May 9-14, 2011

International Society for Salt Lake Research (ISSLR)
PROMAR, Centro de Zoología Aplicada, Universidad Nacional de Córdoba
Fundación Mar

11th International Conference on Salt Lake Research

Miramar, Mar Chiquita
Córdoba, Argentina
May 9-14, 2011

PROGRAM AND ABSTRACTS

Conference Co-Chairs:

Enrique H. Bucher
Erio D. Curto

Local Organizing Committee

Eduardo D. Acosta
Enrique H. Bucher
Marcela Castellino
Erio D. Curto
Alberto Pilati
Eduardo Piovano
Lourdes Perren

Program and Abstracts
Compiled by Jorgelina Brasca and Martín Modenesi

The International Society for Salt Lake Research, PROMAR, and Fundación Mar are very thankful to the following sponsors:

About ISSLR:
The primary purposes of the society are to establish effective liaison between persons interested in any aspect of inland saline lakes (including solar pans), to encourage these interests, and to educate the public in the scientific use, management, and conservation of salt lakes. To accomplish these purposes the society: holds a triennial international conference on salt lake research; produces special publications on salt lake research; maintains this web site for the purpose of facilitating communication among members, other professionals, and the public; provides a listing of members' current interests and research; provides a bibliography of salt lake research; and encourages interest in the limnology of salt lakes. Visit the website at http://www.isslr.org/

Promar:
PROMAR is a research, education and outreach program led by the Post Graduate Program in Wildlife Management from the Universidad Nacional de Córdoba, Argentina. The vision behind this program is to promote the conservation and sustainable development of Mar Chiquita (Córdoba), a large salt lake located in central Argentina. Mar Chiquita is a Provincial Natural Reserve, a RAMSAR Convention site, a member of the Living Lakes Network, and a site of Hemispheric Importance for the Western Hemisphere Network.

The program key goals include development of basic and applied research and environmental education programs (for schools and universities), as well as outreach initiatives for the local community by establishing and promoting links and networks between environmental institutions and regional municipalities.

PROMAR is essentially a multidisciplinary initiative. The proposed actions not only focus on the Wetland Reserve area, but also promotes the conservation and management of watersheds that feed the main tributary rivers of the Mar Chiquita lake system (Dulce, Primero, and Segundo rivers), as proper management of these areas are essential for the survival of Mar Chiquita.

For the implementation of its activities, PROMAR has a Field Station located in the town of Miramar, on the coast of Mar Chiquita. The station serves as the headquarters for all activities developed in the area.

Fundación Mar:
Founded in 2008, Fundación Mar is an organization devoted to preserve and protect the Ramsar site “Bañados del Río Dulce y Laguna Mar Chiquita”, fostering public awareness about the importance of this huge wetland through education, research, and promotion of sustainable regional development.

Since its creation, this foundation has been actively involved in all the initiatives conducted by PROMAR and has cooperated with the municipalities of Ansenuza.Region.

GENERAL INFORMATION

CONFERENCE VENUE

Most of the conference activities will be held at Miramar's SUM Auditorium. The Conference Services office will be located close to the SUM. Wireless Internet will be available.

REGISTRATION

Registration will be opened as follows:

Sunday, May 8, 18:00-20:00 - Hotel La Cañada (full- pre-registered participants only)
Monday, May 9, 18:00-20:00 - SUM, Miramar.
Tuesday, May 9, 8:00-9:00 - SUM, Miramar

USEFUL INFORMATION

To call any of the numbers listed below from outside Argentina:

Land line: 00 – 54 – Area code (without 0) – telephone number
Mobile phones: 00 – 54 – 9 – Area code (without 0) – telephone number (without 15)

Organizers' phone numbers:

Enrique H. Bucher: (03563) 15405872 (from outside Argentina: 00 54 9 3563 405401)
Erio Curto: (03563) 15405401 (from outside Argentina: 00 54 9 3563 405401)

Transportation Services

- Taxi Miramar (03563) 413080
- Taxi Marisel (03563) 491406
- Taxi Paulo (03563) 406020/ 406910
- Taxi Los Soles (03563) 410171/668576
- Taxi Santos (03563) 15412238
- Taxi Tito (03563) 15494417
- Global Remises – Service Ambrosio Taravella Airport (03563) 4753083

Bus Company

- Plus Ultra Miramar 351-2330490
- Plus Ultra Córdoba (Córdoba – Miramar/ Miramar – Córdoba) 0800 333 1970 www.mercobus.com.ar

Bus Terminals

- Bus Terminal in Córdoba (0351) 4284141 www.terminalcordoba.com
- Bus Terminal in Miramar (03563) 403619

Córdoba Airport

- International Airport "Ambrosio Taravella" Córdoba 351-4750871/74/77 www.aa2000.com.ar

Hotels in Miramar

Please visit:

www.turismomiramar.com
www.miramarcordoba.com.ar

Hotels in Córdoba city

- Hotel de la Cañada (Córdoba) 0054 351 4214649/ 4231227/ 0800 555 0084 www.hoteldelacaniada.com.ar
- Hotel Heydi (Córdoba) 0054 351 4233544/ 4218906/4222219 www.hotelheydi.com.ar

Recreation

- Photographic Museum (03563) 493078
- Gran Hotel Viena Museum (03563) 409780 / 410368
- Aníbal Montes Museum (03563) 493621
- Bahía del Sol Tours (03564) 15418171
- Michelutti Guided tours (Bird Watching) (03563) 15569871 / 493125
- Estrella Azul Tours (03563) 15406195 / 493063
- Nautical services and tours Laguna Mar Chiquita (03563) 15491920 / 15491227
- Ultralight flights (03563) 15408739
- Guided horseback riding (03563) 15409755 / 493662
- Bike rental (03563) / 493727

Bank services

- ATM available in Miramar that dispenses $Ar

Additional information

- Primary Care Center (03563) 493298
- Medical Emergencies (Ambulance) (03563) 493399
- Municipality of Miramar (03563) 493003 www.turismomiramar.com
- Tourist information (03563) 493777
- Police (03563) 493930/ 406192
- Mar Chiquita Reserve Administration (03563) 493934

INFORMATION FOR PRESENTERS

Oral Presentations

Computers and projectors will be available in each session for Power Point presentations. Please upload your presentation (Pen drive or CD) before each session. Please contact Marcela Castellino at the Conference Services Office.

Poster Presentations

Posters will be presented in two groups: Group A (Tuesday 10 and Wednesday 11) and Group B (Friday 13 and Saturday 11).
Please contact Marcela Castellino at the Conference Services Office for more details.

Conference Proceedings

The possibility of publishing the Conference Proceeding will be considered during the Conference.

CONFERENCE AGENDA

Sunday, May 8

All day:

- Arrival at Cordoba airport
- Transportation to “Hotel de La Cañada” (http://www.hoteldelacaniada.com.ar)

Evening:

- Welcoming reception

Monday, May 9:

10:30 Opening Ceremony (Aula Magna, Facultad de Cs Exactas, Físicas y Naturales, Universidad Nacional de Córdoba (299 Vélez Sarsfield Av. - Córdoba)
Conference: Mar Chiquita, the Largest Lake in Argentina: an Overview. Enrique H. Bucher

Afternoon:

14:30 Departing for Full Registered participants from Hotel de la Cañada - Arrival at Miramar

- Hotel accommodations

Tuesday, May 10

All day:

- Scientific sessions

Wednesday, May 11

All day:

- Scientific sessions

Evening:

- Special dinner - Tango Show

Thursday, May 12

Field trip

Friday, May 13

All day:

- Scientific sessions

Saturday, May 14

Morning:

- Special meetings and final sessions
- Closing ceremony

Afternoon:

14:00 Departing by bus for Córdoba City and Córdoba Airport.

- Those participating in the Post-Conference Trip will remain in Miramar for the rest of the day.

FINAL SCIENTIFIC PROGRAM (May 9)

Monday, May 9		
10:30	**Opening ceremony**	Aula Magna, Facultad de Ciencias Exactas, Físicas y Naturales de la Universidad Nacional de Córdoba
	Enrique H. Bucher	**Mar Chiquita, the largest lake in Argentina: an overview**

12:00 Lunch

Tuesday, May 10		
09:00	**Stuart Hurlbert**	**The salinity spectrum of inland waters**
10:00	**Welcome from Mar Chiquita regional authorities**	
10:20	COLEMAN, Mark	Alkalinity, pH and Carbon ions: some notes and implications for measurement in saline waters

10:40 Break

11:10	SANDOVAL, Felipe	The use of saline coastal wetlands as indicators of watershed environmental state
11:30	MELLADO, Claudia	Systemic functioning model of a wetland-channel-salty lagoon in the high Andean steppe region of Chile
11:50	URAOKA, Toradji	A spatial multi-scale approach for understanding the distribution patterns and habitat preferences of flamingos in brackish shallow lakes in Southern Santa Fe, Argentina
12:10	NIE, Zhen	Progress in extraction of lithium resources from salt lakes in China

12:30 Lunch

13:30	**María E. Farias**	**From DNA to living stromatolites: a world to discover in high altitude Puna lakes**
14:30	LITCHFIELD, Carol	How Do Haloarchaea survive environmental stresses?
14:50	ZHENG, Mianping	Discovery of terminal late Pleistocene-early Holocene stromatolites on the Tibetan Plateau

15:10 Break

15:40	KONG, Fanjing	Microbial biodiversity in Zabuye salt lake and lithium absorption by halophiles
16:00	AKRISH, Yaacov	The Dead Sea - one basin, three authorities, 4 elements, 7 wonders
16:20	**Round table: Sustainable development of saline lakes**	

Wednesday, May 11		
09:00	**Eduardo PIOVANO**	**Laguna Mar Chiquita: a unique sensor of past and present hydroclimatic variability in south eastern South America**
10:00	WURTSBAUGH, Wayne	Paleolimnological analysis of eutrophication and Artemia cryptobiology in the Great Salt Lake (USA)
10:20	WANG, Hailei	Grain-size composition from core deposits in Zabuye salt lake, Tibet, and its paleoenvironmental significance

10:40 Break

11:10	QUILLAGUAMÁN, Jorge	Carbohydrate transport and metabolism as derived from the genome sequence of *Halomonas boliviensis*: Influences on biopolyester production
11:30	CLARK, Jonathan	Molecular population genetic analysis of the Brine Fly, *Ephydra gracilis*, from Great Salt Lake, Utah
11:50	QI, Wen	Salt lake changes and their observation in China
12:10	WURTSBAUGH, Wayne	Mercury and selenium bioaccumulation in the stromatolite community in the Great Salt Lake, Utah

12:30 Lunch

13:30	**Ariel STEIN**	**Modeling studies of wind-blown salt storms originated from the Mar Chiquita lake (Argentina)**
14:30	KOTTE, Karsten	Saline environments as novel source for Volatile Organohalogens
14:50	COSTA, Diógenes	Spatial modeling of limnological parameters in solar saltponds

15:10 Break

15:40	RIOSECO, Tomás	Combining Remote Sensing techniques and field sampling data to study the spatial and temporal dynamics of aquatic ecosystems at the high Andean salt flats and its relationship with Andean Flamingos (*Phoenicoparrus andinus*) habitat
16:00	**Special Session**	**Stuart Hurlbert: Workshop on statistics for limnologists**
18:00	**Posters session**	

Thursday, May 12	
All day	**Mid Conference Trip**

Friday, May 13		
9:00	**Aharon OREN**	**The Dead Sea and the Aral Sea: two disparate lakes with a similar history**
10:00	BUCHER, Enrique H.	Early maps of the Mar Chiquita region (17th and 18th centuries) and their paleogeographical implications
10:20	OREN, Aharon	Dead Sea - Red Sea and Dead Sea - Mediterranean Sea connections on 17th-19th century maps of the holy land

10:40 Break

11:10	KOPPRIO, Germán	Unstable natural water reservoirs in semiarid regions: moving from fragmented to coordinated eco-hydrological management
11:30	ROCHA, Renato	Characterization and ecological importance of the Brazilian solar saltwork ponds: a review
11:50	LÓPEZ MUÑOZ, Matilde	Total environmental management in surface waters at Salar de Atacama basin, Chile
12:10	ZADEREEV, Egor	Vertical stratification of physical, chemical and biological components in two saline meromictic lakes Shira and Shunet, (South Siberia, Russia)

12:30 Lunch

13:30	RIVERO, Mary Laura	The amphibians and reptiles of salinas and bañados in the Bolivian Chaco
13:50	BUCHER, Enrique H.	Mar Chiquita invasion by the silverside fish (*Odonthestes bonariensis*): a unique event in the lake history
14:10	HUDSON, Peter	Interim results of barcoding Australian pogonine beetles (Carabidae: Pogoninae)
14:30	SCHMIDT, Nadja	Hydrogeological and hydrochemical exploration of a lithium-brine deposit: the Salar de Uyuni, Bolivia

14:50 Break

15:20	**Special Session**	**Workshop: Bird migration routes utilizing salt lakes in the Americas (Flyways BirdLife initiative in the Americas**
18:30	**Posters session**	

