IAH Commission on Managing Aquifer Recharge Plenary
3.40 – 5.00pm, Tues 21 June 2016
Main Hall, Palace of Mines, Mexico City, ISMAR9, Mexico

Present: 83 Attendees from 21 countries.

Agenda:
1. Welcome and Introductions
2. Objectives of Commission
3. UNESCO IHP VIII 2014-2021 context for IAH-MAR role
4. Reports and Plans of Working Groups
   1. Monograph on clogging and its management – Russell Martin
   2. MAR for Development – Yan Zheng
   5. MAR to MARket – Enrique Fernandez Escalante
   6. Global MAR Inventory – Catalin Stefan and Nienke Ansems
   7. 60 years history of MAR – Peter Dillon and Pieter Stuyfzand
   2. MAR Policy and economics – Sharon Megdal;
   4. Adaption to climate change – Bridgit Scanlon (joint with IAH GW & Climate Change Com.)
5. Scientific Publications from ISMAR8 and 9
6. ISMAR10 Announcement and Invitation
7. Information Sharing
   1. GRIPP GW Solutions Initiative for Policy & Practice – Paul Pavelic
   2. MAR-NET activities in China – Weiping Wang
   3. Recent outputs from the EU MAR Projects – ?
   4. South Asia Groundwater Forum- Peter Dillon
8. IAH Recognition of service to MAR – António Chambel
9. Election of IAH-MAR Co-chairs - António Chambel
10. Suggestions for new activities – anyone
11. Volunteers to participate in activities – anyone
12. Information sharing on MAR (not covered elsewhere in ISMAR9) - anyone

Notes of Meeting:

1. Welcome and Introductions
   Peter Dillon on behalf of Co-Chairs, Weiping Wang (China) and Enrique Fernandez Escalante (Spain) welcomed Antonio Chambel, IAH Vice President (Science and Programmes). He warmly welcomed all attendees, particularly those who have attended multiple plenaries and those attending their first IAH-MAR Plenary. Apologies were given on behalf of Alice Aureli of UNESCO and Ben Willardson of ASCE MAR Stds Committee. ASCE, IAH, and UNESCO and are the enduring partners in the ISMAR series. In this year as in ISMAR6 (Phoenix 2007) we are delighted to be joined by Arizona Hydrological Society and also now Groundwater Resources Assoc of California, the two organisations behind BSMAR15.

   He thanked Adriana Palama Nava and the organizing committee of ISMAR9 for organizing an excellent symposium and providing for the Plenary as a single session so that all can participate.
2. Objectives of Commission
Weiping summarised the commission’s objectives as per the website (www.iah.org/recharge)

- To promote the securing and expanding of water resources and improving water quality in ways that are appropriate, environmentally sustainable, technically viable, economic and socially desirable.
- To encourage research, development and adoption of improved practices for management of aquifer recharge
- To improve knowledge, skills and capabilities of practitioners, water resources managers and regulators.
- To facilitate international exchange of information between members (e.g. via a web page and an email list), by disseminating results of research and practical experience (e.g. via conferences and workshops), raising awareness of MAR among IAH members, related professions and the community, and its members undertaking projects and activities identified in plenaries as important.

IAH-MAR activities aligns with the Strategic Plan of UNESCO IHP-VIII (2014-2021) “WATER SECURITY: RESPONSES TO LOCAL, REGIONAL, AND GLOBAL CHALLENGES”

Weiping, on behalf of Alice Aureli, UNESCO IHP, Paris, described how IAH-MAR contributes to International Hydrological Programme VIII (2014-2021) and specifically how the commission supports the achievement of Theme 2 (Groundwater in a changing environment), Focal Area 2.2 (Addressing strategies for management of aquifer recharge).

Focus Area #2.2 Strategies for MAR

General objective:
Improve security and quality of water supplies especially in water scarce areas under climate change and population growth.

The Specific Objectives of IHP Strategies for MAR have influenced the formation of IAH-MAR working groups (whose reports are given at item 5) and progress these objectives.

