IWSC 2012

GEF INTERNATIONAL WATERS SCIENCE CONFERENCE

24–26 September, 2012

United Nations Conference Center

Bangkok, Thailand

Conference Report

Setting the International Waters Science Agenda for the next Decade

Conference Report of the

'GEF International Waters Science Conference 2012'

(IWSC 2012)

Setting the International Waters Science Agenda for the next Decade

24 – 26 September 2012

United Nations Conference Center (UNCC)

Bangkok, Thailand

Contributing participants

Zafar Adeel, Joana Akrofi, Joseph Alcamo, Mukand Babel, Peter Bjørnsen, Annadel Cabanban, Adrian Cashman, Thomas Chiramba, Andrew Dansie, Salif Diop, Robert Duce, Alfred Duda, Cheikh Bécaye Gaye, Tessa Goverse, Jakob Granit, David Grey, Jac van der Gun, Mish Hamid, Astrid Hillers, Hartwig Kremer, Meredith Miller, Marcus Lange, Richard Lawford, Corinne Le Quéré, Carl Lundin, Vladimir Mamaev, Laurence Mee, Andrea Merla, Stephen de Mora, Kelly Munkittrick, Emmanuel Naah, Masahisa Nakamura, Takehiro Nakamura, Chris O'Brien, Daniel Olago, Peter Sale, Kenneth Sherman, Douglas Taylor, Jerker Tamelander, Ofelia Tujchneider, Walter Rast, Chirs Severin, Qisheng Tang, Paul Taylor, Ibrahim Thiaw, Holger Treidel, Isabelle Vanderbeck, Charles Vörösmarty, Patrick Weiler, Peter Whalley, Meryl Williams, Ivan Zavadsky

Compiled by

Marcus Lange

Organized and supported by

GEF	*Global Environmental Facility*	*www.thegef.org*
IW:LEARN	*International Waters Learning Exchange & Resource Network*	*www.iwlearn.net*
UNEP	*United Nations Environment Programme*	*www.unep.org*
UNDP	*United Nations Development Programme*	*www.undp.org/*
Sida	*Swedish International Development Cooperation Agency*	*www.sida.se*
LOICZ	*Land-Ocean Interactions in the Coastal Zone*	*www.loicz.org*
UNU-INWEH	*United Nations University – Institute for Water, Environment and Health*	*www.inweh.unu.edu*
ESCAP	*United Nations Economic and Social Commission for Asia and the Pacific*	*www.unescap.org*
MOST	*Ministry of Science and Technology of Thailand*	*www.most.go.th*

"IWSC 2012 AT A GLANCE"

GEF INTERNATIONAL WATERS SCIENCE CONFERENCE
24-26 September 2012, Bangkok, Thailand

Monday 24 September 2012 - DAY 1

08:45 - 10:00 Session 1: Opening Plenary

- Welcome addresses
- Conference expectations
- Key findings of the IW:Science Project
- Keynote Address "Setting the Science-based Agenda for International Waters for the next Decade"

10:00 - 10:30 NETWORKING BREAK

10:30 - 11:30 Session 2: Aquifers Plenary

- Keynote Speaker
- External Discussant
- Panel Discussion on Aquifers

11:30 - 12:30 Session 3: Lakes Plenary

- Keynote Speaker
- Discussant
- Panel Discussion on Lakes

12:30 - 13:00 **Special Event: Launch of the IW: Science Synthesis Report**

13:00 - 14:00 LUNCH BREAK - Poster Sessions

14:00 - 15:30 Session 4: Rivers Plenary

- Keynote Speaker
- Discussant
- Panel Discussion on Rivers

15:30 - 16:00 NETWORKING BREAK

16:00 - 16:30 Session 5: Open Oceans (OO) Plenary

- Keynote Presentation
- Discussant

16:30 - 17:30 Session 6: Large Marine Ecosystems (LME) Plenary

- Keynote Speaker
- Discussant
- Panel Discussion on LME and OO

17:30 - 18:00 Session 7: Wrap-up Day 1

- Wrap-up Session Day 1

Tuesday 25 September 2012 - DAY 2

09:00 - 09:30 Session 8: Planning for Day 2

- Introduction to the Parallel Working Groups and Scientific Networks

09:30 -11:00 Session 9: Parallel Working Groups

Aquifer Working Group	Lakes Working Group	Rivers Working Group	LME and OO Working Group

11:00 - 11:30 NETWORKING BREAK

11:30 - 12:30 Session 9 *(continued)*: **Parallel Working Groups**

Aquifer Working Group	Lakes Working Group	Rivers Working Group	LME and OO Working Group

12:30 - 14:00 LUNCH BREAK - Poster Sessions

14:00 - 15:00 Session 9 *(continued)*: **Parallel Working Groups**

Aquifer Working Group	Lakes Working Group	Rivers Working Group	LME and OO Working Group

15:00 - 15:30 NETWORKING BREAK

15:30 - 17:00 Session 10: The Science Policy Interface

- Keynote Presentation
- Discussant
- Panel Discussion on Science Policy Interface

17:00 - 18:30 Session 11: Parallel Working Groups on the Science Policy Interface

The role of International Waters-related Science in Support of Regional Cooperation	Analysis (TDAs), Progress Monitoring (SAPs) and Indicators	Effective Knowledge Mobilization	Linking Science to Policy: Strengthening the uptake of scientific findings into policy and practice

Wednesday 26 September 2012 - DAY 3

09:00 - 09:30 Session 12: Wrap-up Day 2 and Planning Day 3

09:30 - 11:00 Session 11 *(continued)*: **Parallel Working Groups on the Science Policy Interface**

The role of International Waters-related Science in Support of Regional Cooperation	Analysis (TDAs), Progress Monitoring (SAPs) and Indicators	Effective Knowledge Mobiization	Linking Science to Policy: Strengthening the uptake of scientific findings into policy

11:00 - 11:30 NETWORKING BREAK

11:30 - 12:30 Session 13: Key Recommendations by Water Body Types

- Recommendations from Water Body Working Groups
  1. Aquifer Working Group
  2. Lakes Working Group
  3. Rivers Working Group
  4. LME and OO Working Group

12:30 - 14:00 LUNCH BREAK - Poster Sessions

14:00 - 15:30 Session 14: Key Recommendations on the Science Policy Interface

- Recommendations from Science Policy Interface Working Groups
  1. The role of IW-related science in support of regional cooperation
  2. Analysis (TDAs), Progress Monitoring (SAPs) and Indicators
  3. Effective Knowledge Mobilization
  4. Linking Science to Policy: Strenthening the uptake of scientfic findings into policy and practice.

15:30 - 16:00 NETWORKING BREAK

16:00 - 17:30 Session 15: The Way Forward and Closing Plenary

- Panel Discussion on Way Forward
- Synthesis Video
- Conference Statement
- Best 'GEF International Water Science Poster' Award
- Closing remarks

Plenary
Working Groups
Special Event

Table of Contents

Acknowledgements vii

Executive Summary viii

Conference Statement ix

Scientific Advisory Committee (SAC) x

Operational Team (OT) xi

Local Organizer (co-host) xii

1 Introduction 1

2 Session Overviews and Responsibilities 3
2.1 Plenary Sessions on Water Body Types 4
2.1.1 Aquifers 4
2.1.2 Lakes 4
2.1.3 Rivers 4
2.1.4 Open Oceans 5
2.1.5 Large Marine Ecosystems (LME) 5
2.2 Plenary Session on the Science Policy Interface 6
2.3 Working Groups on Water Body Types 6
2.4 Working Groups on the Science Policy Interface 7
2.5 Concluding Sessions on Key Recommendations 7
2.6 Closing Session 'The Way Forward' 8

3 Objectives and Expected Outputs 9
3.1 Plenary Sessions on Water Body Types 9
3.2 Plenary Session on the Science Policy Interface 9
3.3 Working Groups on Water Body Types 10
3.4 Working Groups on the Science Policy Interface 10

4 Summaries and Conclusions from Sessions and Working Groups 13
4.1 Plenary Sessions on Water Body Types 13
4.1.1 Aquifers 13
4.1.2 Lakes 15
4.1.3 Rivers 16
4.1.4 Open Oceans 17
4.1.5 Large Marine Ecosystems (LME) 19
4.1.6 Preliminary Conclusions from the Plenary Sessions on Water Body Types 21
4.2 Plenary Session on the Science Policy Interface 22
4.3 Working Groups on Water Body Types and the GEF IW Scientific Network 24
4.3.1 Aquifers 25

4.3.2 Lakes 27
4.3.3 Rivers 30
4.3.4 Large Marine Ecosystems and Open Oceans 32
4.4 Working Groups on the Science Policy Interface 35
4.4.1 The role of IW-related science in support of regional cooperation 35
4.4.2 Analysis (TDAs), Progress Monitoring (SAPs) and Indicators 37
4.4.3 Effective Knowledge Mobilization 38
4.4.4 Linking Science to Policy: Strengthening the uptake of scientific findings into policy and practice 39

5 Key Recommendations from the Working Groups and the Closing Session 'The Way Forward' 42
5.1 Working Groups on Water Body Types 42
5.1.1 Aquifers 42
5.1.2 Lakes 43
5.1.3 Rivers 43
5.1.4 Large Marine Ecosystems and Open Oceans 44
5.2 Working Groups on the Science Policy Interface 45
5.2.1 The role of IW-related science in support of regional cooperation 45
5.2.2 Analysis (TDAs), Progress Monitoring (SAPs) and Indicators 45
5.2.3 Effective Knowledge Mobilization 46
5.2.4 Linking Science to Policy: Strengthening the uptake of scientific findings into policy and practice 46
5.3 Closing Session 'The Way Forward' 47

6 Conclusions 50

7 List of Participants 51

Appendix 58

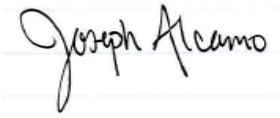
Acknowledgements

Over the years many of our institutions have been working towards developing comprehensive frameworks for studying various water systems with the main objective of proposing best and sustainable resource management options. In this context, UNEP was requested by GEF to organize with key partners this first of a kind GEF International Waters Science Conference (GEF IWSC2012) As Chair of the conference and on behalf of UNEP, I would like to thank the Government of Thailand and the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) for offering to co-host the first GEF IWSC2012. We also appreciate the collaboration and kind support of partners notably the GEF, UNDP and Swedish International Development Agency (SIDA) in the organization of this conference. Additionally I would like to thank the members of the Scientific Advisory Committee for the exceptional commitment of their time and skill to support this important event. Thanks are also due to the international Organizing Team and the local Organizers in Bangkok for their support towards the successful organization of this conference. Last but not least I would like to thank all participants for their contributions and for sharing their views with the wider IW science audience.

The IW Science Conference provided an excellent opportunity for the science community and policymakers to share ideas and exchange knowledge. The conference also identified key priorities and,best approaches to governance and socio-economic issues, and addressed emerging issues.

I am hopeful that the scientific networks established during the conference will promote a fruitful interaction between experts from the GEF IW portfolio and the wider global water community.

Yours Sincerely



Prof. Joseph Alcamo

UNEP Chief Scientist

Executive Summary

The United Nations Environment Programme (UNEP) as part of the UNDP/UNEP Global Environment Facility (GEF) IW:LEARN program and numerous partners as e.g. the Swedish International Development Cooperation Agency (Sida), the global Earth system research project Land-Ocean Interactions in the Coastal Zone (LOICZ), the United Nations University - Institute for Water, Environment and Health (UNU-INWEH) held the first Global Environment 'GEF International Waters Science Conference 2012' (GEF IWSC 2012) in Bangkok, Thailand. The conference was co-hosted by the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) and the Ministry of Science and Technology of Thailand.

The three days conference provided a science-policy interface to strengthen the role of science in the management of water systems at the global, regional and local level. The focus was on emerging issues and critical challenges, and highlighting the scientific findings of GEF International Waters (IW) projects. It included a special series of plenary sessions on the specific water body types, a science to policy plenary session, parallel thematic and science to policy working groups, a concluding session, and a poster exhibition. The conference attracted around 200 participants from more than 45 countries.

The conference program was integrative in nature, linking different scientific disciplines with different levels of decision making and thereby improving the science to policy interface. This offered the opportunity to look at different water body types (aquifers, large marine ecosystems including coastal zones and the open oceans, rivers and lakes) as well as science to policy themes (the role of IW science in support of regional cooperation, analysis, progress monitoring and indicator development, effective knowledge mobilization and the science policy interface in general).

The GEF TDA/SAP process was identified to be an appropriate tool for enabling informed science-based transboundary water body management and linking science to policy. The GEF IW focal area is currently shaping in the way to provide projects with more scientific guidance and advice on emerging issues. Within the discussion the Scientific Evidence Panels (including cooperation with the wider scientific community) were often recommended to be considered where beneficial to the implementation of project interventions.

The full IW project cycle was recommended to be based on sound scientific evidence and use of state of the art knowledge products and ensure that documentation (including data), access, dissemination and archiving of scientific results facilitate future ex-ante impact monitoring and assessment. This will assist reporting to the GEF Council and other GEF stakeholders on environmental and governance/management transformations achieved through the GEF interventions. The GEF IW:LEARN is the platform to capture and process such information.

The recommendations from IWSC 2012 will strengthen the development and implementation of the GEF-6 IW Strategy. GEF agencies should act on Conference recommendations and continue strengthening interaction between GEF IW projects and the scientific community.

The dialogue between scientists, policy makers and project managers initiated in the GEF IWSC 2012 will continue through the GEF IW Conferences as the main fora for GEF IW project stakeholders.

Conference Statement

Global Environment Facility (GEF)
International Waters Science Conference
Bangkok, 24-26 September 2012

CONFERENCE STATEMENT

We, the participants of the GEF International Waters Science Conference, representing a wide variety of scientific institutions, managers and practitioners in transboundary waters and projects, as well as policy makers, met to discuss science-based priorities and challenges for the management of international waters in the next decade. We recognize that the management of transboundary waters is a major global challenge to the long term sustainability of ecosystems of global significance.

We, the participants of the GEF International Waters Science Conference further acknowledge the role of the GEF Science and Technical Advisory Panel (STAP) as well as the contribution to this event of the GEF IW:Science project.

The participants concluded:

1. That the GEF Transboundary Diagnostic Analysis (TDA)/Strategic Action Programme (SAP) process is an appropriate tool for ensuring robust science-based transboundary water body assessment and management, offering a sound methodology for linking science to policy. The GEF IW focal area is currently updating the TDA/SAP methodology in order to provide projects with more scientific guidance and advice on emerging issues, socioeconomic issues and horizon scanning, outcomes of this conference will greatly contribute to this process.

2. That the establishment of project Scientific Evidence Panels (including cooperation and communication with the wider scientific community) and project Science Policy Fora should be considered where beneficial to the implementation of project interventions. IW:LEARN should study best practices on the establishment of such panels.

3. That the full IW project cycle should be based on sound scientific evidence (beginning with the best available baseline) and ensure that documentation (including data), access, dissemination and archiving of scientific results facilitate future ex-ante impact monitoring and assessment.

    - That this will assist reporting to the GEF Council and other GEF stakeholders on transformations achieved through the GEF interventions.

    - That the GEF IW:LEARN is the platform to capture and process such information.

4. That GEF agencies, within their comparative advantage, should act on Conference recommendations and continue strengthening interaction between GEF IW projects and the scientific community.

5. That GEF IW projects should use the best available scientific information to develop a set of indicators (including processes, stressors and environmental and socio-economic status) and improve the capacity of the relevant National and Regional Institutions to monitor long-term project impacts.

6. That the recommendations from this conference will strengthen the development and implementation of the GEF-6 IW Strategy.

7. That the dialogue between scientists, policy makers and project managers will continue through the GEF IW Conferences as the main fora for GEF IW project stakeholders.

Furthermore we, the Conference participants acknowledge the quality of the dialog at this IW Science Conference and are committed to continue this process through IW:LEARN and other networks. We, the Conference participants also thank with great appreciation the Government of Thailand and ESCAP for hosting the IWSC2012, GEF, SIDA, & UNEP for their financial support. As well as partners like UNU-INWEH for their in-kind support that enabled the science-policy dialog on these important issues and UNEP and other GEF agencies for intellectual leadership and potential follow-up.