Saturday, May 14		
09:00	OREN, Aharon	Lourens Baas Becking - a pioneer of biological salt lake research
09:20	CARRASCO, Jesús	The contribution of European funds to the creation and support of a sustainable saltscape-based tourism
09:40	TIMMS, Brian	A review of brine shrimps (Anostraca: Artemiina) in Australian saline lakes
10:00	DATSON, Bindy	Aquatic invertebrate fauna in western Australian wetlands – species variation according to salinity, pH and turbidity
10:20	CARRASCO, Jesús	Iberian inland saline wetlands. A recent inventory and potential for local development as a tool for conservation
10:40	BERTHELEMY, Nicole	Relationships between physiological and biochemical changes following exposure to mercury chloride in the brine shrimp Artemia
11:00	**ISSLR Business**	
12:00	**Closing ceremony**	

POSTER SESSION (Wednesday, May 11)	
AYCAN, Miyesser	Archaeal populations of Meke lake in Turkey
ÇINAR, Seval	Haloviruses from Çamalti saltern, Turkey
ÇIRPAN, Ceyhun	Prokaryotic diversity of Çankiri salt mine in Turkey
DAGA, Romina	Indicators of recent environmental changes in a saline lacustrine sedimentary sequence recovered from lake El Toro, Neuquén steppe, Argentina
JIA, Qinxian	Frame of autumnal carbon flux and contributions of carbon sequestration in Dagze Co lake, Tibet, China
KOPPRIO, Germán	Zooplankton dynamic in a salt lake of the semiarid Argentinean pampa
KOTTE, Karsten	Climatic effects on the emission of Volatile Organohalogens from saline soils
KOTTE, Karsten	Rapid change detection and salt classification as a promising tool to estimate emission of organohalogens from saline ecosystems
OREN, Aharon	Oceanographic equipment used in Dead Sea explorations in the middle of the 19th century
SHI, Linfeng	Magnetostratigraphy of Saline Sediment in Dalangtan, Western Qaidam Basin, China
TIMMS, Brian	Preliminary results on Parartemia diversification in Australia

WANG, Yunsheng	5ºC - isothermal evaporation of autumn brines from the Zhabei salt lake, Tibet, China

POSTER SESSION (Friday, May 13)	
ABATZOPOULOS, Theodore	Preliminary results on genetic characterization of Artemia from Mono Lake (USA)
ALBAYRAK, Ece	Virus-Like Particles in Çamalti Saltern, Turkey
BASCHINI, Miria	Natural materials from Laguna Mar Chiquita and their possible use in human health
BATTAUZ, Yamila	Characterization of the zooplankton of the Pampean saline shallow lakes and its importance for the conservation of Andean flamingoes
BRUNO, Gustavo	Education for the conservation of migratory birds in Mar Chiquita, Córdoba, Argentina
CURTO, Erio	Deforestation process around Mar Chiquita lake: a 30 years assessment
ECHANIZ, Santiago	Population dynamics of the Brine Shrimp *Artemia persimilis* (Crustacea, Anostraca) in Utracán, a hypersaline lake of La Pampa, Argentina
LUNA, Carlos	The importance of paleontological sites of the Mar Chiquita lake (Córdoba province, Argentina) and the need for their technical and legal protection
MONTOYA, Haydee	Phenotypic plasticity of the cyanobacteria *Aphanothece stagnina* at central pacific coastal wetlands at Lima, Peru
MUFARREGE, Mercedes	Adaptability of *Tipha domingensis* to environments with high pH and salinity
NAVARRO RAMOS, Silvia	Characterization of the amount of water in a section of the Dulce river
ORONÁ, Claudia	Limnology of a salt lake endorheic: Laguna del Plata - Mar Chiquita, Córdoba
PILATI, Alberto	Nutrient limitation in Mar Chiquita (Córdoba, Argentina)
SONDOSSI, Mohammad	Genetic characterization of the bacterial endosymbiont, Wolbachia, in Shore Flies from Great Salt Lake in Utah, USA
VIGNATTI, Alicia	Distribution of saline lakes and planktonic crustaceans in the province of La Pampa, Argentina

POSTER SESSIONS

Wednesday, May 11, 18:00

Miyesser Aycan
Archaeal populations of Meke Lake in Turkey

Seval Çinar
Haloviruses from Çamalti saltern, Turkey

Ceyhun Çirpan
Prokaryotic diversity of Çankiri salt mine in Turkey

Romina Daga
Indicators of recent environmental changes in a saline lacustrine sedimentary sequence recovered from Lake El Toro, Neuquén steppe, Argentina

Qinxian Jia
Frame of autumnal carbon flux and contributions of carbon sequestration in Dagze Co Lake, Tibet, China

Germán Kopprio
Zooplankton dynamics in a salt lake of the semiarid Argentinean Pampa

Karsten Kotte
Climatic effects on the emission of Volatile Organohalogens from saline soils

Karsten Kotte
Rapid change detection and salt classification as a promising tool to estimate emission of organohalogens from saline ecosystems

Aharon Oren
Oceanographic equipment used in Dead Sea explorations in the middle of the 19th century

Linfeng Shi
Magnetostratigraphy of Saline Sediment in Dalangtan, Western Qaidam Basin, China

Brian Timms
Preliminary results on Parartemia diversification in Australia

Yunsheng Wang
5 ºC- isothermal evaporation of autumn brines from the Zhabei salt lake, Tibet, China

Poster session

Friday, May 13, 18:30

Theodore Abatzopoulos
Preliminary results on genetic characterization of Artemia from Mono Lake (USA)

Ece Albayrak
Virus-Like Particles in Çamalti Saltern, Turkey

Miria Baschini
Natural materials from Laguna Mar Chiquita and their possible use in human health

Yamila Battauz
Characterization of the zooplankton of the Pampean saline shallow lakes and its importance for the conservation of Andean flamingoes

Gustavo Bruno
Education for the conservation of migratory birds in Mar Chiquita, Córdoba, Argentina

Erio Curto
Deforestation process around Mar Chiquita lake: a 30 years assessment

Santiago Echaniz
Population dynamics of the Brine Shrimp *Artemia persimilis* (Crustacea, Anostraca) in Utracán, a hypersaline lake of La Pampa, Argentina

Carlos Luna
The importance of paleontological sites of the Mar Chiquita Lake (Córdoba province, Argentina) and the need for their technical and legal protection

Haydee Montoya
Phenotypic plasticity of the cyanobacteria *Aphanothece stagnina* at central pacific coastal wetlands at Lima, Perú

Mercedes Mufarrege
Adaptability of *Tipha domingensis* to environments with high pH and salinity

Silvia Navarro Ramos
Characterization of the amount of water in a section of the Dulce River

Claudia Oroná
Limnology of a salt lake endorheic: Laguna del Plata - Mar Chiquita, Córdoba

Alberto Pilati
Nutrient limitation in Mar Chiquita (Córdoba, Argentina)

Mohammad Sondossi
Genetic characterization of the bacterial endosymbiont, Wolbachia, in Shore Flies from Great Salt Lake in Utah, USA

Alicia Vignatti
Distribution of saline lakes and planktonic crustaceans in the province of La Pampa, Argentina

SPECIAL SESSIONS

Round table: "Sustainable development of saline lakes"
Facilitator: Eduardo D. Acosta and Enrique H. Bucher
Tuesday, May 10, 16:20

The challenge

Salt lakes around the world are threatened by several environmental problems, including water appropriation from tributaries, mining, water pollution from different sources, and biodiversity loss. Overimposed on those, climate change is likely to cause further and in many cases unpredictable demands and stresses.

Local populations living on the close proximity of salt lakes face additional environmental problems and constraints that affect local and regional sustainable development, including urban population growth and tourism development, which result in new demands in terms of water sewage treatments and industrial pollution, among others.

An additional constraint comes from the erratic and sometimes substantial variations in water level usually associated with closed salt lakes, as recently experienced in several lakes of Argentina.

Objectives:

- To share knowledge and experiences on environmental management issues in Dead Sea (Israel) and Mar Chiquita, Melincue, and Epecuen lakes (Argentina).
- To learn about initiatives and opportunities related to adaptation to climate change, specially related to wetlands.
- To establish future interactions and initiatives through networking and partnership.

Topics

- Share experiences from municipal authorities of salt lakes from Israel and Argentina
- Response to decreasing water availability from tributary rivers
- How to adapt to erratic water level changes in salt lakes?
- The importance of long-term planning and adaptation to climate change.

Participants:

- Enrique H. Bucher. Promar, Universidad de Córdoba
- Itzik Mazor. Project Leader. Tamar Regional Council. Dead Sea, Israel
- Yaakov Akrish.Dead Sea Tamar Regional Council. Dead Sea, Israel
- Alberto Gutt, Mayor, Adolfo Alsina. Epecuén Lake
- Oscar Raúl Pernigotti, Mayor Melincué. Melincué Lake
- Adrián Walker, Mayor, Miramar. Mar Chiquita lake
- Daniel Costantino, Mayor, Marull. Mar Chiquita lake
- Vicente Costamagna, Mayor, Balnearia. Mar Chiquita lake
- Mindo Tito, Mayor, Balnearia. Mar Chiquita lake
- Ana E. Bucher. World Bank
- Patricia Calandin, Córdoba Ombusdman

SPECIAL SESSIONS

Stuart Hurlbert
Workshop on statistics for limnologists
Wednesday, May 11

Talks and discussions focused on very basic statistical issues that all researchers must understand, including the bad advice on statistics provided by many professors, textbooks and editors.

"*As practiced by most scientists, statistics is first and foremost a religion with mathematical trappings that function to scare the intuitive, the rebellious, and the heretical into submission*." (S. Hurlbert)

16:00 "The logical incoherence of modern statistical practice"

Abstract: As practiced by most scientists, statistics is first and foremost a religion with mathematical trappings that function to scare the intuitive, the rebellious, and the heretical into submission. What is done and taught with respect to particular statistical issues shows little consistency from one nation to another, one university to another, one textbook to another, one discipline to another, one editor to another. Where there is some consistency, the majority is wrong. These problems have their main origin in polemics and cryptic writing of a few brilliant gents in England in the early part of the last century. Peeling away inherited doctrinal pathologies, we discover one should never specify alpha, never use the word "significant", never admit to the possibility of type II error, never get paranoid about 'multiple comparison situations,' never use one-tailed tests, and never use repeated measures analysis of variance. For sinners, an opportunity for absolution will be offered at the end of the talk.

17:00 Open Discussion: "You, statistics, editors and suicidal thoughts"

SPECIAL SESSIONS

Workshop: “Bird migration routes utilizing salt lakes in the Americas (Flyways BirdLife initiative in the Americas)”

Friday, May 13, 15:20

Introduction

Reversing the declines of migratory birds requires joined-up conservation efforts across many countries. Many of the 340-plus species of Neotropical migrants - birds that breed in North America and winter in Central and South America and the Caribbean - are in rapid decline. To date, efforts and resources have been concentrated on conserving breeding habitats in the north, where pressures are certainly acute. However, for such migratory species to survive and thrive, critical sites along their migratory flight paths need to be available to these species.

The energetic costs associated with migration mean that birds are under pressure to use the shortest possible route; however, the precise course taken will depend on weather patterns, resources and the geographical features they encounter. Thus, routes often follow mountain ranges, watercourses and coastlines, frequently avoiding large bodies of open water and take advantage of prevailing wind patterns and updrafts. As a result, a number of species often share analogous flyways, especially those with similar biological and ecological traits.

In the Americas there are three flyways (the Pacific Americas Flyway, Central Americas **Flyway** and **Atlantic Americas Flyway**) connecting the high Arctic to Tierra del Fuego—the southernmost tip of the South American mainland.

Many of the Americas migratory species are in decline, assailed by multiple threats, including habitat destruction and degradation, illegal and unsustainable hunting, infrastructure development, climate change and disease. Their conservation depends on a coordinated response on a global scale. Flyways provide a framework that can help forge international collaboration and focus attention on the strategic needs of migratory birds. Within such a framework, wetlands that have been recognised as Important Bird Areas (IBAs) and Ramsar sites are often identified on the basis of their value to globally significant populations of breeding and/or migratory species. There are many IBAs and Ramsar sites along these flyways that are salt lakes (salars), which provide highly productive environments for both migratory and breeding species.

Salt Lakes are formed when water containing salts or other minerals, drains into an endorheic terminal lake, which accumulates within an internal basin with no significant outlet to the sea. Examples such as the high altitude salars of Catamarca and Salta and Laguna Mar Chiquita (Cordoba) in Argentina, the Atacama Desert of Chile and the Great Salt Lake of Utah in the USA all demonstrate great value as globally important sites for breeding and/or migratory birds. When water evaporates and the remaining dissolved salts accumulate, this leads to increasing salinity, resulting in extreme conditions for aquatic flora and fauna. Frequently such conditions can be very prolific for adapted invertebrates, a situation that can be very favorable for a number of bird species. Such species are generally shorebirds that use salt lakes during migration, as well as highly adapted species such as avocets and flamingos which breed at such sites.

