the Basin (infrastructure, boreholes, irrigation) are estimated as 3800, but only 600 permits (for ground water or surface water) extraction have been issued, and only twenty permits for industrial discharges. Key ecological issues identified by Frank Masese were that large changes in land use for agriculture and needs for water abstraction have placed hydrological stress on the river. Large numbers of cattle exacerbate these pressures, also changing nutrient dynamics in the river as, ecologically speaking, “cattle replace hippos”. The trans-boundary nature of the river makes integrated management more difficult, with pressures on downstream users arising from the water demands and land use emissions (nutrients, sediment, pesticides and heavy metals) by upstream users. The river is subject to large differences in flow between the rainy and dry seasons, with occasions of severe water shortage in the latter affecting river hydrology and likely having large impacts on biodiversity, including fish kills at very low flow. The topography of the river prevents effective water storage upstream for managing flows.



*Welcome and introduction to Day one of the workshop.*

Changes in the morphology of the Lower Mara wetland were described by Francesco Bregoli. He showed with clear evidence from satellite images, historical topographical maps and field measurements that the wetland area has increased over the last 50 years, with increasing sediment loads settling in the wetland, and changes in the course of the river in the wetland area. While the general benefits of wetlands are well recognised globally, local stakeholders can have differing views regarding the ecosystem services or disservices provided by wetlands. These are fruitful areas of further research that link land use, livelihoods, wetland ecology and policy. The assessment of wetland services was followed by the presentation of Ryan Edwards, who provided an overview of the WET-Health assessment tools developed in S. Africa, including how rapid tools are not classical research. Rapid assessment can provide important information to start assessing change and trends in changes in wetland state. These measure changes in wetland hydrology, geomorphology and vegetation to provide overall ecological quality scores. The WET-EcoService assessment provides for relative importance of wetlands, as a support for decision making. The stimulus talks and discussions informed further consideration among participants on the information needs for the Mara, and an exercise based on the “blind man and the elephant”, outlined in the programme booklet, used to construct a matrix of current understanding and possible “blind spots” (Table 1)

**Table 1.** The matrix of known and unknowns in knowledge and understanding to guide considerations for current and future knowledge exchange for the Mara catchment.

	<b>Knowns</b>	<b>Unknowns</b>
<b>Known</b>	<b>Existing findings</b> – things we know we know	<b>Open research questions</b> – things we know we don't know
<b>Unknown</b>	<b>Redundant/obsolete research questions</b> – things a presenter considered an open question but the data/findings actually exist	<b>Blind spots</b> – research questions, concepts or aspects that are relevant to planned work and should/need to be asked to produce state-of-the-art findings

Collation of inputs from this exercise provided a matrix of findings, open questions, obsolete questions and blind spots was constructed (Table 2).



	Knowns	Unknowns
<b>Known</b>	<ul style="list-style-type: none"> <li>- There is sedimentation in the Mara river</li> <li>- There is on Mara</li> <li>- We have too much plans that aren't implemented</li> <li>- Water quality and quantity change</li> <li>- Sediment sink in the wetlands</li> <li>- Wetland expansion</li> <li>- Wetland function in relation to water fluctuation</li> <li>- Study about wetland ecosystem</li> <li>- Flow declines have occurred in the Mara River</li> <li>- Quality of water relates to industrial discharge</li> <li>- Encroached water resources</li> <li>- Livestock replacing natural animals</li> <li>- Livestock is decreasing in Kenyan site</li> <li>- Monitoring sites – low density</li> </ul>	<ul style="list-style-type: none"> <li>- Is the problem climate change or increase in hippo numbers, or both, or neither</li> <li>- Importance of basins other than Mara-Mori</li> <li>- Maximise resilience of all systems</li> <li>- How is the condition for other rivers in the Basin</li> <li>- Monitoring of allocation</li> <li>- What socio-economics factors (other than increase in livestock) negatively impact river</li> <li>- Policy for water resources</li> <li>- Are wildlife numbers being managed</li> <li>- Mou Forrest – maybe climate change maybe agriculture</li> <li>- What data exists</li> <li>- Wetland regime</li> <li>- Is there a comprehensive enough inventory to understand a system to enable sustainable allocation</li> </ul>
<b>Unknown</b>	<ul style="list-style-type: none"> <li>-Sediment load and deposition in river and wetland, and relation to channel avulsion</li> <li>-Water demand by livestock, and required allocation</li> <li>-River health assessment</li> <li>-Effect of wetlands expansion on livelihoods</li> <li>-Potential synergy and partnership on different interventions</li> <li>-Effects of proposed lower Mara dam on wetland extent</li> <li>-Estimating a reference state to assess changes</li> <li>-Effect on land use changes on social dynamics</li> </ul>	<ul style="list-style-type: none"> <li>- Water resource management effects on connectivity with broader ecosystem</li> <li>- Collaboration in water management with other water users</li> <li>- What is reference state/condition and how to use that information</li> <li>- Wetland baseline</li> <li>- Relevant lessons from water management in other countries</li> <li>- Complete definition of water users</li> <li>- Consideration of animals, leaks, evaporation</li> <li>- Would knowing reasons for population growth be beneficial to wetland management?</li> <li>- What is reference state/condition (influence on our view what is good and bad)</li> <li>- Effect of water flow decrease on hippos and effect of hippo in ecosystem function</li> <li>- How to delineate wetland area (see SDG 6/wetland extent)</li> <li>- Differentiating subsistence users vs. commercial/industrial users and allocation usage</li> <li>- What number of livestock can be supported by ecosystem</li> <li>- What taxa are endangered in Mara-Mori</li> <li>- What exactly caused change of river direction</li> <li>- Management implications for shift from wildlife to livestock</li> </ul>

**Table 2.** Outputs of the matrix, from the design of Table 1, provided by participants at the Mara Knowledge Exchange workshop,

## Report on Day Two (25th July)

The second day started with a recap of key points of the previous day including decreasing and increasing wetland, definition of a wetland, and importance of language in describing changes so that there is clear understanding of what is intended to be conveyed. Research questions for the wetland included what is the effect of increasing numbers of cattle, and the underlying drivers of that. The well-established Drivers-Pressures-State-Impact-Response (DPSIR) management model can help frame the discussion and underpin the research questions. In evaluating wetland condition and extent the question of “what is the baseline?” was raised. Given long and short-term cycles and the dynamic nature of a wetland, the question can raise a number of differing views. Other key points raised that led into the second day of presentations and discussions were that information and data collected need to fulfil a clear purpose, and how citizens can help with monitoring and policy objectives.