Scientific Advisory Committee (SAC)

Prof. Joseph Alcamo (chair of the SAC)	United Nations Environment Programme, UNEP Chief Scientist, Kenya
Dr. Zafar Adeel	United Nations University, Institute for Water, Environment and Health (UNU-INWEH), Canada
Prof. John Agard	Department of Life Sciences, University of West Indies, Trinidad
Dr. Annadel Cabanban	CTI Sulu-Celebes Sea Sustainable Fisheries, Management LME Project, The Philippines
Dr. Adrian Cashman	The University of the West Indies, Centre for Resource Management and Environmental Studies, Barbados
Prof. Robert A. Duce	Dept. of Oceanography and Atmospheric Sciences at Texas A&M University, USA
Dr. Alfred Duda	Former Senior Advisor to GEF, USA
Prof. Chris Gordon	Institute of Environment and Sanitation Studies (IESS), University of Ghana, Ghana
Prof. Dr. Joyeeta Gupta	Institute for Environmental Studies (IVM), VU University Amsterdam, The Netherlands
Dr. Thomas Hammond	STAP Secretary, USA
Ms. Eiman Karar	Water Research Commission, South Africa
Dr. Hartwig Kremer	Land-Ocean Interactions in the Coastal Zone project (LOICZ), International Project Office, located at the Helmholtz-Zentrum Geesthacht, Centre for Materials and Coastal Research
Dr. Vladimir Mamaev	GEF Regional Technical Advisor, UNDP Europe and the CIS, Bratislava, Slovak Republic
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Prof. Stephen de Mora	Plymouth Marine Laboratory, UK
Prof. Claudia Pahl-Wostl	Resources Management University of Osnabrueck, Germany
Dr. Walter Rast	International Center for Watershed Studies and Aquatic Resources Program, Texas State University, USA

Dr. Kenneth Sherman	National Oceanic and Atmospheric Administration National Marine Fisheries Centre, USA
Prof. Dr. Ofelia Tujchneider	Universidad Nacional de Litoral and CONICET, Argentina
Ms. Isabelle Vanderbeck	UNEP (UNEP/GEF IW portfolio coordinator), UNEP-OAS Liaison Officer, USA
Dr. Peter Whalley	Project manager/CTA, UNDP/GEF Tisza River, UK
Dr. Frank van Weert	IGRAC - International Groundwater Centre, The Netherlands

Operational Team (OT)

Dr. Salif Diop (chair of the OT)	United Nations Environment Programme (UNEP), Senior Programme Officer, Head Thematic Section, Kenya
Ms. Joana Akrofi	United Nations Environment Programme (UNEP), Kenya
Dr. Thomas Chiramba	United Nations Environment Programme (UNEP), Kenya
Mr. Andrew Dansie	United Nations University, Institute for Water, Environment and Health (UNU-INWEH), Canada, UK
Dr. Tessa Goverse	United Nations Environment Programme (UNEP), Kenya
Mr. Mish Hamid	IW:LEARN Project, Slovak Republic
Ms. Astrid Hillers	GEF Secretariat, USA
Mr. Marcus Lange	Conference Coordinator, External Consultant to UNEP, LOICZ, Germany
Mr. Chris Severin	GEF Secretariat, USA
Ms. Kaisa Uusimaa	United Nations Environment Programme (UNEP), Kenya
Ms. Isabelle Vanderbeck	United Nations Environment Programme (UNEP/GEF IW portfolio coordinator), USA
Mr. Patrick Weiler	IW:LEARN Project, Canada

Local Organizer (co-host)

Dr. Ellik Adler	UNEP COBSEA
Ms. Yoon Young Back	UNEP COBSEA
Ms. Khristine Custodio	GEF/UNEP IW:LEARN
Mr. Tobias Fast	UNEP Coral Reef Unit
Dr. Ampai Harakunarak	UNEP GEF International Waters
Ms. Krittika Kleesuwan	UNEP COBSEA
Mr. Reynaldo Molina	UNEP COBSEA
Ms. Bechaporn Nimsuwan	UNEP GEF Coordination
Mr. Jerker Tamelander	UNEP Coral Reef Unit
Ms. Thiraya Tangkawattana	UNESCAP Environment and Development Division
Dr. Salmah Zakaria	UNESCAP Environment and Development Division

1 Introduction

Aim

The overall aim of the GEF IWSC 2012 was to bring together practitioners and academics to provide a science policy interface to discuss the status and management of water systems at the global, regional and local level, focusing on critical issues. Here the network could look back on twenty years of GEF International Waters (IW) projects that have resulted in a wealth of knowledge. Much of the science used and generated during the projects is embedded in Transboundary Diagnostic Analyses (TDAs). The recent three year study under the GEF UNEP-UNU IW:Science project has uncovered some of the key findings and success factors in enhancing the use of science in GEF IW projects. Hence the GEF IWSC 2012 was setup to provide a key forum for exposing findings to a wider audience and bringing external scientists views from outside the GEF portfolio to reflect on and review these findings. Benefiting from lessons learned can significantly support new and ongoing projects in achieving better results.

Scope

Sessions and Working Groups were arranged around the overarching topics and interconnected **water body types** which are namely:

- Aquifers,
- Lakes,
- Rivers,
- Large Marine Ecosystems (LMEs), including coastal zones and open oceans.

The conference scope also responded to the ongoing discussions in the GEF IW focal area by dedicating a special session to the **Science Policy Interface** and four working groups on the following related issues:

- The role of IW-related science in support of regional cooperation;
- Analysis (TDAs), Progress Monitoring (SAPs) and Indicators;
- Effective Knowledge Mobilization;
- The Science Policy Continuum.

Launch of the GEF IW:Science Project Synthesis Report

The three years study under the GEF UNEP-UNU IW:Science project highlighted key findings and success factors in enhancing the use of science in GEF IW projects. As part of the final wrap up of the IW:Science Project a synthesis report was published and finally launched at the GEF IWSC 2012, see:
http://www.inweh.unu.edu/River/IWScience%20Reports/SynthesisReport_Web.pdf

The final synthesis brings together the findings of the Synopsis and Analysis reports and efforts of the IW System Type Working Groups (Aquifers, Lakes, Rivers, Land-based Pollution Sources and, Large Marine Ecosystems and the Open Ocean). The context is the need for and effective use of science to address the key current and emerging challenges of transboundary water management in light of global, regional and local drivers and pressures. This encompasses to translate the relevant scientific information including process understanding of environmental systems as well as human-environment intervention and scenarios into actionable knowledge (i.e. scientific evidence and strategy for response to inform the multi-country management of shared water resources).

√ **To get a visual impression of the conference please see the 'GEF International Waters Science Conference' video**

- **http://www.youtube.com/watch?v=y3BeiVtBO1Y**
- **http://iwlearn.net/abt_iwlearn/events/iw-science-conference/videos/synthesis-video**

√ **Link to the video 'Welcome address by GEF CEO Dr. Naoko Ishii at the 'GEF IW Science Conference' (on the internal web space of the IW Learn community platform, please use your username and password)**

- **http://www.youtube.com/watch?v=_LFKTNCquwU**
- **https://community.iwlearn.net/communities/international-waters-science-conference-2012/videos/welcome-address-by-gef-ceo-dr.-naoko-ishii-at-the-iw-science-conference-2012/**

2 Session Overviews and Responsibilities

In light of the aim and scope of the 'GEF International Waters Science Conference 2012' was held in plenary and working groups. Following the topics mentioned in chapter 1 Day 1 was arranged in plenary inviting scientists and representatives from inside and outside the GEF portfolio. Each session was supported by a **chair** introducing into the topic and a **rapporteur** documenting and bringing together the outcomes of the presentations and discussions.

Keynote speakers were requested to represent an overall perspective of the respective water body type, so mainly from inside the GEF project portfolio. An **external discussants** was invited to reflect on the keynote presentation, and to provide provoking and innovative thoughts from an outside the GEF portfolio perspective. The two presentations were followed by short panelist statements and a discussion. **Panelists** were expected to interact with each other concerning the topic introduced in the keynote and responded to by the discussant.

Keynote speakers and panelists were expected to build on the key findings of GEF UNEP-UNU IW:Science project (mentioned above) that assessed the use of science in the GEF IW portfolio within the five water systems, including ways of enhancing the use of science, responding to emerging issues and identifying innovative solutions. More information and project results can be accessed via http://www.inweh.unu.edu/River/IWScience.htm.

All presentations were expected to focus on presentations and discussions within the topics and the related interconnected water body types. Overarching issues related to status functioning and governance systems, considering cross-cutting and socio-economic issues over time and space, as well as the critical role of water in sustaining life and well-being on Earth should have been taken into consideration as well.

√ **All presentations of the plenary sessions have been uploaded on the internal web space of the IW Learn community platform (please use your username and password); title 'GEF International Waters Science Conference 2012', https://community.iwlearn.net/communities/international-waters-science-conference-2012/view.html**

√ **All abstracts submitted to the conference have been summarized in an abstract compendium. This document can be downloaded via the conference website, http://iwlearn.net/abt_iwlearn/events/iw-science-conference/**

√ **Key to the generation of findings from plenary sessions and the formulation of key messages and recommendations feeding into the different working groups was the preparatory work of keynote speakers and discussants. Keynote presentations were planned to provide the focal content of the plenary sessions. Therefore speakers were asked to hand in a comprehensive abstract of the overarching elements they were planning to introduce in their presentations. Afterwards these abstract were shared with the session panelists and the discussants. Discussants were asked to reflect on the contents and thereby leading into the following panel discussion. Both abstracts from keynote speakers as well as from discussants are listed in the Appendix.**

2.1 Plenary Sessions on Water Body Types

2.1.1 Aquifers

Moderator:
Ofelia Tujchneider, Professor, Universidad Nacional del Litoral and CONICET, Argentina
Keynote Presentation:
Jac van der Gun, Senior Consultant, UNESCO-International Hydrological Programme (IHP), The Netherlands
External Discussant: Cheikh Bécaye Gaye, Professor, Department of Hydrogeology, University of Dakar, Senegal
Panel Discussion:
1. Djamel Latrech, Northwest Sahara Aquifer Project, Algeria
2. Eberhart Braune, Western Cape University, South Africa
3. Callist Tindimugaya, Ministry of Water, Uganda
4. Julio Kettelhut, Brazil Ministry of Environment, Brazil
Rapporteur: Emmanuel Naah, former UNESCO Regional Hydrogeologist for Africa, Cameroon, and Patrick Weiler, IW:LEARN Project

2.1.2 Lakes

Moderator:
Masahisa Nakamura, Research Center for Sustainability and Environment, Shiga University, Japan
Keynote Presentation:
Kelly Munkittrick, Scientific Director, Canadian Water Network, Canadian Rivers Institute, University of New Brunswick, Canada
External Discussant:
Walter Rast, Director, International Center for Watershed Studies, Texas State University, USA
Panel Discussion:
1. Raymond Mngodo, Lake Victoria Environmental Management Project, Tanzania
2. Sergey Kudelya, Lake Baikal Project, Russia
3. Adelina Santos-Borja, Resource Management and Development Department, Laguna Lake Development Authority, Philippines
4. Alejandro Juárez Aguilar, Corazón de la Tierra, Mexico
Rapporteurs: Isabelle Vanderbeck (UNEP) and Meredith Miller (Resource & Conservation Coordinator, Meadows Center for Water & the Environment

2.1.3 Rivers

Moderator:
Paul Taylor, former Director of UNDP CAP-Net Programme, UK
Keynote Presentation:

Mukand Babel, Coordinator of Water Engineering and Management, Asian Institute of Technology, Thailand
Discussant: Charles Vörösmarty, Director, Environmental Cross-Roads Initiative, Department of Civil Engineering, City University of New York, USA
Panel Discussion:
1. Norbert Fenzl, Amazon River Project, Brazil
2. Cletus Springer, Organization of American States, Saint Lucia
3. Christoph Mor, Orange-Senqu River Project, South Africa
4. Peter Bjørnsen, UNEP-DHI Centre, Denmark
Rapporteur: Richard Lawford, Global Water System Project, Canada, and Andrew Dansie, UNU-INWEH

2.1.4 Open Oceans

Moderator:
Robert Duce, Professor Emeritus, Department of Oceanography Texas, A&M University, USA
Keynote Presentation:
Chris O'Brien, Regional Coordinator, Bay of Bengal LME Project, FAO
Discussant:
Corinne Le Quéré, Director, Tyndall Centre for Climate Change Research, University of East Anglia, UK
Rapporteur: Carl Lundin, IUCN Marine Programme, Switzerland, and Takehiro Nakamura, UNEP

2.1.5 Large Marine Ecosystems (LME)

Moderator:
Kenneth Sherman, Director, Large Marine Ecosystem Program, National Oceanic and Atmospheric Administration, USA
Keynote Presentation:
Annadel Cabanban, Senior Fisheries Expert, Sulu-Celebes Sea Sustainable Fisheries Management Project, Philippines
Discussant:
Qisheng Tang, Professor, Chinese Academy of Engineering, China
Panel Discussion on LME and Open Oceans:
1. Porfirio Alvarez Torres, Gulf of Mexico LME Project, Mexico
2. Chris Corbin, Caribbean Regional Seas Programme, Jamaica
3. Hashali Hamuakuaya, Benguela Current LME Project, Benguela Current Commission, Namibia
4. Birane Sambe, Canary Current LME Project, Senegal
5. Ramesh Ramachandran, Land-Ocean Interactions in the Coastal Zone (LOICZ), Institute for Ocean Management, Anna University Chennai, India
6. Patrick Debels, Caribbean Sea LME, Colombia
Rapporteur: Laurence Mee, Scottish Association for Marine Sciences, UK, and Marcus Lange, LOICZ

2.2 Plenary Session on the Science Policy Interface

Moderator:
Adrian Cashman, Centre for Resource Management and Environmental Studies, University of the West Indies, Barbados
Keynote Presentation:
Alfred Duda, former Senior Advisor, GEF, USA
Discussant: Jakob Granit, International Waters Panel Member, GEF Scientific and Technical Advisory
Panel Discussion:
(STAP) and Centre Director Stockholm Environment Institute, Sweden
Panel Discussion:
1. David Grey, former Senior Water Advisor, World Bank and Oxford University Centre for the Environment, UK
2. H.E. Rejoyce Mabudafhasi, Deputy Minister, Ministry of Water and Environmental Affairs, Pretoria, South Africa
3. Nico Willemse (Benguela Current Commission (BCC)/UNOPS)
4. Jeff McNelly
5. John Pernetta, former South China Seas Project, Thailand
Rapporteur: Meryl Williams, former International Waters Panel Member, GEF STAP, Australia, and Tessa Goverse, UNEP

2.3 Working Groups on Water Body Types

Aquifers
Chair: Andrea Merla, Independent Consultant, Italy
Rapporteur: Holger Treidel, UNESCO-IHP, France

Lakes
Chairs: Masahisa Nakamura, Research Center for Sustainability and Environment, Shiga University, Japan (Day one); Kelly Munkittrick, Canadian Water Network, University of New Brunswick, Canada
Rapporteurs: Meredith Miller, International Center for Watershed Studies, Texas State University, USA and Isabelle Vanderbeck, UNEP (Day 1). Daniel Olago, Department of Geology, University of Nairobi, Kenya (Day 2)

Rivers
Chair: Paul Taylor, former Director of UNDP CAP-Net Programme, UK
Rapporteur: Peter Bjørnsen, UNEP-DHI, Centre on Water and Environment, Denmark

Large Marine Ecosystem and Open Oceans
Chairs: Annadel Cabanban, Senior Fisheries Expert, Sulu-Celebes Sea Sustainable Fisheries Management Project, Philippines, and Hartwig Kremer, Chief Executive Officer, LOICZ, Germany
Rapporteur: Jerker Tamelander, UNEP, Thailand

2.4 Working Groups on the Science Policy Interface

The role of IW-related science in support of regional cooperation
Chair: Jakob Granit, International Waters Panel Member, GEF STAP and Centre Director Stockholm Environment Institute, Sweden
Rapporteur: Douglas Taylor, GEF STAP Consultant, UK

Analysis (TDAs), Progress Monitoring (SAPs) and Indicators
Chair: Peter Whalley, former Project Manager, Tisza River Basin Project, UK
Rapporteur: Chris Severin, GEF

Effective Knowledge Mobilization
Chair: Peter Sale and Andrew Dansie, UNU-INWEH
Rapporteur: Mish Hamid, IW:LEARN Project, Slovakia

Linking Science to Policy: Strengthening the uptake of scientific findings into policy and practice
Chair: David Grey, former Senior Water Advisor, World Bank and Oxford University Centre for the Environment, UK
Rapporteur: Joana Akrofi, UNEP and Astrid Hillers, GEF

2.5 Concluding Sessions on Key Recommendations

Recommendations from the Working Groups on Water Body Types
Moderator: Salif Diop, Head of Ecosystems Section, Scientific Assessment Branch, UNEP
1. Chair/Rapporteur, Aquifers Working Group
2. Chair/Rapporteur, Lakes Working Group
3. Chair/Rapporteur, Rivers Working Group
4. Chair/Rapporteur, LME/Open Oceans Working Group
Rapporteur: Chris Severin, GEF Secretariat, and Jacqueline Alder, UNEP

Recommendations from the Working Group on the Science Policy Interface
Moderator: Ivan Zavadsky, GEF Secretariat
Recommendations from the Science Policy Interface Working Groups:
1. Chair/Rapporteur, The role of IW-related science in support of regional cooperation
2. Chair/Rapporteur, Analysis (TDAs), Progress Monitoring (SAPs) and Indicators
3. Chair/Rapporteur, Effective Knowledge Mobilization
4. Chair/Rapporteur, Linking Science to Policy: Strengthening the uptake of scientific findings into policy and practice
Rapporteur: Thomas Chiramba, UNEP, and Patrick Weiler, IW:LEARN Project

2.6 Closing Session 'The Way Forward'

Moderator: Joseph Alcamo, Chief Scientist, UNEP
Panel Discussion on Way Forward:
1. RaeKwon Chung, ESCAP
2. Jakob Granit, GEF STAP
3. Thomas Chiramba, UNEP
4. Ivan Zavadsky, GEF
5. Mish Hamid, IW:LEARN Project
Panel Rapporteur: Stephen de Mora, Plymouth Marine Laboratory, UK

Synthesis Video
Conference Statement: Joseph Alcamo, Chief Scientist, UNEP
Best 'GEF International Water Science Poster' Award
Closing remarks: Representative, Thai Government, Vladimir Mamaev, UNDP and Ibrahim Thiaw, UNEP

3 Objectives and Expected Outputs

The overall objectives and expected outputs of the conference were to present and discuss science-based persistent and emerging issues for international waters for the next decade and to provide a science-policy setting for discussing how science can best help society to sustainably manage water systems at the global, regional and local level. Focus was on highlighting and disseminating the findings of the GEF UNEP-UNU IW:Science project, including good practices on the use and application of science by GEF IW projects in the last two decades.

In the following sections objectives and expected outputs sets both plenary sessions on water body types (5) and the science policy interface (1) and both working groups on water body types (4) and the science policy interface (4) are presented in bullet points. For the plenary sessions and the working groups on water body types these are generally formulated, for all sessions and for the science policy interface they are formulated individually.

3.1 Plenary Sessions on Water Body Types

Objectives

- To identify persistent and emerging issues for international waters from the GEF project perspective.
- To identify persistent and emerging issues for international waters from the perspective of the science community outside of the GEF community.
- To discuss best practices of using science in international waters projects, within and outside of the GEF project portfolio.

Expected Output

- A wide range of suggestions on programmatic priorities and effective use of science in international waters management over the next decade. These suggestions will be discussed and further refined in the Working Groups.