That such saline lakes are becoming seen as critical to the life histories of many migratory birds is now being acknowledged. This conference, an internationally recognized opportunity for discussing the attributes and values of salt lake ecosystems, provides an ideal opportunity to

share knowledge on the values and problems of salt lakes as flyway sites for migratory species. The growing international interest in migratory birds conservation, with the institutional support that is being developed, provide a valid background to promoting and profiling saline lakes as key sites for migratory bird conservation.

Objectives:

- To learn about and share knowledge on conservation efforts for migratory birds and resident species at saline sites located along flyways in the Americas.
- To describe the ostensible and real connections between North American and South American sites.
- To establish partnerships and a framework for connecting (Linking) communities associated with conservation efforts at flyway sites and that recommends further actions for moving forward.

Topics to be included

- Flyways in the Americas
- Neotropical migratory bird status at IBAs and Ramsar sites
- Science and environment
- Natural resource industries that are associated with saline lakes: impacts and opportunities for sustainable development
- Working with local communities around sites
- Working together – examples of regional or binational conservation projects with Salt Lakes to conserve migratory species in a coordinated hemispheric effort.

Program

Facilitators**:** Itala Yépez and Jonathan Stacey, BirdLife International

Introductory lecture by:

1. **Flyways BirdLife initiative in the Americas: Bridging together sites and migratory species across the continent** – R. Clay, C. Devenish, D. Díaz y I. Yépez, BirdLife International. (10 min)

Participants:

2. **Saline Lakes and the Network of Wetlands of Importance for High Andean Flamingo Conservation -** Authors: Patricia Marconi, Felicity Arengo, Jonathan Stacey, BirdLife International (15 min)

3. **Importance of Riacho Yacaré lagoons for Neartic migrant conservation –** Authors: Centrón, S. y Morales, C., Guyra Paraguay (15 min)

4. **Chilean Salt Lakes towards the implementation of a conservation strategy** – Patricio Ortiz-Soazo, CODEFF (15 min)

5. **Linking Communities, Wetlands and Migratory Birds Program –** Author Don S. Paul, (15 min)

6. **Determination of areas of special protection for the conservation of migrants shorebirds in the Mar Chiquita reserve** – Pinto Ledezma, Jesus N., Centro de Zoología Aplicada, Universidad Nacional de Córdoba, Argentina (15 min)

7. **Education for the conservation of migratory birds in Mar Chiquita, Córdoba, Argentina** – Bruno, G., Aves Argentinas (15 min)

8. **Rio Tinto - BirdLife International Western Hemisphere Flyways program – a mechanism for Migratory Bird and Saline Lake conservation**. Author: Jonathan Stacey, BirdLife International (15 min)

9. **Avian resources of the Great Salt Lake –** Cavitt, John, BirdLife International (15 min)

Open discussion: 25 min

SPECIAL EVENTS

Wednesday, May 11. Evening

Tango night

Informal event: Cheese tasting and tango show

Thursday, May 12. All day

Mid-conference Trip

Mar Chiquita is Argentina's biggest lake. Of geological origin, Mar Chiquita is a terminal lake of tectonic origin, about 50,000 years old[1]. Its size has ranged between 2,000 and 6,000 square kilometers according to water level, whereas water salinity ranged inversely between 25 and 360 grams per liter. Water chemical composition is similar to sea water, except for much higher sulfate content.

Mar Chiquita is rich in biodiversity, particularly birds. Flag species include three of the six flamingo species worldwide. In 1998, about 100,000 adults and 50,000 young Chilean flamingos were recorded. The area also hosts several intercontinental migratory species, particularly shorebirds. Some of the shorebird species seen in Cordoba fly every year nonstop to North America, with stops at Mono Lake and the Great Salt Lake.

Among mammals, the large cat Puma is still seeing in the area. Very common is the coipo, an aquatic rodent that is also bred in captivity for the fur industry. Coipos were exported from Argentina (and Mar Chiquita) to several countries around the world during the first half of the 20th century, and in some places became wild and a serious pest. Given its conservation value, Mar Chiquita is a Provincial Reserve (Córdoba). In 2002 was nominated as a Ramsar Site by the Ramsar convention.

The lake water level oscillated significantly along its geological history, and particularly during the last hundred years. A very intense wet period started at the end of the 1970 decade, leading to a 9 m increase in water level. As a result, the lake area was triplicated, the salinity decreased accordingly, and the lake was invaded by silverfish (*Odonthestes bonariensis*), giving place to a significant fishing industry. Moreover, the only coastal town, Miramar, was partially flooded. The ruins of the old town are still visible, including the paradigmatic Viena Hotel. Today, Miramar is in a process of rapid growth, boosted by its growing importance as a resort site.

Since 2003, rainfall in the lake catchment area decreased significantly, leading to a steady level decline of Mar Chiquita that continues at present. Silverfish disappeared from the lake when water salinity went over the 60 grams per liter threshold. Since 2006 the constant drop in rainfalls in Mar Chiquita river basin has led to a marked reduction of water level that still continues

[1] Notice that two other saline lakes in Argentina are also named “Mar Chiquita”, both located in the Buenos Aires province. The first is a coastal albufera near the city of Mar del Plata, and the second is smaller lagoon close to the city of Junin.

Low water level has generated extensive mudflats along the shores of Mar Chiquita from where large salt dust plumes form under suitable wind speed conditions. These plumes have reached up to 350 km from the origin, extending over very productive agricultural areas of Argentina).

At present the main environmental threats affecting Mar Chiquita is water withdrawal from its tributary rivers, for urban consumption, irrigation, and mining. Water pollution is also increasing.

Itinerary

First stop: Bird Observatory

The bird observatory is located in the Segundo River delta, where usually it is possible to see a great variety of birds, including flamingos, skimmers, swans, ducks and cormorans, among others. Since it was open to the public (2003) the receding water level led the coastline at considerable distance from the observatory. On the wide shore mudflats, salt efflorescence on dry days feed the frequently seen wind-blown salt dust. Limnology of the area shows great variability driven by the mixing of freshwater from the river with salty water from the lake.

Second stop: Meteorological station. National Atmospheric Deposition Program

After leaving the Bird Observatory, the road crosses the Segundo River bridge, and shortly after we stop at the Meteorological Station, located in a typical Argentine farm. The station is one of the few operating in South America in connection with National Atmospheric Deposition Program, which aims at the study of chemical compounds that contaminate rainwater worldwide. Additionally, the station collects samples of salt dust generated in the Mar Chiquita area.

Third Stop: Campo Mare.

On the coast of Mar Chiquita lake. A massive sand dune from an ancient dry period generated a picturesque cliff where fragments of Pre-Columbian pottery are frequently seen.

Fourth stop: Laguna del Plata

Of estuarine lake type, Laguna del Plata is connected to Mar Chiquita main lake. It collects the water inflow from the Rio Primero. Its limnology is strongly affected by human-generated pollution, showing clear indications of eutrophication. The cliffs that surround the Southern coast provide interesting information on the geological history of the site.

In Laguna del Plata a traditional Argentine “asado” lunch will be served, followed by a horse riding exhibition by local “gauchos”).

PLENARY SPEAKERS

Enrique H. Bucher:
"Mar Chiquita, the Largest Lake in Argentina: an Overview"
Monday, May 9, 10:30

Professional affiliation:
Promar, Centro de Zoología Aplicada
Facultad de Ciencias Exactas, Físicas y Naturales
Universidad Nacional de Córdoba

ABSTRACT

The Bañados del Rio Dulce and Laguna Mar Chiquita Ramsar site (Córdoba province, central Argentina) includes a large, terminal salt lake (present area = 4,000 km^2) and its associated grasslands and wetlands. The area is very rich in biodiversity, particularly migratory shorebirds and flamingos (three species).Mar Chiquita is a provincial Reserve and a Ramsar Convention site. Climate change has altered the region dramatically. Between 1970 and 2000 the rainfall regime in the Mar Chiquita basin increased in about 30%, which resulted in a 9 m elevation of the lake's water level, together with a substantial decrease in water salinity, from 23% to 2.7%. Lower salinity levels allowed the silver-side fish (*Odontesthes bonariensis*) to expand into the lake in the early 1980's, becoming an important economic resource. The only riverine town, Miramar, was partly flooded. Since 2003 the climatic trend reversed, and water level has been declining steadily since then. As a result, large mudflats become exposed, which generate significant salt-dust storms that transport salt dust over 300 km away on agricultural land. Even if still largely pristine, the region is becoming increasingly threatened by man-induced environmental problems. Main negative factors include a) water appropriation in the upper tributary rivers, b) increasing water pollution, and c) increasing sport hunting pressure from international bird-hunting tourism. Water appropriation is driven mostly by agriculture expansion and urban growth along the three main Mar Chiquita tributaries. A decrease in water availability and new projected dams in the upper tributaries may result in changes in the annual flooding and fire regime, which in turn may have profound effects on the grasslands and wetlands that surround the lake. The University of Cordoba, through the PROMAR initiative, is promoting development and implementation of a Management Plan for the site, following Ramsar guidelines and criteria.

PLENARY SPEAKERS

Stuart Hurlbert:
“The salinity spectrum of inland waters”
Tuesday, May 10, 9:00

Professional affiliation:
Department of Biology
San Diego State University
San Diego, California

ABSTRACT
The salinity of inland waters ranges over about 6 orders of magnitude, from 0.005 g/L to 500 g/L, and is factor of great importance in determining the structure and functioning of these ecosystems. A variety of salinity classification schemes have been proposed over the last century, some authors have worried about the dividing line between "freshwater" and "saline" lakes, and a few have examined the actual frequency distribution of salinity. These matters will be reviewed, new information will be presented, and its relevance to lake conservation discussed. If you ever wondered about the connections between G. Evelyn Hutchinson's divorce, David Frey's death, and Bill Williams' tongue, this is the talk for you.

PLENARY SPEAKERS

María E. Farias:

"From DNA to living stromatolites: a world to discover in high altitude Puna lakes"

Tuesday, May 10, 13:30

Professional affiliation:
LIMLA-PROIMI-CONICET

ABSTRACT

High-altitude Andean lake (HAAL) ecosystems of the South American Andes are almost unexplored systems of shallow lakes formed during the Tertiary geological period, distributed in the geographical area called the Puna-High Andes at altitudes from 3,000 to 6,000 m above sea level, and isolated from direct human activity. The HAAL ecosystems are unique not only for their geographical characteristics and broad range of extreme environments but also for their abundant biodiversity. The microbial communities that have evolved within these high-altitude aquatic ecosystems tolerate chemical and physical stresses such as wide fluctuations in daily temperatures, hypersalinity, and variable pH and have proved to be adapted to high levels of UV radiation, a low level of nutrient availability, and high concentrations of heavy metals, especially arsenic. So far these outstanding microbial diversity and resistance mechanisms to extreme factors have been described in most Lakes at these locations, i.e. Laguna Azul, Laguna Verde, Laguna Negra, Laguna Vilama, Laguna Aparejos, Laguna Chaxas where microbes have been isolated mainly from shallow water and sediments. In a recent exploration, the presence of modern stromatolite-like ecosystems at hypersaline lakes: i.e. Socompa Lake, "Sea Eyes" at Tolar Grande and Lake Diamante have been determined. Stromatolites are internally-laminated, macroscopic sedimentary structures, commonly of biological origin that form the dominant part of Earth's early fossil record and so provide a potentially important source of information about early life. The oldest examples of these preserved formations are more than 3 billion years old and are found mainly in Western Australia and South Africa. Recent studies have reflected a widespread and growing acceptance of the oldest stromatolites from the Pilbara region of Western Australia as biogenic. In turn, modern stromatolites have been so far recorded in four locations: i) an hypersaline region of Hamelin Pool, Shark Bay in Western Australia, ii) shallow subtidal regions at the margin of Exuma Sound in the Bahamas, iii) fresh-water areas at the Cuatro Ciénagas basin in Mexico; and iv) Yellowstone Hot Spring. All of these locations are situated at the sea level where microorganisms cope with little or no stress conditions. In the dessertic region of Salta, Northwestern Argentina, we have found characteristic stromatolite-like ecosystems laying and developing in shallow hypersaline lakes located above 4,000 meters, under the pressure of harsh conditions, very similar to the ones present in the Early´s Earth atmosphere.

PLENARY SPEAKERS

Eduardo Piovano:
"Laguna Mar Chiquita: a unique sensor of past and present hydroclimatic variability in south eastern South America"
Wednesday, May 11, 9:00

Professional affiliation:
CICTERRA – CONICET
Universidad Nacional de Córdoba
Córdoba, Argentina.

