

Format for Biennial Reports by UNESCO's Water-related Centres on activities related to the IHP in the period (June 2012- May 2014)

1. Basic information on the centre

Name of the Centre		Water Center for Arid and Semi-Arid Zones of Latin America and the Caribbean (CAZALAC)
Name of Director		Gabriel Mancilla
Name and title of contact person (for cooperation)		Gabriel Mancilla, Executive Director.
E-mail		gmancilla@cazalac.org
Address		Benavente 980, La Serena, Chile
Website		www.cazalac.org
Location of centre		city/town <u>La Serena</u> country <u>Chile</u>
Geographic orientation *		<input type="checkbox"/> global <input checked="" type="checkbox"/> regional
Region(s) (for regional centres)		Latin America and Caribbean
Year of establishment		2006
Year of renewal assessment		2016
Signature date of most recent Agreement		October 9 th , 2010
Themes Of activities during reporting period	Focal Areas ♦	<input checked="" type="checkbox"/> groundwater <input type="checkbox"/> urban water management <input type="checkbox"/> rural water management <input checked="" type="checkbox"/> arid / semi-arid zones <input type="checkbox"/> humid tropics <input type="checkbox"/> cryosphere (snow, ice, glaciers) <input checked="" type="checkbox"/> water related disasters (drought/floods) <input checked="" type="checkbox"/> Erosion/sedimentation, and landslides <input checked="" type="checkbox"/> ecohydrology/ecosystems <input checked="" type="checkbox"/> water law and policy <input checked="" type="checkbox"/> social/cultural/gender dimension of water <input type="checkbox"/> transboundary river basins/ aquifers <input checked="" type="checkbox"/> mathematical modelling <input type="checkbox"/> hydroinformatics <input type="checkbox"/> remote sensing/GIS <input checked="" type="checkbox"/> IWRM <input checked="" type="checkbox"/> Watershed processes/management <input checked="" type="checkbox"/> global and change and impact assessment <input type="checkbox"/> mathematical modelling <input checked="" type="checkbox"/> water education <input type="checkbox"/> water quality <input type="checkbox"/> nano-technology <input type="checkbox"/> waste water management/re-use <input checked="" type="checkbox"/> water/energy/food nexus <input checked="" type="checkbox"/> water systems and infrastructure <input type="checkbox"/> other: (please specify) _____
	Scope of Activities ♦	<input checked="" type="checkbox"/> vocational training <input type="checkbox"/> postgraduate education <input type="checkbox"/> continuing education <input checked="" type="checkbox"/> public outreach <input checked="" type="checkbox"/> research <input checked="" type="checkbox"/> institutional capacity-building <input type="checkbox"/> advising/ consulting <input type="checkbox"/> software development <input checked="" type="checkbox"/> data-sets/data-bases development <input type="checkbox"/> other: (please specify) _____

* check on appropriate box
 ♦ check all that apply

Support bodies ¹	Chilean General Water Directorate (General Water Board)
Hosting organization ²	University of La Serena, Chile
Sources of financial support ³	Extrabudgetary fund UNESCO/Flanders; JRC-EU; Research funds of Chilean Government; Research funds from Coquimbo region local government.
Existing networks and cooperation ⁴	UNCCD; FAO; European Union.
Governance	<input checked="" type="checkbox"/> director and governing board <input type="checkbox"/> other: (please specify) _____ Link to election of board members to the IHP Intergovernmental Council (IGC) and hosting country IHP National Committee _____ Chile _____ Frequency of meetings: once every 1__year(s) <input type="checkbox"/> Existence of UNESCO presence at meetings
Institutional affiliation of director	Executive Director in CAZALAC (full-time); Assistant Professor at University of Chile (on seconded Commission)
Number of staff and types of staff	total number of staff (full-time, or equivalent) : _____4_____ number of staff who are water experts: _____3_____ number of visiting scientists and postgraduate students: _____1_____
Annual turnover budget in USD	360,000

2. Activities undertaken in the framework of IHP in the period June 2012 – May 2014

2.1 Educational activities (i.e., those with accreditation) that directly contributed to the IHP-VII/VIII (Appendix-1 and 2) and WWAP *Please include here those activities which led to accreditation of degrees, or those held in formal school settings.*

- CAZALAC was invited to deliver course in National workshop for capacity building in the management of extreme hydro-climatic events, Ministry of Science, Technology and Environment, Havana, Cuba. May 28 to June 1, 2012.

- CAZALAC was invited to dictate ongoing research in Engineering and Technology Center, Autonomous University of Baja California, Tijuana, Mexico. 10th to 18th June 2012.

- CAZALAC engineer Jorge Núñez participated as instructor in the Training Institute for Adaptive Water Management in Vulnerable River Basins under Climate Change. Inter-American Institute for Global Change Research (IAI), Center of Excellence for Water Security in the Americas (AQUASEC) and Water Centre for Arid and Semi-Arid Zones in Latin America and the Caribbean (CAZALAC). La Serena, Chile, 8-17 October, 2012. The workshop included 35 graduate students, including workers and specialists, most from more than 12 countries in Latin America and the United States.

- CAZALAC engineer Jorge Núñez participated as instructor in the Pan American Studies Institute (PASI) on Adaptive Management of Water and Power in the Dry Areas of the

¹ please specify bodies that cover the operational costs of the centre, and other essential costs such as salaries and utility bills, and that provide institutional support to ensure centre's sustainability

² if different from support bodies

³ please specify sources of main budgetary and extrabudgetary funds to implement projects

⁴ please write international networks, consortiums or projects that the centre is part of, or any other close links that the centre has with international organizations or programmes, which are not already mentioned above

Americas. This training was held in La Serena, Chile, between 24 June and 3 July 2013. The event was organized by the Inter-American Institute for Global Change Research (IAI), Center of Excellence for Water Security in the Americas (AQUASEC) for Arid and Semi-arid zones of Latin America and the Caribbean (CAZALAC), University of Arizona, Pontificia Universidad Católica de Chile, UNESCO-IHP and the Stockholm Environment Institute Center. The workshop included 30 students from various countries of Latin America, the U.S. and Europe, mixing under-graduate and graduate students.