Specific Objectives:
1. Integrate managed aquifer recharge into IWRM to address effects of locally changing climate (WG4), population and food production (WG2, WG3, & joint proposal IAH-UNESCO –now being followed up within GRIPP proposal of IWMI and partners, incl. IGRAC, IAH)
2. Develop and apply methods to assess impacts of recharge structures on water availability and quality, social and economic resilience and local ecosystems (WG2,WG3, WG6, ISMAR9 (SWARM J and J Water thematic issues)
3. Evaluate the costs and benefits of recycling of appropriately treated urban waste and storm water for aquifer recharge (WG5, ISMAR9 (J Water thematic issue)...plus new WG
5. Develop a scientific basis for the prevention and management of clogging (WG1)

Reports from these Working Groups are given later in the meeting.
4. Reports and Plans of Working Groups

These are listed under five active groups; 1,3,5,6,7 and two groups that have disbanded having completed their tasks: 2,4.

1. Monograph on clogging and its management – Russell Martin

Monograph on clogging and its management (ed:– Russell Martin (Aqueon Pty Ltd) was mounted on IAH-MAR web site before ISMAR8, Oct 2013: www.iah.org/recharge/clogging.htm

However more contributions are needed, particularly on management of clogging and synthesis of data from multiple sites and standardization of investigation methods. Russell intends to edit a sequel monograph on these topics. Please contact Russell if you wish to contribute, or are aware of relevant open access material: russell.martin@aqueon.com.au

3. MAR for Development – Yan Zheng

Summary of activities and outcomes of UNESCO-IAH Workshop, 20 June 2016, ISMAR9, Mexico City:

Decision makers, especially those in low and middle income countries, are generally unaware of MAR, let alone the economic and ecological benefits of MAR, resulting in a lack of enthusiasm in including MAR as part of the water resources management portfolio. Dissemination of information on selected successful MAR projects in all countries may help. However, the metrics for measuring success MAR project are not well defined and could vary. To what extent you agree that the IAH MAR for Development Working Group should work on developing such metrics to help identify successful MAR projects in low, middle and high income countries?

Total Response: 18 (Research 11, Client/Consulting etc 7)
Strongly Agree 13 (72%)  Agree 3(17%)  Slightly Disagree 1(5.5%)  no answer 1(5.5%)

Action Items for working group:
- Place MAR within the framework of groundwater storage, conjunctive groundwater management and sustainability.
- Help individual hydrogeologists
  - Identify long running MAR projects with a goal of developing a common metrics of measuring success for MAR professionals
  - Develop factsheets in multiple languages for decision makers
- Raise awareness among decision makers locally and globally
  - Work with IAH and others to promote the concept of groundwater storage/sustainability during Stockholm water week at global level
  - Identify volunteer at country/local government level
  - Educate civil engineers through online courses such as “Groundwater for Civil Engineers” (Sth Africa-Ricky Murray; UNEP-Saroj Sharma)

Proposed Output: Products (factsheets, online course) available on IAH website, peer reviewed publication for success metrics development.

Anyone with a case study or interested in joining please contact: yan.zheng.unicef@gmail.com

The working group also convened a Chinese Workshop 7 Sept 2015 at Peking University on forming MAR Guidelines for China had unanimously agreed to proceed to offer to the most appropriate Ministry, to form a technical group of members of China MAR Network to develop
the guidelines. This work is being led by Yan Zheng and Weiping Wang. It is also proposed for comprehensive monitoring of selected demonstration / research sites.

5. MAR to MARket – Enrique Fernandez Escalante

Widening MAR applications with European Innovation Network (& other communications activities) (commenced ISMAR8, Beijing 2013) – To identify and communicate effectively with a wide range of water users and water managers to explain MAR and its benefits. Main case study site- Arenales aquifer (c y l, Spain). Engaging with: Agro-industry, Water supply industry, Waste water treatment plants (SAT), Desalination companies, Bottled water companies, Public administration, Balnearies & spas (sallus per aquam), Hotels and tourist facilities (market uptake). Contact: Dr. Enrique Fernández Escalante, Department Research and Development (Tragsa Group), E-mail: efernan6@tragsa.es, dinamar@tragsa.es, Tel. +34 91322 6106

6. Global MAR Inventory – Catalin Stefan and Nienke Ansems

Working group commenced Sept 2015 at IAH-MAR Plenary, IAH Congress 43, Rome. 1200 case studies have been identified from literature. These are already available via IGRAC MAR Portal: marportal.un-igrac.org The Group is seeking to input more sites. See this web site.