ABSTRACT
The 20th century in the Argentinean Pampas has been characterized by a pronounced hydrological variability as evidenced by distinct lake level fluctuations and varying river discharges. Instrumental records show dominant dry conditions up to the decade of 1970s followed by a hyper-humid phase that triggered dramatic lake level rises with important social consequences. The hydrological conditions after the 1970s have rendered obsolete a great part of the infrastructure, since it was designed for a different climate.Maximum lake levels were observed in 1987, 1993, and 2003, followed by a rapid drop that began after 2003 and that is still ongoing. The paleolimnological record of Laguna Mar Chiquita (30°S-62°W) provides sedimentological, geochemical and biological evidences to analyze the most recent hydrological changes within a larger time-window (i.e., last 13,000 years). Paleohydrological reconstructions show dominant dry conditions during cold phases, such as those occurring during the mid-Holocene or the Little Ice Age, whereas wet conditions prevailed during warm climatic phases such as the Medieval Climatic Anomaly or the late 20th century. When Laguna Mar Chiquita paleolimnological record is compared to other records from the Pampean plains (e.g., Laguna Melincué-34°S; Lagunas Encadenadas del Oeste de Buenos Aires- 37°S) a coherent and synchronic pattern of hydrological variability is present. Furthermore, there is a close correspondence between the 20th century hydrological variability recorded in Pampean lakes with those shown by large-scale fluvial systems (e.g., Río Paraná; Río Paraguay). Results underscore the need to reinforce paleoclimate research at mid latitudes in South America, in an attempt to fully appreciate natural climate variability beyond the instrumental record, as well as to aware the technical community about the regional hydroclimate trends for planning infrastructure.

PLENARY SPEAKERS

Ariel F. Stein:

"Modeling studies of wind-blown salt storms originated from the Mar Chiquita lake (Argentina)"

A.F. Stein, S. Gasso and D.M. Gaiero

Wednesday, May 11, 13:30

Professional affiliation:
Earth Resources & Technology, on assignment to NOAA's
Air Resources Laboratory, Silver Spring, MD, USA

ABSTRACT

Dust particles originating from erodible land areas and subjected to long range transport are a subject of increasing scientific interest due to their effect on climate, biogeochemistry, and air quality. In particular, the impact of salt storms on the environment and vulnerable population is of high concern due to its disrupting impacts on health and many relevant economic sectors, such as agriculture. The assessment of the influence of such storms can be tracked using simulation tools that provide insightful information on predicted paths and geographical distribution. The Hybrid Single Particle Lagrangian Integrated Trajectory (HYSPLIT) model offers a conceptual framework to help understanding the main atmospheric processes driving such storms. The HYSPIT model is a complete system for computing trajectories, complex dispersion, and deposition simulations of air particles. The model can be applied to study a wide range of atmospheric phenomena including accidental radionuclide releases, smoke originated from forest fires, volcanic ash, and dust storms. In this work, the core capabilities of the model are presented and special emphasis is made on the application to the emission, transport, dispersion, and deposition of dust originated from saline lake shores. The original dust emission module included in HYSPLIT was constructed exclusively for desert areas using the concept of a threshold friction velocity which is dependent on surface roughness. The surface roughness was correlated with geomorphology or soil properties and a dust emission rate is computed where the local wind velocity exceeds the threshold velocity for the soil characteristics of that emission cell. For application to domains where detailed digital soil characteristics are not always available, such as in the shores of Mar Chiquita, the original emission module was modified to use a simple formulation based on the friction velocity and is independent on the soil characteristics. In this application, potential dust producing areas have been defined by assuming emissions could occur from active dust sources as detected by the MODIS satellite throughout the year 2009. A total of 8 sources have been identified as potential dust emitters. Dust emissions only occur during dry days and when the friction velocity exceeds the threshold value (0.28 m/s). Once the emission of salt particles strength is determined, particles are emitted by the model with a mass computed by multiplying the emission flux by the area also determined by the satellite measurement. These particles are dispersed and transported forward in time according to meteorological fields from NOAA's Global Forecast System (GFS) model with a horizontal resolution of one degree. The model results have been compared against available satellite images and a surface measurement site in Marcos Juarez, Province of Cordoba, (about 200 km South of Mar Chiquita) for the entire 2009. These kinds of models represent a useful tool to help evaluate climate and environmental conditions that might trigger dust storms and help monitor areas of high exposition to such events.

PLENARY SPEAKERS

Aharon Oren:
"The Dead Sea and the Aral Sea: two disparate lakes with a similar history"
Aharon Oren, I.S. Plotnikov, S. Sokolov and N.V. Aladin
Friday, May 13, 9:00

Professional affiliation:
Department of Plant and Environmental Sciences,
The Institute of Life Sciences,
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91904 Jerusalem, Israel.

ABSTRACT
In spite of far-reaching differences in size, depth, salinity and other properties, the Dead Sea located on the border between Israel and Jordan (current elevation -423 m, surface area 940 km^2, volume 152 km^3, maximum depth 332 m) and the Aral Sea on the border between Kazakhstan and Uzbekistan (surface 66,500 km^2, volume of 970 km^3, maximum depth 67 m [1960 values] share many features as shown in a comparison of the histories of both lakes. Fifteenth and early sixteenth century maps based on the 'Geography' of Ptolemy show both lakes. The first successful limnological surveys of the lakes were made in the same year 1848, when William Lynch mapped the Dead Sea and Alexey Butakov explored the Aral Sea Paintings and drawings by David Roberts (Dead Sea) and Taras Shevchenko (Aral Sea) document the landscapes around the lakes in the first half of the 19^{th} century. The water balance of both lakes has been strongly negative in the past decades, leading to a decrease in lakes' surface and volume, an increase in salinity, and deterioration of the local infrastructure. For both lakes complex and expensive mitigation schemes have been proposed based on the import of large amounts of water from far-away sources by means of canals or pipelines (the Mediterranean Sea or the Red Sea to be connected with the Dead Seal; Siberian rivers or the Caspian Sea to supply water to the Aral Sea). Less dramatic solutions to improve the local situation have already resulted in an improvement in water quality in the Aral Sea and partial restoration of fishery activity. The Dead Sea remains far too saline to support higher forms of life, but a biblical prophecy predicts that also this, most hypersaline of all lakes will eventually be teeming with fish of many kinds.

ABSTRACTS

THE DEAD SEA - ONE BASIN, THREE AUTHORITIES, 4 ELEMENTS, 7 WONDERS

Y. Akrish

Mr. Yaakov Akrish Tamar regional council Neve zohar Israel, Council secretary & Tourism department director. akrish@ma-tamar.co.il

The Dead Sea is disappearing. Due to various climatic, manmade and natural experiences the Dead Sea level is receding. This in turn creates several difficulties on the shore for residents, visitors and nature itself.
Several actions have already been taken in order to address the problems the Dead Sea is facing. International recognition of the Dead Sea and all its properties has been created. Co-operation between all the surrounding countries and authorities has been established. Tourism has been promoted to a present maximum by erecting various levels of accommodation and attractions. The Dead Sea is unique. There is no other sea on earth with such a high content of salt and minerals. The health benefits are enormous and are being taken advantage of on a daily basis. The Dead Sea is a heritage of thousands of years and features in many religions throughout the world. Over the past half century, agriculture and industry has been established and settlements along the Dead Sea shore are thriving until today. By the Dead Sea being elected as one of the Seven Wonders of the World the potential benefits would be considerable. There would be increased global interest that would focus on the problems of the Dead Sea. An increase in tourism and visitors/settlers to the area would ensure the protection of the Dead Sea. Co-operation between the surrounding countries would also ensure a future for this unique lake and would enable the establishment of a regional committee to co-ordinate on the problems such as; drop in Dead Sea water level, sinkholes and other threats.

VIRUS-LIKE PARTICLES IN ÇAMALTI SALTERN, TURKEY

E. Albayrak[1], S. Çınar[1,2] and M.B. Mutlu[1]

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Çamaltı Saltern is the biggest coastal solar saltern on the Aegean cost of Turkey and produces most of the salt consumed in the country. The microbiota inhabiting this saltern was examined by culture-dependent studies. However there were no previous reports on the viral diversity of this hypersaline environment. In this preliminary study, brine samples were collected and centrifugated with low speed to remove bacterial cells. Supernatant was filtered through 0.22 µm filters. Bacteria free filtrates were mixed with *Haloarcula hispanica* culture and after inoculation cultures were centrifugated and supernatant filtered again. We have used Transmission Electron Microscopy (TEM) to analyze virus-like particles in our filtrates. Filtrate inoculated cultures, cell-free filtrates of the brine samples and cell-free filtrates from the filtrate inoculated cultures were examined by TEM. Negative staining was used for the TEM analysis. Virus-like particles were observed in our samples. Most of these particles were roughly spherical and about 200nm in diameter.

ARCHAEAL POPULATIONS OF MEKE LAKE IN TURKEY

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Konya is a province of Turkey located in a central Anatolia. Crater lake named "Meke" near the Karapınar district 110 km away from the Konya. Meke Lake is one of the most important wetland in Turkey. This lake is called "blue bead of the world", due to the fact that there are small islands in the middle of the lake. In addition the lake feeds from underground and its salinity goes ahead 32% in drying seasons. The archeal diversity of the lake was examined by fluorescence in situ hybridization (FISH) and denaturing gradient gel electrophoresis (DGGE). Composition of Archaea community from six different media has been monitored by DGGE analysis and 29 bands were counted of the sample from the Meke Crater Lake. Sequenced DGGE bands were related to *Halorubrum* sp., *Haloterrigena* sp., uncultured archaeon and Halobacteriacea sp. The probe Arc915, specific for the domain Archaea, was used to detect Archaeal community.

CHARACTERIZATION OF THE ZOOPLANKTON OF THE PAMPEAN SALINE SHALLOW LAKES AND ITS IMPORTANCE FOR THE CONSERVATION OF ANDEAN FLAMINGOES

Y. Battauz[1], S. José de Paggi[1,2] and J.C. Paggi[2]
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In southwestern Santa Fe and southern Cordoba Provinces, center of Argentina Pampean Region, Argentina, there are several shallow lakes which are important habitats for two of three South American species of flamingos (*Phoenicoparrus andinus* y *Phoenicopterus chilensis*).The knowledge of these ecosystems is a valuable tool for developing an efficient conservation policy for these waterfowls which migrate, also for finding feeding sources. The aim of this work is to assess the composition and abundance of zooplankton. Ten shallow lakes were studied: Las Tunas, La Badenia, Carmen, Martín García, Bella Vista, Melincue, Maggiolo, Quirno, Encadenada and La Picasa. Samplings were carried out in winter 2009 and 2010, and summer 2010.Along with zooplankton samples several environmental parameters were measured in situ and water samples were taken for chemical analysis in laboratory. Zooplankton was represented by 21 species, with the rotifers as the predominant group, most of them belonging to the genus Brachionus. Cladocerans were represented by 8 species, mainly of the genera Daphnia and Moina, and Copepods by 4 species of the genera Boeckella and Metacyclops. Most of the species can be considered as halobiont, being cosmopolitan the most of rotifers and crustaceans mainly Neotropical endemic. Taxonomic richness was generally low (α diversity = 0-12) due to the constraining effect of salinity level of waters. The groups of lakes with highest levels of similarity varies widely depending of the season. Abundance also varies widely, between 0 and 16,343 ind/L in La Picasa. Moreover, abundances were highly variable between summer and winter. The highest mean abundance (2,000 ip/l) was found in Melincué Lake one of the lakes with lower salinity.PCA shows relationships between salinity, abundance, and dominance of rotifers and copepods. Abundance seems to be positively related to lower levels of salinity and the eutrophic nature of the studied lakes.

PRELIMINARY RESULTS ON GENETIC CHARACTERIZATION OF *ARTEMIA* FROM MONO LAKE (USA)

A.D. Baxevanis[1], R.S. Jellison[2], S. Staggos[1], S. Maniatsi[1], I. Kappas[1] and T.J. Abatzopoulos[1]

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From a taxonomical point of view, *Artemia* from Mono Lake has been intriguingly enigmatic. Mono Lake is an inland, deep, alkaline lake; it differs significantly from the majority of *Artemia* habitats recorded in the New World (mainly in terms of ionic composition). Mono Lake *Artemia* has been identified as *Artemia monica* due to its ecological isolation, as well as unique physiological characteristics (e.g. different diapause deactivation treatments are required for Mono Lake *Artemia*). However, until now, its species status has not been confirmed on the basis of molecular data. In this study, *Artemia* individuals from Mono Lake (both males and females) were scored with two genetic markers: one nuclear (ITS1) and one mitochondrial (COI). Obtained sequences were added to a dataset containing representatives from all known *Artemia* bisexual species and numerous parthenogenetic strains (39 sequences in total). The lengths of aligned sequences for ITS1 and COI were 1578 and 580, respectively. For ITS1, genetic distance values of Mono Lake *Artemia* to other *Artemia* species ranged from 0.031 (*A. franciscana*) to 0.332 (*A. persimilis*), while the mean intrapopulation genetic diversity was 0.002. For COI, the respective values ranged from 0.021 (*A. franciscana*) to 0.599 (*A. persimilis*), with a mean genetic diversity of 0.001. Phylogenetic inference (based on Maximum Parsimony, Maximum Likelihood and Bayesian Analysis) showed that *Artemia* individuals from Mono Lake were grouped within *A. franciscana* cluster. These results indicate that the endemic *Artemia* population in Mono Lake belongs to *A. franciscana*, while its taxonomical identity is still debatable. Further laboratory work (i.e. cross-breeding experiments, genetic analysis based on more molecular markers, etc) is needed in order to assess the degree of genetic isolation of *Artemia* from Mono Lake as well as its genealogical affinities to certain *A. franciscana* phylogroups.