3.2 Plenary Session on the Science Policy Interface

Objectives

- To determine the kind of scientific knowledge most useful to inform decisions at the transboundary and other levels of governance.
- To review processes for using science to inform policy decision-making and for involving the science community.

Outputs:

- Stock-taking of effective, and less effective, uses of scientific information and science processes in transboundary waters management and process for involvement of the science community.

- Identification of the factors that determine success or failure in use of scientific information. How much information is too much? How can one best explain the benefits/costs of action/inaction? This discussion will be continued in the Working Groups.

3.3 Working Groups on Water Body Types

Objectives

- To identify persistent and emerging issues facing respective transboundary water body types.
- To discuss the science required to address these issues.
- To discuss how the status and sustainable management of transboundary waters can be improved through the use of science and the consideration of cross-cutting issues.

Outputs

- A list of science-based priority issues for guiding research and management of transboundary waters.
- Concrete recommendations for the GEF portfolio on the use of science to address transboundary waters issues over the next ten years.

3.4 Working Groups on the Science Policy Interface

The role of IW-related science in support of regional cooperation

Objectives

- To consider whether there are generalizable and regionally transferable lessons from GEF supported work by international waters water body supporting benefit generation and cooperation at the regional level.

Outputs

- Recommendations on strategies for international waters science to address gaps in support of regional cooperation meeting IW objectives.
- Recommendations on capacity building likely to enhance the cross-disciplinary technical and political capacity of scientific advice in fulfilling the needs of regional intergovernmental commissions.

Analysis (TDAs), Progress Monitoring (SAPs) and Indicators

Objectives

- To ensure that the best and most effective information on project activities, performance, assessments and results are fed-back to the country policy and decision makers, donors, GEF etc. to convey a realistic representation of the issues, pressures and status of the water body and/or ecosystem.

Outputs

- The identification of improved means to enhance the TDA/analysis, SAP objectives and measures, and the communication of complex issues from the ecosystem to decision makers and other stakeholders enabling the ability to track improvements in status at a water body as well as at global levels.

Effective Knowledge Mobilization

Objectives

- To explain and discuss the knowledge mobilization (KM) approach from the GEF IW:Science project.
- To discuss the effectiveness of this approach and the lessons learned from using it.
- To discuss how to sustain a network of scientists concerned with transboundary water issues.
- To discuss new tools, methodologies and approaches to knowledge management and mobilization.

Outputs

- Summary of findings and lessons learned behind knowledge mobilization approaches for international waters.
- Identify actions and recommendations at the GEF corporate level for effective KM across all GEF focal areas.
- Proposed actions to maintain a network of scientists and the utilization of such a network to address the objectives of the parallel working group sessions.

Linking Science to Policy: Strengthening the uptake of scientific findings into policy and practice

Objectives

- To discuss successful experience in incorporating science in the management of transboundary waters, especially outside the GEF portfolio.

- To develop recommendations for enhancing the use of science in policy formulation and management of transboundary waters.

Outputs

- Recommendations on how to use more science for developing better policies and practices for the management of transboundary waters.
- Recommendations for GEF and other agencies on how they can encourage the use of science to improve the policy and practice of managing transboundary waters.

4 Summaries and Conclusions from Sessions and Working Groups

The following chapter summarizes the outcomes of the plenary sessions on water body types and the science policy interface and the respective sets of working groups. In the guidance for responsible session organizers, rapporteurs were asked to provide a full documentation of their session. Session outcomes will be introduced by a short summary, key findings and recommendations for (targeted) research to be prioritized by GEF-STAP and existing science or projects that fill a gap (including those identified in the IW:Science Synthesis Report, both optional.

4.1 Plenary Sessions on Water Body Types

4.1.1 Aquifers

Rapporteurs: Emmanuel Naah, former UNESCO Regional Hydrogeologist for Africa, Cameroon, and Patrick Weiler, IW:LEARN Project

Moderator: Ofelia Tujchneider, Professor, Universidad Nacional del Litoral and CONICET, Argentina

Summary

The Aquifer Plenary session was moderated by Professor Ofelia Tujchneider. The following key findings, gaps and recommendations came out from presentations made by the Keynote Speaker Jan van Gun, the Discussant Cheik Becaye Gaye and the Panelists Eberhard Braune, Callist Tindimugaya and Julio Kettelhut.

Key Findings

1) Because groundwater is hidden and complex good science is the foundation for its sustainable management:

   Its important role is in the identification and characterization of transboundary aquifers as well as the identification of the drivers impacting them (anthropogenic, human uses, pollution, climate change), and the understanding of causes of problems and producing consistent models

2) Predominance of fragmented approaches, therefore need for more holistic approach of view:

   A holistic perspective integrating water systems and policy sectors should be adopted when designing new projects on transboundary aquifers systems. Disequilibrium still exists between discovery and application, science and practitioner, know-how and end-user, mostly due to lack of methodological holistic approaches involving not only the physical aspects of

groundwater systems, but also the management processes in term of water sharing for different users including the ecosystem and potential impacts (quality and quantity) on the neighboring countries sharing the resources. A botton-up analysis looking at the community level will also often reveal the value individuals or communities place on a particular solution.

3) Improving balance between physical aspects of groundwater systems and socio-economic aspects:

   Project design should aim for a balance between natural science and social science components and reflect their coupled nature by adopting the social-ecological system approach. Multiple dimensions of biophysical, social, economic and political processes need to be considered and captured in the framework of analysis.

4) Communication between science and management needs to be improved in transboundary aquifer projects:

   Communication is not usually evident and there has limited interaction between the scientific community and policy/decision makers, the local community who have the major role in the use and conservation of the resources

Gaps

1) Poor attention to drivers and causal chains:
2) Little attention to drivers of change such as population growth, urbanization, pollution, climate change impacts and lack of systematic interdisciplinary analysis using new technologies.
3) Mismatch of scales:
4) Physical, social, economic and political processes occur at different scales from local to national or regional scales. It is particular important to groundwater resources utilization and management.
5) Scarcity and accessibility of data
6) Scarcity, accessibility and quality of data all hold back the sustainable management of groundwater resources, especially in transbounadry situation.
7) Lack of holistic and scientific assessment process on Transboundary Diagnostic Analysis (TDAs)
8) Appropriate groundwater information is still largely missing to introduce groundwater effectively in the TDA analysis

Recommendations

- Project design should have a balance between natural science and social science components and adopt the social-ecological systems approach
- Systematic assessment and analysis of relevant drivers of change should be included as a standard component of all projects.
- Clever use of drivers

- Improve reporting, communication and information dissemination.
- Transformation of relevant information into policy formulation
- Attention for post-project activities

4.1.2 Lakes

Rapporteurs: Isabelle Vanderbeck, UNEP and Meredith Miller (Resource & Conservation Coordinator, Meadows Center for Water & the Environment

Moderator: Masahisa Nakamura, Research Center for Sustainability and Environment, Shiga University, Japan

Summary

Recognizing that over 90% of liquid freshwater on Earth surface is in lakes/reservoirs and that lakes (lentic) are used for wider range of ecosystem services than any other types of water systems henceforth can also be a greatest potential for water use conflicts, recognizing that lakes have important 'Sink" buffer function as 'barometers' of human activities inside/outside basin and therefore are good 'triggers' for initiation of remedial actions, the session participants strongly recommend the following.

Recommendations and Key messages

1) There is a need to consider lakes as part of a linked hydrologic continuum (lakes, rivers, coastal zones and aquifers as an integrated and interconnected system); Accordingly, an integrated management process is required for successful lake management
   - Lakes provide more water-based ecosystem services than other water systems
   - Lakes have unique features and behaviors that must be considered in their management, and can be indicators of watershed health and the influences of external drivers

2) It is important to address gaps in data availability in order to provide sound science-based guidance for effective lake basin management
   - No global scale lake database/datasets exist
   - Few studies incorporate baseline data for study and comparisons; there often is a failure to consider historical data, which can address these gaps to some degree

3) Stakeholder involvement, scientific and indigenous knowledge, and ecosystem-based governance are fundamental requirements for successful transboundary lake and watershed management
   - Temporal scale of lake/reservoir processes must be considered at the scientific, policy and management levels

- Scientists, stakeholders and policy/decision makers require more effective communication processes that can satisfy the specific knowledge requirements/goals of each group

4.1.3 Rivers

Rapporteurs: Richard Lawford, Global Water System Project, Canada, and Andrew Dansie, UNU-INWEH

Moderator: Paul Taylor, former Director of UNDP CAP-Net Programme, UK

Summary

The rivers session featured a keynote paper followed by four case studies. The few minutes at the end of the sessions were used for questions and answers from the audience. In the review of the GEF river projects it was found that the majority addressed water quality issues such as eutrophication/ nutrients, contaminants, etc. while others dealt with hydrology/water balance, bio-diversity and social/governance issues and links to other environmental issues. Most of these projects overlapped with other water types (lakes, etc). Issues that will affect GEF projects in the future include: increased water scarcity and quality degradation due to urbanization and economic growth, land use change, developmental activities in upstream and downstream riparian countries and climate change.

Implementation of the Rivers type projects relied on science for project design, studies and assessments of rivers, application of science for management, and tools and monitoring programs. Missing science inputs include lack of application of useful technologies (e.g. remote sensing), socio-economic and gevernance data and understanding, and the impacts of climate change. A wide range of approaches is used including scientific information, however underrepresentation of social and policy scientists and local communities/universities and the private sector is a clear gap. Linkages with science are important to give GEF projects more visibility and credibility. Some successes in effective use of science include pilot projects and national case studies that translate scientific innovations into policies.

Some of the points raised by the discussant included the role of global processes in preconditioning river basins; asymmetries and conflicts between upstream and downstream water use; human development without concern for the environment; lack of progress toward a green economy and the lack of an ecosystem framework.

The four panelists reported on their experience in linking science with GEF project implementation. One overarching concern involved the project cycle viz a viz the political cycle. Issues that came from these presentations included recognition of the need for longer terms investments by GEF, the need for design criteria for Decision Support Systems, diverse government policies that may affect the publication of data and findings, the lack of a complex systems approaches, the need to consolidate information on best practices, use of the procurement policies to encourage more science input, and the need to expand innovative communication approaches such as simulations. In the discussion with the audience the issue of deltas and the effects of infrastructure construction on sediment transport to deltas were discussed.

Key Messages

Rivers projects share primary concerns of project implementation with lakes and aquifers but also posess river-specific issues and opportunities:

1) Basin scale effects: The complex in-basin interactions (upstream/ downstream, infrastructure development, land/ river management, demographics and water use, etc) demand improved integrated approaches to data involving in-situ, satellite and models to effectively monitor, simulate and predict in-basin changes and to monitor project implementation.
2) Global/regional scale effects: While river basins and rivers are basin scale they are strongly influenced by regional (e.g., geopolitical instability) and global influences (e..g, climate change, food exports) which must be more effectively accounted for in planning, approving and monitoring GEF and related projects.
3) Building and using green economy tools provides opportunities for new integrated approaches to transboundary basin management. These approaches would bring together scientists, engineers, economists, ecologists, sociologists and stakeholders, to plan and implement sustained river and river basin projects by applying principles of water and land management, environmental services, and bioeconomies, to address the effects of present and future local and global forcings (e.g., population, role ofriver).

Recommendations

In order to more effectively include science in GEF projects it is recommended that:

1) a broad set of data and tools for transboundary basins be consoldiated and, if necessary be developed through targeted reserach and made available to GEF projects.
2) GEF and its implementing agencies should build links with other science programs so they can more effectively utilize the science knowledge, data sets and resources that are produced through those projects. In return, GEF projects should be required to publish their findings in peer reviewed journals, document their views on further reserach and development needs and make their data avialable to the scientific community.
3) GEF should set aside a small percentage of its funds to develop scientific knowledge, tools, baseline data sets for transboundary basin, and assessments of global effects that will improve the efficiency of GEF project development and assessment and create benefits for scientists who engage with GEF projects.

4.1.4 Open Oceans

Rapporteurs: Carl Lundin, IUCN Marine Programme, Switzerland, and Takehiro Nakamura, UNEP

Moderator: Robert Duce, Professor Emeritus, Department of Oceanography Texas, A&M University, USA

Summary

The Open Ocean (OO) is a true international water issue addressing a global common. The GEF has so far invested limited funds in OO projects but given the global significance of OO, expansion of GEF intervention in this field is expected. Such an OO program needs to be built on science. There are many governance challenges in the OO that need to be analyzed using emerging science. This science is costly and will need strong partnerships with key partners and the global research community. GEFs role in the OO is to help empower developing countries to take a meaningful part in emerging governance discussion and solutions and to give them an opportunity to participate in some of the OO research programs.

The open ocean (of which 64% is beyond national jurisdiction) is the largest source of oxygen, the greatest heat sink (keeping land temperatures relatively stable despite increasing greenhouse gas levels), the greatest storehouse of CO2 (now changing the fundamental chemistry of ocean water), and continues to be globally significant in absorbing CO2 in the present day. The development of the GEF OO portfolio will require a strong partnership with the global scientific community and more exchange with the different groups of researchers working on emerging scientific issues. This includes science on critical open ocean processes such as ocean acidification, ocean deoxygenation, shifting currents, oxygen levels and productivity patterns due to ocean warming, temperature and salinity shifts geo-engineering, carbon cycles in the ocean, ocean plastics; and monitoring open ocean ecosystem health.

GEF needs to have a stronger engagement with different mechanisms and institutions charged with managing the OO, including global conventions, regional conventions and management bodies as well as national programs to improve the state of knowledge. A GEF supported review of OO governance mechanisms and institutions, based on strong legal and social science will help ensure the ability to develop stronger institutions and speed up reforms. GEF has a catalytic role to play in this respect and can help to foster a new sense of common purpose and solidarity in the oceans. Advice on what institutions do not fulfill their mandate will also be useful to provide fodder for reform and catalytic change.

A particular priority will be to develop a comprehensive understanding of OO ecosystems and marine biodiversity in the OO its distribution and degree of threat. Ocean plastics will also need to be a specific area of work, in light of recent findings that plastic is now to be found in practically all parts of the ocean, and is increasingly being incorporated into the marine food chains, ultimately posing a threat to human wellbeing. There are multiple threats to the functions of the OO. Destructive fishing practices and Illegal, Unreported and Unregulated (IUU) have been plaguing the OO for some time, and seabed mining and navigation may have impacts on the health of the OO ecosystems. A science that attributes the impacts on ecosystems to various stressors should be effectively used, and an integrated ecosystem-based approach using science-driven Regional Ocean Management Organizations (ROMOs) should be seriously considered.

In light of the above GEF should consider how to develop the current portfolio and permit a scientifically driven process to make recommendations on what the portfolio should look like. GEF science strategy on open ocean can guide GEF partnership with global research communities and major global change projects, which can be used for the design of the new interventions. A primary emphasis on the issue of fisheries management should be balanced with all the other challenges facing the OO.

Key Messages

1) OO is truly International Waters and requires international solutions; GEF has an opportunity to provide developing countries with the capacity to have a meaningful part in the emerging governance discussions and solutions.

2) The state of scientific knowledge relevant to management is less developed in the OO compared to other parts of the IW portfolio and the GEF has an opportunity to be at the cutting edge of emerging issues relating to critical open ocean processes such as ocean acidification, geo-engineering, carbon cycle in the ocean; and monitoring open ocean health; particularly thru partnerships with global research community.

3) OO is subject to multiple stressors and any interventions to address these stressors will require multiple sector involvements. In taking an integrated multiple sector approach, to develop the GEF portfolio, science should be used as a main driver for the selection and design of interventions and a GEF scientific strategy for the OO intervention would be useful in developing the portfolio, including an identification of the key partners.

Existing projects filling a gap

- ICSU Projects (Earth system science context),
- ABNJ GEF Programme and TWAP,
- Open Oceans Science Strategy to be funded and developed,
- UNESCO-IOC projects,
- UNU deep sea bio prospecting project,
- International Geosphere-Biosphere Programme.

Recommendations

- Review of Governance options in OO (for example a recent Institute for Sustainable Development and International Relations (IDDRI) study on this and the discussion in the ad hoc working group on Areas Beyond National Jurisdiction (ABNJ),
- Scientifically sound area-based management in the OO (following the CBD-STAP paper on the Marine Spatial Planning),
- Advice on new STAP members with OO expertise,
- Help facilitate the OO Science Strategy.

4.1.5 Large Marine Ecosystems (LME)

Rapporteurs: Laurence Mee, Scottish Association for Marine Sciences, UK, and Marcus Lange, LOICZ

Moderator: Kenneth Sherman, Director, Large Marine Ecosystem Program, National Oceanic and Atmospheric Administration, USA

Summary

This session included projects that were pursuing an ecosystem approach through explicit use of LME designation or through work across the land-sea interface. The LME projects have strong links to the wider science community that has benefitted from an established methodology reviewed during 14 international meetings and is widely published in the literature. The TDA/SAP approach and the paradigm of adaptive management are compatible with this thinking. The session was informed by the keynote speaker, Dr. Annadel Cabanban, that despite this issue, a big gap remains in the monitoring of indicators, particularly following project completion, and the documentation of the science used. She outlined a number of critical issues that need attention including climate change adaptation and the risk of tipping points, and emerging issues such as microplastics, lifestyle chemicals, acidification, deep sea fishing and sea mounts. Challenges for the future include the difficulties of scaling interventions up and down, understanding response timescales for solving identified problems, multiple stressors and the so called 'wicked' problems that defy simple linear solutions. She recommended the improved use of science advisory groups in projects, integrated information management systems, regional science conferences, structured dialogues between scientists and policymakers and thhe improved use of market-based instruments (such as Payments for Ecosystem Services, Public-Private Partnerships and Corporate Social Responsibility).