A series of 3-minute summaries linking the discussion were provided by Frank Masese on eflows, and competition of water during times of drought. Extensive fish kills at low flows in the Mara River provide a dramatic bio-indicator and illustrating why such indicators need to be developed and applied long before thresholds are reached that lead to widespread fish mortality. This is the benefit of agreeing on appropriate eflows that are connected with appropriate monitoring and permitting for water abstraction. A minimum flow of about 20 m<sup>3</sup>/s is required to sustain the ecosystem system. Fish kills occur at about 1 m<sup>3</sup>/s.

Emmanuel Mwinga outlined the objectives of the Integrated Management Plan (IMP) for the Lower Mara, and the process of conducting intensive stakeholder engagement in its preparation. The plan required looking at environmental management challenges from different (e.g. hydrology, ecology, sociology, economic) perspectives; and considering multiple pressures including land use, population density, pastoral and agricultural activities (livestock no), and climate variations. A key question is how much water is needed to sustain wetland in the desired extent, and what is that desired extent?



*Presentation during the workshop*

An overview of the Stockholm Environment Institute (SEI) contribution to the Sustainable Water Partnership (SWP) was provided by Kennedy Wahome. This partnership provides for understanding and input for sustainable water use of the Mara, water security assessment, and mapping of water users, and agricultural data. This posed questions on what is known about the overall water demand. The water allocation plan for the Lower Mara should be able to at least assemble current data on this, and help build scenarios for water use and identify and fill data gaps.

Overall, the second day had a more technical focus on Mara data, databases and data collection, and decision support. This included the use and re-use of existing data, including exploration of community-based monitoring as an opportunity to expand the available datasets for catchment and SDG monitoring to support the UN Sustainable Development Goals (SDGs). Stimulus talks concerned involving communities in data collection, Citizen Led River Health Assessment in the Mara River basin, Social accountability monitoring for water and Citizen Science data quality and integration into formal monitoring systems.

Water resources data management by LVBWB was outlined by senior hydrologist, Ogama Mangassa. Developments that can support management is how a number of institutions (Tanzania Met Agency, National Electricity

Services, Private Sectors, Agricultural Research Centres, Nile Basin Initiative, Researchers, Students, Water allocation) share data. A focus can be investing in telemetry stations to also address capacity needs. Priorities are technical (sharing knowledge), social (capacity building, how citizens can collect some of the information), tools (analysis tools GIS, Aquarius) and infrastructure. Social challenges include vandalism of hydrometric stations. The need for support of water managers is clear for managing water resources and to build on successes in assembling data on time series data, water quality, and dissemination and involvement of communities and WUAs (as provided for in the Tanzanian Water Resources Management Act of 2009). Most water users downstream, and many in Kenya, use boreholes, although groundwater is not yet monitored systematically. Water abstraction report exists in Kenya, but there was uncertainty to the extent this is accessible. There were some focussed discussion on the effects of large scale water abstractions upstream in the Mara and the largely unknown effects of water use by cattle. It was also emphasised that effective water management needs to be applied to the sub-catchments of the Mara and Lake Victoria. These are often neglected as most attention is directed towards the main river channel.

The Citizen Science toolbox miniSASS for river health monitoring, was summarised by Mark Graham of Ground-Truth (South Africa). The citizen observations and measurements provide information on how the health of a river changes along the course of the river. A combination of simple techniques measuring water quality, turbidity, water flow and invertebrate communities can provide useful monitoring data but, more so, provide a



*Citizen scientists using the miniSASS toolbox for river health monitoring*

means for engaging with and, therefore, empowering communities. Discussions included the capacity of citizens to support statutory required monitoring and in collecting data to support local needs, such as water quality for domestic use, or landscape data for environmental assessment. This also provides potential for broader working with communities, schools, raising awareness, and environmental literacy. Data quality and precision of measurements are often mentioned as a weakness of citizen monitoring, with counter-arguments that this is also useful for identifying trends or triggering where further investigations are needed. In the Kenyan part of the Mara, school children monitor weather, and collaboration with Trans African Hydrometeorological Organisation (TAHMO) provides important outreach and educational materials for schools.

Kevin Gigchangi provided an overview of the river monitoring and score cards that were rolled out in the Kenyan side of the Mara River. This provides a development of good potential for

linking communities, scientists and institutions. Communities report pollution incidents, and can evaluate changes they observe in the river. Citizen data collection includes water quality (pH, temp, clarity) and use of miniSASS, and perceptions on health, catchment health and riparian vegetation. A River Health Assessment pilot project by WWF seems to be effective tool that evokes societal concern about human impacts on the river. Current work is harmonizing the approach in Kenya and Tanzania.

Taking a step back from actual monitoring, and considering the enabling environment for citizen science, Ellen Pfeiffer opened the discussion of “what about the people” in her presentation. Drawing on the GroundTruth2.0 project (<https://gt20.eu/>) working in 6 different countries across Europe and Africa, and the Women and Water for Change in Communities” project working in Tanzania, Zambia and Uganda, key insights have been: 1) engagement of communities to improve decision making benefits from even modest data inputs, which can serve as a valuable form of communication; 2) if “you can only manage what you measure”, it is important to know what you want to achieve, what happens to the things that aren’t measured, and recognising that who decides

what gets measured, very much influences what is a problem; 3) deciding what gets measured benefits from, and in many cases requires, a co-design process; 4) communities are subject to many policy agendas rolled out by different agencies with their own perspectives of the “stakeholder”. This provides a complex landscape for the communities who are either managing a resource, or are affected by management decided by agencies; and 5) reporting is a form of communication, and effective engagement provides not only a mean of motivation among resource but, crucially, can change the perceptions and assumptions of funders and donors of what the problem is.

Maintaining the social and governance theme, Herbert Kasililah provided experience on social accountability and crucial issues and challenges for equitable water use. Recognising that water is necessary for both growth and poverty reduction, the distribution of who has access and how is that managed and accounted for are key issues for sustainability. Complicating this social dynamic are issues about biodiversity and the river health that can lack a voice and representation in political and stakeholder fora. With increasing impacts from climate change the potential for conflict among all stakeholders, including the river itself will increase. Hard to monitor processes like water for the 30 million cattle of the Mara bring a serious and volatile dimension to water management. Water User Associations in Tanzania report to catchment institutions, and then to the ministry. Empowering citizens and the social accountability that comes with that raises question on democratization and democracy, ultimately affecting service delivery. Within communities, voluntary engagement by interested citizen help understand the issues, improve communication skills and promote relevant contacts among the various stakeholders. Key aspects that come from the considerations of social accountability include: the socio-economics of water abstraction and allocation and use of permits to manage that; protection and conservation of water resources including pollution control; and the need for review of existing regulations. Key questions were how to scale sustainability, what works in different contexts, what stimulates and sustains citizen engagement and the use of information in decision making?