RELATIONSHIPS BETWEEN PHYSIOLOGICAL AND BIOCHEMICAL CHANGES FOLLOWING EXPOSURE TO MERCURY CHLORIDE IN THE BRINE SHRIMP *ARTEMIA*

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The goal of this work was to quantify the effect of mercury chloride (HgCl) on brine shrimp survival, growth and reproduction and to correlate these effects to concurrent biochemical changes. A 24-h toxicity threshold for MgCl occurred at 0.1 g/L for both larvae and adult. An increase in temperature from 20 to 25^{o}C raised the mortality rate by tenfold. Lifetime exposure in 10^{-2} g/L MgCl or above resulted in 100% mortality. The maturation time significantly increased by about 15% and the number of eggs per brood decreased by about 25% at 10^{-4} g/L MgCl or above. Acute exposure of 10^{-2} g/L or higher MgCl triggered the expression of hsp90. Concentrations of 10^{-3} g/L or higher triggered the expression of hsp70, a cytochrome reductase-like and a metallothionein-like protein. Seven-day chronic exposure did not trigger the expression of hsp90 and 90. Expression of the cytochrome reductase and metallothionein-like protein were inconclusive.

EDUCATION FOR THE CONSERVATION OF MIGRATORY BIRDS IN MAR CHIQUITA, CÓRDOBA, ARGENTINA

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Within the framework of the project Towards sustainable migratory bird conservation: linking sites, linking people since the end of the year 2009 to date, work has been carried out on the development of three components in the field of study: conservation, work with the community and environmental education. The objective of this work is to promote the conservation of habitats critical to migratory birds in the west hemisphere, through integrated conservation actions in sites connected by shared migratory birds considered of conservation priority. As regards education, the objective is to highlight the area's values for the conservation of migratory birds and biodiversity in general, promoting environmental awareness among all the actors who have influence upon the site's conservation. The environmental education program developed in Mar Chiquita, Córdoba, involved holding educational workshops, elaborating instructional material, organizing a birds festival at a regional level and creating a local conservation group under the shape of a Birdwatchers Club. The educational strategy presented in this work sought to complement the already existent local efforts to generate effective actions which contribute to the conservation of Mar Chiquita Region, Córdoba, Argentina.

EARLY MAPS OF THE MAR CHIQUITA REGION (17TH AND 18TH CENTURIES) AND THEIR PALEOGEOGRAPHICAL IMPLICATIONS

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In the 16th century, priests of different religious orders set out to evangelize the Americas, with the purpose of converting the indigenous peoples to Christianity. The Jesuits, only formally founded in 1540, were relatively late arrivals in the New World (about 1570), especially compared to the Dominicans and Franciscans, and therefore had to look to the frontiers of colonization for mission areas. The Jesuit reductions originated in the early seventeenth century and expanded significantly in Argentina, Paraguay, and Southern Brazil. Córdoba, Argentina, the largest city associated with the Jesuit's presence in Argentina, functioned as a center for the Jesuit presence with a novitiate centre, and a college that is now the local university. During their work in America, and particularly after their expulsion in 1767, several Jesuit priests produced a very important collection of books and maps describing the geography and natural history of the New World. Several Jesuit maps included the Mar Chiquita salt lake region, providing a very valuable information on the area at a time when it was aborigines' territory, and therefore mostly unknown for the Europeans. Of particular interest are maps that document changes in the tributary rivers course shifting between the Mar Chiquita and the Parana River basins.

MAR CHIQUITA (CÓRDOBA, ARGENTINA) INVASION BY THE SILVERSIDE FISH (*ODONTHESTES BONARIENSIS*): A UNIQUE EVENT IN THE LAKE HISTORY

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Available information indicates that fish was absent from Mar Chiquita open waters until the end of the 1970 decade, when water level rose rise rapidly reaching peak values in 2003. Accordingly, water salinity decreased from historical values of over 100 g/L to less than 30 g/L. At this time silverside fish (*Odonthestes bonariensis*) invaded the lake from the tributary rivers. The Silverside belongs to a taxonomic family (Atherinidae) of marine origin that includes both freshwater and marine species. It is a carnivore species that feeds on zooplankton at juvenile stages, becoming partly piscivorous (cannibal) as adult. Shortly after invasion, commercial fishing developed as a rapidly growing and profitable activity. Total annual catches per fisherman in the 1992-1995 period ranged between 4-8 tons (2 cases). Total number of active fishermen ranged between 10-30. The lake water level started to decrease steadily after 2003. By 2009 salinity increased over the 60 g/L threshold and the silverside became extinct in open waters, although remained present in the tributary rivers mouth.

THE CONTRIBUTION OF EUROPEAN FUNDS TO THE CREATION AND SUPPORT OF A SUSTAINABLE SALTSCAPE-BASED TOURISM

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Salinas and saline wetlands are a growing issue of interest for eco/cultural tourists. An important challenge faced by managers of these sites is to find funding to adequate the facilities and their surroundings to the ever growing flow of visitors and ensure visitor satisfaction while enhancing public awareness and preserving the landscape. The European Commission has financed three large – scale transnational projects (ALAS, SEL, ECOSAL Atlantis) in which sustainable salt-based tourism was a central issue. On a smaller scale, Life – funds have contributed to the preservation of saltscapes, whether solar evaporation salinas or other saline wetlands, in different European countries. A few other European funded projects indirectly contribute to the development of a sustainable saltscape tourism, be it at a smaller scale. Partners of European funded projects contribute to the conservation and local development of saltscapes with a broad range of tools: basic research, management documents, technical advice, practical implementation of initiatives and dissemination of results, among others. However, although EU funding is supposed to contribute to the financial self-support of partners, this is not always achieved and the long term effects of these projects are often lost. In this contribution we will discuss the role of these European funded projects in the preservation of saltscapes and sustainable salt-based tourism.

AVIAN RESOURCES OF THE GREAT SALT LAKE

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The Great Salt Lake (GSL) lies within the Great Basin region of North America and is considered the fourth largest terminal lake in the world. This ecosystem is an extensive complex of salt water, wetlands, uplands and drainage systems occupying roughly 7,800 km^2 and thus provides substantial wetland habitat within the vast arid region of western of North America. Consequently, it is one of the most important inland sites for wintering, migrating and breeding shorebirds, waterfowl and waterbirds. The GSL and its associated wetlands are used annually by millions of birds and therefore are of significant continental and hemispheric importance for these diverse populations. For example, over 500,000 Wilson Phalarope stage at GSL en route to wintering sites, representing the largest concentrations in the world. Approximately 25% of all California Gulls nest at GSL and 50% of the world's Eared Grebe population stage on the lake in preparation for fall migration. Consequently, the GSL's importance has been recognized within numerous avian conservation planning documents including the US Shorebird Conservation Plan, The North American Waterbird Conservation Plan, and The North American Waterfowl Management Plan. This presentation will examine the unique avian resources of the Great Salt Lake and the importance of this site within the western flyways of North and South America.

IMPORTANCE OF RIACHO YACARE SALT LAKES FOR NEARTIC MIGRANT CONSERVATION

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Paraguay is a key site for migration of neartic species as they use landscapes for passing routes or stopover sites. Between 2007 and 2010 it was conducted monitoring focused mainly on Neartic species on three important sites along their migration routes: Bahía de Asunción, Lagunas Saladas – Riacho Yacaré and Río Negro – Pantanal Paraguayo. The Lagunas Saladas – Riacho Yacaré are extensive saline wetlands of 111km^2 area in Central Chaco. It is an Important Bird Area with higher concentration of acuatic bird species and particularly Neartic migrants. Also, one of the lagoons of the Chaco Lodge complex was designed as Ramsar site. Those lagoons have variable inter- annual water level. On 2008 and subsequently on 2009, was registered the first records for Short-billed Dowitcher (*Limnodromus griseus)* at the Capitan Lagoon. The most common shorebirds are White-rumped Sandpiper (*Calidris fuscicollis*), Pectoral Sandpiper (*Calidris melanotos*) and *Tringa* spp. Also, there are *Stilt Sandpiper* (*Micropalama himantopus*) and Wilson's Phalarope (*Phalaropus tricolor*). Captain and Campo María lagoons are regular sites for observation of Common Nighthawk (*Chordeiles minor)*. Only one Raptor species was registered, Peregrine Falcon *(Falco peregrinus). A* rare species for Paraguay, Blue-winged Teal *(Anas discors)* was registered on Capitán Lagoon. Monitoring work on these lagoons is crucial for establishing bird migration routes and priority areas for migrating shorebirds species. Coordination effort between South American countries is crucial for understanding of regular movement of migrating birds, stop-over and wintering areas and flyways at regional level.

HALOVIRUSES FROM ÇAMALTI SALTERN, TURKEY

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The Çamaltı Saltern is the greatest saltern in Turkey. It is located in the west part of Anatolia-Turkey. The Camalti Saltern is the most important salt production center in Turkey. Although extremely halophilic Archaea and Bacteria populations were reported from this saltern viral diversity has never been studied. In this preliminary study, hypersaline brine samples were collected from different pools of the saltern and screened for haloviruses by plating directly on lawns of *Haloarcula hispanica, Haloferax volcanii, Haloferax mediterranei, Haloarcula argentinensis, Halomonas elongata, Chromohalobacter salexigens* and *Pseudomonas halophila.* Phage plaques were observed on lawns of *Haloarcula hispanica*.

PROKARYOTIC DIVERSITY OF ÇANKIRI SALT MINE IN TURKEY

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Culturable bacterial biodiversity of the isolates indigenous to Çankırı salt mine, Turkey was assessed. Three different colonies appearing on sea water agar were purified and analysed by ARDRA using *mbo*I restriction enzyme after DNA was extracted from the dissolved salt sediments. Different profiles of Amplified ribosomal DNA restriction analysis (ARDRA) were further analysed for sequence analysis. PCR amplification of 16S rDNA of isolates was carried out by using three universal primers, 518R, 907R and 1492R. The alignment of these sequences with sequences in the GenBank (NCBI) revealed two genera, namely, *Chromohalobacter* sp. and *Haloterrigena* sp. sharing 97-99% 16S rDNA identity.

MOLECULAR POPULATION GENETIC ANALYSIS OF THE BRINE FLY, *EPHYDRA GRACILIS*, FROM GREAT SALT LAKE, UTAH

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Shore flies (Ephydridae) represent one of the largest families of acalyptrate Diptera and many species thrive in physically stressful habitats. Brine flies associated with Great Salt Lake in northern Utah are perhaps the quintessential example of shore fly ecology. During the summer months, adult brine flies blanket the rocks and shore and have been estimated to reach densities of nearly one billion individuals per kilometer of shoreline. Within Great Salt Lake (GSL) ecosystem, brine flies perform a critical ecological function, processing an estimated 90 million kg of organic matter annually and serving as an important food source for the millions of birds that depend on GSL. Little is known about the precise distribution of this species or the extent to which flies of one region can interbreed with members of the same species from different geographic regions. The focus of this study was a molecular genetic analysis of the internal transcribed spacer (ITS-1) region within two populations of *Ephydra gracilis*, the principal brine fly in GSL. Specific comparisons include an examination of the extent of ITS-1 sequence variation within individuals; the extent of intra-population ITS-1 variation; and comparison of intra- and inter-population genetic variation.

FLYWAYS BIRDLIFE INITIATIVE IN THE AMERICAS: BRIDGING TOGETHER SITES AND MIGRATORY SPECIES ACROSS THE CONTINENT

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The decline of migratory bird populations requires joint conservation efforts between various countries. The BirdLife Flyways Program in the Americas seeks to develop cross-border coordination mechanisms using the knowledge generated through the identification of Important Bird Areas (IBAs) to determine connections between sites using species and to achieve this goal. There are more than 340 species of neotropical migrants (birds that breed in North America and winter in Central America, South America and the Caribbean) many of them are in rapid decline. To date, efforts and resources have been focused on the conservation of breeding habitats in the north, where the pressures are indeed acute. However, long been suspected that some migrants do not return to breed, due to habitat destruction in their wintering areas. The Important Bird Areas Program uses this approach to identify and prioritize actions to protect different scales in the wintering areas of neotropical migrant birds. A number of projects have been developed under this program, linking sites and people through conservation, environmental education and research. Two major projects that BirdLife supports are: A- Linking communities, wetlands and migratory birds in Chaplin Lake (Saskatchewan, Canada), Great Salt Lake (Utah, USA) and Marismas Nacionales (Nayarit, Mexico) related to its importance for ten migratory species; B- Linking sites, linking people, funded by NMBCA and Rio Tinto BirdLife Program working for migrants conservation in Peru, Chile and Argentina.