In his response to the keynote presentation, Dr Qisheng Tang illustrated the case of the Yellow Sea LME where the system has profoundly changed through over-exploitation, climate change and eutrophication. He illustrated how adaptive management had occurred using technical interventions including fisheries closures and carbon sink fisheries. Specific examples of this approach were scallop and seaweed aquaculture, allowing the removal of 1.2 M tons of carbon per year from the system.

Work in LME's and interface systems was illustrated by speakers from the Gulf of Mexico, the Caribbean, the Benguela Current and the Canaries Current. A common thread in these presentations was the need for a multidisciplinary approach involving natural and social sciences and the use of more explicit science. Some of the projects noted that the absence of a reliable baseline had made it difficult to measure change. Summarizing the land-based pollution sources (LBS) projects, Dr Ramesh Ramachandran noted that some projects could be highlighted as 'lighthouse projects' for their excellence in achieving practical results. He also noted that the issue of 'blue carbon' had received insufficient attention.

Key Findings

1) The LME and TDA/SAP approaches are fully compatible and implemented in at least 20 projects, leaving a legacy of published science.
2) There is a continued need to address combinations of stressors operating across multiple temporal and spatial scales.
3) Engagement with livelihood issues is essential including innovative interventions to restore ecosystems and to achieve multiple benefits (e.g. for seaweed and shellfish aquaculture).

4.1.6 Preliminary Conclusions from the Plenary Sessions on Water Body Types

Chair: Joseph Alcamo (United Nations Environment Programme, UNEP Chief Scientist, Kenya)

1) Transboundary waters are large in scale, and expensive to study (Many transboundary aquifer areas and watersheds are very large, as are obviously LMEs and open oceans. Monitoring programmes are very costly).

Recommendation

Science can help by:

- identifying priority areas for study and management (using modelling analysis of hot spots, for example.)
- stimulating innovation in managing transboundary waters
- related here is the opinion of many participants that aquifers and open oceans should receive more attention from GEF International Waters.

2) Environmental changes occurring in different types of water systems are often/normally driven by more than one driving force. For example, the chemistry of lakes is often affected by both atmospheric deposition and surface runoff of substances; the chemistry of oceans is altered by both land-based pollution as well as the increasing atmospheric concentration of carbon dioxide; and changes in flow patterns of rivers are driven by both impoundments and changes in precipitation due to climate change.

Recommendation

Studies of international waters should take a multi-stressor approach, i.e., they should take into account a range of driving forces of change.

3) Water is tightly coupled with other parts of the global system and the global economy.

Recommendation

More attention should be given to the linkage of international waters with:

- Green growth/Green Economy – e.g. the impact of water use for agriculture on the ecological status of aquifers and river; conversely, the positive impact of increasing water use efficiency in agriculture on reducing the depletion of aquifers and rivers.
- The "water-food-energy nexus", i.e., the linkage between (i) water availability in rivers and aquifers, (ii) water supply for agriculture, (iii) water supply for energy production.

4) Up to now science has contributed mostly biogeophysical (e.g. hydrology, oceanography) knowledge to the study and management of international rivers. However, it is also important to contribute social science knowledge to this effort.

Recommendation

It is important to more energetically engage social scientists (political scientists, sociologists, jurists, others) in the study and management of international rivers to provide understanding about the following topics:

- Institutions and regulations appropriate for management of watersheds, the coastal environment, and the marine environment.
- Feasible actions for promoting water-saving behaviour.
- Engagement of stakeholders in the study and management of water systems.

5) Actions can be taken to better take advantage of the science already produced within, and for, GEF International Waters projects.

Recommendations

- Steps should be taken to improve the communication of scientific results from GEF IW projects. For example, GEF Secretariat or GEF Implementing Agencies could encourage, support or provide specific mechanisms for communicating scientific results such as: Science-Policy Forums, Policy Briefs summarizing scientific results, or web pages devoted to explaining scientific results.
- A data repository should be set up with the encouragement or support of GEF Secretariat or GEF Implementing Agencies. This repository should make important scientific data produced by GEF IW projects available and accessible to a wide range of users.
- Structures within GEF IW should be set up to encourage stronger scientific input. For example, GEF or GEF Implementing Agencies should consider setting up Scientific Advisory Committees for each water system (e.g. for rivers) or for clusters of water systems (e.g. for rivers and aquifers, and for open oceans and LMEs).

4.2 Plenary Session on the Science Policy Interface

Rapporteurs: Meryl Williams, former International Waters Panel Member, GEF STAP, Australia, and Tessa Goverse, UNEP

Moderator: Adrian Cashman, Centre for Resource Management and Environmental Studies, University of the West Indies, Barbados

Summary

The Science Policy Interface session was moderated by Dr Adrian Cashman. The following key findings, gaps and recommendations were developed from presentations made by the Keynote

Speaker: Al Duda and the Panel Discussants composed of: Jakob Granit, David Grey, H.E. Rejoyce Mabudafhasi, Nico Willemse, Jeff McNelly and John Pernetta.

Key Messages

1) The Policy-Science interface is a more correct term emphasizing that typically policy leads science.
2) The Policy-Science interface needs to function at different scales from the level of the community to that of the regional organization.
3) Policy-relevant science is that which translates science results into risks/opportunities relevant to actual economic and human issues and that helps improve decision-making. Fewer rather than more options are better for policy-makers.

Key Findings

1) Transboundary work is becoming more complex as the drivers stressing fresh and marine water systems increase and too little collective governance action yet exists to address the issues. Governance can be conceived as being comprised of a governance system of political, economic and social factors, or as a governance world inside an environmental system, or as a network-centric world where nodes are based around businesses, governments, NGOs, CSOs, etc). In addition, inter-connected processes are both globalized and regionalized. In these frameworks, IW TB projects/programs are not yet well connected to many of the regional economic bodies. More broadly, IW science can find its policy interface in the water/food security/energy/security/environmental services themes, and their various combinations. Is a "nexus" approach, e.g., water-food-energy also relevant to scientific analysis? Are tools such as IWRM, ICM, LMEs becoming outdated in the new political economy? Can they achieve the necessary focus on drivers and risks required?
2) Science is usually not the major constraint to taking action, but a dearth of appropriate social science may seriously constrain its policy-relevance for decision makers. For example, benefits-focused advice can help create political will. Conversely, policy-making is not usually science driven.
3) Water systems are all ultimately interconnected. To address the science needs of policy-makers, do we need a Global science framework for water? Major water events such as the 2011/12 Bangkok floods had global as well as national economic and human security impacts.
4) Policy makers working with GEF-IW projects have learned how from good ideas in other countries, e.g., in the Benguela Current (BCLME) project, South Africa has shown the other countries how a national oceans policy can integrate sectors and ecosystem services in a single framework for policy decisions. However, many decisions are hard and even if well founded on good science will not make all parties happy.
5) The actual conduct of science and its formulation and translation into policy advice can benefit from use of simplifying metaphors such as "water footprint", "ecosystem services, "

opening the opportunity to then engage scientists and policy advisors to engage in the more detailed work leading to policy advice from science results.

6) Regional and local scientists are essential to have involved and carrying out the bulk of the work in TB projects.

Gaps

1) TB water governance would be well served if regional and inclusive science conferences were convened regularly to address policy needs. Among the needs are information on trends, state of resources, comparative analyses among countries. These types of information should all be based on robust indicators.
2) Social scientists and economists are not often part of the science system for TB water systems, potentially weakening the potential to turn bio/geo/physical science results into policy focused advice. Where are these specialists to be found? IW projects have not managed to include many on committees and in the projects.
3) GEF-IW is perceived to have been too fisheries focused in many TB systems and needs to become more inclusive of other sectors and themes. Inter-ministry challenges remain large both in science and policy-making in most countries.
4) Scientists and policy makers need to each meet separately before discussing an issue together.
5) Women and younger scientists are also less common than older male scientists in the water-related disciplines of IW.

4.3 Working Groups on Water Body Types and the GEF IW Scientific Network

Andrew Dansie (United Nations University, Institute for Water, Environment and Health (UNU-INWEH))

In line with the design and set up of Working Groups for the Conference a Scientific Network has been inaugurated addressing the topics and the science to policy interface issues on 'Setting IW Science Priorities for the Next Decade'. The GEF IW Scientific Network is organized by the United Nations University Institute for Water, Environment and Health in partnership with UNEP and UNDP. The network serves to consolidate the findings and gaps identified from the GEF IW:Science project with the outputs of the GEF IW Science Conference. The final output of the IW:Science project was launched in Bangkok at the conference. This final synthesis report 'Science-Policy Bridges Over Troubled Waters - Making Science Deliver Greater Impacts in Shared Water Systems' is based on the findings of a series of ten IW:Science System Type Reports (River Basins, Groundwater, Lakes, Land-based pollution Sources, and LMEs and the Open Ocean). Each core group of the scientific network is designed to have representatives at both the Core Group (CG) Co-chair and member level from the previous IW:Science Project Working Groups. The group will continue to work in the months following the conference to consolidate the outputs of the IW:Science report, the Working Groups discussions and

agreements at the conference. This is in the form of an IW Type-specific document that will then be rolled into a final summary consisting of:

A document that highlights the key outcomes of the IW-Science project that integrates the dialogue at the Bangkok Meeting will be produced that is intended to enable GEF to implement processes that bring science into GEF decisions and projects. It should demonstrate with success stories how integration of science has enhanced the outcomes and effectiveness of GEF investments acting as a catalyst.

It will have:

1. Introduction to the process
2. A summary that has the "synthesis" of the common conclusions among the themes
3. There are many common themes such as lakes, rivers, LME, atmosphere linkages being critical.
4. Major conclusions based on the executive summary of the synthesis report
5. The key points from each water type
    a. The highlights from each theme area (from reports and workshop)
    b. a success story that emphasizes how science was key in achieving the desired ecosystem/social goals. Example: Lake Victoria adaptive management that incorporated the science.
6. Referral to the on-line documents, logos, etc.

4.3.1 Aquifers

Rapporteur: Holger Treidel, UNESCO-IHP, France

Chair: Andrea Merla, Independent Consultant, Italy

Challenges and most crucial issues to be addressed

- National scientists and government agencies should play a lead role in project execution. GEF should reach full involvement of the scientific communities the project countries, from the design of the project and throughout the execution of groundwater projects.
- Water security implies, amongst others, conjunctive management and use of surface and groundwater resources - this needs to be implemented within the framework of GEF projects. In view of global change and associated uncertainty GEF projects provide an opportunity to showcase conjunctive water management and for the replication of best practices elsewhere.
- Increase the role and application of social sciences, economic valuation, and the use of scenarios, as important tools for managing groundwater resources, and translating science into policy options.

- Science based assessments of groundwater resources and harmonized transboundary aquifer monitoring are a prerequisite for initiating the TDA/SAP process aimed at engaging decision makers. GEF should also support the baseline assessments and establishment of groundwater monitoring networks in project countries.
- Improve targeted communication of project findings and results to decision makers and enhance the visibility of groundwater by advocating its central role for water- and food security.
- Pay full attention of the drivers of change, including demography, economic development and climate change in the context of GEF projects.

Key Messages

- National scientists and government agencies should play a lead role in project execution. GEF should reach full involvement of the scientific communities the project countries, from the design of the project and throughout the execution of groundwater projects.
- Water security implies, amongst others, conjunctive management and use of surface and groundwater resources - this needs to be implemented within the framework of GEF projects. In view of global change and associated uncertainty GEF projects provide an opportunity to showcase conjunctive water management and for the replication of best practices elsewhere.
- Increase the role and application of social sciences, economic valuation, and the use of scenarios, as important tools for managing groundwater resources, and translating science into policy options.
- Science based assessments of groundwater resources and harmonized transboundary aquifer monitoring are a prerequisite for initiating the TDA/SAP process aimed at engaging decision makers. GEF should also support the baseline assessments and establishment of groundwater monitoring networks in project countries.
- Improve targeted communication of project findings and results to decision makers and enhance the visibility of groundwater by advocating its central role for water- and food security.
- Pay full attention of the drivers of change, including demography, economic development and climate change in the context of GEF projects.

Recommendations

- Application of remote sensing technology for mapping and characterization of aquifers,
- Quantification of groundwater-surface water interactions in support of integrated management of water resources.

4.3.2 Lakes

Rapporteurs: Meredith Miller, International Center for Watershed Studies, Texas State University, USA and Isabelle Vanderbeck, UNEP (Day 1); Daniel Olago, Department of Geology, University of Nairobi, Kenya (Day 2)

Chairs: Masahisa Nakamura, Research Center for Sustainability and Environment, Shiga University, Japan (Day one); Kelly Munkittrick, Canadian Water Network, University of New Brunswick, Canada

Summary

Keynote Speaker: Kelly Munkittrick, Canadian Water Network, Canadian Rivers Institute, University of New Brunswick, Canada.

Discussant: Walter Rast, International Center for Watershed Studies, Texas State University, USA

Working Group Members: Juarez Alejandro, Burin Chotichaicharin, Sergey Kudelya, Vladimir Mamaev, Satoru Matsumoto, Raymond Mngodo, Simbotwe Mwiya, Masahisa Nakamura, John Pernetta, Adelina Santos-Borja, Mark Servos, Poonyawee Srisantear, Isabelle Van der Beele, Gullaya Wattayakorn, Teraohon Ketthan, Walter Rast.

Lakes/lentic systems provide a wider range of ecosystem services than other water systems. Lakes function as pollutant sinks and buffers have the greatest potential for water use conflicts. Lake health provides a 'barometer' of ecosystem effects of human activities inside/outside lake and river basins, and can be 'triggers' for initiation of remedial actions.

Further, lakes are hydrologically linked with outher water systems, including aquifers, rivers and coastal zomes and must be managed in an inegrated fashion.

A review of lake projects in the GEF portfolio produced the following findings:

1) Common critical issues studied include Eutrophication/nutrients; biodiversity; invasive species; wetlands; climate change; contaminants; governance and management; social impacts; economics and dams.
2) Unique issues include dependence on external drivers, such as changing land use; effects of aerial deposition; climate change; and temporal scales of lake responses are often affected by retention times that result in response time frames longer than project durations.
3) Critical science 'gaps' included absence of baseline data; lack of pristine areas for comparison; many projects lacked rigorous study designs and regular evaluation of deliverables; projects failed to consider lake-specific processes and considered the lake as part of a river system, or failed to consider the past history of lakes.
4) Common failures among projects included:
5) not using best available and up-to-date science;

6) not replicating or using adequate statistical designs;
7) not explicitly developing or following QA/QC guidelines for the available data; and
8) not collecting adequate data prior to initiating changes to evaluate the impacts of changes.
9) Factors that improved success include early and meaningful engagement of stakeholders and international science community; effective utilization of traditional ecological knowledge; rigorous peer review; and linkages to social, economic, political scientists.

Recommendations include the need for projects to develop (early on):

- priorities for management activities;
- criteria, indicators and milestones for project evaluation;
- processes or frameworks for expanding influence beyond pilot sites; and
- a strategy for dealing with implementation barriers.

Further recommendations include:

- an external team should assess the level of local scientific capabilities;
- capacity-building;
- engage local and global scientific communities AND have a shared vision;
- local and global participants must have shared responsibilities, mutual understanding, and well-defined roles;
- incorporation of local approaches and traditional knowledge; and
- mechanisms needed to pass communication barriers.

To address emerging science challenges, there is a need to increase focus at the ecosystem level; improve the development of proxy indicators; develop strategies for climate adaptation; improve understanding of long-range transport of contaminants, changing chemical use patterns, and the impacts of habitat rehabilitation, including reforestation.

Therefore, the session participants strongly recommend the following:

- Development of projects that look at the system holistically – the whole natural system including the rivers, groundwater and the lakes, and activities within the basin
- Review databases with lake metadata and come up with a list of priority indicators to be included in baseline studies, and look for linkages to IWLearn (link to visualization tool by ecosystem type)
- with IW Learn to identify best practices for developing panel and make suggestion to GEF that such a body should be part of the agreement in the signing for transboundary lake projects and ensure that there is a scientific panel evaluation is included in each of TDA SAP projects to help them develop their priorities.

Key Messages

1) Need to consider lakes as part of a linked hydrologic continuum in need of integrated management,
2) Address gaps in data availability,
3) Stakeholder involvement, scientific and indigenous knowledge and ecosystem-based governance are fundamental requirements.

Existing projects from inside GEF filling a gap

- Existing projects related to impacts and strategies for dealing with invasive species
- Studies being conducted under co-financing on Lake Tanganyika
- Existing North American Great Lakes studies
- Swedish investments in studies on Lake Victoria
- Lake Baikal studies funded by the Russian government
- Lake Saboma (??) in Japan and strategies for improving fisheries and development of a research agenda and capacity and sustainable mechanisms
- Michigan's development of wetland indicators
- Great Lakes indicators development project
- European framework directive – basin-wide approach and indicators development (including former GEF project sites)
- OECD development of indicators and sub-basin management plans
- UNEP development of early warning and assessment maps
- Citizen science activities in using simple tools to complement research institute information

Existing projects from outside GEF filling a gap

- Existing projects related to impacts and strategies for dealing with invasive species
- Studies being conducted under co-financing on Lake Tanganyika
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- Swedish investments in studies on Lake Victoria
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- Michigan's development of wetland indicators
- Great Lakes indicators development project

- European framework directive – basin-wide approach and indicators development (including former GEF project sites)
- OECD development of indicators and sub-basin management plans
- UNEP development of early warning and assessment maps
- Citizen science activities in using simple tools to complement research institute information
- Some biodiversity TDAs/SAPs are useful for lake studies especially in relation to global warming

Recommendations

1) Lakes experts can make recommendations about types of data and platform that should be included in new lakes projects to improve comparability of data across lakes – specific data expectations – including social information and quality of metadata (minimal requirements for data started already with GEF secretariat) – maybe also include some indicator after project ends.
2) Development of simple and clear environmental indicators of lake status.
3) Develop a common approach for interfacing of the ILBM methodology and work it out within the IWRM and ICZM methodology – some pilot projects are started

√ **An overarching and full assessment considering questions addressing specifically the Lakes working group objectives can be found in the Appendix.**

4.3.3 Rivers

Rapporteur: Peter Bjørnsen, UNEP-DHI, Centre on Water and Environment, Denmark

Chair: Paul Taylor, former Director of UNDP CAP-Net Programme, UK

Summary

Key issues and associated research needs

Several key issues for transboundary river basin management are still poorly understood, especially in developing countries, including the socio-economics of WRM, water flow management including environmental flows, pollution and water quality, and ecosystems dynamics, thresholds and tipping points. Documentation of baselines and trends is often constrained by data limitations and gaps. Scientific approaches and methods from developed countries are not always applicable to the more complex and uncertain context in developing countries. An increased research effort in developing countries is needed to address these limitations. Integrated approaches across disciplines, sectors (in particular reflecting the water-

energy-food nexus), ecosystems (e.g. land/water, rivers/coastal) and drivers (including climate change and variability) are needed.