Luigi Ceccaroni brought a global perspective to the discussion on citizen involvement in monitoring and management through his work with *Earthwatch*, posing an initial question if the workshop participants were comfortable with the term “citizen science”, and its connotations of involving people in data collection and information sharing. The term as commonly used covers many aspects, including not only those related to collecting environmental data, but broader considerations of management, political and societal aspects. It is often an opportunistic tool, and that the higher engagement required the lower amount of citizens’ involvement. This raises important questions of whether citizen science is effectively just a means of crowdsourcing using citizens for broader aims such as statutory catchment monitoring, or community-based management involving participation in scientific research. Whichever scale is applied in practice, a key element of engagement and sustainability of practice is that the data goes back to the citizens. This can also provide powerful visualisations of local water quality, or other environmental, issues. It can connect citizen science to the policy process, and develop procedures for ensuring data are of good quality, collected over a long period of time, and at spatial scales that inform development of policy. Currently the application of citizen collected data is generally still in the early development stages in continental Africa, but provides the potential to support policy and be part of the Citizen Science global partnership. The more sophisticated and higher tech aspects where citizens’ data can be uploaded immediately to data clouds would need further development, and possible investment, as in many parts of the Mara basin. There is a lack of electricity or limited use of smart phones. Similarly, concerns about data quality needs to be put in context, and appropriate mechanism for quality assurance incorporated in the process. The workshop concluded that community based monitoring can help measure changes in the Mara catchment area but it can help also empower communities to advocate for these changes. It is also an opportunity that research can be inspired by citizens, or research can be designed to incorporate citizen input.

The presentations on Day 2, interspaced with discussions on application of knowledge and access to information, were followed by a discussion on the SDGs led by Ken Irvine, and how the goals and targets can relate



to key topics outlined in the previous two days. Some connection across goals and targets are obvious, some less so. Sometimes there may be conflicts between ambitions under separate goals. The workshop discussion on this helped to identify both challenges and opportunities.



*Discussing the content of a presentation*

The final session summed up the day, with a focus on data collection, accessibility and usability; and the opportunities and constraints to that. There is much historical data that may be “hidden” in old reports. There are data sets collected by agencies and researchers for different purposes, which can make combined analysis of assimilation difficult. Within all this are data for which there is an associated willingness to share and data where that willingness is either not present, or involves some negotiations. Some data can have commercial sensitivities. Sometimes there can be suspicions of what the data will be used for, and by whom. For all of these there can be issues of data quality of original measurements, format of databases, ease of use, or subsequent management and analyses. As data sharing is of key importance, mechanism for improving accessibility and working in a partnerships provides collective benefit, also for transboundary water management. MoUs on access, format and use across agencies and researchers, and between governments provide well established mechanisms for improved use of data for evidence informed water and catchment management, and could be greatly facilitated by creating a trans-boundary forum for data sharing. Convincing all users of this can take persuasion. Taking data to communities and, in contrast, use of data collected by communities opens up new dimensions of data access and use. Clear policies in on all of the data issues were recommended in the discussions. Above all data used has to be “fit for purpose”, and accounting for natural and methodological variabilities. It was strongly recommended that all data used in reports be available and also published.

There are many opportunities for improved access to information and formal and informally collected data. Better coordination among data providers was recognised as a key element. Coordinated platforms across the basin such as the Sustainable Water Partnership and Mara Mori forum, and their coordination with e.g. LVBWB providing great opportunities into the future. It is recognised that there are associated capacity needs for data collection and management, where support from interested external organisations and governments can be sought. Data collection can benefit from both large and small scale coordinated initiatives, including large regional projects with healthy budgets and small e.g. student projects with much more modest, or extremely limited, resources. This highlights a need for coordinated, often partnership approaches to funding opportunities. Success stories should be shared. Fundamentally, a key need is effective communication about initiatives and projects.

## Day Three (26th July)

The third day of the workshop included citizens from across the Lower Mara for an introduction to how they can play a role in monitoring water resources. A key innovation in the proposed Mara Watch Action Group is the use of a citizen science data stream as a channel of continued communication and knowledge exchange between local communities in remote areas and higher governance levels. A citizen science monitoring programme offers sustained disaggregated water quality data as a valuable resource for catchment management and planning. It offers possibilities to contribute to national objective for water quality targets as outlined in SDG Goal 6.3.2 (UN Environment, 2018). Demonstration and joint training with community resource persons

lasted approximately four hours. The training was led by Luigi Ceccaroni from Earthwatch (UK) and Vice-Chair of the European Citizen Science Association, and Mark Graham from the consulting company Groundtruth, South Africa. A group of participants consisted of around 30 community facilitators, field officers, WUA members, teachers and community volunteers from two catchments. The first, theoretical, part of the training was conducted at the conference venue of Victoria Palace Hotel in Mwanza, Tanzania and related to general information about community based monitoring, its advantages and possible applications. After that the participants were divided into two groups of approximately 15 people each for field activities.

The first group learned how to assess river health using miniSASS, a simple monitoring tool which was developed by Groundtruth. The idea is based on collecting samples of macroinvertebrates (small spineless animals) from the water, and depending on which groups are found, the general river health and water quality in that river can be measured. In addition there was a demonstration on how to prepare the net for sample collecting using only piece of wire and mosquito net. The participants worked with commitment on the samples that were collected from Mirongo River in Mwanza using an identification guide. At the same time the second group was learning how to use Freshwater Watch application on the shore of Lake Victoria. The app was developed also in Swahili so there was no language barrier.

The only limitation was that there was only a small number of smartphones in the group. The questions in the app considered observation of bank vegetation, water colour, animal species, land use and visible pollution sources. The group gladly discussed the findings, and measured the nitrate and phosphate content in the water using testing tubes. This part aroused great interest and a lot of questions were asked regarding testing tubes and nitrate and phosphate impact on the water environment. After that both groups changed places.

The last part of the training was summary of the results. The Mirongo River was assessed by the participants to be in poor and very poor condition. The results from the Freshwater Watch app were displayed on the map.



*Learning how to use the Freshwater Watch application*

The participants asked about the lack of access to internet connection and smartphones, what seems to be a challenge, but also an opportunity to build a center for collecting responses and uploading them to the app. Other questions were related to bacteria testing. During the session participants were very involved in the activities. The demonstration and training explored the practical application of citizen science in Mara communities.



*Participants investigate a macroinvertebrate sample*

## Next steps

The Mara Knowledge Exchange workshop provided an opportunity for relevant local stakeholders, communities of the Mara and international workers familiar with the Mara or the key principles discussed to share ideas and interests. It provided an opportunity for stakeholders to get to know each other and work together on functional transboundary water user and catchment management. A participant list for the first two days comprises Annex 2, and an evaluation and suggestions of the workshop are in Annex 3. The workshop was designed to stimulate further knowledge creation and sharing in a way to support the sustainable use of the basin's water resources, and decision support for local agencies and communities. It provided development of a knowledge platform

supporting current and future projects and initiatives. Continuity of such activities is essential for building knowledge, awareness and outreach. The content and outputs of the workshop provide an important input to the *Mara Water and Wetland Watch* supported by a number of the partners who contributed to the workshop.