ALKALINITY, pH AND CARBON IONS: SOME NOTES AND IMPLICATIONS FOR MEASUREMENT IN SALINE WATERS

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Salinity must be taken into account when determining alkalinity and carbon ion concentrations in saline water. This is especially true for the hypersaline range where the dissociation constants for the carbon species change with salinity and other ions contribute to the Total Alkalinity. Care must be taken when interpreting pH values at varying salinities. The following discussion outlines approaches to minimise error and contributes to the understanding of carbon ion speciation over the hypersaline range of salinities. This has implications for studies in hypersaline primary production.

SPATIAL MODELING OF LIMNOLOGICAL PARAMETERS IN SOLAR SALTPONDS

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In solar saltworks, the limnological characteristics of the brines vary considerably through salt ponds, where drastic changes in these characteristics can damage the entire salt production. Although these systems constitute unique wetland habitats, new strategies and tools for management are poorly studied. In this sense, the Geographic Information Systems - GIS emerge as a technological alternative for analysis of ecological processes in different saltponds, and assessing the influence of transfers between the brines on the ecological parameters. In this research, were monitored diverse limnological parameters in seven sampling points distributed over the Salina Unidos (Macau-Brazil) circuit, during a complete production cycle. The software Spring 5.1.6 was used to build, store, analyze and model the spatial distribution of the parameters. Salinity and alkalinity showed a relationship to salt production with extreme values in crystallizer zone. We identified a stratification of the salinity and temperature gradients, with values increasing from evaporation zone to concentration zone. Depth, dissolved oxygen and total phosphorus concentrations showed a decrease from evaporation zone to concentration zone. For the nitrogen forms analyzed (NH3, NO2- and NO3-2), the nitrate was predominant. The concentrations of chlorophyll a were higher in initial and intermediate evaporation zone, observing a distinct dynamics of these parameters in relation to other environmental variables, with an increase of concentrations of this and others parameters from evaporation zone to concentration zone, which showed a seasonal distribution heterogeneous and significantly different. This approach by GIS proved to be a practice tool for an adequate administration of solar saltworks (economic activity) and of the ecosystem managed.

DEFORESTATION PROCESS AROUND MAR CHIQUITA LAKE: A 30-YEAR ASSESSMENT

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We assessed the deforestation process around the Mar Chiquita lake (Córdoba, Argentina) that took place over the 1976-2006 period using remote sensing techniques with comparative digital analysis of LANDSAT satellite imagery. Sequential vegetation cover maps revealed a 434,588 ha forest loss, at an annual rate of 4.77 % for the study period. Mature, climax forest is the cover type that has been most affected. The degree of fragmentation was described and quantified using indicators of ecological significance. According to the current criteria for biodiversity conservation and maintenance, fragments of *tall forest* of minimum sizes of 400 ha

were found in the western sub region only. Deforestation rate was similar inside and outside of the Mar Chiquita protected area, showing that present protection status did not contribute to prevent deforestation. Therefore, our study indicates the urgent need for a more effective management plan that includes special protection of the remaining forest fragments.

INDICATORS OF RECENT ENVIRONMENTAL CHANGES IN A SALINE LACUSTRINE SEDIMENTARY SEQUENCERECOVERED FROM LAKE EL TORO, NEUQUÉN STEPPE, ARGENTINA

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The analysis of lacustrine sedimentary sequences allows the reconstruction of past environmental conditions and processes through the study of materials derived from lake and catchment processes, or from catastrophic events that reach the bottom of the lake. A short sedimentary sequence was extracted with a messenger activated gravity type corer from Lake El Toro, a small saline and closed depression located in the steppe region, southeast of Neuquén province, Argentina. The sedimentation rate, estimated by means of ^{137}Cs technique, was 0.111 g cm $^{-2}$ y $^{-1}$ (0.27 cm y $^{-1}$). Organic matter contents (OM), biogenic silica (BSi), and major and trace elements, including rare earth (REE) were analyzed throughout the sequence, in sections of 1 cm. The deposition of volcanic ashes was clearly recorded by the parameters studied showing depletion of OM and BSi and increase in allochthonous elements contents (e.g. Al, Fe, Cr, Co, Sc). Besides, it was possible to observe an increasing tendency in allochtonous elements, including REE, in the upper 20 cm of the sequence, together with a shift to lower values in the OM content, which could be associated with increases in clastic input from the catchment in the last 60 years. On the other hand, BSi shows a strong increase in 9 to 6 cm depth layers. The increase in lake level water and the consequent decrease in total dissolved solids in the water would favor the precipitation of BSi, as it was observed in other saline lakes. At the same depth, Ca concentration undergoes a sharp decline, possibly associated to Ca compounds dilution. The biogeochemical indicators studied allowed to infer an increase in lake water level associated to the increase in the precipitations recorded in Northwest Patagonia during the cool-wet conditions in the seventies.

HOW DO HALOARCHAEA SURVIVE ENVIRONMENTAL STRESSES?

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Many extremely halophilic *Archaea* are tolerant to environmental stresses such as UV light, temperature fluctuations, and salinity changes. We have investigated an isolate (NA6-27) from the North Arm of Great Salt Lake, U.S.A., (GSL) that is found year round even though the temperature range for GSL is from 5 ºC in winter to 45 ºC in summer and the salinity ranges 4.1-4.8 M. Therefore, NA 6-27 must have mechanisms to cope with these changes. Additional studies focused on the effects of changes in salt composition in the Newark, CA solar salterns on *Halrorubrum californiensis* .These salterns are fed by San Francisco Bay with changing salinity and salt composition. Growth of NA 6-27 occurs over the salinity range of 2.5-4.6M and temperature range of 5° to 50 ºC. The optima are 3.4 M NaCl and 42 ºC, respectively. *Hrr. californiensis* grows over the temperature range of 15° - 37 ºC with an optimum at 25 ºC and requires a minimum of 1.5 M NaCl with other anions substituting for the chloride ion and an optimum salt concentration of 1.5 M NaCl and 2.0 M additional salt (K or Na chloride, nitrate, acetate, or sulfate). The genetic responses of both isolates to changes in the salinity, temperature, or salt composition were investigated. At 4.6 M NaCl, NA 6-27 exhibited up regulation of four genes and down regulation of five, while decreased temperature resulted in up regulation of eleven genes. With *Hrr. californiensis*, depending on the anion substituted, four or five genes were up regulated and three to five were down regulated. Several housekeeping genes were involved regardless of the stress imposed on either organism. Thus specific genetic responses are responsible for haloarchaeal survival during environmental stress.

AQUATIC INVERTEBRATE FAUNA IN WESTERN AUSTRALIAN WETLANDS – SPECIES VARIATION ACCORDING TO SALINITY, pH AND TURBIDITY

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The Yilgarn Craton in Western Australia is one of the oldest exposed bodies of land on Earth. Several Palaeodrainage systems cut into the Archaean rock (2,500 to 2,900 million years) filled in during the Cretaceous Period about 65 million years ago (Morgan 1993). These palaeochannels express as surface wetlands in the form of large bare gypsum and clay playa lakes and their satellite wetlands. The satellite wetlands vary in type and can be saline gypseous pans, fresh water gypsum and clay pans, vegetated gypsum and clay pans, non-vegetated clay pans and fast-running but short-lasting creeks. Often the aquatic invertebrate fauna is specific to each palaeodrainage system, especially the crustacean fauna, and often the fauna is specific to a particular wetland type within that palaeodrainage system. Over fifty wetlands have been sampled since 2003 and about 100 species of invertebrate species identified. The salinity, turbidity and pH of the wetlands were documented at the time of invertebrate collection. This paper looks at the correlation of these chemical parameters and selected species found at individual wetlands, specifically the endemic species to the wetlands. The absence of species with certain chemical ranges does not indicate physiological limitations as their absence may be due to intraspecies interaction (predation, competition). Of the nine species of Branchinella found in the study only one *B. simplex* was found in salinities above 15 g/L. The other species

were all found in salinities less than 5 g/L. The Parartemia species were found in consistently higher salinities than 50 g/L. The two species of Triops found in the wetlands could be separated on salinity and turbidity. The four species of Anisops could not be separated on any of the three parameters in the field. In general pH and turbidity were a very poor correlation with species found in the wetland although combined with salinity a number of species were found only in wetlands with a specific physio chemical environment.

POPULATION DYNAMICS OF THE BRINE SHRIMP *ARTEMIA PERSIMILIS* (CRUSTACEA, ANOSTRACA) IN UTRACÁN, A HYPERSALINE LAKE OF LA PAMPA, ARGENTINA

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Hypersaline lakes are particular environments that can be inhabited only by organisms that have physiological mechanisms to withstand osmotic stress. Among these organisms is the Anostraca Artemia. In Argentina, this genus is represented by two species: *A. franciscana* and *A. persimilis*, the latter being recorded in the province of La Pampa. Several works have studied some of the biological aspects of *A. persimilis*, but, since most have been carried out in the laboratory, there are no data on their ecology in natural conditions. The aim of this work is to present information on the abundance and population structure of *A. persimilis* in relation to environmental variables in Utracán, a hypersaline lake of the province of La Pampa. To this end, water and zooplankton samples were taken monthly from May 2009 until August 2010. The mean abundance of *A. persimilis* throughout the study was 60.8 (± 109.3) ind.l^{-1}. The highest density was recorded in April 2010, when it reached 399.3 ind.l^{-1}, time at which nauplii (35%), metanauplii (30%) and postmetanauplii (30%) predominated. The minimum density occurred in July 2010, with only 0.83 ind.l^{-1}, time at which the population was dominated by postlarvae (62.5%) and adults (37.5%). The species was recorded from the beginning of the study until October 2009, when salinity fluctuated between 155.5 and 264.5 g.l^{-1}, and between March and July 2010, when salinity fluctuated between 99.2 to 228.4 g.l^{-1}. The species was negatively affected by salinity and it was absent between November and February, when the salinity exceeded 320 g.l^{-1}.

CARBOHYDRATE TRANSPORT AND METABOLISM AS DERIVED FROM THE GENOME SEQUENCE OF HALOMONAS BOLIVIENSIS: INFLUENCES ON BIOPOLYESTER PRODUCTION

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Bolivian Andean region is located at 4000 m above the sea level, and is interspersed by several salt lakes and salterns. The first description of the microbial biota able to thrive in some of these lakes was related to diatoms (Iltis 1984). These studies showed that the diatoms *Navicula pseudolaceolata* and *Nitzschia hungarica*habited the red colored lake named "Laguna Colorada". More recently, the bacterial species *Halomonas boliviensis* was reported. *H. boliviensis* is a halophilic heterotroph able to accumulate large amounts of poly(3-hydroxybutyrate) (PHB). PHB is a biodegradable polyester with plastic like properties that is currently exploited in biomedicine. In this work, we present part of our research work on the genome sequence of *H. boliviensis*. We found that the chromosome size of *H. boliviensis* is 4116785 bp, containing 3863 genes. Carbohydrate transport and metabolism by the bacterium involve 173 genes; including alles of some of these genes. Studies on such genes have permitted us to discern the metabolic routes used by *H. boliviensis* to assimilate different types of carbon sources. Furthermore, the evolution of the proteins encoded by the genes of *H. boiviensis* with regard to clusters of orthologous genes of archaea and other bacteria was analyzed as well. The assimilation of carbon sources by different pathways plays a remarkable roll on the optimization of PHB production by *H. boliviensis* using combination of carbohydrates. The interplay of the enzymes of *H.boliviensis*involved in cell catabolism and anabolism should be a stamp of the evolutionary process experienced by this organism in a salt lake, hence being central for the development of novel bioprocess.

INTERIM RESULTS OF BARCODING AUSTRALIAN POGONINE BEETLES (CARABIDAE: POGONINAE)

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To date 166 specimens of Pogonine beetle have been collected from 29 sites and their DNA sequenced from a 650 base-pair fragment of their mitochondrial cytochrome *c* oxidase I (COI) gene. These "DNA barcodes" are being obtained to provide insights to relationships and speciation within the Australian Pogonines. Australian Pogonine beetles are generally restricted to saline habitats such as coastal mudflats and inland salt lakes. Although the 18 species described to date from Australia exhibit a high morphological diversity (including some which are flightless) some, such as those in the *Pogonus grossi* group, are very similar in appearance. Analysis of the DNA data show a common widespread species capable of flight clustering quite tightly, in contrast to those that are flightless where the population on each lake is probably a separate species. The analysis also serves to illustrate the complexity of the *Pogonus grossi* group.

IBERIAN INLAND SALINE WETLANDS. A RECENT INVENTORY AND POTENTIAL FOR LOCAL DEVELOPMENT AS A TOOL FOR CONSERVATION

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A recent inventory of saline wetlands in inland Spain and Portugal shows that these are unique habitats within a European context, from both the point of view of diversity as of abundance. In the inventory, an estimated number of 245 inland saline wetlands of different typology, size and condition were found in Spain and Portugal, although this figure is not final due to methodological limitations. Despite their evident biological and ecosystem values, true islands of life in a sea of land, saline habitats have traditionally been seen as a nuisance or even a threat to public health and are today simply being ignored, save a few exceptions in which the authorities have declared them as protected sites. In this contribution the methodology and results of the inventory are presented. We will also discuss the traditional and current values and uses of these wetlands, and their potential contribution to local socioeconomic development as a tool for their conservation.