Governance and institutional capacity also remains critical constraints to maximizing the impact, speed of transfer, assimilation and conversion of science generated from GEF transboundary river basin projects as well as the science from non-GEF-project initiatives into the design and execution of new GEF projects.

Global leadership

There is an urgent need to improve the policy, institutional, financial and cultural environment in which science is managed in the GEF partnership. A structured learning approach across the partnership will strengthen its scientific foundation and the GEF partnership should leverage the full sphere of its influence to secure stronger involvement by and interactions with research and science-based entities and partner institutions and programmes with mandates in GEF-related themes.

Stronger focus on securing long-term commitment from Governments in transboundary projects

Presently, Governments are often not integrally involved in project management beyond the provision of endorsement letters and participation in steering committees. This limited involvement reduces the scope for securing long-term Government support for the continuation of post-project science. GEF should encourage countries to promote the diffusion and absorption of the results of GEF projects and to commit longer-term involvement following these projects.

Strengthen the capacity of Project Steering Committees (PSCs)

PSCs are on the front-line of the enhancement of science generated by GEF-funded projects. It is important that these Committees by their composition (including local expertise) and operation be enabled to give effective treatment to the science generated by projects. To this end, it is recommended that GEF develop guidelines for the operations of PSCs to foster the effective use of science, to promote accountability and build local capacity and ownership.

Develop appropriate tools for the enhancement of science in GEF projects

It is recommended that an operational framework and strategy be developed to guide the STAP and the PSCs to more effectively structure the science aspects of GEF projects as well as to assist the beneficiary countries to mine the scientific outputs of these projects.

Project design / development

The project design process should identify demands and synthesize knowledge from all stakeholders. Each project needs to establish a sound baseline, integrating natural scientific and social assessments and research. This generates knowledge for wide dissemination within and outside the project environment. The capacity of the stakeholders to utilize appropriate knowledge should be enhanced through organizing workshops/trainings and providing technical supports in order for projects to be effectively implemented. The sustainability of projects needs to be reflected upon from the project-designing phase, to ensure that ownership is built and the risks and uncertainties during the projects are managed.

Knowledge bridging and brokerage

The GEF partnership should take leadership, through the projects, in a global effort to establish protocols and agreements for data exchange between countries, apply the newest ICT and data acquisition tools, promote open access and open data feed, and facilitate communication across disciplines to reduce knowledge fragmentation.

Key Messages

- Key limitations for a sustainable management of transboundary river basins include: institutional robustness for multilevel governance; stakeholder and public participation/ownership; data gaps; understanding of economics, flow management, water quality and ecosystems dynamics.
- Further research and technology development needed on: communication tools; socioeconomics and policy analysis; indicators and metrics; data and information management; integrated approaches (across disciplines, sectors (nexus), water systems, drivers including climate change)
- The GEF partnership should: strengthen its leadership role and partner with other programmes; ensure long-term commitment from countries; balance sustainability and replicability with a catalytic/experimental approach; strengthen project steering committees using local expertise; develop monitoring and evaluation beyond the project M&E.

Recommendations

- global assessment of the deterioration of water quality and ecosystem status,
- methods and guidelines for valuation of water related ecosystem services,
- develop a global architecture for data aggregation and modeling of water systems.

4.3.4 Large Marine Ecosystems and Open Oceans

Rapporteur: Jerker Tamelander, UNEP

Chairs: Annadel Cabanban, Senior Fisheries Expert, Sulu-Celebes Sea Sustainable Fisheries Management Project, Philippines, and Hartwig Kremer, Chief Executive Officer, LOICZ, Germany

Summary

Keynote Speakers: Annadel Cabanban; Ramesh Ramachandran, Anna University, and brief presentations/statements by Porfirio Alvarez, Simon Nicol, Christopher Corbin, Randolph Payet

The session (ca. 50 participants) incorporated brief keynote presentations based on the IW Science project, interventions from projects in the IW portfolio, and identification of persistent

and emerging issues, means for addressing them, and practices for using science in IW projects through written submissions and discussion.

Persistent threats include nutrient loading and over enrichment; HABs, chemical pollution (e.g. PAHs; Mercury); resource depletion, especially fisheries; exploitation of vulnerable offshore and deep sea habitats including seamounts; ship based pollution; impacts from mining and oil exploration on land and in the sea; and vulnerability of densly populated deltas (increasing).

Emerging issues identified included

- climate change and possible ecosystem based as well as geoengineering solutions, their effectiveness and risks (e.g. the potential impact of geoengineering in areas beyond national jourisdiction (ABNJ) on coastal systems), and appropriate methodologies;
- ocean acidification;
- understanding synergistic stresses and cumulative effects;
- disasters, impacts and recovery responses under multiple chronic stresses;
- identification of global and regional trends, tipping points, predicting regime shifts and enhancing resilience;
- threats associated with the loss of Arctic sea ice; Marine litter; endocrine disruptors (e.g. POPs in microplastics, lifestyle chemicals); Deep sea mining; Invasive Alien Species (IAS) in the marine environment)
- large scale use of continental shelves for renewable energy and carbon storage

Science required includes development of methods for understanding and addressing cumulative effects (synergistic, antagonistic and additive) across different temporal, spatial and institutional scales and including catastrophic events; setting standard indicators for global comparison and lessons sharing; sea-level rise using LIDAR; pollution modeling, bioresource modeling; modeling including use of RS techniques; impacts of demographic trends and urbanization; dealing with uncertainty and risk.

Cross cutting issues, interfacing across scales

Addressing emerging topics, cross cutting science:

- Multiple issues cut across water bodies as well as across GEF focal areas (e.g. IW, CC, biodiversity), calling for better interlinkages between these as well as an engagement of a greater transdisciplinary diversity of science communities.
- Effective transformation of scientific data into decision support information for existing problems is essential, requiring integrated research and assessment (social, economic, ecological; climate change vulnerability, disaster risk). Greater focus on ecosystem services may be useful.
- TWAP may provide a foundation for making progress on integrated assessment, and a roadmap for partnerships beyond TWAP could be developed.
- Enhanced use of modeling and tools for accumulation, aggregation and visualization can support scenario development and provision of advice to environmental managers and policy makers.

- Consistent application of monitoring data and information in research activities is necessary to this end. Addressing heterogeneity in formats, methods and capacity is needed, including good quality control and good metadata.
- Behavioral and social sciences can support analysis of socio political barriers to implementation, assessment of project impact/success and improvements in intervention logic. This is particularly important with regards to institutionalization of national and regional governance structures
- Analysis of governance baselines (interplay of markets, government and civil society) can also provide a measure of system/community resilience; and support horizon scanning and planning for conflicts arising from land/sea uses and change (e.g. water-food-energy nexus)
- Promoting Capacity Building in developing countries remains a priority, including to service basic research and monitoring needs, ensure quality assurance and control, and promote harmonized protocols.
- Transfer and use of innovative technology and South South Cooperation
- Information and knowledge that support a greater national level understanding of pressures, impacts and implications
- Addressing potential of and integration of indigenous knowledge

Review process prior and during project implementation

- GEF projects find a means to know and draw on research that is underway / has been done to address needs (appropriate assessment of existing knowledge and research underway, networks existing)
- Scientific panels in all projects, ideally based on existing mechanisms for sustainability and closely engaging with the global research community
- Establishing peer review throughout the project cycle
- Prioritization of emerging issues requires a structured process along scientifically rigorous and transparent criteria

Key Messages

- there is a need for greater focus on understanding uncertainty in global and regional trends, synergistic threats and cumulative impacts, requiring research that cuts across disciplines and where appropriate across water bodies. Prioritization of the research based intervention needs to be regionally tailored and conducted based on transparent criteria underpinned by scientific rigour.
- a mechanism for consistent, systematic, and inter-disciplinary science input co-designed and reviewed with the knowledge users throughout the IW project process is needed, broadening the base for scientific input and review to encompass social and political science and economics, proximate and distal drivers, and developing a system/community of practice for peer-review.

- Effective transformation of scientific data into knowledge for decision support: a strengthened foresight process is needed, building on enhanced use of modeling that incorporates data from physical, ecological , socio economic and behavioral sciences. Reliable hind- and forecasting enables the evaluation of the effect of interventions and development of scenario-based forward looking policy support. Political and social sciences can provide greater understanding of barriers to policy change or to impacts of IW portfolio beyond the lifetime of projects.

Existing projects filling a gap

- Research: e.g. LOICZ, IMBER, FUTURE EARTH: Research for Global Sustainability (new Earth system research program by the Science and Technology Alliance for Global Technology), OCEAN Compact;
- Assessments and Observation: e.g. TWAP, GOOS, GEOSS, World Ocean assessment

Recommendations

- address multiple stressors and cumulative impacts,
- identifying tipping points/thresholds. Can they be identified before they are crossed?
- STAP to identify priorities from the emerging issues above in a collective scientifically sound process.

4.4 Working Groups on the Science Policy Interface

4.4.1 The role of IW-related science in support of regional cooperation

Rapporteur: Douglas Taylor, GEF STAP Consultant, UK

Chair: Jakob Granit, International Waters Panel Member, GEF STAP and Centre Director Stockholm Environment Institute, Sweden

Summary

Keynote Speakers: Raymond Mngodo (LVBC), Cletus Springer (OAS)

The session, chaired by Jakob Granit, opened with a reflection on key barriers and options for policy support for regional cooperation raised in the five thematic sessions in Day 1. Raymond Mngodo (Lake Victoria Basin Commission) and Cletus Springer (Organization of American States) respectively identified how support for successful regional cooperation was achieved. The findings of the session were that:

- Transboundary collaboration was initiated by local demand to solve transboundary problems and confidence building on solutions was incremental, building on existing

capacity and institutions. Science to policy processes in some successful projects included translation and transboundary exchange of project findings before distillation into policy.

- Participants (20+) contributed evidence for the role of science in enabling collective action and highlighted GEF's role over long timescales in building confidence and platforms to cement regional cooperation.
- GEF's tools and its facilitation are highly valued and proposals were made for enhancing GEF's regional outreach and capacity regarding delivery of social and economic policy relevant science.
- The 1995 GEF IW goal (promotion of collective management), carried forward into the current GEF strategy, provides a sound foundation for transboundary collective action, and continues to be one of very few agreements between North/South that address common pool resources such as the oceans, aquifers and transboundary freshwater systems. This enables not only project-based science to be valued but policy-relevant science that transcends national and regional boundaries.
- The working group proposed a role for GEF at non-project level to assist in confidence building and environmental diplomacy across proposed intervention areas (including coasts, landscapes, watersheds) also acting as an agent of change and drawing on GEF's existing expert contacts to deliver relevant support.
- While the TDA/SAP tools are considered to be effective, some adjustments were proposed, including investing GEF-funded effort to understand processes, conflicts and understandings to achieve an effective enabling framework upstream of TDA formulation and if necessary to support the costs to bridge the period between TDA completion and SAP implementation. As part of the TDA process project implementers could also estimate the costs of non-cooperation.

Key Messages

Observation: that the 1995 IW goal built also into the current GEF strategy (2010-2014), provides a sound foundation for transboundary collective action and is an agreement between North/South to address the management of common pool resources.

- Scientific evidence as developed through GEF financed projects addressing transboundary stocks and flows is catalytic in generating compelling evidence and thereby providing incentives for collective action by riparian states.
- Non-project GEF catalytic interventions in the political/economic sphere including environmental diplomacy can create regional cooperative opportunities, such interventions could be explored by the GEF for the GEF 6 period.
    - From the technical domain to the political/economic domain
- The GEF should be re-positioned to address the realities of ongoing regionalization processes running in parallel to global in preparation for the 6th replenishment period.
    - Leveraging regional economic institutions is key to ensure sustainability beyond the catalytic GEF intervention.

- The TDA/SAP process could be augmented to widen the evidence base underpinning policy impact and post-project up-scaling of GEF results, upstream activities addressing the political economy of cooperation could be included.

Recommendation

- Undertake analytical work on how GEF could strengthen its support for political and economic sciences likely to promote regional cooperation to feed into the GEF 6 strategic discussions.
- Analytical work on the process of regionalization and the role of GEF in such processes is proposed.

4.4.2 Analysis (TDAs), Progress Monitoring (SAPs) and Indicators

Rapporteur: Chris Severin, GEF

Chair: Peter Whalley, former Project Manager, Tisza River Basin Project, UK

Summary

The International waters portfolio has had a tracking tool since the ending of GEF3, hence quite a substantial experience exists within the International Waters Portfolio on tracking performance. However, there still seems to be a gap between the performance status captured in the Tracking Tools and how these are communicated effectively to stakeholders. This session therefore focused on discussing and identifying effective ways to catalyze such communication in clear concise terms. The Transboundary Water Assessment Project (TWAP) was identified as a key project to help develop indicators and address prioritization as well as potential research areas, which potentially would be enabling bridging gaps in tracking performance. Further, the lively session did outline a couple of key messages to be brought forward to GEF and its IW taskforce for further consideration, along with some potential areas for GEF-STAP to consider for targeted research, namely; Development of rapid assessment/status/proxy environmental indicators, Valuation of Ecosystems Services as a vehicle for stronger science/policy interfaces.

Key Messages

- GEF and its partners should review the IW Tracking tool (TT) and its indicators.
- Post project monitoring is essential and needs to be streamlined into the national ministries.
- Revision of the National Focal Point Terms of Reference to enable their ongoing engagement in project implementation.

Next steps

- Mainstream the discussion of IW indicators into next GEF International Waters Conference;
- Experiences on IW indicators are being uploaded to IWLEARN and will be reflected upon in the Project Management Manual;
- The Session participants agreed to continue the dialogue on indicator development and fine-tuning of the IW Tracking Tool.

4.4.3 Effective Knowledge Mobilization

Rapporteur: Mish Hamid, IW:LEARN Project, Slovakia

Chair: Peter Sale and Andrew Dansie, UNU-INWEH

Summary

Keynote Speaker: Andrew Dansie (UNU-INWEH), Mish Hamid (IW:LEARN Project)

1) Session commenced with brief overviews of the knowledge management aspects of IW:LEARN and IW:Science. These projects are a first attempt by GEF IW to capture the science developed in GEF IW projects. Despite sincere effort both projects are deficient in terms of their effectiveness in capturing science that clearly was done in GEF IW projects. This is because existing GEF IW requirements and procedures did not adequately provide for capturing of science achieved in projects.
2) The discussion then turned to recommendations to improve this situation in the future, beginning with basic storage, sharing and archiving of scientific data. We were told that GEF stipulates that all data collected are in the public domain but compliance with this requirement tends to be weak.
3) The ability to learn from the successes and failure of projects requires that GEF have a much better system for gaining information about project performance. This includes scientific knowledge gained, but extends far beyond this to project governance and to effective implementation of science-based policy.

Key Messages

1) GEF should develop an effective learning strategy including a meta-database of scientific knowledge and also capturing evaluations of effectiveness, government structures and transfer of science into project governance and policy. Official guidance on GEF IW learning budgets (use of 1%).

2) Data generated in GEF projects must be publically available and permanently achieved. Corporate policy for data sharing needs to be built into the legally binding Project Document.

3) GEF has to take a more active role in providing knowledge mobilization training to new projects and providing linkages to partners with knowledge of best practices in the area.

4) There area advantages in building a community among project participants and GEF should continue to encourage the use of the IW:LEARN platform for interaction between members and access contact information (including Community of Practices).

Recommendation

Bringing the results of the discussion within the working group to a wider audience and strengthening the science-policy interface should be approached through mechanisms such as the IW:LEARN project but in particularly through the discussion and endorsement of the recommendations by the GEF and its agencies.

4.4.4 Linking Science to Policy: Strengthening the uptake of scientific findings into policy and practice

Rapporteur: Joana Akrofi, UNEP and Astrid Hillers, GEF

Chair: David Grey, former Senior Water Advisor, World Bank and Oxford University Centre for the Environment, UK

Summary

The session addressed the challenge of how science can be more effectively used to support transboundary dialoge, policy and management decisions on TB waters. Poor countries generally face larger variability in rainfall, their economies are vastly more vulnerable to water induced shocks from droughts and floods, and at the same time they have less information available to manage their water and related resources combined with a fraction of water storage infrastructure to buffer the effects from extreme events. Further, there is a lack of effective two-way communication between scientists and policy makers to underpin decision making by relevant and timely information provided in an accessible format.

Interventions by David Grey, H.E. Rejoyce Mabudhafhasi and Solene Le Doze-Turvill inspired discussion on how to improve the effectiveness of existing links between science/scienctists and policy makers in such complex settings; how to best harness innovative approaches as well as build on indigenous knowledge; and, forward looking, how to make use of game changing developments in technology that will allow comprehensive global modeling of our 'blue planet'. In maybe less than a decade we will be able to track movement of water on global and down to local levels at the same time water related data and information is for most part rapidly moving outside of the exclusive control of governments. Further, developments in crowd sourcing facilitated through evolving media is likely to result in a cascacde of solutions for wider input and

access to information on water flows and other data leveling the playing field in terms of access to this information.

There was keen interest in the question on how the GEF together with other players can jump start the development of such a global water model and global access to water and related information.