- CAZALAC personnel participated as instructors in the RALCEA-ATOS - CAZALAC workshop in Santiago, Chile, from 11 to 13 March 2013. The objective of the workshop was to present, analyze, discuss and evaluate the results and respective national maps that were developed by the attendees, who were all part of the EUROCLIMA-WATER project. In the workshop, the participants were trained on the Regional Frequency Analysis methods of precipitation, by using L-moments. After that, they designed their maps.

- CAZALAC engineer Jorge Núñez was the main instructor of the "Development of National Drought Atlas for Caribbean countries workshop", organized through MWAR - LAC and RALCEA projects, coordinated by UNESCO and CAZALAC (4 to 8 of November 2013, in Kingston, Jamaica). Training consider professionals from respective national institutions of the Caribbean countries, for the development of local maps in drought frequency.

2.2 Research activities that directly contributed to the IHP-VII and/or IHP-VIII activities

Please include research/applied projects outputs such as publications that directly contributed to the IHP-VII/VIII and WWAP objectives

- **Project "Development of an innovative drive system seawater using wave energy to osmosis desalination plants "**. Funded by the Innova-Chile CORFO (Chilean Economic Development Agency). This is a project conducted by the Catholic University of Valparaiso, Chile, in which CAZALAC is an associate. The project assumes that the use of wave energy should provide sufficient energy to drive the operation of reverse osmosis plants, reducing production cost of desalinated water and increasing the competitiveness of this type of desalination technology. This is linked to a project under development by the researchers referred to the creation of innovative converter wave energy to electrical energy. Therefore, the project addresses the water-energy issue. There are still no publications regarding this project.

- **Project "A Forest and Environmental Development Plan for Rio Hurtado"**. Funded by funds of the Regional Government of Coquimbo, Chile. The project was conducted by the University of Talca (Chile), in association with CAZALAC and the National Forestry Corporation (CONAF). The objective of the project was to develop a Forest and Environmental Development Plan for Rio Hurtado, which include participation of stakeholders through integrated methodologies for obtaining information from people living in the territory, as well as from the natural environment, thereby achieving a spatial planning tool. In addition, the plan would generate economic activity and develop concrete actions to combat desertification phenomenon. The project was conducted from June 2012 to June 2013.

Output. Book: "Plan de Desarrollo Forestal y Ambiental del Río Hurtado, PLADEFORA" (A Forest and Environmental Development Plan for Rio Hurtado, PLADEFORA). Edited by the University of Talca and the Regional Government of Coquimbo Region (Chile). ISBN: 978-956-7669-36-3. 81 pages.

• **Project "Implementation of a Meteorological Monitoring Network as a tool to support decision making in the field of agriculture and aquaculture of the Coquimbo Region"**. Funded by the Regional Government of Coquimbo Region (Chile). Project conducted by the Center for Applied Studies in Dry Areas (CEAZA), in which CAZALAC was an associate for the years 2012 and 2013. CAZALAC provided online climate data and seasonal forecasts.

Outputs: Monthly reports for climate and climate indicators that are relevant for agriculture decision-making.

• **Project "Options for energy solutions for Rural Water Systems (APR) of the Coquimbo Region"**. Funded by the Regional Government of Coquimbo Region (Chile), and conducted by CAZALAC, in collaboration with Ecoingenieros Ltd. The project was carried out between October 2012 and October 2013, however there is still a review pending. The objective of the project was to determine the economic, legal and technical feasibility for supplying either wind or photovoltaic energy power to the APR of Coquimbo Region. It also defined the conditions of the sites where it is possible to install such kind of power plants. The main beneficiaries of the project are the rural Drinking Water Committees, which make up a total of 179 APR systems, serving more than 150,000 people from rural population of the Region of Coquimbo.

Outputs: Four technical reports already delivered. A manuscript to be submitted to a peer-referred journal will be prepared in the second semester of 2014.

• **Project "Sea water desalination through Inverse Osmosis and Photovoltaic Energy for the provision of drinking water in Isla Damas, Coquimbo Region"**. Funded by the Regional Government of Coquimbo Region (Chile), and the Belgian company VMW (Vlaamse Maatschappij voor Watervoorziening). The project was conducted by CAZALAC and the collaboration of the National Forestry Corporation of Chile (CONAF), between November 2011 and October 2013. This project was the first project in Chile that applied reverse osmosis for drinking water supply in rural areas, which included solar energy as main energy source. The objective was sizing, design, install and evaluate a desalination plant with reverse osmosis system which will use photovoltaic power to ensure energy sustainability of the system, beyond the protection of the environment.

Outputs: i) Reports provided to Regional Government of Coquimbo Region.

ii) Technical Report UNESCO PHI – LAC N°33. "Desalación de agua de mar mediante sistema Osmosis Inversa y Energía Fotovoltaica para provisión de agua potable en Isla Damas, Región de Coquimbo". UNESCO 2013.

iii) Articles highlighting the project in four newspapers (regional and national).

iv) TV report on the project, in Chilean National Television (TVN).

v) In the second semester of 2014, a new TV report will be performed for a scientific program of the Catholic University channel (UC-TV).

• **Project "Development of a model for sustainable water management in Huasco Valley, through environmental flow assessment, economic valuation and social hydrological services"**. Project funded by the Regional Government of the Atacama Region. It started in April 2011 and finished at the end of June 2012. The project was conducted by CAZALAC, an associated parties were the International Union for Conservation of Nature (IUCN), the Water Stakeholders Association of the Rio Huasco and the General Water Directorate of the Atacama region in Chile. The objective of the initiative was to design a comprehensive hydrologic model for the Huasco river basin, considering environmental flows as a basis. Therefore, a decision-making tool for water management was achieved, contributing to the sustainability of water resources and the economic and social activities that depend on it.

Outputs: i) Technical Report. M. Pouilly and G. Aguilera (2012). Evaluación inicial de

caudales ecológicos/ ambientales en la Cuenca del río Huasco-Chile, mediante la simulación del hábitat físico del pejerrey *Basilichthys microlepidotus* y el camarón de río *Cryphiops caementarius* (Initial evaluation of environmental flows in the Huasco river basin, by simulating the physical hábitat of the silverside *Basilichthys microlepidotus* and the river shrimp *Cryphiops caementarius*. UICN, Quito, Ecuador. 57 pages.

ii) Wagnitz, P. 2012. Cost Benefit analysis regarding environmental flow implementation in the semiarid Huasco watershed, northern Chile. Thesis to obtain the degree of Master of Science (M.Sc.), Cologne University of Applied Sciences. Germany.

iii) Modelación de Recursos Hídricos de la Cuenca del Río Huasco: Tutorial Modelo WEAP-Huasco (Modeling water resources of the Huasco river basin: tutorial of the WEAP-Huasco model).

iv) Article: Wagnitz, P., Núñez, J., and Ribbe, L., 2014. Cost of environmental flow during water scarcity in the arid Huasco River basin, northern Chile. *Hydrological Sciences Journal*, 59 (3–4), 1–13.