FRAME OF AUTUMNAL CARBON FLUX AND CONTRIBUTIONS OF CARBON SEQUESTRATION IN DAGZE CO LAKE, TIBET, CHINA

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The studies were conducted over 3 years at 6 sites from 2006 to 2010: 4 pelagic, one estuary and a nearshore in Dagze Co Lake. The lake covers about 254 km^2, the average depths 17.5m, maximum depths 31.7m, salinity 33-35g/l and pH 9.4-9.9. The surface luminance of the central area is 111000 lx, but decreased to 7020 lx and 8.31 lx at water depth 17.5m and bottom respectively. The DO contain above 4.43mg/l and 0.93mg/l at depth 17.5m and bottom respectively. The inflowing water of $5\times10^8 m^3 y^{-1}$ entered the lake with the Bocangzangbu River, expected about 89.9 % of the total inflowing water, mean 15.86 $m^3 sec^{-1}$. The average contents (gC l^{-1}) of DIC, DOC and POC in the lake were 1.299967, 0.02343, 0.02624 respectively, the DIC stock and TOC stock were 5.118×10^6 t C and 3.6355×10^5 t C respectively. The riverine fluxes (t CO_2 d^{-1}) of DIC and TOC in Bocangzangbu River were 32.145 and 11.691 respectively. No methane flux was found on the surface between estuary site and pelagic sites. The diurnal variation tends of C fluxes to stabilization, ranged from 8.82 to -34.45 mg C $m^{-2}h^{-1}$, the net flux was -0.1339 mg C $m^{-2}h^{-1}$ among the 4 pelagic sites. The most net flux was -0.2016 mg C $m^{-2}h^{-1}$, located at nearshore site. The C net flux in whole lake was 139.3275 t d^{-1}.Compared CO_2 sink 375.0~398.4 t CO_2 d^{-1} based on the net primary productivity, the result had lost huge amount of the CO_2 sink (65.03%) with used the CO_2 flux method. The difference in the estuary area was the highest (93.52%), the deep water area was the next (54.89~ 63.35%). The minimum lose also attain 52.45~55.88% at nearshore site. The 34.97% of total CO_2 sink was the part of net CO_2 fluxes of the lake surface, and the 9.54% was the part of inflowing water of Bocangzangbu River, the rest 55.49% was the part of benthos metabolism and the organic matter oxidize in sediments. The sedimentary C, which fluxes from water, was about 188.11 t CO_2 d^{-1}.

PRELIMINARY RESULTS ON *PARARTEMIA* DIVERSIFICATION IN AUSTRALIA

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Australia hosts a remarkable diversity of saline habitats. Both intermittent saline lakes and permanent ones, even saline creeks, are scattered abundantly throughout the continent, occasionally forming larger saline wetland complexes. Given this ample ecological opportunity, it is not surprising that Australia, and especially its south-western tip, harbours an unparalleled diversity of halophilic anostracan fauna. Renowned endemic representatives of this fauna are the brine shrimps of the genus *Parartemia*. Recent morphological analyses have strongly implied that the current taxonomic diversity of *Parartemia* is seriously underestimated. In this work, we present the preliminary results of a molecular-based investigation of the extent of lineage diversification within *Parartemia*. A number of localities (as part of a broad sampling campaign throughout the continent) were sampled and *Parartemia* specimens were assayed for sequence variation in the mitochondrial cytochrome oxidase subunit I (COI) locus and the nuclear internal transcribed spacer 1 (ITS1) region. Uncorrected interspecific sequence divergence reached a maximum of 22.9% and 34.4% for COI and ITS1, respectively. These values are substantial and normally associated with distances to close relatives, like *Artemia* and *Streptocephalus*. Nucleotide diversity for putative *Parartemia* conspecifics ranged from 0.6% to 15.7% and 0.4% to 10.4%, for COI and ITS1, respectively. Bayesian phylogenetic inference largely confirms the existence of several distinct lineages and prolific cladogenesis in *Parartemia*, given its endemicity. The preliminary results of this work strongly suggest that the radiation of the Australian endemic *Parartemia* is indeed extraordinary and call for further and more detailed investigations into its causes.

MICROBIAL BIODIVERSITY IN ZABUYE SALT LAKE AND LITHIUM ABSORPTION BY HALOPHILES

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Based on field observation,microbial diversity in Zabuye salt lake was investigated by culture-independent approaches and culture methods.The interaction of halophiles from Zabuye salt lake and lithium was also studied by absorption test, scanning electron microscope observation and infrared spectroscopy analysis in this projet. The phylogenetic tree showed that some belonged to 23 genera in γ-proteobacteria, , □-proteobacteria, δ-proteobacteria, bacteroidetes, firmicutes, and verrucomicrobia. The rest was quite different and were most related with uncultured sequences, forming special division in the tree. 24 strains were isolated and enriched from Zabuye salt lake,and they belonged to Firmicutes, Betaproteobacteria, and Gammaproteobacteria.The average absorption of 15 strains was 2.8121μg/g dry weight,with max 9.2165μg/g dry weight. After scanning electron microscope and infrared spectroscopy

analysis, it was found that the surface of strains and the surface groups did appear different degrees of changes. It was inferred that selected halophilic strains did have some positive effects in the enrichment, aggregation, deposition process of lithium carbonate.

UNSTABLE NATURAL WATER RESERVOIRS IN SEMIARID REGIONS: MOVING FROM FRAGMENTED TO COORDINATED ECOHYDROLOGICAL MANAGMENT

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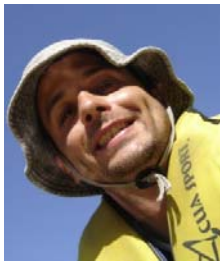

Adaptive management at proper scales of unstable water resources is critical in semiarid regions, particularly when long meteorological and hydrological data series are scarce. This precludes differentiation of superimposed local, regional and global trends, resulting in erroneous short-term policies based on a rationale derived from main shifting environmental baselines, either occurring or remembered by most stakeholders, such as the recurrent floods of the last 3 decades in the Argentinean Pampa. As presented here, the wet phase from 1970 - 2007 produced a dramatic area increase of the coastal, brackish Chasicó Lake, resulting in loss of agricultural land, complete submersion of a touristic village and danger of flooding of large neighbouring saltworks. Simultaneously, reduction of lake salinity produced a drastic biomass increase of the commercially important fish *Odontesthes bonariensis*. Generalized misperception of flood hazards led managers to propose measures focused exclusively in the reduction of such impacts. However, recent studies on historical records strongly suggest the current onset of a dry phase that could last 25-50 years. This can lead to an increase of lake salinity beyond tolerable limits for its fish population; increased estuarine salinity and reduced freshwater availability for direct human consumption, agriculture and industry. This could induce a socio-economical collapse in a region with recurrent freshwater shortage due to infrastructure weakness and paradoxically, strong industrial development. Several solutions have been proposed for the management of Chasicó and adjacent basins. We discuss main approaches, their advantages, shortcomings and conflict potential in changing scenarios from multi-decadal wet to dry periods.

ZOOPLANKTON DYNAMIC IN A SALT LAKE OF THE SEMIARID ARGENTINEAN PAMPA

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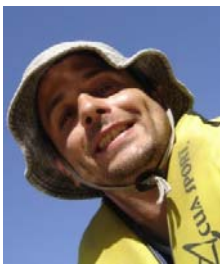

Lake Chasicó is a large salt lake with an extension of ~ 12,000 Ha and salinity of ~20 and characterized for an unstable hydrology. In order to protect the fish populations of *Odontesthes bonariensis* and the native vegetation, this water body together with the adjacent area was declared to be a nature reserve of the Buenos Aires province. Aim of this work is to describe the biodiversity and to contribute to the understanding of the seasonal ecology of halophilic zooplankton in Lake Chasicó. The calanoid copepod *Boeckella poopoensis* dominated in abundance and biomass during the study period. This species is typical of inland salt lakes of South America and tolerate salinities up to 90. The female with eggs of *B. poopoensis* were abundant during the whole year and no reproductive seasonality was inferred. The partenogenetic females of the cladoceran *Moina eugeniae* were found mainly during summer, while the sexual females and male in autumn. The highest abundance of *M. eugeniae* coincided with one of the lowest values of transparency and a drop in the chlorophyll *a* summer values, suggesting a high effectively filtration and a strong top-down regulation over phytoplankton. The rotifer *Brachionus plicatilis* shows the highest abundance in March in the sampling station near the river. *B. plicatilis* was particularly abundant during the second part of the sampling period. The increment of dissolved organic carbon (2000µM) was related to a top down regulation of bacterial biomass by microzooplankton predation, especially by the rotifer *B. plicatilis* directly, or indirectly through Protozoa. Other species with low abundance were the harpacticoid copepod *Cletocampus deitersi* and the rotifer *Hexarthra sp*. Lake Chasicó, as is typical of salt lakes, is characterized by a low zooplankton biodiversity.

CLIMATIC EFFECTS ON THE EMISSION OF VOLATILE ORGANOHALOGENS FROM SALINE SOILS

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Regional effects of the proposed global warming will vary from place to place, in which most regions will face increased mean temperatures, whereas only very few regions will experience a cooling effect. Depending on he regional characteristics an increasing ground level temperature will lead to elevated evaporation, which, sometimes enhanced by decreasing precipitation, promotes land degradation and desertification. Due to their negative water budget most semi-/arid regions are characterized by vast evaporates (salt lakes) and salty soils. During the DFG Research Unit 763 HALOPROC (Natural Halogenation Processes) we identified those (hyper-)saline environments as novel source for a number of volatile halogenated organic

compounds (VOX), such as halomethanes (e.g. $CHCl_3$, CH_3Cl, CH_3Br) or halogenated alkenes (e.g. $C_2H_2Cl_2$, $C_2H_3Cl_3$). VOX have been considered of industrial origin only, but to-date more than 4,700 naturally produced organohalogens are known. For example, the natural production of chloromethane (5 MT/a) exceeds the anthropogenic production of 50 KT/a by the factor 100, originating from various bio- and geochemical processes. Natural halogenation is a widespread phenomenon in the terrestrial environment, including biota (fungi), halophilic bacteria and archaea, plants, animals and insects as de-novo producers of (semi-) volatile or polar organohalogens. VOX can affect the ozone budget of the planetary boundary layer and play a key role in the production of aerosols, thus they are of outstanding importance. Effectively linked to atmospheric chemistry cycles, they potentially induce significant feedbacks on cloud formation, Earth's albedo and eventually the regional and global climate. Deposition of VOX can strongly influence terrestrial ecosystems due to their phytotoxic potential. Since number and size of saline ecosystems will increase from the time when deserts and semi-deserts start spreading, the formation of naturally produced organohalogens will tremendously increase. Elevated fluxes to the atmosphere are conceivable in the 21st century, resulting in additional climate feedbacks and phytotoxic effects. This poster presents data on potential VOX emission from different saline soils in Southern Africa and Central Asia, sampled and determined during HaloProc. The applied setup reproduces short-term changes in climatic conditions starting from dried-out saline soil instantly humidified during rain events. Using a custom build purge-and-trap GC-MS system the spontaneous emission of several C_1 and C_2 halocarbons was followed up.
Minor or no VOX emission under almost dry condition points to soil humidity as a major factor in VOX production schemes. Furthermore, by interpreting main soil characteristics additional driving forces behind the VOX production have been identified as pH-level and salt composition (halite, sulphate, carbonate).

SALINE ENVIRONMENTS AS NOVEL SOURCE FOR VOLATILE ORGANOHALOGENS

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We identified hyper-saline environments as novel sources for volatile halogenated organic compounds (VOX), such as halomethanes (e.g. $CHCl_3$, CH_3Cl, CH_3Br) or halogenated alkenes (e.g. $C_2H_2Cl_2$, $C_2H_3Cl_3$). VOX have been considered for a long time of industrial origin only, but to date there are more than 4,700 known organohalogens to be naturally produced through bio-and geochemical processes. They are of outstanding importance since they affect the ozone budget of the planetary boundary layer and play a key role in the production of aerosols. Effectively linked to atmospheric chemistry cycles, their occurrence leads to potentially significant feedbacks on cloud formation, earth's albedo and eventually the regional and global climate. Emission and deposition of VOX to and from the atmosphere can strongly influence the functioning of terrestrial ecosystems because some of the VOX possess strong phytotoxic potential. In consequence of predicted climate change some regions face an increase in quantity and scale of (hyper-) saline environments -especially in Central Asia, the Middle East, Northern and Southern Africa and Australia. Since number and size of saline ecosystems will increase from the time when deserts and semi-deserts start spreading, it has to be questioned whether and how the recent and future formation of saline soil systems will have an impact on global VOX budget. This talk exemplifically shows specific VOX emission characteristics of different types of saline sediments, collected during field expeditions in Central Asia, Southern and Northern Africa.