Summary of activities and outcomes of IAH Workshop, 20 June 2016, ISMAR9, Mexico City:

A better dissemination of results from successful projects could help stakeholders to understand the benefits of MAR and adopt the methodology on a larger scale.
The Workshop was led by Catalin Stefan (TU Dresden) and Nienke Ansems (IGRAC) and including Christoph Sprenger (Berlin KW8), Andrew Ross (ANU) and Peter Dillon (IAH), and discussed:

- The methodology for data collection, key information collected, statistical data analysis;
- Introduction of MAR portal, testing various features
- Group discussions to address improvements and continuation and updating of the inventory

Conclusions:

- **Validation of the MAR portal**
  - Useful tool for MAR promotion, to inspire and motivate people;
  - Reference to find MAR projects in the region;
  - Recommendations for further improvement (additional information on groundwater stress, hydrogeology, climate zones).

- **Identification of gaps and utilisation for MAR promotion**
  - Include additional parameters (e.g. depositional environment, financial costs, cost-effectiveness of MAR), identify new approaches for filling the gaps (water quality, year of shut-down, operational scale), crowd-sourcing development.

- **Main outcomes and follow-up**
  - Dissemination of global inventory and MAR portal, suggestions for improvement;
  - Initiation of national focus points (Brazil);
  - Setup of online discussion board and template for data submission – facilitation of database update, everyone invited to contribute.

7. **60 years history of MAR – Peter Dillon and Pieter Stuyfzand**

A working group has formed convened by Peter Dillon and Pieter Stuyfzand to contribute national and technology perspectives on this topic, for presentation as an international summary in Montpellier IAH Congress, Sept 2016 and for subsequent publication in a thematic
Hydrogeology J issue celebrating IAH’s 60th year. To date draft precis for Australia, China, India, Israel, Netherlands, Spain, Sth East Asia, and for ASR in USA have been received, others are in progress. Anyone interested in contributing their national history in MAR, or for a specific methodology, we have some vacancies. Please contact either leader.

2. MAR Policy and economics – Sharon Megdal;

This WG commenced at ISMAR8, Beijing, 2013, with the aim of completing a special issue based on the ISMAR8 papers on this topic. This was achieved and the special issue of the open access MDPI Journal Water was published in early 2015, edited by Sharon Megdal (University of Arizona) and Peter Dillon: [http://www.mdpi.com/journal/water/special_issues/MAR](http://www.mdpi.com/journal/water/special_issues/MAR)

This is now available in book form and can be downloaded free or bought as hard copy at: [http://books.mdpi.com/pdfview/book/141](http://books.mdpi.com/pdfview/book/141). Cost is CHF82 + shipping from Switzerland: (within Europe 12 to 24 CHF and beyond Europe 18 to 32 CHF). As the working group has completed its task it has closed.

4. Adaption to climate change – Bridgit Scanlon (joint with GW & Climate Change Comm.)

(This WG commenced at 39th IAH Congress Niagara Falls). Vladimir Smakhtin (IWMI) and Bridget Scanlon (U. Texas at Austin) edited a Special Issue of Environmental Research Letters, an open access journal. This was done jointly with IAH Commission on Groundwater and Climate Change. Ten papers were published, two focused on MAR (in Saudi Arabia, California and Arizona). The issue is found at: [http://iopscience.iop.org/1748-9326/focus/Water%20Storage%20for%20Managing%20Climate%20Extremes%20and%20Change](http://iopscience.iop.org/1748-9326/focus/Water%20Storage%20for%20Managing%20Climate%20Extremes%20and%20Change) The working group has successfully completed its task and has closed.

5. Scientific Publications from ISMAR8 and ISMAR9

Scientific Publications from ISMAR8

The scientific committee of ISMAR8 led by Prof Xuan Zhao and our Commission co-chair Weiping Wang, took a decision to publish as many papers as possible in journals. Of the >85 oral papers and 37 poster papers presented, 33 were selected for publishing in special issues of three journals. This has been a successful venture in maximising the future accessibility of peer reviewed papers. Specific outputs occurring as a result of much activity in 2014 are :

- **Water**- the MDPI open access journal:
  - *Policy and Economics of Managed Aquifer Recharge and Water Banking*
  - 14 papers, collated on web site in Feb 2015 and downloadable will also be reprinted in book form.
  - Edited by Sharon Megdal and Peter Dillon

  - Edited by Zhuping Sheng and Xuan Zhao.
  - 12 papers abstracts are found at [http://ascelibrary.org/toc/jhyeff/20/3](http://ascelibrary.org/toc/jhyeff/20/3)