• **Project “Strengthening the Agro-climatic Observatory”**. Project funded by the Government of Chile and headed by the Agriculture Secretariat (Ministry of Agriculture). CAZALAC participates as an associate, together with UNESCO, CEAZA, some universities and the General Water Directorate of Chile (DGA). The objective for strengthening the Agro-climatic Observatory in Chile is using hardware components, as well as providing technical assistance in the collection and computational implementation of compiled national data. The project started in October 2013.

Output: An initial platform of data management is available at the web site <http://www.climatedatalibrary.cl/UNEA/maproom/>

• **Project EUROCLIMA-RALCEA. Contract ATOS-CAZALAC**. Funded by the European Commission. CAZALAC participates as an associate of the group headed by Dr. Cesar Carmona-Moreno of the JRC (Joint Research Center). The contract period of performance extended from late 2012 until 05/15/2014, and seeks concrete actions for implementing the theme "Variability of Water Balance Components in Latin America" by using the methodology that CAZALAC has widespread in the region, called Regional Frequency Analysis with L-moments.

Outputs: i) Technical reports

ii) A set of thematic maps for many countries of Latin-America

iii) Trained professionals of many countries of LAC.

• **Project MWAR-LAC (Management of Water Resources in Arid and Semi- Arid Zones in Latin America and the Caribbean). Phase III: Adoption of the draft framework MWAR -LAC**. Funded by UNESCO – Government of Flanders. CAZALAC participates as an associate. The project aims to strengthen the management capacity of water resources in arid and semi-arid areas in Latin America through networking and facilitate international and regional cooperation. This is achieved through the development of pilot projects and participation in regional projects with relevant partners in Latin America. Three main thematic priorities are performed: a) improve water governance as the basis for achieving integrated resource management; b) the use of modern techniques and methodologies to assess and improve the efficiency of water use ; c) hydro-climatic risk management including decision making. The overall objective of the proposed project is to improve the quality of life and alleviate poverty of local communities in arid and semiarid regions of Latin America and the Caribbean (LAC) , by reducing the vulnerability of water resource systems to global changes based on sound science. The project started in 2012 and will finish in 2014.

Outputs: i) An initial platform of data management is available at the web site <http://www.climatedatalibrary.cl/UNEA/maproom/> (and that is also part of the project "Strengthening the Agro-climatic Observatory" of the Chilean Ministry of Agriculture).

ii) Drought observatories, data library, drought atlas, and many other products (see http://www.cazalac.org/mwar_lac/index.php?id=36&L=0 for more information about MWAR-LAC products).

• **Project "Cooperation in the field of water resources management between the Regional Government of Coquimbo Chile and the Mexican Institute of Water Technology (IMTA)".** Project funded by the Joint Cooperation Fund Chile – Mexico. The initiative is conducted by the association of the Regional Government of Coquimbo, the Mexican Institute of Water Technology (IMTA), CAZALAC and the Center for Advanced Studies in Arid Zones (CEAZA). The project started in August 2012 and it will finish by July 2014. The objective of the project was to establish cooperation and exchange of experiences and knowledge on water issues between all the parties.

Outputs: i) Water management professionals from public institutions were trained in Chile and Mexico in technology delegations to each country.

ii) Open seminars were performed to raise awareness about the proper use and conservation of water to civil society, and dissemination of both Mexican and Chilean experiences in water resources technology.

iii) Open seminars were performed to analyze water policy in Chile and contrast with the Mexico water policy. In addition, actions related to water culture were enhanced.

• **Project "Regional Strategy for Water Resources 2014-2030".** Project funded by the Regional Government of Coquimbo Region through the Regional Corporation for Productive Development. The project started in April 2014 and it will finish in December 2014. The study focus in each watershed of Coquimbo region. There, CAZALAC will collect all local water stakeholders' opinions and then elaborate a common strategy to improve planning, use and governance of water in a short (2014-2018) and long term period (2018-2030). Of course, a baseline of available data will be provided. The strategy for each watershed will contrast the stakeholders opinion, technical and financial issues to result in defining the more appropriate actions for water use in the future.

Outputs: Not yet.

• **Other projects waiting for financial support.** There are two proposals that were presented by CAZALAC and are waiting for a decision about financial support. These are:

i) "Generación y desarrollo de una propuesta tecnológica de captura de aguas lluvias para el incremento de las disponibilidades de agua con fines productivos en zonas de secano de la Región de Coquimbo" (Developing a technological proposal for rainwater catchment and store to increase water availability for productive uses in dry areas of the Coquimbo region). Applying to the funding "Public Goods for Competitiveness" of the Chilean Economic Development Agency (CORFO).

ii) "Cooperación en el ámbito de la gestión de la recarga de acuíferos (Managed Aquifer Recharge - MAR) entre la Dirección General de Aguas (Chile), CAZALAC (ALC) y el Instituto Mexicano de Tecnología del Agua (IMTA-México)" (Cooperation on Managed Aquifer Recharge between the Chilean Water Directorate, CAZALAC and the Mexican Institute for Water Technology). Applying to the Joint Cooperation Fund Chile – Mexico.

• **Proposals that were not funded.** Between June 2012 and May 2014, three proposals were not funded:

i) Proposal "A system for climate risk management and water availability for the Coquimbo region", applied to 2012 Funds from the Regional Government of Coquimbo.

ii) Proposal "A system for climate risk management and water availability for the La Ligua and Petorca rivers basins in Valparaiso region, Chile". Applied to 2012 Funds from the Regional Government of Valparaiso region, Chile.

iii) Proposal "Supporting water resources provision for agriculture and livestock, by designing and constructing catchment and store of rainwater (SCALL) and the water distribution by non-conventional renewable energy sources, in Río Hurtado, Coquimbo region, Chile. Applied for Funds of the Regional Government of Coquimbo.