Field officers Zablon Israel and Filbert Matondwa for the Women and water for Change in Communities project, with Suzana Marwa village volunteer for water quality testing, and project coordinator Ellen Pfeiffer.

## Post script:

### Demonstration of citizen-science tools (FWW) and joint training with community champions in the Mara wetland (Kongoto and Bisarwi)

Following the workshop, Luigi Ceccaroni visited sites at Kongoto in the south Mara wetland and Bisarwi in the north of the wetland, and was accompanied by LVBWB staff (Rochi Michole and Joseph Masaka), and Zablon Israel of the Victoria Farming & Fishing Organisation (VIFAFIO). At both sites a number of local “champions” (identified in a separate field report) joined the field work. Several Fresh Water Watch (FWW) measurements were taken during the trip in three new sites and uploaded to the Earthwatch database (<https://freshwater-watch.thewaterhub.org/>).

Lessons learned from the experience summarised by Luigi Ceccaroni were:

- In Lake Victoria and in the Mara, transboundary management of waters is important.
- A definition of water user is needed.
- In water management, animal use, leaks and evaporation are often not measured or considered.
- There is an overemphasis of the Mara-Mori basin, while other basins are not considered enough.
- An increase in agriculture led to deforestation.
- A decline in water quality led to fish death.
- Changes in land use led to changes in water quality, biodiversity (measured via macroinvertebrates as indicators) and the food web.
- Livestock (mainly cattle) is replacing wildlife (e.g., hippos).
- There is, incredibly, no agreement on whether the Mara wetland is expanding or not. Maybe wetland expansion needs a more formal definition.
- Local people *are said* not to want the wetland to expand because the agricultural land would be reduced.
- Irrigation and damming can quickly improve the situation and make agriculture independent of the weather. And this could be done respecting wild animals and the surrounding ecosystem. In this sense, climate change has no significant impact, but can be used as an excuse to attract funding.
- Lake Victoria water level, between 1961 and 1962, rose 2.5 m in one year and it was not the end of the world, even if the 0.01% of the population living around the lake died. Tanzania now is much, much better than in 1962.
- There is no drinkable tap-water anywhere in Tanzania.
- The cost of a smartphone or a computer in rural Tanzania is half the typical annual salary. This is probably the main barrier to development, not letting disadvantaged people take advantage of the power of the Internet, especially with respect to education.



## Annex 1: Programme

Wednesday, 24th July 2019

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9:00 – 9:30

### Opening Knowledge Exchange Workshop

#### Opening

**Majura Maingu**

*Chair, Mara Mori Catchment Forum*

#### Welcome

**Ken Irvine**

*Chair for Aquatic Ecosystems, IHE Delft Institute for Water Education*

**Presentation:** <https://www.dropbox.com/s/n14c6e5ndy76jo0/Irvine%20Introduction%20Mara%20Knowledge%20exchange.pdf?dl=0>

#### Table Round

##### Introduction of Participants

*What is the first thing you think of when you think about “the Mara”?*

9:30 – 10:00

### Who we are: Research Perspectives in the Room

Introducing each other’s way of studying a catchment:

- What do you UNDERSTAND?
- What do you LOOK at?
- Who do you LISTEN to?
- What do you DO when you study a catchment?
- What do you SAY to describe the catchment?
- WHY (for what purpose) do you study the catchment?

10:00 – 12:30 (incl. tea break)

**Stimulus Talks & Audience Response: Finding our Blind Spots**

Four stimulus talks will present different facets of research for better catchment stewardship. To stimulate discussion and identify overlaps synergies, audience reactions will be used to build a matrix of findings, open questions, obsolete questions and blind spots.

	Knowns	Unknowns
Known	<b>Existing findings</b> – things we know we know	<b>Open research questions</b> – things we know we don't know
Unknown	<b>Redundant/obsolete research questions</b> – things a presenter considered and open question but the data/findings actually exist already	<b>Blind spots</b> – research questions, concepts or aspects that are relevant to planned work and should/need to be asked to produce state-of-the art-findings

**Presentation 1** Managing Water for People in the Lower Mara

**Batuli Seif**, Lake Victoria Basin Water Board, Mwanza

The Lake Victoria Basin Water Board (LVBWB) is the custodian of the water resources management within the basin. It was established in 2000 and covers an area of 115,400 km<sup>2</sup>. The major roles of the LVBWB are water resources assessment, allocation and water sources protection and pollution control. Its mission is to promote integrated water resources management in order to meet the socioeconomic and environmental needs within the basin. Among LVBWB's objectives are: preparation and implementation of Integrated Water Resources Management and Development Plan; prepare and implement a Capacity Development Plan; and the establishment of water resources management institutions. The strategic plan for 2019-2021 is to protect and conserve water resources. The plan focuses on vision for people and environment of the basin and responsibilities of authorities to improve service delivery, capacity building and capital investment.

*The Lake Victoria Basin Water Board (LVBWB) (2019). Strategic Action Plan 2019/2020-2023/2024. The Ministry of Water, Lake Victoria Basin Water Board, The United Republic of Tanzania.*

*Lake Victoria Basin Commission. (2016) Mara River Basin. Transboundary Integrated Natural Resources Management Plan. Kisumu, Kenya.*

**Presentation:** [https://www.dropbox.com/s/hy1ijhb2qhiwqwk/Seif%20LVBWB1\\_Knowledge%20Exchange%20workshop.pdf?dl=0](https://www.dropbox.com/s/hy1ijhb2qhiwqwk/Seif%20LVBWB1_Knowledge%20Exchange%20workshop.pdf?dl=0)

**Presentation 2** Ecosystem processes and functioning supporting sustainable use of the Mara River: The present understanding and knowledge gaps

**Frank Masese**, Eldorat University, Kenya/ IGB, Berlin

Frank's research interests lie primarily in freshwater ecosystems, investigating the influence of land-use change and human activities on water quality, biodiversity (invertebrates and fish), ecosystems health and ecosystem

functioning (ecosystem metabolism, energy [carbon] sources and flow in food webs). With more than 10 years of research experience in the Mara River and other rivers and wetland systems in the Lake Victoria basin.