Four topics were discussed:

1. North-South divide (needs/interests) & the challenge of complexity:

– Should GEF explore / invest in new/different science solutions?

2. Policy miscommunications/misperceptions have serious consequences

– Should GEF have special focus on 'misunderstood' international waters under pressure?

3. Policy – Science dialogue: 2-way street communication

– Should GEF organise targeted policy -> interdisciplinary science - > fora?

4. Science Revolution: One 'Blue Planet' idea

– how can GEF IW harness this revolution?

– Idea to Action: can GEF just get started?

Key Messages

Selected key findings & recommended GEF actions:

- GEF to further explore and fund ways to bridge N-S capacity gap – incl. with regard to access and collection of data & information (incl. concrete specifications of data & origin); support exchange of experiences S-S and N-S; formal training/scholarships, etc.
- GEF funding of/need for integrated/nested models to adapt to different situations and complexities in countries/regions/waterbodies;
- GEF funding of/need for exploring technology innovations – global modeling and data & information access; community/citizen involvement in data collection/monitoring; private sector participation in data collection/sharing/processing (incl. apps);
- Improve two-way flow of communication between policy makers and science community as well as affected stakeholders – incl. via creating common, improved knowledge base and targeted interactions between scientist and policy makers (e.g. request science-policy fora/platforms within projects; improve the communications strategies and targeting to different audiences; demystify misconceptions);
- GEF to build on existing GEF mechanisms (e.g. TWAP; IW:LEARN) to initiate scoping study of 'One Blue Planet' concept (incl. building a one-stop, structured platform & repository of data, information, and models of river basins and other water bodies of the world and at different scales)

Existing projects filling a gap

- IW:LEARN meetings/conferences,
- TWAP – in next phase aiming to build a publically available reposit of information.

Recommendations

- Advancing the 'one Blue Planet' idea through scoping study to identify and address challenges by defining next steps and a 'roadmap' for discussion/input through broad consultations.
- Overview of experiences, challenges and options for use of low cost technologies for greater citizen involvement in data collection and monitoring while maintaining robustness of such information over time.

5 Key Recommendations from the Working Groups and the Closing Session 'The Way Forward'

In the following key recommendations from the working groups on water body types and the Science Policy Interface are highlighted. These were presented by the chairs or rapporteurs at one of the two concluding plenary sessions of the conference.

5.1 Working Groups on Water Body Types

Rapporteur: Chris Severin, GEF Secretariat, and Jacqueline Alder, UNEP

Moderator: Salif Diop, Head of Ecosystems Section, Scientific Assessment Branch, UNEP

5.1.1 Aquifers

Key Messages

- Groundwater seen through the eyes of science - Major challenges ahead:
    - Depletion of groundwater, in particular shallow unconfined aquifers;
    - Groundwater quality degradation.
- Targeted research:
    - Quantify the interaction between surface and groundwater;
    - Remote sensing for groundwater mapping and characterization;
    - Groundwater dependent ecosystems: characteristics, role and economic value.

Recommendations

- National scientists and government agencies should play a lead role in project execution;
- Science based assessments of groundwater resources and harmonized transboundary aquifer monitoring with GEF support;
- Implementation of conjunctive management and use of surface and groundwater resources to reach water security;
- Increase the role and application of social sciences, economic valuation, and the use of scenarios;
- Improve targeted communication of project findings and results to decision makers and enhance the visibility of groundwater by advocating its central role for water- and food security;
- Pay full attention of the drivers of change, including demography, economic development and climate change;

- Adopt a holistic approach in assessing and managing groundwater resources

5.1.2 Lakes

Key Messages

- Need to consider lakes as part of a linked hydrologic continuum in need of integrated management;
- Address gaps in data availability;
- Stakeholder involvement, scientific and indigenous knowledge and ecosystem-based governance are fundamental requirements

Recommendations

- Lakes experts in the GEF-STAP context can make recommendations about types of data and platform that should be included in new lakes projects to improve comparability of data across lakes – specific data expectations – including social information and quality of metadata (minimal requirements for data started already with GEF secretariat) – maybe also include some indicator after project ends;
- Development of simple and clear environmental indicators of lake status;
- Develop a common approach for interfacing of the ILBM methodology and work it out within the IWRM and ICZM methodology – some pilot projects are started.

5.1.3 Rivers

Key Messages

Key limitations for a sustainable management of transboundary river basins include:

- institutional robustness for multilevel governance;
- stakeholder and public participation/ownership;
- data gaps;
- understanding of economics, flow management, water quality and ecosystems dynamics.

Recommendations

Further research and technology development is needed on:

- communication tools;
- socioeconomics and policy analysis;
- indicators and metrics;
- data and information management;

- integrated approaches (across disciplines, sectors (nexus), water systems, drivers including climate change).

The GEF partnership should:

- strengthen its leadership role and partner with other programmes;
- ensure long-term commitment from countries;
- balance sustainability and replicability with a catalytic/experimental approach;
- strengthen project steering committees using local expertise;
- develop monitoring and evaluation beyond the project M&E.

5.1.4 Large Marine Ecosystems and Open Oceans

Key Messages

Emerging Issues:

- Issues of Climate Change and Ocean Acidication , the effectiveness and risks of solutions and appropriate methodologies;
- Synergistic stresses and cumulative effects, incl. interplay of disasters and chronic stress;
- Identification of tipping points, predicting regime shifts and enhancing resilience;
- Threats associated with loss of Arctic sea ice; marine litter; endocrine disruptors; deep sea mining…

There is a need for greater focus on understanding uncertainty in global and regional trends, synergistic threats and cumulative impacts, requiring research that cuts across disciplines and, where appropriate, across water bodies. Prioritization of research requires a structured process with scientifically rigorous and transparent criteria, and needs to be regionally tailored

Recommendations

Broadening the base for scientific input and review:

A mechanism for consistent, systematic, and inter-disciplinary science input is needed throughout the IW project process, co-designed with and reviewed by knowledge users. Scientific input must encompass social and political sciences and economics to effectively assess proximate and distal drivers. In addition the development of a system and community of practice for peer-review should be aimed at.

Effective transformation of scientific data into knowledge for decision support:

- A strengthened foresight process is needed, building on enhanced use of modeling that cuts across systems/disciplines, to enable scenario-based policy support;
- Political and social sciences can provide greater understanding of barriers to policy change or impacts beyond the lifetime of projects.

5.2 Working Groups on the Science Policy Interface

Rapporteur: Thomas Chiramba, UNEP, and Patrick Weiler, IW:LEARN Project

Moderator: Ivan Zavadsky, GEF Secretariat

5.2.1 The role of IW-related science in support of regional cooperation

- Overall observation is that the 1995 GEF IW goal built into new GEF Strategy and provides a sound foundation for collective Transboundary action by enabling agreement between North/South.

1) Scientific evidence for Transboundary stocks and flows is catalytic in generating evidence and incentives for collective action
2) Non-GEF catalytic interventions in the political economic sphere, and environmental diplomacy can create regional cooperation opportunities (From the technical domain to the politic/economic)
3) Repositioning GEF to the realities of regionalization:
    a. Leveraging regional economic institutions is key to ensure sustainability beyond the catalytic GEF intervention.
    b. TDA/SAP could be augmented to widen the evidence based underpinning policy impact and post-project up scaling of GEF results.

5.2.2 Analysis (TDAs), Progress Monitoring (SAPs) and Indicators

Key messages

- Review the IW Tracking Tool (TT) and its indicators to get a consensus on this tool.
- Post project monitoring is essential and needs to be streamlined into the national ministries.
- Revision of the National focal point terms to enable their ongoing engagement in project implementation.

Projects filling a gap

TWAP was mentioned to be key helping to develop indicators and address prioritization and potential research areas.

Recommendations

Research to be considered by the GEF STAP

- Plastics

- Development of rapid assessment/status/proxy environmental indicators
- Valuation of Economic services as a vehicle of the science policy interface

5.2.3 Effective Knowledge Mobilization

- GEF should develop an effective learning strategy, including a meta-database of scientific knowledge that also should capture evaluations of the effectiveness of governance structures, and the transfer of science into project governance and policy. There needs to be official guidance on GEF IW learning budgets (use of 1%).
- Data generated in GEF Projects must be publically available and permanently archived. Corporate policy for data sharing needs to be built into the legally binding project document.
- GEF has to take a more active role in providing knowledge mobilization training to new projects and providing linkages to partners with knowledge of best practices in the area.
- GEF should continue to encourage the use of the IW:LEARN platform for interaction between members and access contact information (including CoPs).

5.2.4 Linking Science to Policy: Strengthening the uptake of scientific findings into policy and practice

- North south divide (needs/interests) & the challenge of complexity
    - Modeling needs to adapt tools and models for temperate climates and developed economies.
    - Data acquisition/Intellectual Property Rights (IPR) – technical and institutional innovation, and open source data/journal, concern ove the cost of IPR.
    - Capacity building

  GEF actions: North-South and South-South partnership, needs developing, and to build science capacity.

- Policy miscommunications/misperceptions have serious consequences

  GEF Actions: Developed FAQ for GEF IW to identify and assess misconceptions, design project communication strategies to address them

- Problem of sectoral silos and disciplines in science

  GEF Actions:
    - Create platforms for dialogue between scientist and policy makers as well as stakeholders,
    - Facilitate message uptake by targeted social media,

- Carry out focused interdisciplinary assessments forecasts and research
- Present results in digestible format.

- Science revolution – one blue planet idea
  - Challenges: creditability quality of info – misuse of info QA access to data - bandwidth varies, assumption that people are willing to engage, shouldn't make that assumption, resilience of info system and flooding systems

GEF Actions:

- New technologies and approaches to address them,
- Proposal for a scoping study to address it,
- Public awareness through social media and networking, games
- Awareness through early warning systems (e.g. through mobile phones).

5.3 Closing Session 'The Way Forward'

Panel Rapporteur: Stephen de Mora, Plymouth Marine Laboratory, UK

Moderator: Joseph Alcamo, Chief Scientist, UNEP

The final session was chaired by Joseph Alcamo (UNEP), with Stephen de Mora (PML) acting as rapporteur. The panel comprised Rae Kwon Chung (ESCAP), Jakob Granit (GEF STAP), Thomas Chiramba (UNEP), Ivan Zavadsky (GEF), and Mish Hamid (IW:LEARN). Joseph Alcamo introduced the final plenary session entitled "The Way Forward" and briefly introduced the panelists and rapporteur.

Jakob Granit offered his thanks to the Government of Thailand and the organizers of the GEF IWSC2012 conference. He noted that this had been an extraordinarily rich event, based on the findings of several International Waters projects. The forward look leads us to consider new areas of technical work and fields of intervention that must be considered, together with elucidating looming science – policy implications. STAP is very happy to engage with International Waters projects. The GEF is a trust fund with specific responsibility in the field of international waters that relies on implementing agencies and the countries, which are the owners of the project. STAP can promote new ideas on science and policy at GEF Council. From the STAP perspective, they are very pleased to be involved in implementation and facilitate outputs of the conference. Thus, STAP can make sure that the findings of the science conference are brought to the attention of the GEF Council for further action.

Ivan Zavadsky expressed his gratitude to all participants for their expertise, energy and commitment to the future. In order to make full use of the results of the conference, we need to ensure that they are better recorded. For example, we need more of the underlying information, where the deficiencies exist and how to measure progress. He noted the absence of eight GEF agencies, apart from UNEP and UNDP. The GEF international taskforce agreed that one outcome of the meeting would be to organise a retreat early next year to incorporate knowledge,

experience and guidance of the conference from here into future strategy – the 2020 Vision. Also, he announced that there would be an International Waters Conference in October 2013 where science will play a central role.

Rae Kwon Chung explored concepts of how to link water with the green economy. ESCAP has recently released a relevant report – a roadmap available online compiling 114 case studies of how to promote green growth in Pacific region (http://www.unescap.org/esd/publications/environment/lcgg-roadmap/Roadmap-FINAL-rev.pdf). Noting that we cannot rely on the present paradigms of cheap water and labor, he expressed the need to improve efficiency in the way we use resources, notably water. To do so, we must improve water management, particularly by promoting a better pricing policy and increasing the awareness of the value of water. Through a change fiscal structure and infrastructure design, water can become a significant driver for green growth. Thus, we need to change the way we work our economy, notably with respect to improved water use and efficiency.

Thomas Chiramba offered his thanks to the remaining participants who had worked so hard over three days. He noted the presentation of many good items that will require further contemplation. In this regard, he questioned how the conference results could help shape freshwater and and marine strategies, and how we could take forward outputs from this meeting. He stated that brokering knowledge is crucial, and that UNEP would like to take part in this process. He believed that in order to link science to policy and vice versa, there was a key role to play in helping scientists to tackle more policy – relevant studies. He confirmed the commitment of UNEP to taking this process forward, noting that this successful conference had already made a lot of progress. Finally, he thanked the organizers of the meeting.

Mish Hamid was both excited and concerned that IW:LEARN was mentioned a lot during the meeting. He looked forward to meeting the challenges identified. IW:LEARN acts as a secretariat for the IW programme and serves all IW projects through a range of activities. They maintain a portfolio results archive, and expect to add a metadata database and improve visualization tools. They have a scientific network, and invited the participation of conference attendees. They have recently produced a Transboundary Waters journal, and invite relevant IW submissions. They revised the TDA-SAP methodology and the Project Managers Manual had scope to improve based on the outputs of this meeting. He promoted two communication tools. Firstly, the Communities of Practice had been praised often during the conference. Secondly, he noted that there would be another GEF International Waters Conference next year. He stated that there would be much work to implement recommendations, particularly as regards suggestions for better indicators, bridging scientific communities, and doing hot spot analyses. He expressed the desire that IW:LEARN continue to play a part in future strategies, and invited all participants to stay in touch and communicate with IW:LEARN.

Joseph Alcamo briefly summarized the final session, commenting on the general agreement for going forward. He thanked the panel for their valuable comments. Apparently some gaps exist between scientific communities and the GEF International Waters family. Mutual benefits could be readily gained if they communicated better with each other. There were several consistent messages expressed over the past three days, such as the importance of social science, monitoring the success of projects, strengthening assessments of the progress of projects, modeling and linking with the green economy. There was a high level of energy throughout the meeting, which should help stimulate rapid progress. In this vein, UNEP will convene a small strategic meeting

in the next couple of months that will include external experts. They will plan the next concrete steps for the GEF International Waters portfolio to benefit from the outcomes of this scientific conference.

Closing Remarks

In their final statements delegates from different institutions pointed at future perspectives in GEF International Waters science. Vladimir Mamaev (UNDP) stated that UNDP fully supports principles of incorporating sound science into proven transboundary management strategic planning methodologies. The methodologies should be applied to GEF IW programs to ensure that decisions on policy and market instruments to address agreed transboundary issues are based on the best possible science (and economics). Sound science has historically been a significant driver in helping to set priorities and identify required actions in a wide range of UNDP/GEF transboundary waters programs, from the Black Sea to the Benguela Current LME to the Nubian Aquifer system. UNDP/GEF upcoming publication, Catalyzing Ocean Finance, documents the tremendous impact of science-based transboundary waters strategic planning methodologies in creating an enabling environment that can catalyze sizeable sums of both public and private finance to restore and protect shared aquatic systems. These methodologies, which include TDA/SAP, Integrated Coastal Management (ICM) and building on regional and global legal frameworks, have proven highly effective at addressing some of the key threats to ocean and freshwater ecosystems including nutrient over-enrichment, overfishing, habitat loss and degradation and invasive aquatic species.

The proven effectiveness of each of these science-based methodologies in affecting policy change and market transformation underscores the value of both continuing their wide application across the portfolio, and scaling them up to other transboundary systems eligible for GEF support in GEF-5 and GEF-6.

6 Conclusions

In summary the GEF IWSC 2012 provided a platform for the science community and policy-makers to share ideas and exchange knowledge on the use of science. The main outcomes of the conference are highlighted hereafter:

- The GEF TDA/SAP process is an appropriate tool for ensuring robust science-based transboundary water body management and assessments and thereby offering a sound methodology for linking science to policy.
- The GEF IW focal area is currently updating the TDA/SAP methodology in order to provide projects with more scientific guidance and advice on emerging issues and horizon scanning.
- The establishment of project Scientific Evidence Panels (including cooperation with the wider scientific community) and project Science Policy Fora should be considered where beneficial to the implementation of project interventions.
- The full IW project cycle should be based on sound scientific evidence and ensure that documentation (including data), access, dissemination and archiving of scientific results facilitate future ex-ante impact monitoring and assessment.
    - This will assist reporting to the GEF Council and other GEF stakeholders on transformations achieved through the GEF interventions.
    - That the GEF IW:LEARN is the platform to capture and process such information.
- GEF agencies, within their comparative advantage, should act on Conference recommendations and continue strengthening interaction between GEF IW projects and the scientific community.
- GEF IW projects should use best available scientific information to develop a set of indicators (including processes, stressors and environmental and socio-economic status) and improve the capacity of the National and Regional Institutions to monitor long-term project impacts.
- The recommendations from IWSC 2012 will strengthen the development and implementation of the GEF-6 IW Strategy.

That the dialogue between scientists, policy makers and project managers will continue through the GEF IW Conferences as the main fora for GEF IW project stakeholders.

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Appendix

Abstracts of Keynote Speakers and Discussants of Plenary Sessions

Aquifers

Name of the Keynote Speaker

Jac van der Gun (GEF IW:Science/Participation as a UNESCO-IHP consultant)

Abstract Title

Transboundary aquifer resources management: how can science be of help?