2.3 Training activities that directly contributed to the IHP-VII/VIII and WWAP objectives

- CAZALAC participated in the coordination and teaching of the Training Institute for Adaptive Water Management in Vulnerable River Basins under Climate Change. Organized by the Inter-American Institute for Global Change Research (IAI), Center of Excellence for Water Security in the Americas (AQUASEC) and Water Centre for Arid and Semi-Arid Zones in Latin America and the Caribbean (CAZALAC), in La Serena, Chile, 8-17 October, 2012. The workshop included 35 graduate students, including workers and specialists, from more than 12 countries in Latin America and the United States. The workshop was funded by the MWAR-LAC project and the IAI.
- CAZALAC participated by teaching in the Pan American Studies Institute (PASI) on Adaptive Management of Water and Power in the Dry Areas of the Americas. This training was held in La Serena, Chile, between 24 June and 3 July 2013. The event was organized by the Inter-American Institute for Global Change Research (IAI), Center of Excellence for Water Security in the Americas (AQUASEC) for Arid and Semi-arid zones of Latin America and the Caribbean (CAZALAC), University of Arizona, Pontificia Universidad Católica de Chile (Catholic University of Chile), UNESCO-IHP and the Stockholm Environment Institute Center. The workshop included 30 students from various countries of Latin America, the U.S. and Europe, mixing under-graduate and graduate students. The workshop was funded by the MWAR-LAC project and the IAI, the latter through the National Science Foundation (NSF) of the United States of America.
- CAZALAC engineers taught in the RALCEA-ATOS - CAZALAC workshop in Santiago, Chile, from 11 to 13 March 2013. The objective of the workshop was to present, analyze, discuss and evaluate the results and respective national maps that were developed by the attendees, who were all part of the EUROCLIMA-WATER project. In the workshop, the participants were trained on the Regional Frequency Analysis methods of precipitation, by using L-moments. After that, they designed their maps.
- CAZALAC participated in organizing and teaching in the "Development of National Drought Atlas for Caribbean countries workshop", organized through MWAR -LAC and RALCEA projects, coordinated by UNESCO and CAZALAC (4 to 8 of November 2013, in Kingston, Jamaica). Training consider professionals from respective national institutions of the Caribbean countries, for the development of local maps in drought frequency. The instruction dealt with the implementation of the Regional Frequency Analysis Using L-moments. Specifically, the objectives were: a) to train professionals in the use of Regional frequency analysis using L-moments for hydrological applications and analysis of vulnerability to drought; b) training in the various options of open source software (R and REFRAN-CV); c) increase the number of specialists in the region who are trained in the methodology; d) generate maps of drought frequency in the participating countries of the Caribbean.

- Quenting Satge, was a student of ISTOM, École Supérieure d'Agro Développement International, France. He developed his professional practice in CAZALAC. The goal of their practice was the development of a simulation model and planning of water resources, in WEAP environment to Choapa river basin. Practice Period: 15/04/2012 to 30/09/2012.

3. Collaboration and linkages

3.1 Participation in major international networks, programmes, partnerships with other UN or other International Agencies, media and professional bodies

- Collaboration agreement framework between CAZALAC – CEAZA.

There is currently a broad collaboration agreement with CEAZA in order to facilitate mutual form, skills in human resources, equipment, information and infrastructure of both centers for the development of Research, Development and Innovation in matters of common interest.

- Collaboration agreement with the European Commission (EUROCLIMA – RALCEA).

There is a tacit agreement between CAZALAC and the EUROCLIMA-RALCEA project group. CAZALAC has coordinated EUROCLIMA activities in Latin America and the Caribbean, and it will continue doing that in the future.

- Collaboration agreement with FAO (Food and Agriculture Organization), related to the participation of CAZALAC in specific actions that are linked to data management and climate prediction tools.

3.2 Participation in meetings related to the IHP and UNESCO (e.g., the UNESCO General Conference, the UNESCO Executive Board, the IHP Intergovernmental Council and/or other meetings organized by IHP)

- Workshop for linking the PROMEP RRHIFLUCO network with the UNESCO International Hydrological Programme. 19-22 of November 2012, in Queretaro, Mexico. Former CAZALAC CEO, Mr. Guido Soto Alvarez, attended the workshop. The main objective of the conference was to strengthen the bonds of "Red PROMEP for characterizing hydro, river and coastal risk" with the various national and international actors (UNESCO IHP LAC) in hydrology of extreme floods, civil protection and hydro-meteorological general phenomena.
- CIH UNESCO-FRIEND meeting. CAZALAC Engineer, Mr. Manuel Soto-Benavides attended the meeting, which related to analysis and implementation of the PHI-LAC database (FRIEND Program). The meeting was held in Ciudad del Este, Paraguay from 6 to 10 May 2013. The meeting was hosted by experts from the Center for Hydro - CIH, and UNESCO-FRIEND. The event aimed to review the status of development of the Integrated Database (SIBD) and establish an implementation plan.
- UNESCO Joint Strategic and High -level Meeting on Water Security and Cooperation. Nairobi, Kenya 11 to September 13, 2013. Meeting at which was discussed in depth the scope of Phase VIII of the International Hydrological Programme. CAZALAC Executive Director, Dr. Gabriel Mancilla, attended to the meeting. IHP- VIII priority is water security (quantity and quality), from a holistic view that integrates people, ecosystems, water, culture and economy. Detailed of the objectives and challenges of the new phase were described at the meeting, noting that they will be implemented by the usual UNESCO programs and effective participation of National Committees of the IHP.

- Tenth National Committees and IHP Focal Point Meeting of Latin America and the Caribbean, Jiutepec, Morelos state, Mexico; December 2nd – 4th, 2013. Dr. Gabriel Mancilla, Executive Director of CAZALAC attended the meeting. There, the activities of each of the National Committees, Centers, Programmes and Chairs were detailed and analyzed.
- Coordination Meeting of MWAR-LAC project. Montevideo, Uruguay, 3-5 February 2014. Meeting that was organized by MWAR-LAC and the IHP of LAC. Advances of the project were described, as well as the proper activities of each of the institutions attending the meeting. Dr. Gabriel Mancilla, Executive Director of CAZALAC attended the meeting.