*Masese, F., McClain, M. (2012). Trophic resources and emergent food web attributes in rivers of the Lake Victoria Basin: a review with reference to anthropogenic influences. Ecohydrology: 5(6).*

*Masese, F. O. (2015) Dynamics in organic matter processing, ecosystem metabolism and trophic sources for consumers in the Mara River, Kenya. PhD thesis. UNESCO-IHE/Wageningen University, The Netherlands*

**Presentation:** [https://www.dropbox.com/s/1fhmcjlm989l860/Masese\\_Mara%20river%20ecosystem%20process%20and%20functions%20July-2019.pdf?dl=0](https://www.dropbox.com/s/1fhmcjlm989l860/Masese_Mara%20river%20ecosystem%20process%20and%20functions%20July-2019.pdf?dl=0)

### Presentation 3 Natural and anthropogenic causes forcing river channel avulsions and wetland expansion in the Lower Mara River, Tanzania

**Francesco Bregoli**, Hydraulic Engineer, Independent researcher

Francesco Bregoli is a researcher in hydraulic and environmental engineering. In 2008 he received the MSc in Environmental Engineering at the University of Florence, Italy. In 2015 he obtained the PhD in Civil Engineering in the Technical University of Catalonia, Barcelona, Spain. He successively worked as researcher in the Catalan Institute for Water Research, Spain, and IHE Delft, the Netherlands. His interests embrace topics such as natural hazards including floods, landslides, debris flows and landslide tsunamis as well as human-induced hazards as pollution in river networks aggravated by global population growth and climate changes. Between 2017 and 2019, in IHE Delft, thanks to a European Union Marie Curie fellowship, Francesco studied the role of fine sediments on river morpho-dynamics including the effect of sediments input discontinuity on morphology and ecosystem of rivers. The Mara Wetland, Tanzania, was a case study of his recent research.

*Bregoli, F.; Crosato, A.; Paron, P; McClain, M. (2019) Humans reshape wetlands: unveiling the last 100 years of morphological changes of the Mara Wetland, Tanzania. Science of the Total Environment, <https://doi.org/10.1016/j.scitotenv.2019.07.189>.*

**Presentation:** [https://www.dropbox.com/s/hl3vw467vnfc49q/FBregoli\\_MaraWetland\\_Workshop.pdf?dl=0](https://www.dropbox.com/s/hl3vw467vnfc49q/FBregoli_MaraWetland_Workshop.pdf?dl=0)

### Presentation 4 Wet-health and wetland eco-services

**Ryan Edwards**, Eco-Pulse Consulting

Ryan Edwards a wetland ecosystem specialist in wetland ecosystem assessments and associated management. His core field of focus, specialisation and passion is wetland ecology and regularly conducts wetland assessments for private, commercial and industrial clients as well as for provincial and national government departments and municipalities. He is a leading ecologist in the field of wetland offset planning in South Africa, with extensive involvement in the Water Research Commission (WRC) project to revise the wetland ecosystem services / functional assessment tool and the wetland ecological / biodiversity assessment tool. Ryan holds a Bachelor of Science (BSc) in Geography and Environmental Management, a Bachelor of Science Honours (BSc Hons) in Geography and Environmental Management and a Master of Science (MSc) in Environmental Science (Research Masters). His master's dissertation was on wetland geomorphology and as such has expertise in the methods of data collection and analysis in the discipline of geomorphology. Ryan is currently accredited as a

professional natural scientist by the South African Council for Natural Scientific Professions (SACNASP) under the field of practice – ‘environmental science’.

*Wetland Management Guidelines: Building capacity and supporting effective management of wetlands within South African municipalities (2018). Eco-pulse environmental consulting services, preliminary version.*

*Kotze, D.C., Ellery, W.N., Macfarlane, D.M., Jewitt, G.P.W. 2012. A rapid assessment method for coupling anthropogenic stressors and wetland ecological condition. Ecological Indicators, 13: 284-293*

**Presentation:** [https://www.dropbox.com/s/lujubkch5m35jnl/Edwards\\_WET\\_Health\\_NWI\\_2019\\_Mara.pdf?dl=0](https://www.dropbox.com/s/lujubkch5m35jnl/Edwards_WET_Health_NWI_2019_Mara.pdf?dl=0)

### Lunch Break

13:30- 17:00 (incl. tea break)

**Analysis and Discussion: “What do we know, what do we need to know”**

The session will bring back a collation of key points from the five previous presentations and the reactions from different disciplinary perspectives. Connecting and elaborating on individual points will help identify key areas for further research and likely raise new ways of viewing known problems. Given the scale and scope of the information needs and the myriad of possible interactions in the socio-ecological landscape of the Mara, this could be an infinite exercise, not possible in an afternoon, or even a month! This session is not, therefore, about very specific research questions, but the key areas of multidisciplinary work that can provide the necessary overview to identifying the need for further knowledge and, if possible, the means for gathering it. The needs of the end users is a crucial consideration, so as to retain a focus on the application of knowledge for sustainable management.

Several interactive rounds will be used to clarify key knowledge gaps and how to build on the foundation of existing understanding.

#### Guiding questions:

- What are important scientific research gaps for catchment management?
- Where are overlaps or redundancies (including repeated inventories)
- Where are opportunities for synergies – and where is collaboration a must to advance understanding?

#### Capturing outcomes

- Key individual thoughts.
- Key collective thoughts.
- Means to summarise the knowledge and gaps.



## Thursday, 25th July 2019

9:00 – 9:30

### Recap and Opening Remarks: Data collection in the age of the SDG

Day Two of the workshop focuses on mapping the needs of key stakeholder groups, and the data that can support those needs. Extensive data sets have been collected over the last two decades, but are largely scattered, fragmented or unavailable. The arrival of the SDG and their monitoring has opened a broad range of conversations how to capture the complex dynamics of nature and human societies in a handful of reportable numbers. Modern technologies change how communities can be involved in environmental monitoring and management. Social groups have different information needs, but the needs for different data user groups are often interwoven. Data needs for one group can support and drive the activities of another. A key example is how the scientific understanding can guide what and where to measure variables of water quality. Local communities with a special interest in their own health can potentially support the collection and even measurement of those variables, including the key ambient water quality parameters of oxygen, electrical conductivity, pH, nitrogen and phosphorus recommended under the UN SDGs Indicator 6.3.2 of Ambient Water Quality. To address this context, Day Two comprises three sections of, respectively, mapping end user demands, the current landscape of citizen science, and a discussion of the resulting challenges for more integrated data access and use in the Mara catchment.

9:30 – 10:45

### Mara Data: Who wants it, who needs it, who uses it?

Large amounts of data have been collected in research projects in the past and are collected every day. However, it is not always clear how the collected data relates to the needs of various end users and for what purpose it might be useful. Similarly, data collections are frequently guided by limited objectives, without exploration if slight adjustments could make them re-usable for other users or multiple purposes. Obtaining clarity on data demands paves the way for future data collection and data excavation from the past.