Abstract

Science and management are completely different fields of human activity, guided by different principles (objectivity versus preferences). The differences may easily lead to a lack of interaction between these fields of activity, or – if interaction does occur – to a lack of mutual understanding between scientists and managers, and even to conflicting views. A more optimistic vision is that science and management can be seen as complementary activities, with a potential for synergy. Exploring how synergy can be established and enhanced then becomes an issue. This paper focuses on such options for synergy in the context of transboundary aquifer management. Making use of science for optimal policy development is certainly an ambition of projects like those in GEF's IW portfolio. The GEF IW: Science project was launched in 2009 to assess the use of science in these projects, to explore options for enhancing the use of science and to create a learning network for the benefit of IW projects and the wider water science community. This paper will summarize the findings of the Groundwater Working Group in that project and reflect on their relevance for improved results of transboundary aquifer projects. The GEF IW: Science project has been structured around a limited number of themes and questions. The emphasis was on aspects that are shared between the different IW components, of which groundwater is only one. This should not deter us from paying attention to other important scientific questions that are highly relevant for underpinning transboundary groundwater resources management . Are all parties speaking the same scientific language? Are policies being built on solid ground? How to deal with differences in exploitation and protection strategies at different sides of the borders? Which part of a transboundary aquifer is really relevant for transboundary aquifer management? Questions like these will be briefly reviewed.

Keywords: Groundwater; Transboundary aquifer management; GEF IW:Science project; Groundwater science.

Name of the Discussant

Cheikh Bécaye Gaye

Abstract Title

Transboundary aquifers management: how can science help?

Abstract

The paper addresses tow key issues related to the management of international waters and particularly transboundary aquifers. The first issue is related to the differences of approaches and methodologies between science and management and the difficulties to transfer the scientific know-how into policy.

This can be illustrated in the field of groundwater where the development of the resources has been rapid, generally unregulated, leading to falling water tables and little understood problems of pollution from both natural and man-made impacts. Numerous scientific investigations have drawn attention to these problems, yet their impact has not resulted in significant institutional actions. Is this the fault of science community to communicate effectively or is it an institutional failure - or both?

The understanding and resolution of this issue is urgent and the framework of the projects like those in the GEF's IW portfolio has been thought to be a good opportunity to build synergies between science and management.

The second part of the keynote presentation elaborates on the findings of the Groundwater working group established for GEF IW: science project to assess the use of science in these projects. It clearly appears from the review of the implemented GEF transboundary groundwater projects that science has played an important role, particularly the hydrological sciences including groundwater hydrodynamics, water quality and application of other tools such isotope hydrology and modelling. Science has provided understanding of water occurrence in most of the projects, great benefits and opportunities but also carries a warning

Yet, deficiencies still remain in scientific knowledge, data, and understanding of the functioning of the aquifer systems under investigation. Disequilibrium still exists between discovery and application, science and practitioner, know-how and end-user, mostly due to lack of methodological holistic approaches involving not only the physical aspects of groundwater systems, but also the management processes in terms of water shares for the different users including the ecosystem and potential impacts (quality and quantity) on the neighbouring countries sharing the resources.

Lakes

Name of the Keynote Speaker

Kelly Munkittrick (Canadian Water Network, University of New Brunswick)

Abstract Title

A global analysis of lakes science and transboundary management

Abstract

The GEF: IW Science Project Lakes working group reviewed 58 projects distributed across Europe (21), Africa (13), Asia (8) and the Americas (8). Due to the nature of the projects, most study areas had some overlap with the rivers working group. Lake ecosystems have some challenges that were not always recognized or dealt with effectively, transboundary lake ecosystems are less linear than river systems, and in general often have higher economic, social and political frictions. Lakes were not often considered as specific ecosystems, and many projects did not consider lake physical processes as a component of the system or as a possible modifier of impacts. In addition to the differences in physical processes, lakes are often more dependent on external drivers such as changing land use, aerial deposition, and climate change. Furthermore, the temporal scale of lake responses are often affected by retention times that result in response time frames longer than project durations. There were some clear factors that improved the success of projects, including the use of pilot projects, rigorous peer review, and international science teams linked to policy development. Climate change affects all ecosystems, and lakes may experience future changes in salinities, water quality, food web structure and biodiversity, fisheries (alternate species, new invasive species), navigation patterns and use of waterways. Developing issues that will continue to affect lake ecosystems include changing agriculture and energy policies, water diversions, biofuels and resource extraction. The emerging science challenges included the need for increasing the focus on the ecosystem level, improving the development of proxy indicators, developing strategies for climate adaptation, and improving our understanding of long-range transport of contaminants, changing chemical use patterns, and the impacts of habitat rehabilitation, including reforestation. The over-arching actions which are needed include effective capacity development and training, planning processes which include policy development and harmonization, and the development of strong regional collaboration. There is an increasing need to strengthen the linkage of science to economic incentives, policy frameworks, and the development of adaptive management capabilities that leads to optimal use of water resources while sustaining ecosystems on which social and economic systems depend.

Keywords: lake ecosystems, transboundary waters, policy development, social and economic linkages

Name of the Discussant

Walter Rast (International Lake Environment Committee, Kusatsu, Japan, and International Center for Watershed Studies, Texas State University)

Abstract Title

Integrated Management of Transboundary Lakes for Sustainable Use

Abstract

The Earth contains an estimated 27 million natural lakes, and another half million artificial lakes (reservoirs), one hectare or greater in size, including approximately 1,600 transboundary lakes. Dramatic features of the global landscape, lakes collectively contain more than 90% of the liquid freshwater on the surface of our planet. Their effective management must accommodate three unique characteristics; namely, a long retention time, an integrating nature, and complex response dynamics. Their long retention times ensures in-lakes changes are incremental, that lake problems can persist for a long time, and finding solutions for them also can take a long time. Their integrating nature means lake issues are mostly inseparable, while their responses to human impacts are often unpredictable and uncontrollable because of their complex dynamics. As barometers of the impacts of human activities in their watersheds, degraded lake conditions are often the trigger for initiating needed remedial actions. Further, lakes are lentic water systems providing a wider range of ecosystem services than other types of water bodies. Accordingly, they are more likely to experience water use conflicts than other water systems, especially transboundary lakes. Downstream water needs also can dictate upstream lake management requirements. Thus, lakes do not exist in isolation of other water systems, but typically have hydrologic connections with inflowing and outflowing river systems, and possible sub-surface systems as well. An integrated approach that recognizes these linked lentic and lotic water systems is essential for effective lake management. Because explicit consideration of these hydrologic linkages, and their assessment and management implications, is often lacking in most IWRM efforts, however, effective lake governance remains problematic, particularly for transboundary lakes.

Rivers

Name of the Keynote Speaker

Mukand Babel (Asian Institute of Technology (AIT)

Abstract Title

Enhancing the Use of Science in Managing and Addressing Complex Issues in International Rivers

Abstract

Understanding the underpinning science behind problems and issues in international rivers is essential in developing and implementing appropriate measures. In an effort to enhance the use of science in International Waters projects of the GEF, the IW: Science project was aimed at assessing how science was and can be used in IW projects to improve results in future GEF projects. The Rivers Working Group reviewed 38 projects implemented in different parts of the globe. Projects reviewed dealt mostly with several other ecosystems (such as lakes, aquifers, coastal areas), with only a few focusing on river basins alone. One of the main challenges in the review was that project documents seemed not designed to highlight the type and use of science in the projects. Nevertheless, substantial information was extracted from the project documents and recommendations were made.

Results of the review indicate that science played an important role in IW projects, mainly as the foundation or basis of project designs and implementation activities. While the use of science helped in achieving project outcomes, several gaps were also identified that need to be considered in future projects. Substantial efforts were observed to cover the coupling of social and ecological systems in addressing river basin issues. However, addressing complex transboundary river issues is even made difficult by the regional and global drivers (climate change, land use change, population and economic growth, varying economic conditions and political systems, trade and globalization, etc.). Local and international scientific entities were engaged in various ways, yet social and policy scientists seemed underrepresented, not to mention the local communities and universities. The preparation of stakeholder involvement plan and appropriating corresponding budget seem promising to address this. The importance of the dissemination of project results is manifested in the use of data and information in other GEF projects and even in national programs. This also indicates the significance of generating and wide dissemination of robust scientific information, along with project ownership and implementation of pilot projects, to influence policy formulation.

In view of the above, it is imperative that in order to enhance the use of science in future projects, GEF needs to develop a mechanism to capture science in all its projects from the beginning to implementation, explicitly include such information in the project deliverables, and widely disseminate these documents to the stakeholders. There is an increasing need of social science integration with natural sciences. Apart from recommendations by the Rivers Working Group, this presentation also includes additional recommendations on addressing emerging issues on rivers including innovative solutions in view of the current science and understanding.

Keywords: Transboundary rivers, social and ecological systems, emerging science issues, engagement of scientific communities, communicating science

Name of Discussant, Charles Vörösmarty (Environmental Cross-Roads Initiative, Department of Civil Engineering, City University of New York, USA

Open Oceans

Name of the Keynote Speaker

Chris O'Brien (Food and Agricultural Organization of the United Nations)

Abstract Title

Open Ocean Science in the GEF

Abstract

The GEF's portfolio of dedicated open ocean projects is relatively small and focuses on governance activities and supporting the environmental dimensions of other initiatives, more than science. This focus, and because most of the Large Marine Ecosystem projects (which include ocean areas) concentrate on coastal waters, means that, overall, there is comparatively little open ocean science being funded by the GEF.

The GEF funds science that answers management questions and the scientific activities in the open ocean to-date have been modest and involved routine methods relating to developing species inventories, modelling ecosystems; and investigating ocean hydrography and productivity. While it appears that no topic of scientific investigation is off the table at the GEF - as long as it answers a critical question for management, the high cost of ocean research and the long term commitments needed for such research are likely to be a major factors limiting the GEFs involvement in funding open ocean science activities.

The forthcoming 'Areas Beyond National Jurisdiction Programme' will be one of the largest single GEF investments in the open oceans to date and it is probably a blue print for future open ocean projects. The programme involves a range of well-considered scientific activities that support the governance objectives and includes basic ecological and bycatch data collection, risk assessments of critical habitats. However, it also includes technological development of electronic compliance techniques and bycatch mitigation; and the relatively new areas of ocean science pertaining to social and economic analyses.

The science that supports the GEF Project Documents in general is often not comprehensive and is poorly analysed in the context of the project being proposed; moreover, the Project documents rarely prescribe specific scientific methods or the production and nature of the scientific outputs. However, the design, implementation and outputs of the open ocean scientific activities following project implementing appear to be sound as most projects use appropriate experts and include processes involving working groups and review panels for technical oversight (e.g. technical working groups). Overall, the best practice comes in the form of ensuring that the science is relevant, performed well and contributes to answering a management question.

Several scientifically credible data sharing systems are available for ocean information systems and GEF projects contribute to these. On the other hand, the publishing of GEF funded science in the peer reviewed literature is not usually prescribed in the Project and this may mean that some important findings are not readily available to the scientific community.

The IW Science Project's global analysis of large marine ecosystems and the open ocean science and transboundary management recommended that the three most pressing critical science issues relate to: climate change, acidification and atmospheric change; life history, ecology and conservation of transboundary stocks; and multiples stressors, tipping points and resilience of coupled social ecological systems.

This list of (management) topics is of limited use to those project designers that seek GEF open oceans funding as the GEF does not appear to have restrictions on the nature and extent of the science it funds - the major criterion appears to be that the science will answer a critical management question. Notwithstanding this, there probably needs to be a marked increase in the amount of work being done in socio-economics science compared to other disciplines.

There are several issues related to non-research activities that also deserve some consideration. These include the need to set up processes to ensure that the science purported to be the basis of project documents and TDAs is comprehensive and interpreted correctly; to better coordinate and integrate the scientific activities undertaken in the open ocean by different agencies; and improve the communication of scientific outputs to policymakers and managers.

Finally, it appears ironic that the GEF does not fund long-term monitoring and observation programmes, yet it relies on such information to establish baselines, assess the impacts of its investments and derive ecological indicators. Perhaps the GEF might better facilitate the integration of different focal area funds e.g. those relating to international waters, biodiversity and climate change to enable some of the more expensive open ocean activities, such as ocean observation programmes, to be supported. Also, perhaps more ways can be found for GEF to indirectly support the agencies that undertake such programmes of work for their mutual benefit, or require beneficiaries to commit to funding this work as part of their cofinancing and commitment to being part of a GEF project.

Name of the Discussant

Corinne Le Quéré (Tyndall Centre for Climate Change Research)

Abstract

The Keynote presentation of Chris O'Brien introduced the role of the open ocean for society, and discussed the ongoing activities and needs of GEF in this particular region. In the discussion, I would like to pick up particularly on the "persistent and emerging issues for international waters from the perspective of the science community outside of the GEF community" that are relevant for the open ocean. Not all of them can be addressed with better or better-coordinated management, but all of them may impact and interfere with projects undertaken by GEF in the next decade. Furthermore, findings from GEF projects could help better quantify the importance of the global issues discussed here, and thus provide key information for international negotiations and research priorities and in return benefit from improved visibility and relevance. Many of the points discussed below have been inspired from new research presented at the second symposium on the Effects of climate change on the world's oceans (May 2012).

Climate Change and Ocean Acidification

It is well established that the ocean surface temperature has warmed by about 0.1°C per decade and sea level has risen by about 2 cm per decade since at least 1970. These changes are accompanied by an acceleration of the water cycle (salty waters becoming saltier, fresh waters fresher), increased winds, increased wave height, and changes in ventilation and ocean circulation. At the same time, the increase of CO2 in the atmosphere is causing the acidification of the surface ocean, and the shoaling of the aragonite and calcite saturation horizon. These physical and chemical changes affect marine biogeochemistry in ways that are difficult to quantify. Some marine species will be affected directly through the destruction of their shells, others via either trophic cascades or ecosystem shifts. The uptake of CO2 by the oceans will also be affected, and thus the important role of the oceans in regulating atmospheric trace gas concentrations and climate could change.

Ocean Deoxygenation

The concentration of oxygen in the intermediate waters of the world oceans (200-700 m) has decreased around the world in the past decades. This signal has been attributed to the effects of climate change, and is consistent with model projections. Ocean deoxygenation appears about twice as fast in the coastal regions than in the open oceans. Ocean deoxygenation raises a numbers of issues regarding the well-being of ecosystems, the emissions of N2O from the ocean, and the possibility of crossing tipping points from a balanced environment (current situation) to a highly stratified and recycling system and the expansion of the oligotrophic waters.

Atmospheric Nutrient Deposition

The deposition of reactive nitrogen from the atmosphere is increasing due to the burning of fossil fuels and the production and use of fertilizers for agriculture. The fertilization of the oceans trough atmospheric nitrogen deposition appears to be increasing new production and carbon export, and could lead to increased N2O emissions from the oceans.

Geoengineering and Iron Fertilization

A range of geoengineering proposals have been suggested to control the effects of climate change, involving both Carbon Dioxide Removal (CDR) or Solar Radiation Management (SRM). Iron fertilization of the oceans is extensively researched, yet its effectiveness is still fiercely debated, and its side effects on the ecosystem essentially

unknown. SRM proposals that affect the atmospheric chemistry could have an impact on surface winds and cloud cover, with impacts on the marine environment.

Plastic Accumulation

Plastics and marine debris accumulate in the world's ocean, particularly in the ocean gyres. The accumulation of plastic debris in the oceans does not follow the rapid increase in disposal of plastic to the ocean, suggesting that plastic debris either sink and accumulate in sediments, are deposited on shore, disintegrate to smaller particles or are ingested by marine organisms. Resolving the fate of plastic accumulation in the ocean is an essential first step to ensure a healthy ocean in the future.

Thresholds, Extreme Events and Tipping Points

Little is known about the self-regulating capacity of marine ecosystems and marine biogeochemical cycles. There is however, a disconnect between the time response of marine ecosystems (days to a few years) and that of the biogeochemical cycles that regulate them (one to a thousand years), so that changes in marine ecosystems could be precursors of more fundamental changes in the earth's functioning. There are many documented evidence of tipping points in marine ecosystems at the regional level, and evidence of large-scale tipping points occurring over long time scales from geological evidence. There is, however, little information available and limited understanding to assess the risks associated with multiple stressors on marine ecosystems at the scale of the open ocean.

Finally, there have been important international efforts to expand, synthesize and analyze observations of lower-trophic marine ecosystems and ocean biogeochemical cycles in recent years, such as the SOCAT project to gather surface ocean CO2 concentration, the MAREMIP project to quantify the carbon concentration of several types of plankton, and the development of biogeochemical sensors to be deployed on ARGO floats. There are also efforts coordinated efforts to produce decadal predictions of climate, which could greatly assist in the assessment of risks and adaptation strategies in the marine environment. These efforts could help inform management studies and benefit from their input in return.

Large Marine Ecosystems

Name of the Keynote Speaker

Annadel Cabanban (Sulu-Celebes LME Project, Coral Triangle Program, UNOPS/UNDP)

Abstract Title

Improving the Use of Science to Attain the Vision for Large Marine Ecosystems and Open Oceans

Abstract

The Global Environment Facility has supported management of Large Marine Ecosystems (LMEs) to address the stressors that originate from the coasts, where human settlements and economic activities are concentrated, and from commercial activities in offshore waters and open oceans where economic activities are increasing. The Land-based Pollution Sources Science and Transboundary Management Working Group and the Large Marine Ecosystems and Open Oceans Working Group have found that secondary scientific data and information were generally used in preparing the Transboundary Diagnostic Analysis but targeted research for management is few. The emerging issues of climate change, atmospheric changes, and acidification, insufficient recognition of transboundary stocks, persistence of microplastics and lifestyle compounds in marine waters, the interaction of multi-stressors, the tipping-points, and the resiliency of ecosystems were not yet studied in depth. Scientific findings from applied research and resulting from projects as well as formulation and implementation of the Strategic Action Program, were not well-documented and disseminated. Monitoring of stress reduction and outcome/impact indicators were not conducted systematically by the relevant agencies. Some of the practices that were identified, that can enhance the use science for LME management, are: 1. establishing a scientific advisory group; 2. establishing integrated information management system; 4. conducting regional scientific conferences; 4. conducting dialogues between scientists and policy-makers. The challenge to achieve short-term and long-term objectives and to attain the ultimate goal of the improvement of LMEs is the execution of regulatory actions at the scale of the coasts and hotspots and the scaling-up of the outcomes to the (regional) LME-level. The incorporation of behavioral science with natural and social sciences in formulating and implementing management and monitoring plans is one innovation to explore, especially at local scales. The linkage of two concepts in financing for environmental work and community development, i.e., payment for ecosystem services and corporate social responsibility, can be explored (for local to regional scale) and advanced to co-finance, with governmental agencies and regional institutions, the needed monitoring of stress and impact indicators, support for applied and targeted research and multi-causality of environmental problems, and the dissemination of scientific results in regional conferences.