3.3 Collaboration and networking with other UNESCO category 1 or 2 institutes/ centres

3.3.1 cross-appointment of directors of the category 1 or 2 institutes or centres on the governing board

3.3.2 exchange of information on activities such as training/educational materials, and funding opportunities

- Exchange of information with the ICIWarm, of the US Army Corps of Engineers. CAZALAC and ICIWARM are continuously exchanging information related to databases (climate data mainly), and participating in workshops. In addition, as Global Coordination of G-WADI program, ICIWARM has designated CAZALAC as its coordinator in LAC.
- CAZALAC is in charge for seeking local candidates for applying to graduate studies sponsored by the International Centre for Water Hazard and Risk Management (ICHARM) of Japan. However, this is a verbal agreement with Mr. Kuniyoshi Takeuchi.

3.3.3 exchange of staff, most notably professionals and students

- CAZALAC and ICIWARM have started some exchange of professionals. In particular, engineer Jorge Núñez has been involved in some activities that are supported by ICIWARM. CAZALAC expects to increase this collaboration, but it is necessary to formalize this relation.
- CAZALAC, through engineer Mr. Manuel Soto, participated in activities developed by the Center of Hydro Informatics (CIH) in Paraguay. In the future, there is an interest for increase this collaboration, but first it is necessary to formalize this relation.

3.3.4 implementation of joint activities, such as workshops, conferences, training programmes, joint projects, field visits, software and data sharing, knowledge exchange and publications

- CAZALAC and ICIWARM have performed some joint activities, such as exchange of professionals, workshops, data sharing and knowledge exchange. This collaboration needs to be formalized anyway.

3.4 Relationships with the UNESCO field and regional office whose jurisdiction covers the country of location

- Relationship with UNESCO Santiago (Chile). CAZALAC has a fluid relationship with the UNESCO headquarters in Santiago. Particularly, there has been continuous activity through the MWAR-LAC project, that is headed by Dr. Koen Verbist.
- Relationship with UNESCO Montevideo (Uruguay). The LAC regional headquarters for hydrology issues is located in Montevideo, in particular the regional hydrologist, Mrs. Zelmira May. CAZALAC is regularly asking questions and getting support from Montevideo.

3.5 Relationship with the UNESCO National Commission and the IHP National Committee in the country of location and with other organizations of other countries

- Relationship with the local IHP National Committee is pretty fluid. Once a month a meeting takes place, where all the IHP National Committee members describe their ideas, goals and needs. In addition, joint work is performed. CAZALAC is an active member of the IHP National Committee.

3.6 Relationship with other UNESCO-related networks, such as UNESCO Clubs, ASPnet, and UNESCO chairs

- CAZALAC participates in IHP UNESCO Programmes. Particularly, CAZALAC has made contributions in FRIEND and G-WADI Programs, and plans to do it in the Ecohydrology Program. In the FRIEND Program, CAZALAC participated in the CIH -FRIEND UNESCO meeting in May 2013 on Paraguay (Ciudad del Este). The event aimed to review the status of development of the Integrated Database (SIBD) and establish an implementation plan. For G-WADI, CAZALAC has made some contribution to the Program web-site and newsletter. CAZALAC plans to deliver a drought related book for LAC during 2014. In the ECOHYDROLOGY Program, CAZAAC will start contributing during 2014.

4. Communication

4.1 Communication and knowledge dissemination activities undertaken in the framework of IHP

- M. Pouilly and G. Aguilera (2012). Evaluación inicial de caudales ecológicos/ ambientales en la Cuenca del río Huasco-Chile, mediante la simulación del hábitat físico del pejerrey *Basilichthys microlepidotus* y el camarón de río *Cryphiops caementarius* (Initial evaluation of environmental flows in the Huasco river basin, by simulating the physical hábitat of the silverside *Basilichthys microlepidotus* and the river shrimp *Cryphiops caementarius*. UICN, Quito, Ecuador. 57 pages.
- Wagnitz, P. 2012. Cost Benefit analysis regarding environmental flow implementation in the semiarid Huasco watershed, northern Chile. Thesis to obtain the degree of Master of Science (M.Sc.), Cologne University of Applied Sciences. Germany.
- Modelación de Recursos Hídricos de la Cuenca del Río Huasco: Tutorial Modelo WEAP-Huasco (Modeling water resources of the Huasco river basin: tutorial of the WEAP-Huasco model).

- Wagnitz, P., Núñez, J., and Ribbe, L., 2014. Cost of environmental flow during water scarcity in the arid Huasco River basin, northern Chile. *Hydrological Sciences Journal*, 59 (3–4), 1–13.
- Technical Report UNESCO PHI – LAC N°33. “Desalación de agua de mar mediante sistema Osmosis Inversa y Energía Fotovoltaica para provisión de agua potable en Isla Damas, Región de Coquimbo”. UNESCO 2013.
- Núñez, J., Rivera, D., Oyarzún, R. and Arumí, J.L. 2013. Influence of Pacific Ocean multidecadal variability in the distributional properties of hydrological variables in North-Central Chile. *Journal of Hydrology*. 501 (25): 227–240.
- Oyarzún, J.; Carvajal, M.; Maturana, H.; **Núñez, J.**; Kretschmer, N.; Amezaga, J.; Rötting, T.; Strauch, G.; Thyne, G. and Oyarzún, R. 2013. Hydrochemical and isotopic patterns in a calc-alkaline Cu- and Au-rich arid Andean basin: The Elqui River watershed, North Central Chile. *Applied Geochemistry*. (33):50-63.
- CAZALAC newsletter, edited in Spanish and English every two months. Digital newsletter.
- MWAR LAC web-site. Managed by CAZALAC in its configuration and creation.
- CAZALAC web-site. Managed, created and updated by CAZALAC.