- **Environmental Earth Sciences**, Volume 73, No 12, June 2015: Thematic Issue ISMAR8 China
  - Edited by Xuan Zhao and Weiping Wang
  - 17 papers abstracts are found at [http://link.springer.com/journal/12665/73/12/page/1](http://link.springer.com/journal/12665/73/12/page/1)
Other reviewed papers and volunteered powerpoint slides are on www.iah.org/recharge. Poster papers were documented or photographed by Enrique Fernandez Escalante and uploaded for all to see at http://www.dina-mar.es/post/2013/11/27/P-ISMAR-serie-Titulo-5-P-ISMAR-8-(descarga-gratuita-del-Ebook-Free-download).aspx

Scientific Publications from ISMAR9

Recognising that many do not have access to library services, ISMAR9 followed the trend for journal publication set in ISMAR8, and received offers from two open access journals to produce thematic issues based on papers presented at ISMAR9 in two themes without author charges. Papers will be reviewed by the editorial team and selections made and offers made to authors to submit their papers by the journal web-based systems.

Special Issue: Water Quality Considerations for Managed Aquifer Recharge Systems
Journal: Water (MDPI)
Special Issue Editor: Prof. Pieter J. Stuyfzand
Deadline: 31 October 2016

Thematic Issue: Integrated Water Management Incorporating Managed Aquifer Recharge
Journal: Sustainable Water Resources Management (Springer)
Thematic Issue Editor: Peter Dillon, Weiping Wang, Paul Pavelic and Adriana Palma Nava
Deadline: Papers presented at ISMAR9 and received in full by 31 October 2016

Papers which have unpublished high value data or are otherwise meritorious but for which a journal is not the appropriate means of communication, will be considered for web publication on the IAH-MAR web site following peer review. Scientific Committee members and others may be contacted to assist with reviews of full papers.

6. ISMAR10 Announcement – Madrid, Spain, May 2019 – Enrique Fernandez Escalante

Enrique invited all present to come to Spain for ISMAR10 in May 2019. The Symposium Organizing Committee includes experts from Spain, Netherlands and Portugal. There are a constellation of European Commission Projects with results to be presented at ISMAR10. Enrique will Chair the Organizing Committee. This is a great follow up to ISMAR9 and we hope many from Latin America will come beside the Symposium receiving strong support from Europe, USA and around the world. Enrique conducted

7. Information Sharing

1. GRIPP - GW Solutions Initiative for Policy & Practice – Paul Pavelic
Paul Pavelic (IWMI) presented information on this major initiative with multiple partners that picks up from the Global Groundwater Governance Program to see implementation of policies and policy reform in managing systems with unsustainable groundwater use particularly for agriculture. IGRAC and IAH have agreed to partner GRIPP. MAR has a role within this Initiative. For more information on objectives, activities and participation see: http://www.iwmi.cgiar.org/issues/groundwater/gripp/ or contact Karen Villholth K.Villholth@cgiar.org or Paul Pavelic P.Pavelic@cgiar.org .

2. MAR-NET activities in China – Weiping Wang
   1. Objectives: To act as a communication bridge among Chinese MAR proponents and researchers and between them and those in foreign countries.
2. Activities in 2015/16: Held a workshop at Peking Univ 9 Sept 2015 in assoc with Yan Zheng to initiate process of developing Chinese GLs for MAR

3. Future plan for four years
   • Every two years in China to hold a MAR Seminar
   • Publish a book on “The theory and practice of MAR”
   • Promoting step by step Chinese MAR guideline.

3. Recent outputs from the EU MAR Projects – Enrique Fernandez Escalate
   • At least 15 projects have been identified supported by the EU related to MAR in some extent, including 2 EIP Water Action Groups
   • All of them have been interconnected in a network created to support ISMAR 10
   • Communication between coordinators, with capacity to reach (directly) more than 200 institutions related to MAR
   • EU projects involve partners from Israel, Peru, Brazil, Algeria, Tunisia (several MENA countries)...
   • 2016: Two courses on MAR in developing countries

4. South Asia Groundwater Forum- Peter Dillon
   • World bank interest in extending MAR depends on validation of effectiveness and account for upstream-downstream sharing of water within a basin- also requires water accounting to help form a plan
   • These views shared by Indian Govt and MAR should be part of inducement towards demand management at village scale
   • Role of groundwater monitoring and literacy among farmers is vital to secure cooperative management
   • “Solar Tsunami”- solar power already supplies 40,000 wells and electrical energy demand management policies alone may not be enough to curb groundwater demand
   • Recycled water use planned to increase and with it impacts on groundwater need assessment for intentional and unintentional recharge to protect groundwater quality