Keywords: Large Marine Ecosystems, Land-based Pollution Sources, use of science, adaptive management

Name of the Discussant

Qisheng Tang (Yellow Sea Fisheries Research Institute)

Abstract Title

Climate Change Effects in the Yellow Sea Large Marine Ecosystem and Adaptive Actions in Ecosystem Based Management

Abstract

The Yellow Sea is a typical large marine ecosystem with distinctive bathymetry, hydrography, productivity, and trophically dependent populations. Shallow but rich in nutrients and resources, the Yellow Sea Large Marine Ecosystem (YSLME) has productive and varied coastal, offshore, and transboundary fisheries. Over the past several decades, the resource populations in the YSLME have changed greatly with the variable states of productivity and biomass yields under the influence of climate change and anthropogenic forcing. Many valuable resources are threatened by unsustainable exploitation and by the effects of climate change. Promoting sustainable development of the sea and implementing effective management strategies is an important and urgent task. In order to replace the loss of capture fisheries in the YSLME, the UNDP-GEF supported YSLME program initiated a pilot project using an innovative integrated multi-trophic aquaculture (IMTA) approach. The IMTA technology includes the production of algae (kelp), mollusks (abalone) bivalves (bay scallop), and echinoderms (sea cucumber) to help close the fisheries protein gap, while capture fisheries recover to sustainable levels. Preliminary results suggest that the IMTA pilot should be expanded throughout the YSLME and into other Asian LMEs, where applications could provide job opportunities as well as food security. The IMTA pilot project proved to be highly energy efficient and optimized the carrying capacity of coastal embayments while improving water quality, increasing protein yields, and, through carbon capture, contributing to mitigation of the effects of climate change. To reduce stress and promote the sustainable development of Yellow Sea LME and its watershed, the establishment of joint research programs for monitoring and assessing the YSLME using ecosystem based management is very necessary. Suggestions for adaptive actions in ecosystem-based management in the YSLME will also be discussed.

Keywords: large marine ecosystems, climate change, ecosystem-based management, integrated multi-trophic aquaculture

Science Policy Interface Session

Name of the Keynote Speaker

Alfred M. Duda (GEF Senior Advisor, Retired)

Abstract Title

Introduction to Science Policy Interface and Recommended GEF Processes

Abstract

The GEF International Waters (IW) focal area represents $1.3 billion in GEF grants along with over $7 billion in co-financing for projects addressing transboundary surface, ground water, and Large Marine Ecosystems and their coasts. 170 countries, 149 of the GEF eligible, have worked together on their shared transboundary concerns and opportunities over the 20 years of the GEF. More than any GEF area, IW is so very complex, politically charged, and in need of processes that harness the science community so that complexity can be broken down into manageable chunks and governments do not politically skew nor ignore important transboundary issues.

The aim of this Science/Policy Interface Session is to promote discussion among GEF IW practitioners about the recommended processes and key factors that can help to inform management decision-making at all levels from the multi-country transboundary scale to national sector scale to subnational entities ranging from provinces and watersheds to communities. What has worked, what can be useful? Another overarching scale--the global scale--is also discussed with the GEF Secretariat commissioning a number of initiatives. This keynote outlines processes and key factors associated with GEF IW projects over the years to bring science, developing country scientists, and science processes to help engage transboundary waters. The processes range from: the Transboundary Diagnostic Analysis (TDA) to science advisory bodies for the TDA, science advisory bodies for transboundary basin and LME institutions, transboundary science conferences in IW projects, activity centers, GEF targeted research projects, M & E indicator development and sampling requirements, co-management based on scientific extension services, and adaptive management strategies utilizing periodic TDAs or state of the water environment reporting to catalyze action.

On the global scale, global assessments such as GEF GIWA or the GEF TWAP, effectiveness reviews such as undertaken by the GEF EO or the GEF IW Science Project, global social science learning and capacity building like GEF IW:LEARN, GEF global targeted research or methodology development IW projects, and work of the GEF STAP all help put a focus on science. Key features can also be listed and include first and foremost a project manager/CTA with credibility, fearlessness, and political savvy as well as GEF agency backstopping expertise with a stubborn streak to enforce GEF recommended processes, adequate budget from all sources, and stronger commitments from ALL GEF agencies to participate in the GEF IW Task Force and in GEF IW events. If GEF agencies and their project managers don't walk the talk, inherent complexity and political interference in transboundary projects will ensure that science and the local science community will be missing from projects and decision-makers will throw their hands up in confusion and not move from the status quo.

Keywords: Science Policy Interface, Improved Decisionmaking, Participation, Social Sciences, GEF International Waters Processes, TDA, SAP

Name of the Discussant

Jakob Granit (International Waters Panel Member; GEF Scientific and Technical Advisory Panel (STAP) and Centre Director Stockholm Environment Institute, Sweden)

Abstract

The GEF International Waters GEF5 goal, which includes a call for the promotion of collective management for transboundary water systems with the aim of contributing to sustainable use and maintenance of ecosystem services, remains as relevant today as it was when formulated in 1995. The issues addressed by the GEF, however, continue to be very challenging; 80% of the world's population remains exposed to high levels of threat to human water security, while virtually no marine area is unaffected by human impact and low oxygen 'dead zones' in coastal oceans have spread exponentially since the 1960s.

The GEF has created well-respected tools to apply science to determine baseline status, project design and management in addressing challenging issues in transboundary waters, but their continuing poor state is not due to a science deficit but, as Stephen Olsen puts it, 'Failures and poor performance in ecosystem management lie primarily in the realm of governance, not in science knowledge'. Given the evolution of governance from top-down government-driven towards a 'network-centric' world in which civil society, business and government collectively negotiate outcomes and benefits, based on a nexus of drivers including water security, energy security, food security and the provision of ecosystem goods and services, science needs to be relevant for collective action. Accordingly the role of social sciences should be increased within the GEF to support policy choices for collective action.

The GEF can usefully reflect on whether its approaches and tools are effective today. It is true that scientific evidence, as developed through GEF financed projects addressing transboundary stocks and flows, is often catalytic in generating compelling evidence and thereby providing incentives for collective action by riparian states. However, transboundary waters governance and management may link more strongly to the emerging broader regional political and economic frameworks and institutions and it could be argued that leveraging of regional economic institutions is key to ensuring sustainability beyond the catalytic GEF intervention. The TDA/SAP process could be augmented to widen the evidence base underpinning policy impact and post-project up-scaling of GEF results; upstream activities addressing the political economy of cooperation could be included.

Encouragingly, evidence is emerging that non-project GEF catalytic interventions in the political/economic sphere, including environmental diplomacy, can create regional cooperative opportunities; such interventions could be explored by the GEF, including re-positioning to address the realities of ongoing regionalization processes running in parallel to global in preparation for the 6th replenishment period, supported by policy-relevant science that transcends national and regional boundaries.

Lakes Working Group Documentation:

Overarching Full Assessment considering Questions addressing specifically the Working Group Objectives (see section 3.3.2)

Rapporteurs: Meredith Miller, International Center for Watershed Studies, Texas State University, USA and Isabelle Vanderbeck, UNEP (Day 1); Daniel Olago, Department of Geology, University of Nairobi, Kenya (Day 2)

Chairs: Masahisa Nakamura, Research Center for Sustainability and Environment, Shiga University, Japan (Day one); Kelly Munkittrick, Canadian Water Network, University of New Brunswick, Canada

Questions Considered During the Break-out Session to Address the Objectives

What are the key elements/ pressing scientific issues (including cross-cutting and socio-economic) for lake ecosystems?

What scientific knowledge is needed to guide policy responses and develop solutions to priority issues?

How can we enhance/improve mechanisms that facilitate the design, conduct, and integrations into decision and policy-making?

How can science contribute towards better integration of ecosystems services provided across different geographical and time scales into the valuation of water body types?

What does the large body of science on climate change means to ongoing and future management of lakes?

What are the 5 top priorities emanating from the scientific evidence in lakes and international waters in general for the next decade according to the group?

What specific types of lakes projects are required?

What are some of the considerations for best management practices?

How, based on the scientific knowledge available, should the GEF International Waters portfolio and its stakeholders prepare to respond to these major challenges over the next 10 years?

- ***OBJECTIVE 1: Identify persistent and emerging issues facing respective transboundary water body types.***
- ***OBJECTIVE 2: Discuss the science required to address these issues.***

PERSISTENT ISSUES	HOW TO ADDRESS
• Synthesis of baseline data; availability of databases; • data incompatibility or non-comparable; • difficulty of data access post-project,	• Perhaps use the IW learn platform and link it to existing databases (ILEC World Lakes Database; Russian Academy of Science WorldBase, HYDREA, and other available databases) – need some sort of global

including that used to formulate the TDAs - no continuity and nothing to showcase; • linking lakes dbase to rivers, groundwater, LME/Open Oceans dbases.	database to make them useful collectively • develop guidelines for data collection • Inventory available databases and their characteristics as they are useful for project development and in assessment phase of TDA; • Consider the world open ocean data repository as a model - expand IWLearn capability to not only archive project reports but have a data repository
• Issue related to host institution for data collected in a project to keep it available and to keep the baseline data which is collated, and to keep the data available post project closure	• in some cases challenge is institution to host the data collected – needs deliberate investment
• Integration of social, economic and political science - these issues are often not well addressed	• Need inventory of social databases? • need to identify what data is needed for political decisions (scientists always want more- what is the minimum needed for decision) – must include summary/brief with data to expand usefulness
• Post-project unsustainability	• promote stakeholder ownership of projects by involving them from the beginning; • capacity building; • policy makers to involve scientists in policy process (e.g. formulation) arising from science-based outputs; • Raise funds from the project lake e.g. Lake Victoria has Fish Levy Trust and Environmental Trust Fund - also good for leveraging additional funds
• Integration of external drivers such as contributing drainages, changing land use, aerial deposition, and climate change;	• Incorporate in project planning/initiation stages

Irrigation needs versus other water services - food water nexus	
• improving our understanding of long-range transport of contaminants, changing chemical use patterns, and the impacts of habitat rehabilitation, including reforestation	• Incorporate in project planning/initiation stages
• need explicit recognition of water linkages to other types	• Incorporate in project planning/initiation stages
• Lack of a basic set of common environmental indicators for lakes	• Lake experts can make recommendations about types of data and platform that should be included in new lakes projects to improve comparability of data across lakes – specific data expectations – including social information and quality of metadata (minimal requirements for data started already with GEF secretariat – maybe also include some indicator after project ends)

EMERGING ISSUES	**HOW TO ADDRESS**
• Emerging approaches and methodology for integrated lake management	• Develop an integrated framework protocol for linking ILBM, IWRM and ICZM methodologies to enhance hydrological linkages aspects of water studies
• How can science contribute towards better integration of ecosystems services provided across different geographical and time scales into the valuation of water body types? - ongoing challenges related to a lack of regional infrastructure - how to quantify the value of in-stream flows from contributing drainages - how to tie downstream needs	• development of better models, calibration and evaluation • economic valuation applied in the context of south china sea – convert values into a common currency and change over time by consumer price index – need to integrate • need good indicators, and mechanisms to work across • idea of linkages between upstream, contributing drainages, downstream,

	estuarine and coastal
• Global warming/climate change - lake warming impacts - changing water quality and quantity impacts - In some jurisdictions, increases in dams related to future water needs associated with climate change - mitigation and adaptation challenges	• IW Learn needs to look and get linkages to international efforts on climate change that are not integrated • Be ready for surprises in the future - we do not know tipping points nor thresholds
• Disaster prevention issues	• Incorporate in project planning stages
• Role of lakes in the Green Economy (Rio+20)	• Derive economic valuation of lake ecosystem goods and services as lakes are major sources of livelihoods in developing countries
• Invasive species and non-point pollution	• Specify indicators for monitoring; • devise technological and managerial interventions; • define "necessary" conditions and "sufficient" conditions for e.g. stress reduction

- ***Discuss how the status and sustainable management of transboundary waters can be improved through the use of science and the consideration of cross-cutting issues.***

The issues discussed here were:

1. What scientific issues needed to be addressed
2. Scientific knowledge needs to inform policy responses and develop solutions to priority issues
3. Enhance/improve mechanisms that facilitate the design, conduct, and integration of science into decision and policy-making

1. Specific scientific issues to address:

- need better models (belongs in science/knowledge needs)
- long term monitoring data – also for science needs

2. Scientific knowledge needs to inform policy responses and develop solutions to priority issues:

- identify and develop a strategy and evaluation procedures for dealing with implementation barriers
- need to identify what data is needed for political decisions (scientists always want more- what is the minimum needed for decision) – must include summary/brief with data to expand usefulness
- mechanisms needed to surmount communication barriers, e.g. embed communication strategist in GEF projects
- development of a process to link and predict and manage impact of data generated to potential social responses
- linkages of social and political potential responses to allow integration of potential responses
- DSS tools for communication and modelling – make a more robust DSS for policy-makers
- Integration of discussions with politicians early in the process, involvement of intermediaries
- Economic data and economic and values on goods and services - Evaluation of goods and services of the lakes – need info for evaluation of tradeoffs
- Transferability and comparability of subjective and qualitative economic data and transfer valuations – changes in demands, use and values – linkages of natural scientists with economic scientists needed

3. Enhance/improve mechanisms that facilitate the design, conduct, and integration of science into decision and policy-making:

- a need for more rigorous study designs and regular effective evaluation of project deliverables
- early and collaborative setting of objectives
- involvement of public stakeholders in a process that included a commitment to public engagement, acceptance and uptake of recommendations
- a representative balance between local and international scientists,
- a commitment to regular review and peer scientific review during data collection
- institutionalization can be a challenge
- need to take some steps to make science more popular – increase public awareness, and communicate science to the public stakeholders - projects develop communication strategies,
- opportunities for public:private partnerships
- 2005 world bank report – chapter 8 reviews 28 lakes in terms of lake-based management-
- development of requirements into legal framework for the development of management plans, requirement to renew management framework and planning on a cyclical basis,
- development of environmental status indicators and setting of targets and requirements for monitoring towards achievement of targets,
- involvement of politicians into the scientific process in terms of both the science background and publicity
- increase public profile and use social factors as driving factor for continuing long term monitoring
- focus on developing a sustained platform to continue benefits of project

- mechanism for direct interaction of politicians and scientists in interpreting and implementing or developing outcome – need to make sure data is interpretable by politicians and interpreted correctly – co-locate political meetings and scientific meetings
- present policy makers with a range of plausible scenarios due to uncertainties related to data quality/availability; use of analogs to convey scenarios to policy makers in relation to systems that lack adequate data for direct policy guidance.

- ***EXPECTED OUTPUT 1: A list of science-based priority issues for guiding research and management of transboundary waters.***

- **Science-based priority issues specific to lakes:**
    - Database and data availability and knowledge base linkages
    - Economic data valuation and social systems
    - Linkages of lake issues to other hydrologic systems
    - Understanding the impacts of climate change for lake systems
    - Clear, simple, scientific, environmental indicators that inform political processes
    - High altitude, African lake, coastal lagoon clusters that include both national and international lakes in the clusters

- **What specific type of lakes projects are required:**
    - Review of lake management projects
    - Development of guidance for the development of consistent information requirements and basic data sets that would be required across different sets of systems
    - Development of simple and clear environmental indicators of status
    - Look at non-transboundary lakes for extrapolations of tools to transboundary lakes - TDA-SAP-ILBM linkages (i.e San Juan river basin studies)
    - Develop an approach to develop a common approach for interfacing of the ILBM methodology and work it out within the IWRM and ICZM methodology – some pilot projects are started
    - Twinning project of Great Lakes with African lakes and using it as a platform to test out the applications
        - Impacts of warming in African lakes
        - Use capabilities from previous UNEP large lake studies to move issues forward
    - Documentation of legal challenges – need to link decisions at a national level to international level to improve the international buy-in
    - Comparison of ILEC priorities and IWScience priorities for studies

- ***EXPECTED OUTPUT 2: Concrete recommendations for the GEF portfolio on the use of science to address transboundary waters issues over the next ten years.***

- Development of projects that look at the system holistically – the whole natural system including the rivers, groundwater and the lakes, and activities within the basin - for example, many projects did not consider lake physical processes as a component of the system or as a possible modifier of impacts

- Review databases with lake metadata and come up with a list of priority indicators to be included in baseline studies, and look for linkages to IWLearn (link to visualization tool by ecosystem type)
- Need some sort of global database to make them useful collectively and need at least an inventory of what databases are available and their characteristics
- Need general environmental indicators for all system types
- Lake community needs to provide more detailed information on what should be collected when doing a TDA for lakes
- Develop specific indicators to monitor the impact of the GEF project
- Use the economic valuation tools during the TDA process
- Develop approaches for developing a legacy strategy for self-sustainability
- identify best practices for developing panel and make suggestion to GEF that such a body should be part of the agreement in the signing for transboundary lake projects
- Require that there is a scientific panel evaluation is included in each of TDA SAP projects to help them develop their priorities (can this be a Best Practice – do they exist for Lakes??)
- Not sure who will be the scientific body – but sit with IW Learn to identify best practices for developing panel and make suggestion to GEF that such a body should be part of the agreement in the signing for transboundary lake projects
- Roadmap or guidelines for developing lake management strategy including communication plans
- Make GEF aware of the approaches being taken in different basins and integrate them to meet their needs