4.2 Policy documents and advice

5. Update on Centre Operations

5.1 Membership of the Board of Governors between designated period

CAZALAC´s Governing Board is still integrated just by representatives of Chilean institutions (International Governing Board is being arranged with the parties). The President of the Governing Board is the Governor of the Coquimbo region (where La Serena city is located). There were four different Governors in the June 2010- May 2012 period, Mr. Sergio Gahona (until November 2012); Mr. Mario Burlé (November 2012- August 2013); Mr. Juan Fuenzalida (August 2013-March 2014); and Ms. Hanne Utreras (March 2014 to present). The vice-President of CAZALAC Governing Board is the Director of the Water General Directorate of Chile, and Mr. Francisco Echeverría was in charge of that duty until March 2014, being then replaced by the actual Director, Mr. Carlos Estevez. The directors were the representative from the University of La Serena, Mrs. María Aguirre; the representative from the Catholic University of Valparaíso, Mr. Manuel Cerda; the representative from the University of Chile, Mrs. Ximena Vargas; the representative from the University of Talca, Mr. Roberto Pizarro; and lastly, the representative from the University of Concepción, Mr. José Vargas.

5.2 Key decisions made (attach minutes of meetings)

- During the June 2012- May 2014 period, CAZALAC Governing Board achieved some important decisions, which are included in the minutes of the meetings. Even though the related minutes of the Governing Board meetings are attached, these are exclusively written in Spanish and there is not an official translation to English.
- In meeting of November 13th, 2012, the Governing Board decided to start all the arrangements to achieve the new international Governing Board of CAZALAC.
- In meeting of January 18th, 2013, CAZALAC´s Executive Director at that time, Mr. Guido Soto communicates the Governing Board about his retirement during that year (2013), so the Governing Board agrees to recruit candidates for CAZALAC´s Executive Director Position.

- In an Extraordinary meeting of CAZALAC´s Governing Board (January 18th, 2013 as well), the directors agreed in modifying one of the Articles of Association. In particular, it will be established now that once the actual CAZALAC (which has a national status) moves to an international status (and thus, with a different tributary identification number), all the goods belonging to the Centre will go to the new international Centre.
- In an Extraordinary meeting of CAZALAC´s Governing Board (June 7th, 2013), the Governing Board designates Mr. Gabriel Mancilla as the new Executive Director of CAZALAC.

6. Evidence of the Centre´s Impacts

6.1 Science Impacts (Major contributions to the science, technology, education, and regional and/or international cooperation in the field of water)

Between June 2012 and May 2014, CAZALAC contributed in different ways to water and water-related science:

- Publishing Scientific and Technical documents (books and manuscripts) that can be consulted everywhere by people (most of them online).
- Working on database and decision-support computer platforms that can be accessed easily from the Internet.
- Media impact: Some of the CAZALAC´s projects have been highlighted by the media, such as TV and newspapers. Particularly, the project "Sea water desalination through Inverse Osmosis and Photovoltaic Energy for the provision of drinking water in Isla Damas, Coquimbo Region" had a great impact in the media, enhancing the scientific and technological joint to provide solutions in water security for remote sites without freshwater resources.
- CAZALAC´s work in climate database and useful mapping is often recognized. Many requests for joining CAZALAC to national and international projects are received every year.

6.2 Knowledge Transfer Impacts (Major achievements in the dissemination of knowledge and technology transfer)

- Through the European Commission's EUROCLIMA and RALCEA Projects, and also the UNESCO - M-WAR LAC project, CAZALAC spread the Regional Frequency Analysis with L-moments, as a standard analysis tool for the execution of the Variability and frequency properties of the Water Balance component in Latin America project.
- Distribution of technical documents that are related to PHI topics, which is the result of some projects developed by CAZALAC.
- CAZALAC has organized many seminars and workshops, which have been related to the projects achieved during 2012 and 2013. Professionals that have been trained in these workshops usually apply their new knowledge in their respective countries. These actions demonstrate that the role of CAZALAC as a training institution receives a very good recognition.

- 6.3 Policy Impacts (advice sought by government and other bodies and evidence of inputs into policy arena)

7. Future activities that will contribute directly to IHP and/or to WWAP

- 7.1 Operational Plan (attach if available)
7.2 Strategic Plan linked with IHP-VIII (Appendix 2)
(Attach strategic plan if available)

At the end of 2013, CAZALAC finished writing its Strategic Plan, which focuses in water security, as the same of the IHP. Therefore, the Centre has an important tool for future plans. The strategic plan is attached; however, it is only available in Spanish.

8. Strategic Alignment with IHP-VIII

- 8.1 Focal areas within IHP-VIII the centre plans to contribute to and specific actions the centre will undertake to align its activities with the strategic plan for IHP-VIII (Please see Appendix-2)

a. Theme 1. Water-related disasters and hydrological cycle.

Focal area 1.1 - Risk management as adaptation to global changes. Specific actions: CAZALAC will continue contributing to EUROCLIMA and RALCEA projects with JRC (Joint Research Center); in addition, CAZALAC will continue being an associate in the M-WAR LAC project.

Focal area 1.3 - Benefiting from global and local Earth observation systems. Specific actions: CAZALAC will continue working on Chilean National Observatory. It will possibly be participating in creating the Honduras` National Observatory.

b. Theme 2. Groundwater in a changing environment. Focal area 2.1 - Enhancing sustainable groundwater resources management. Specific actions: CAZALAC joins IMTA (Mexican Institute in Water Technology) to study aquifers artificial water recharge.

Focal area 2.2 - Addressing strategies for management of aquifers recharge. Specific actions: CAZALAC joins IMTA (Mexican Institute in Water Technology) to study aquifers artificial water recharge.

c. Theme 3. Addressing water scarcity and quality.

For all Focal area 3.1 - Improving governance, planning, management, allocation, and efficient use of water resources; Focal area 3.2 - Dealing with present water scarcity and developing foresight to prevent undesirable trends; and Focal area 3.3 - Promoting tools for stakeholders involvement and awareness and conflict resolution. Specific actions: CAZALAC was called by the Government of the Coquimbo region (north of Chile) to perform the "Regional Strategy for Water Resources 2014-2030". This study will be focused in each watershed of Coquimbo region and it will consider the opinion of all local water stakeholders, in such a way to find a common strategy to improve planning, use and governance of water in a short (2014-2018) and long term period (2018-2030).