8. IAH Recognition of service to MAR – António Chambel

Antonio presented Certificates of Appreciation from IAH to the following people present:

Citation

Mario Lluria
Over 50 years Mario has actively contributed to MAR innovation and development in Spain, USA and Latin America, including managing the pioneering Salt River Project and City of Scottsdale Water Campus Project. He has trained and mentored colleagues and assisted in ISMAR and BSMAR symposia over many years.

Paul Pavelic
Paul Pavelic has for 25 years been a source of innovation in MAR research on groundwater processes, including clogging, mixing, and water quality improvement. He is devoted to capacity building and to accelerating the wise application of MAR in South East Asia, including flood harvesting, as an integral part of water resources management.
Weiping Wang

Weiping founded, and has sustained, the first active national MAR Network (in China). His skills as a network convenor have helped unify many institutions that now collaborate on items of agreed importance. He was the main driver for ISMAR8 in Beijing and he co-edited two thematic issues of journals arising from ISMAR8.

Albert Tunihof *

Albert has synthesised many years of hydrogeological experience through the 3R concept (Recharge, Retention and Reuse), to buffer water supplies. He has championed this world-wide primarily to the benefit of developing countries in Africa and Asia. Albert has worked with UNESCO and IAH in leading many international training workshops.

Gabriel Pérez de los Cobos

Gabriel has led the application of MAR in Switzerland and demonstrated the value of MAR to solve water reliability and quality problems caused by a warming climate in the Swiss Alps and to meet local water supplies and international obligations. He has published a book on this topic and has contributed to many ISMAR symposia.

* absent, to be conveyed to Albert after ISMAR9

9. Election of IAH-MAR Co-chairs - António Chambel

The three co-chairs had expressed a desire to continue in office. There were no other nominees and in the absence of dissent or abstainance Antonio declared Peter, Weiping and Enrique elected for a three year term, until ISMAR10.

Adriana Palma Nava expressed her willingness to stand for the position of co-chair at the next election, and this notice was willingly received. Peter advised he would stand down at the next election.

10. Suggestions for new activities – anyone

Andrew Ross expressed a desire to form a working group to evaluate the economics of MAR. This would interface with Catalin Stefan’s working group on MAR inventory, and with Yan Zheng’s working group on MAR for development. He sought volunteers interested in participation to meet with him after the poster session.

11. Volunteers to participate in activities – anyone

All working group leaders had expressed a willingness to have additional volunteers to contribute to their tasks. If anyone is interested please contact the relevant working group leaders.

Enrique offered to help with publishing in some form those papers unpublished in journals from ISMAR8 and ISMAR9.

Peter offered to facilitate a community of practice, that may consist of national groups. If anyone is willing to lead a national group to improve the operation of MAR systems through sharing data, information and experiences, and to inform groundwater management in a coordinated way at a level above site-specific issues, please contact Peter.
12. Information sharing on MAR (not covered elsewhere in ISMAR9) – anyone

INOWAS Summer School on MAR, TU Dresden 4-9 Sept 2016

In the course of the INOWAS project two summer schools are going to be held on the topic of managed aquifer recharge. The first school with 25 participants from various backgrounds will take place 4-9 September 2016 in Dresden, Germany. During the Summer School, the participants will get familiar with different MAR techniques and will be guided through different steps in planning, operation and optimization of MAR schemes. Practical exercises (modelling, field and laboratory experiments) will have a key role in the summer school. As these are the first summer schools planned on the topic of MAR, we are happy to share the experience made and feedback given from the participants with interested colleagues. The following school will take part in the summer of 2017.

For more information please refer to:

An NCGRT Short Course on MAR is due to be held in Christchurch, NZ on 17-19th August 2016. This will be led by Russell Martin (Aqueon), Peter Dillon (CSIRO Hon Fellow, Adjunct Chair Flinders Uni) Bob Bower and Clare Houlbrooke (Golder Associates) and Helen Rutter (Aqualinc). This will include a visit to the Hinds recharge site for ecosystem protection on Canterbury Plains.

For further details and registration see: http://www.groundwater.com.au/events/98


Peter declared the Plenary closed and the poster paper session open.