Three broad end-user groups are proposed:

- 1) Local catchment agencies charged with collecting data to fulfil their legal and other obligations;
- 2) The research community who are trying to make sense of the structure and function of the catchment; and
- 3) Local communities, whose needs provide an ultimate goal and rationale for “what gets measured, gets managed”



*Tea Break*

11:00 – 14:30 (incl. lunch break)

**Stimulus Talks: Involving Communities in Data Collection****Presentation 1. The potential of citizen science and the MiniSaSS programme****Mark Graham**, Ground Truth, South Africa

Mark is an aquatic ecologist with 30 years' experience in terrestrial and aquatic ecosystem functioning and management. Mark's early career started at Umgeni Water, where he had extensive involvement in the management and development of an ISO 17025 quality accredited laboratory and the National River Health Programme – Quality Assurance programme. Mark then made a move to professional consulting in starting GroundTruth, Water, Wetlands, Biodiversity and Environmental Engineering. Over the years Mark has provided specialist input on numerous projects for national and international corporations and government departments, developing innovative solutions to a range of practical and applied environmental and water-related issues. Mark is also actively involved on numerous research projects for the Water Research Commission and the Department of Water and Sanitation, having co-developed numerous of the published assessment tools and EcoStatus models currently used in South Africa (e.g. SASS5, IHI, VEGRAI, MIRAI). Mark plays an active role in promoting and developing citizen science within the African region, with an aim to empowering and educating the public to collectively improve the state of our water resources.

*Graham, M., Tylor, J. Development of citizen science water resource monitoring and communities of practice for South Africa, Africa and the World (2018). Water Research Commission Report No TT 763/18, South Africa*

[http://www.wrc.org.za/wp-content/uploads/mdocs/WW%20Sept-Oct%202018\\_Citizen%20science.pdf](http://www.wrc.org.za/wp-content/uploads/mdocs/WW%20Sept-Oct%202018_Citizen%20science.pdf)

**Presentation:** <https://www.dropbox.com/s/ki7h8daqmj0q3ma/Graham%20Citizen%20science%20monitoring%20tools%20Mara%20workshop%20%202019.pdf?dl=0>

**Presentation 2. Citizen Led River Health Assessment in the Mara River basin****Kevin Gichangi**, WWF Kenya

Kevin is an Environmental Scientist and currently the Programme Coordinator for WWF-Kenya's Mau Mara Serengeti Landscape Programme. The Programme focuses on three interlinked thematic areas; a) forest resources management in the upper watershed, b) water resources management across the landscape, and c) wildlife management in and around the wildlife conservation areas and dispersal areas. The Mara River basin is the core of this landscape; and I therefore focus more on Integrated Water Resources Management while liaising with WWF-Kenya's Wildlife Programme which has a strong presence in the Landscape.

*The Trans-boundary Mara River Basin strategic environmental assessment (2012). Report prepared for LVBC, WWF, USAID and the Government of Tanzania and Kenya by SEA and WWF.*

*Studd, K., Agol, D. and Hepworth, N. (2012) Emerging insights for sustainable river basin management from the trans-boundary Mara of Tanzania and Kenya: Documentation of the Mara River Basin Management Initiative 2003 – 2012. WWF Kenya /Common Futures Consulting Ltd. Edinburgh*

<https://www.wwfkenya.org/?229930/The-Mara--River-Citizen-Led-Health-Assessment>

**Presentation:** [https://www.dropbox.com/s/2ktmqxu3uv1acdb/Gichangi%20River%20Health%20Assessment%20Mara%20River\\_WWF.pdf?dl=0](https://www.dropbox.com/s/2ktmqxu3uv1acdb/Gichangi%20River%20Health%20Assessment%20Mara%20River_WWF.pdf?dl=0)

### Presentation 3. What gets managed gets measured

**Ellen Pfeiffer**, IHE Delft

Ellen is specialized in process, project and knowledge management in political contexts related to sustainable development, with a focus on integrating management approaches and social science insights to address complex governance challenges. Her current work with IHE Delft focuses on the potential of citizen monitoring as tool for community empowerment in natural resource management, and the design of co-design processes to develop such monitoring schemes with local communities in rural Africa. Current activities include capacity development in Zamba, Tanzania and Uganda under the EU funded GroundTruth 2.0 , and the ColaCola Foundation supported Women and Water for Change in Communities with field sites in the lower Mara, Tanzania.

*Pfeiffer, E.; Wehn, U.; Charli-Joseph, L.; Irvine, K. (2017). Training Sustainability Change Agents: Lessons from International Water Education In: Handbook of Theory and Practice of Sustainable Development in Higher Education. DOI: 10.1007/978-3-319-47877-7\_3*

*Pfeiffer, E., Wehn, U., et al. (2018). Daring to start on a blank page: Co-Design that 'Goes the last mile', presentation at the Adaptation Futures, 16-19th June 2018, Cape Town.*

**Presentation:**

[https://www.drobox.com/s/4szpu40mqx34w44/Pfeiffer%20MWW\\_What%20gets%20managed.pdf?dl=0](https://www.drobox.com/s/4szpu40mqx34w44/Pfeiffer%20MWW_What%20gets%20managed.pdf?dl=0)

### Presentation 4 Social accountability monitoring for water - experiences in Tanzania

**Herbert Kashililah**, SHAHIDI wa MAJI, TAWASANET, Lake Rukwa Water Board

Kash has over 30 years' experience in WASH program and project management in Tanzania and has worked with both government and CSO organisations. He has a broad knowledge and understanding of the **WASH sector** in East Africa, with focus on urban and rural water supply, and water resources management. Kash has been involved in the implementation and supervision of program and project M&E including evaluations, with good knowledge of participatory planning and monitoring methodologies. He was instrumental in contributing to formulation of national water policy and its legislation during his 20 years working with government. He has also provided technical quality assurances related to WASH infrastructure development, including Design, contract management and monitoring. As a Senior Manager – during 15 years with WaterAid Tanzania, Kash has variously acted as Acting Country Representative, Head of Programs and Strategic program advisor. He was recently involved in the WPM data verification IRC and WEL group project funded by DFID for baseline towards Payment by Results, and has been active with private sector and working with CSO network in advocating for right to water. He was a former Deputy Chair of National Water Board, Chair of Shahidi wa Maji, Chair of Tanzania water and Sanitation network, chair of Lake Rukwa water basin Board, Governing board member for Alliance for water Stewardship Africa (AWS) and former advisory board member at International Union for Conservation of Nature (IUCN).