Focal area 3.5 - Promoting innovative tools for safety of water supplies and controlling pollution. Specific actions: i) CAZALAC has just finished the project "Sea water desalination through Inverse Osmosis and Photovoltaic Energy for the provision of drinking water in Isla Damas, Coquimbo Region". Through that project, a solution for obtaining drinking water was provided for an area (Isla Damas. "Damas Island") without any freshwater sources. The desalination system was

supplied by solar energy; ii) CAZALAC is now finishing the project "Options for energy solution for Rural Drinking Water Systems in the Region of Coquimbo". The project is supported by the local government of the Coquimbo region, and provides an analysis to decide which non-conventional energy source (wind or photovoltaic) is more convenient for each of the Rural Drinking Water Systems. Nowadays, energy is more than 50% of the cost that rural people must pay for drinking water supply, so a solution to make that cost cheaper is strongly necessary.

d. Theme 4. Water and human settlements for the future

Focal area 4.3 - Institution and leadership for beneficitation and integration.

Specific actions: The "Regional Strategy for Water Resources 2014-2030" study, that is being developed by CAZALAC for Coquimbo region, will try to find a common strategy to improve planning, use and governance of water in a short (2014-2018) and long term period (2018-2030). For planning, CAZALAC must involve all stakeholders of each watershed, coordinating local institutions to integrate their objectives in such a way of sharing benefits and tasks.

e. Theme 5. Ecohydrology. Engineering harmony for a sustainable world.

Specific actions: CAZALAC was asked for participating in the Ecohydrology Program of LAC region, starting 2014. There is still not clarity about which focal areas the Centre will be contributing to.

f. Theme 6. Water Education, key for water security.

Focal area 6.1 - Enhancing tertiary water education and professional capabilities in the water sector.

Specific actions: CAZALAC will continue performing and collaborating in workshops for training students from LAC region in modeling tools and techniques such as the L-moments. The Centre is performing new agreements with M-WAR LAC project and EUROCLIMA projects in order to do that.

9. Annexes

9.1 List of publications released by the centre (there can be overlap with those listed in 2.3 above)

- M. Pouilly and G. Aguilera (2012). Evaluación inicial de caudales ecológicos/ ambientales en la Cuenca del río Huasco-Chile, mediante la simulación del hábitat físico del pejerrey *Basilichthys microlepidotus* y el camarón de río *Cryphiops caementarius* (Initial evaluation of environmental flows in the Huasco river basin, by simulating the physical hábitat of the silverside *Basilichthys microlepidotus* and the river shrimp *Cryphiops caementarius*. UICN, Quito, Ecuador. 57 pages.
- Wagnitz, P. 2012. Cost Benefit analysis regarding environmental flow implementation in the semiarid Huasco watershed, northern Chile. Thesis to obtain the degree of Master of Science (M.Sc.), Cologne University of Applied Sciences. Germany.
- Modelación de Recursos Hídricos de la Cuenca del Río Huasco: Tutorial Modelo WEAP-Huasco (Modeling water resources of the Huasco river basin: tutorial of the WEAP-Huasco model).
- Wagnitz, P., Núñez, J., and Ribbe, L., 2014. Cost of environmental flow during water scarcity in the arid Huasco River basin, northern Chile. *Hydrological Sciences Journal*, 59 (3-4), 1-13.

- Technical Report UNESCO PHI – LAC N°33. “Desalación de agua de mar mediante sistema Osmosis Inversa y Energía Fotovoltaica para provisión de agua potable en Isla Damas, Región de Coquimbo”. UNESCO 2013.
- Núñez, J., Rivera, D., Oyarzún, R. and Arumí, J.L. 2013. Influence of Pacific Ocean multidecadal variability in the distributional properties of hydrological variables in North-Central Chile. *Journal of Hydrology*. 501 (25): 227–240.
- Oyarzún, J.; Carvajal, M.; Maturana, H.; Núñez, J.; Kretschmer, N.; Amezaga, J.; Rötting, T.; Strauch, G.; Thyne, G. and Oyarzún, R. 2013. Hydrochemical and isotopic patterns in a calc-alkaline Cu- and Au-rich arid Andean basin: The Elqui River watershed, North Central Chile. *Applied Geochemistry*. (33):50-63.
- CAZALAC newsletter, edited in Spanish and English every two months. Digital newsletter.

9.2 List of training courses conducted (there can be overlap with those listed in 2.1 above)

- Eng. Jorge Nuñez, from CAZALAC, is invited to be a trainer of a Course in the Center for Engineering and Technology of the Universidad Autónoma de Baja California, Tijuana, México, from June 10th thru 18th, 2012.
- Eng. Jorge Nuñez, from CAZALAC, is invited to teach in the National Workshop for strengthening capabilities for managing extremes hydroclimatic events, by the Ministry of Science, Technology and environment of Cuba. La Habana, Cuba, May 28th to June 1st, 2012.
- CAZALAC participated in the coordination and teaching of the Training Institute for Adaptive Water Management in Vulnerable River Basins under Climate Change. Organized by the Inter-American Institute for Global Change Research (IAI), Center of Excellence for Water Security in the Americas (AQUASEC) and Water Centre for Arid and Semi-Arid Zones in Latin America and the Caribbean (CAZALAC), in La Serena, Chile, 8-17 October, 2012. The workshop included 35 graduate students, including workers and specialists, from more than 12 countries in Latin America and the United States. The workshop was funded by the MWAR-LAC project and the IAI.
- CAZALAC participated by teaching in the Pan American Studies Institute (PASI) on Adaptive Management of Water and Power in the Dry Areas of the Americas. This training was held in La Serena, Chile, between 24 June and 3 July 2013. The event was organized by the Inter-American Institute for Global Change Research (IAI), Center of Excellence for Water Security in the Americas (AQUASEC) for Arid and Semi-arid zones of Latin America and the Caribbean (CAZALAC), University of Arizona, Pontificia Universidad Católica de Chile (Catholic University of Chile), UNESCO-IHP and the Stockholm Environment Institute Center. The workshop included 30 students from various countries of Latin America, the U.S. and Europe, mixing under-graduate and graduate students. The workshop was funded by the MWAR-LAC project and the IAI, the latter through the National Science Foundation (NSF) of the United States of America.
- CAZALAC engineers taught in the RALCEA-ATOS - CAZALAC workshop in Santiago, Chile, from 11 to 13 March 2013. The objective of the workshop was to present, analyze, discuss and evaluate the results and respective national maps that were developed by the attendees, who were all part of the EUROCLIMA-WATER project. In the workshop, the participants were trained on the Regional Frequency Analysis methods of precipitation, by using L-moments. After that, they designed their maps.
- CAZALAC participated in organizing and teaching in the "Development of National Drought Atlas for Caribbean countries workshop", organized through MWAR -LAC and RALCEA projects, coordinated by UNESCO and CAZALAC (4 to 8 of November 2013, in

Kingston, Jamaica). Training consider professionals from respective national institutions of the Caribbean countries, for the development of local maps in drought frequency. The instruction dealt with the implementation of the Regional Frequency Analysis Using L-moments. Specifically, the objectives were: a) to train professionals in the use of Regional frequency analysis using L-moments for hydrological applications and analysis of vulnerability to drought; b) training in the various options of open source software (R and REFRAN-CV); c) increase the number of specialists in the region who are trained in the methodology; d) generate maps of drought frequency in the participating countries of the Caribbean.