*Tanzania Water and Sanitation Network (TAWASANET) 2019. No-one left behind: Putting the water sector to work for inclusive growth and sustainable industrialisation. Water Sector Equity Report.*

**Presentation:** <https://www.dropbox.com/s/1zjxe09oew9rma9/Kashililah%20Social%20accountability%20monitoring.pdf?dl=0>

## Presentation 5 Citizen Science – State of the art, data quality and integration into formal monitoring systems

**Luigi Ceccaroni**, Earthwatch Europe

Luigi Ceccaroni is Innovation Lead at Earthwatch Europe, with a BSc degree in Environmental Sciences, an MSc degree in Information-Technology Languages and Systems, an MBA, and a PhD degree in Artificial Intelligence from the Technical University of Catalonia. He has more than twenty years of innovation experience in citizen science; ontologies; impact assessment; and the application of artificial intelligence to environmental sciences. He is Vice-Chair of the European Citizen Science Association and his activities include leading international initiatives on citizen-science data and metadata standardisation and interoperability. He is chairman of the working group to “Improve data standardisation and interoperability” of the COST Action “Citizen Science to promote creativity, scientific literacy, and innovation throughout Europe” (2016-2020). In 2012-2015, he was the principal investigator and coordinator of the Citclops project on citizens' observatories for coast and ocean monitoring, and is currently a key contributor to the MICS, MONOCLE, EU-Citizen.Science, COS4CLOUD and Ground Truth 2.0 European projects.

*Mazumdar, S., Ceccaroni, L., Piera, J., Hölker, F., Berre, A., Arlinghaus, R., & Bowser, A. (2018). Citizen science technologies and new opportunities for participation. In: Hecker, S., Haklay, M., Bowser, A., Makuch, Z., & Vogel, J. (Eds.). (2018). Citizen science: innovation in open science, society and policy. UCL Press. DOI: <https://doi.org/10.14324/111.9781787352339>.*

*Luna, S., Gold, M., Albert, A., Ceccaroni, L., Claramunt, B., Danylo, O., ... & Radicchi, A. (2018). Developing mobile applications for environmental and biodiversity citizen science: considerations and recommendations. In Multimedia Tools and Applications for Environmental & Biodiversity Informatics (pp. 9-30). Springer, Cham. ISBN: 978-3-319-76444-3. DOI: 10.1007/978-3-319-76445-0.*

**Presentation:** [https://www.dropbox.com/s/3r0x4rfoh4swvaj/Ceccaroni%20Citizen%20science%20%20Mwanza%202019\\_07\\_25.pdf?dl=0](https://www.dropbox.com/s/3r0x4rfoh4swvaj/Ceccaroni%20Citizen%20science%20%20Mwanza%202019_07_25.pdf?dl=0)

**14:30-17:00** (incl. tea break)

### Linking data, linking people

The call for better integration and usability of research data is easily raised. However, making data more easily compatible and accessible in reality faces multiple challenges - in technical, legal and practical terms. Methods of data collection, data storage and policies of data access are typically dictated by the needs of the research effort, and subject to regulations. If databases are created, questions of ownership and data protection arise. Can technologies and standards can be helpful to facilitate better integration? Who can contribute to shared data sets? Who is allowed to use shared data and for what purposes? Who has the right to decide about access? Can data collected by communities play a meaningful role in formal monitoring processes?

The session invites an open discussion about scenarios for better accessibility and usability of catchment data, and aims to identify both opportunities and core challenges that need to be addressed to take such initiatives going forward.



## Day 3: Citizen Science Tools: Demonstration and Joint training with Community Resource Persons

The key innovation in the proposed Mara Watch Action Group is the use of a citizen science data stream as a channel of continued communication and knowledge exchange between local communities in remote areas and higher governance levels. Activities and effectiveness of local WUAs is often restricted by the lack of financial resources for activities and transport to attend face-to-face meetings, and the lack of resources and manpower in Water Boards to visit local WUAs on a regular basis.

A citizen science monitoring programme offers a low cost opportunity for communities to assess and communicate their situation to the Water Board through observation data, and receives feedback through the data portal, complemented with additional information by the Water Board. This will establish a clear role and responsibility for the WUAs, allows continuous engagement instead of disjointed activities when donor funds become available, and anchor them visibly in the institutional decision-making process. At the same time, sustained disaggregated water quality data collection will be a valuable resource for the ongoing catchment management and planning processes.

The demonstration and training back-to-back with the Knowledge Exchange workshop will kick off a series of capacity development activities exploring the practical application of citizen science in Mara communities. A group of around 25 community facilitators, field officers, WUA members, teachers and community volunteers from two catchments will join the workshop participants for this day. A core aim of the session is to equip participants with the skills needed to take part in a citizen-science project. Activities will involve both a presentation and practical exercises at the lake.



Friday, 26th July 2019

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9:00 – 10:00

Recap and Opening Remarks: Data collection in the age of the SDG

**Luigi Ceccaroni**, Earthwatch

What is a citizen scientist and Introduction to the FreshWater Watch Method

The session will introduce the new participants to citizen science, recall the research question for the Mara and demonstrate the **Earthwatch FreshWater Watch** Method and theory.

**Presentation:** [https://www.dropbox.com/s/pwkr8hrkmpcr4bq/Ceccaroni%20Training%20Day%20Presentation%202019\\_07\\_25%20short.pdf?dl=0](https://www.dropbox.com/s/pwkr8hrkmpcr4bq/Ceccaroni%20Training%20Day%20Presentation%202019_07_25%20short.pdf?dl=0)

*Tea Break*

Transfer to Lake Victoria in small groups: FreshWater Watch practical/field session for local monitoring led by Luigi Ceccaroni, Earthwatch

In parallel: Demonstration of The MiniSass Tool with Mark Graham, Ground Truth:

*Lunch Break*

Demonstration of FreshWater Watch platform and visualization of results

Discussion on next steps and questions

**Expected end of training: 14:00**

If you want to have a more direct experience and to collect your own measurements of water quality, download the FWW app from:

- <https://play.google.com/store/apps/details?id=com.wk.android.fww&hl=en>
- <https://apps.apple.com/gb/app/freshwater-watch/id882890751>