Appendix-1

Overview of the Core Programme Themes of the Seventh Phase of the IHP (2008-2013) WATER DEPENDENCIES: SYSTEMS UNDER STRESS AND SOCIETAL RESPONSES

Theme 1: ADAPTING TO THE IMPACTS OF GLOBAL CHANGES ON RIVER BASINS AND AQUIFER SYSTEMS

Focal area 1.1 - Global changes and feedback mechanisms of hydrological processes in stressed systems

Focal area 1.2 - Climate change impacts on the hydrological cycle and consequent impact on water resources

Focal area 1.3 - Hydro-hazards, hydrological extremes and water-related disasters

Focal area 1.4 - Managing groundwater systems' response to global changes

Focal area 1.5 - Global change and climate variability in arid and semi-arid regions

Theme 2: STRENGTHENING WATER GOVERNANCE FOR SUSTAINABILITY

Focal area 2.1 - Cultural, societal and scientific responses to the crises in water governance

Focal area 2.2 - Capacity development for improved governance; enhanced legislation for wise stewardship of water resources

Focal area 2.3 - Governance strategies that enhance affordability and assure financing

Focal area 2.4 - Managing water as a shared responsibility across geographical & social boundaries

Focal area 2.5 - Addressing the water-energy nexus in basin-wide water resources

Theme 3: ECOHYDROLOGY FOR SUSTAINABILITY

Focal area 3.1 - Ecological measures to protect and remediate catchments process

Focal area 3.2 - Improving ecosystem quality and services by combining structural solutions with ecological biotechnologies

Focal area 3.3 - Risk-based environmental management and accounting

Focal area 3.4 - Groundwater-dependent ecosystems identification, inventory and assessment

Theme 4: WATER AND LIFE SUPPORT SYSTEMS

Focal area 4.1 - Protecting water quality for sustainable livelihoods and poverty alleviation

Focal area 4.2 - Augmenting scarce water resources especially in SIDS

Focal area 4.3 - Achieving sustainable urban water management

Focal area 4.4 - Achieving sustainable rural water management

Theme 5: WATER EDUCATION FOR SUSTAINABLE DEVELOPMENT

Focal area 5.1: Tertiary water education and professional development

Focal area 5.2: Vocational education and training of water technicians

Focal area 5.3: Water education in schools

Focal area 5.4: Water education for communities, stakeholders and mass-media professionals

Appendix-2

Overview of the Core Programme Themes of the Eighth Phase of the IHP (2014-2021) WATER SECURITY: ADDRESSING LOCAL, REGIONAL, AND GLOBAL CHALLENGES

THEME 1: WATER-RELATED DISASTERS AND HYDROLOGICAL CHANGE

- Focal area 1.1 - Risk management as adaptation to global changes
- Focal area 1.2 - Understanding coupled human and natural processes
- Focal area 1.3 - Benefiting from global and local Earth observation systems
- Focal area 1.4 - Addressing uncertainty and improving its communication
- Focal area 1.5 - Improve scientific basis for hydrology and water sciences for preparation and response to extreme hydrological events

THEME 2: GROUNDWATER IN A CHANGING ENVIRONMENT

- Focal area 2.1 - Enhancing sustainable groundwater resources management
- Focal area 2.2 - Addressing strategies for management of aquifers recharge
- Focal area 2.3 - Adapting to the impacts of climate change on aquifer systems
- Focal area 2.4 - Promoting groundwater quality protection
- Focal area 2.5 - Promoting management of transboundary aquifers

THEME 3: ADDRESSING WATER SCARCITY AND QUALITY

- Focal area 3.1 - Improving governance, planning, management, allocation, and efficient use of water resources
- Focal area 3.2 - Dealing with present water scarcity and developing foresight to prevent undesirable trends
- Focal area 3.3 - Promoting tools for stakeholders involvement and awareness and conflict resolution
- Focal area 3.4 - Addressing water quality and pollution issues within an IWRM framework - improving legal, policy, institutional, and human capacity
- Focal area 3.5 - Promoting innovative tools for safety of water supplies and controlling pollution

THEME 4: WATER AND HUMAN SETTLEMENTS OF THE FUTURE

- Focal area 4.1 - Game changing approaches and technologies
- Focal area 4.2 - System wide changes for integrated management approaches
- Focal area 4.3 - Institution and leadership for beneficitation and integration
- Focal area 4.4 - Opportunities in emerging cities in developing countries
- Focal area 4.5 - Integrated development in rural human settlement

THEME 5: ECOHYDROLOGY, ENGINEERING HARMONY FOR A SUSTAINABLE WORLD

- Focal area 5.1 - Hydrological dimension of a catchment– identification of potential threats and opportunities for a sustainable development
- Focal area 5.2 - Shaping of the catchment ecological structure for ecosystem potential enhancement – biological productivity and biodiversity
- Focal area 5.3 - Ecohydrology system solution and ecological engineering for the enhancement of water and ecosystem resilience and ecosystem services
- Focal area 5.4 - Urban Ecohydrology – storm water purification and retention in the city landscape, potential for improvement of health and quality of life
- Focal area 5.5 - Ecohydrological regulation for sustaining and restoring continental to coastal connectivity and ecosystem functioning

THEME 6: WATER EDUCATION, KEY FOR WATER SECURITY

- Focal area 6.1 - Enhancing tertiary water education and professional capabilities in the water sector
- Focal area 6.2 - Addressing vocational education and training of water technicians
- Focal area 6.3 - Water education for children and youth
- Focal area 6.4 - Promoting awareness of water issues through informal water education
- Focal area 6.5 - Education for transboundary water cooperation