## Annex 2: Participant List

First Name	Last Name	Position	Affiliation	Country
Luigi	Ceccaroni	Senior Freshwater Research Manager	Earthwatch Institute	UK
Frank	Masese	Senior Lecturer	Egerton University	Kenya
Mark	Graham	Specialist Aquatic Scientist	GroundTruth	South Africa
Ellen	Pfeiffer	WWCC Project Coordinator	IHE Delft	Netherlands
Ken	Irvine	Professor of Aquatic Ecosystems	IHE Delft	Netherlands
Fransceso	Bregoli	Post Doc Researcher	IHE Delft	Netherlands
Alexander	Imbo	PhD fellow	IHE Delft	Netherlands
Batuli	Seif	Community Development Officer/Unit Head	Lake Victoria Basin Water Board	Tanzania
Emmanuel	Mgimwa	Manager	Birdlife International	Tanzania
Majura	Maingu	Coordinator	Victoria Farming and Fishing Organization	Tanzania
Hadija	Malimusi	NTSE Tanzania	Nile Basin Discourse	Tanzania
Ryan	Edwards	Senior scientist	Eco-Pulse Environmental Consulting	South Africa
Herbert	Kashililah	Chairperson	SHAHIDI wa MAJI / TAWASANET	Tanzania
Joseph	Masaka	LVBWB-Musoma Water Officer	LVBWB Musoma	Tanzania
Kevin	Gichangi	Programme Coordinator	WWF Kenya	Kenya
Nesco	Manyanza	Manager	Water Quality Laboratory Musoma	Tanzania
Kennedy	Wahome		Stockholm Environmental Institute	Kenya
Rochi	Michole	Chemist	Water Quality Laboratory Musoma	Tanzania
Benson	Bashange	Environmental Engineer	Lake Victoria Basin Water Board	Tanzania
Frank	Baregu	Chemist	Water Quality Laboratory Mwanza	Tanzania
Herman	Mashimba	Hydrology Technician-Project Coordinator	Lake Victoria Basin Water Board	Tanzania
Ogoma	Mangassa	Hydrologist/Head of Unit	Lake Victoria Basin Water Board	Tanzania
Ndobiri	Meigalu	Hydrologist	Lake Victoria Basin Water Board	Tanzania
Jaqline	Shumbushi	Hydrology Technician	Lake Victoria Basin Water Board	Tanzania
Henry	Chisute	Manager	Water Quality Laboratory Mwanza	Tanzania

## Annex 3: Workshop Evaluation and Suggestions

Please do not write your name on the form. Your feedback will help us improve future workshops in the Action Group project.

### The meeting

1. To what extent did this meeting/the meetings meet your expectations?

Completely	Mostly	Moderately	Slightly	Not at all	No opinion
<b>3</b>	<b>12</b>	<b>3</b>			

2. The meeting activities were clear and easy to do.

Strongly agree	Agree	Undecided	Disagree	Strongly Disagree	No opinion
<b>6</b>	<b>11</b>	<b>1</b>			

3. Participants were given the opportunity to bring their views and experiences to the table.

Strongly agree	Agree	Undecided	Disagree	Strongly Disagree	No opinion
<b>14</b>	<b>4</b>				

4. The outputs of the meeting are a good starting point for building further collaboration.

Strongly agree	Agree	Undecided	Disagree	Strongly Disagree	No opinion
<b>7</b>	<b>10</b>	<b>1</b>			

5. What did you find the most valuable part/aspect of the meeting?

- Getting insight from the people working on the ground in the Mara catchment, some of the comments, varied perspectives, emphasis and importance of CS
- Meeting new Mara partners
- Discussion regarding presentation – the questions opened up my understanding
- Citizen science and data collection
- Participation in the activities, active participation to discussions, interdisciplinary
- Discussing real issues affecting the basin and how scientists can ensure their work assists
- Citizen science, potential of citizens to monitor water resources and to be included/involved from the first step
- Baseline information is very important in making decision, SDGs very important for implementation in my project
- What get measured get managed
- Shared knowledge from different participants
- Meeting other resources (building networks) and getting insights into the researchers work
- The need for communication among research partners to learn what they work on
- The researchers' topic were very interesting eg. Citizen science
- Discussion
- Field equipment for sampling and data collection
- Issues around Mara wetland catchment
- Presentations, especially on 1<sup>st</sup> day about water and sedimentation. This is valuable for me because I have seen the increase in sedimentation in rivers – it is terrible

6. What did you find the least valuable part/aspect of the meeting?

- Not getting into detailed around strategic issues
- Some of long sessions and an presentations which went way over time

- Group discussion
- Outcome of the meeting a bit “sloppy”: I look at active involvement of the local authorities eg. Data sharing, monitoring improvement plans
- Citizen science
- Small number of participants
- Not very conclusive (how to foster collaboration in the future)
- Lack of discussion about potential funding
- Part of socialization with each other

### Logistics & facilitation

7. What is your opinion of the length of the meeting?

- Quite ok basing on the length of discussions
- Adequate x3
- Good x2
- Fine x2
- Ok but visit Musoma and Wetland would be more useful
- Too long days
- Short (still are things to be shared) x 3
- Should be 1 week
- 5-7 days and more topics x 2
- Moderate

8. Are there ways to make it easier for you to attend the next meeting?

- I am satisfied and look forward to the next meeting x2
- Yes x 7
- Financial logistics should be availed at the meeting rather than transfer to bank
- Sharing program before
- Early communication and information
- Adequate

9. What is your opinion of the meeting room and room set up?

Very appropriate	Appropriate	Undecided	Inappropriate	Highly inappropriate	No opinion
7	10				1

10. What did you think of the meeting facilitation?

- Very good x4
- Good x 5
- Quite ok x2
- Excellent x3
- Facilitation process wasn't clear during invitation. Bank transfers are fine but at least information should be available in advance
- Problems with Wi-Fi

**Relevance and Structure**

11. The structure of the meeting regarding timing and breaks was...

Very good	Good	Fair	Poor	Very Poor	No opinion
<b>4</b>	<b>14</b>				

12. What is your opinion regarding the relevance of the meeting as a whole?

Extremely relevant	Very much relevant	Moderately relevant	Slightly relevant	Not relevant at all	No opinion
<b>4</b>	<b>14</b>				

13. What suggestions do you have for improving future Action Group workshops?

- Consideration of more time to capture the necessary feedback and insights relevant to the meeting
- More practical sessions
- Should be scheduled on morning
- Sharing program before and visit to the wetland
- I think they work quite well
- More group work
- More participation is needed
- More time, clear logistic (especially founding)
- More topic regarding management of water resources
- Invite more stakeholders (researchers) from Kenya to promote cross- boundary collaboration network
- Early communication on the details of the meeting
- Early information to participants
- More field work
- More time is needed x2
- More communication with participants

Any other comments or suggestions (optional)

- Exploring ways of creating synergy, partnership and joint functioning in the future
- Meeting was fruitful, we need to continue it
- The workshop has to be conducted at least twice a year

**Thank you for sharing your opinion with us.**



## Forum Conveners

Florence Mahay, Basin Director, Lake Victoria Basin Water Board

Kenneth Irvine, Chair for Aquatic Ecosystems, IHE Delft

Luigi Ceccaroni, Senior Innovation Lead, Earthwatch Europe

Gordon Mumbo, Team Leader, Sustainable Water for the Mara

## Organization Team

Ellen Pfeiffer, IHE Delft

Sonia Bazan, IHE Delft

Zablon Isreal, VIFAFIO

## Acknowledgements

*The event was made possible by generous support from The Coca-Cola Foundation (Community Grant IG-2016-1764) and the European Union's Horizon 2020 Research and Innovation Programme (Grant No. 689744 and No. 689162), and IHE Delft, The Netherlands. We thank the staff of the Lake Victoria Basin Water Board offices Mwanza and Musoma, and the Victoria Farming and the Fishing Organisation (VIFAFIO), especially Majura Maingu, for their contributions.*

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