Main driving forces behind the VOX production, such as pH-level, organic content, soil humidity and temperature will be discussed in context of possible geochemical versus biochemical production mechanism. Predicting source strength and annual emission cycles it is of special importance to follow certain steps of desertification, degradation and salinization e.g. from fresh water ecosystem.

TOTAL ENVIRONMENTAL MANAGEMENT IN SURFACE WATERS AT SALAR DE ATACAMA BASIN, CHILE

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Salar de Atacama is an endorrehic basin located at middle east of Antofagasta region (23°SL-70°WL). It is an area of 15.620 Km^2 approximately. The average altitude is 2.400m.a.s.l and the real humid surface is 1.500 Km^2. The basin is the outlet of San Pedro and Vilama rivers being both the main affluents. The salar, in the deepest section has few remnant lagoons connected by a complex channel system. These lagoons support different population of birds, were the Andean flamingo (*Phoenicoparrus andinus*) is one of the more important. San Pedro River sustains the major irrigation surface (M.O.P.-D.G.A., 2004). There are also, relevant contributions from underground waters that spring through the east border of the basin. The main objective of this work was to know the significant anthropogenic pressures on the waters (claims for irrigation, drinking and industrial uses) using semi structured interviews to the relevant customers. Variations in the water quality were measured as physic-chemical parameters (electric conductivity, pH, temperature and total dissolved solids) and biological components (macrozoobenthos and phytobenthos). For these measurements Wetzel &Likens (1979) and ISO 7828 (1985) were consulted. Chemical temporal scales comparisons were done using data provided by Chilean government agencies (MOP,DGA,2004). There are seven (7) water irrigation communities in the salar periphery belong to villages of: Peine, Socaire, Talabre, San Pedro among others. The users of these villages were interviewed about the quality and quantity of water they receive and the possibility (in the future) to establish a better management control. The main contribution of the working team was to talk and write the proposal for a secondary rule for Salar de Atacama basin including potential surveillance areas and defining environmental quality for conflicted points detected. These results were sent to the regional government services (Financial support from Licitación CONAMA N°1853-4-LE10).

RAPID CHANGE DETECTION AND SALT CLASSIFICATION AS A PROMISING TOOL TO ESTIMATE EMISSION OF ORGANOHALOGENS FROM SALINE ECOSYSTEMS dar format

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Due to their negative water budget most recent semi-/arid regions are characterized by vast evaporites (salt lakes) and salty soils. We identified those hyper-saline environments as novel sources for volatile halogenated organic compounds (VOX), such as halomethanes (e.g. $CHCl_3$, CH_3Cl, CH_3Br) or halogenated alkenes (e.g. $C_2H_2Cl_2$, $C_2H_3Cl_3$). Effectively linked to atmospheric chemistry cycles, they play a key role in the production of aerosols where their occurrence leads to potentially significant feedbacks on cloud formation, earth's albedo and eventually the regional and global climate. Short-term climatic effects and fluctuations in soil humidity, such as rainfall and recrystallization have been proven to mainly influence the VOX production and to trigger VOX bursts. To predict regional emission characteristics and seasonal climatic effects it is of importance to follow certain steps of desertification, degradation and salinization e.g. from fresh water ecosystem to hypersaline salt lakes and desiccated saltpans. Linking previously identified driving forces of VOX production (e.g. soil humidity and salt quality) to certain land-cover classes, which can be distinguished and monitored by means of remote sensing, is a prerequisite for upscaling of VOX emission from local measurements to landscape scale. More specifically, we address the classification of different salt types (e.g. sulphate versus halide) as well as detection and verification of the effects of rapid changing climate condition. A remote sensing based analysis was performed in the southern Aral Sea Basin, Uzbekistan, using hypertemporal MODIS time series and advanced image classification approaches. Different stages of salinization in the Aral Kum dessert were classified between 2000 and 2008. The recession of the Aral Sea resulted in a quick build up of extensive salt crusts directly adjacent to the sea. Almost all of these salt crusts converted into a series of different Solonchak types and then, in some parts of the study area, further into almost sand free bare areas. This was found out to happen within 8 years at some places, giving raise to the question how this rapid land cover change influences the VOX budget in the Aral Sea Basin.

THE IMPORTANCE OF PALEONTOLOGICAL SITES OF THE MAR CHIQUITA LAKE (CÓRDOBA PROVINCE, ARGENTINA) AND THE NEED FOR THEIR TECHNICAL AND LEGAL PROTECTION

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The paleontological sites of Mar Chiquita Lake constitute one of the sites with major biological diversity for the Quaternary of the province of Córdoba. The known ones were named as Barrancas de Milanesi, Barrancas de Albarracín, Playa Grande and El Silencio, all of them are located in a sector of the southern arch of the lake. These have provided an abundant and diverse quantity of fossils, whose preliminary studies allow referring them to 12 extinct taxa and 4 to current representatives, which correspond mainly to mammals, some of singular

paleoclimatic importance. The taxa association corresponds to the Lujanense Mammal Age. The stratigraphic position and the characteristics of the fossiliferous levels allow referring them to the Tezanos Pinto Formation deposited during the Last Glacial Maximum (ca. 36-15 ka BP) and the cold and dry period of the Late Pleistocene/Early Holocene (ca. 14-8 ka BP); during this time the lake suffered a large volume reduction. The aforementioned paleontological sites are on the coast of the lake, exposed to erosion, which periodically provides new materials but also contributes to its disappearance. The human alteration, which through the removal of materials without appropriate technologies and without a suitable control of the geographical or stratigraphic origin, determines the loss of their value as palaeoenvironmental indicators, therefore it is necessary to establish technical guidelines and specific legal limits to ensure their protection. As a property of cultural heritage, their legal protection at the provincial level is mainly covered by the terms of Act (Law) 5.543, terms to which can be added those of Natural Areas Law 6.964 and the Decree 3.215 of creation of the Natural Protected Area "Bañados del Río Petri (Dulce) y Laguna Mar Chiquita (Laguna o Mar de Ansenuza)", although there is a lack of specific provincial legislation for the safeguarding of this heritage. It is therefore necessary to establish ordinances that contribute to the protection of these sites, as well as laws that declare them of provincial interest.

SALINE LAKES AND THE NETWORK OF WETLANDS OF IMPORTANCE FOR HIGH ANDEAN FLAMINGO CONSERVATION

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It is clear is that saline lakes, both in the breeding areas of the Altiplano - Puna and Atacama Desert, as well as some key lowland wintering lakes (Laguna Mar Chiquita) are critical habitat for Andean (*Phoenicoparrus andinus*) and James' (*P. jamesi*) Flamingos. The ecology of salt lakes (salars) - both High Andean and lowland - is of crucial importance for the three South American flamingos, and support their entire global populations. Grupo de Conservación Flamencos Altoandinos (GCFA) is a regional project with the key objective of achieving sustainable and integrated conservation of wetlands of importance for these species. It seeks to do this through the establishment of a regional network of priority sites, focusing on the high Andean wetlands, but also including key lowland sites. Based on explicit criteria *(Inclusion criterion: the wetland must be within the geographic distribution -summer and winter- of Andean and James' Flamingos. Priority sites: where 1% of the global Andean or James' Flamingo population has been recorded or where breeding colonies have been recorded either historically or in recent years)* and careful analysis of available information *(data obtained by the GCFA during the comprehensive censuses conducted by the four flamingo range countries through 2005)*, 14 sites of Argentina, Bolivia, Chile and Peru were selected for the initial phase of the project started in 2007. Two new priority sites were added to this basic network in 2008, and other six new sites were proposed for inclusion in 2010 considering the results of the fourth simultaneous flamingo census. The project is being developed into four main programmatic components (1) Research and Monitoring, (2) Conservation and Management, (3) Institutional Strengthening and Interinstitutional Coordination, (4) Training and Outreach, with objectives that are in line with those of the Regional Strategy for Conservation and Sustainable Use of High Andes Wetlands. Main achievements on component (1) were annual monitoring of Andean and James' Flamingo breeding sites and effective protection of key sites, annual flamingo banding activities at successful breeding sites, annual flamingo and waterbird population monitoring and habitat characterization at summer and/or winter key sites, Andean Flamingo movements and

habitat use using satellite telemetry, flamingo health studies, updating of GCFA common data base and improving of Data management and spatial (GIS) analysis. Among Conservation and management outputs we highlight the Evaluation of degree of implementation of Wetland Network priority sites, the designation of five priority sites as new Ramsar sites, and the establishment of pilot activities for cross-border integrated conservation in priority sites (Triple frontier Argentina, Bolivia and Chile). Component (3) have been strengthen departing from GCFA basic structure and functioning. At present representatives from Argentina, Bolivia, Chile and Peru governments at national, sub-national and/or local levels, multilateral agencies, international conventions, specialist networks, NGOs, private sector and other stakeholders are supporting and participating in the implementation of the network of wetlands, following annual workplans. Finally, Training and Outreach main outputs were annual capacity building workshops, and two regional publications: an information brochure on flamingo wetland network and a handbook for monitoring ecological variables (limnology, waterbirds, flamingo reproduction) in wetlands in South America. The Network of Wetlands has been consistently supported from its inception by the Ramsar Convention, Río Tinto - BirdLife Program, Wildlife Conservation Society, World Wide Fund – Freshwater Program, the American Museum of Natural History and 15 governmental, non-governmental and academic organizations.

SYSTEMIC FUNCTIONING MODEL OF A WETLAND-CHANNEL-SALTY LAGOON IN THE HIGH ANDEAN STEPPE REGION OF CHILE

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Water resources in endorheic river basins of northern Chile allow the sustenance of terrestrial flora and fauna of great environmental value, particularly shallow wetlands with halophyte vegetation as well as communities of flamingos that nest and feed in shallow salt lakes. These biological communities are adapted to extreme conditions such as high evaporation rates and high salinity, among others. Using field observations and low-dimensionality models, we studied which are the main physical processes that control the distribution of biological communities mentioned, to high Andean wetlands whose waters are naturally channeled off into a shallow salty lagoon. These systems are known as Vega-Canal-Laguna (VCL), which are joined by flows of water, salts and nutrients. In a first stage, the discrete and continuous monitoring of weather, soil, water levels and water quality, coverage and state of vegetation, among others, helped to define the physical controls of VCL correspond to evaporation, flow and quality of groundwater. Variations in these controls give rise to the following processes: salinization of soils, evapoconcentration of salts in channel and lagoon, and changes of level and surface of the terminal lagoon. The subsequent conceptual and numerical modeling of VCL using a mass and volume balance scheme and the software Hydrus 1D, identified that the occurrence of sporadic rainfall of a certain intensity, and changes in the upwelling of groundwater is very important in changing the natural rate of the soil salinization process, which would determine changes on the health of vegetation. Also, changes in flow or water quality in shallow wetlands may have implications for the habitability of flamingos in salty lagoons connected to them, due to the availability of food and nesting sites. Integrated understanding in terms of physical, chemical and biological process, constitutes a very important tool for decision makers regarding the conservation of these ecosystems.

PHENOTYPIC PLASTICITY OF THE CYANOBACTERIA *APHANOTHECE STAGNINA* AT CENTRAL PACIFIC COASTAL WETLANDS AT LIMA, PERU

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Coastal tropical shallow lagoons of Puerto Viejo wetland (Lima department) are locatedat the Pacific Coast in South America. Standard cyanobacterial collection and physical - chemical parameters were registered irregularly between 1998-2010. Morphotypes of *Aphanothece stagnina*(Synechococcaceae, Chroococcales) from natural populations in spring (september-november) with floating irregular colonies turned to benthic ones (Batis pool) under optimal conditions such as pH: 7-8, salinity: 4-5 ppt (NCl), water temperature: 20 - 27ºC, and eutrophic conditions. The largest colonies, with stratified colonial envelope reached up to 20 cm of diameter with peripherical proliferations of elongated daugther colonies. Cell size reached (2.7) 4.8 -6.4 um in diameter and (4.3) 6.4 – 9.6 um in length. However, during fall (late March-April) colony desintegration with daughter colonies formation was recognized under higher salinity values (6-10 ppt) at Mirador lagoon. *A. stagnina* life cycle stages from natural populations evidenced its phenotypic plasticity with different distributional patterns (planktic and benthic phases) and salinity tolerance (4-10 ppt) which are related to its adaptative strategies for successful colonization at saline coastal wetlands.

ADAPTABILITY OF *TYPHA DOMINGENSIS* TO ENVIRONMENTS WITH HIGH pH AND SALINITY

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To successfully grow in a saline environment, hallophyte plants must be able to acquire water and avoid accumulating excess salt. Althoug *Typha domingensis*is a glycophyte species, we observed a healthy state in plants growing under high salinity and pH conditions in a constructed wetland (CW). The aim of this work was to compare the adaptability of two different populations of *T. domingensis*exposed to high pH and salinity. The plants were sampled from an uncontaminated natural wetland (NW) and a constructed wetland (CW) for the treatment of an industrial effluent with high pH and salinity. The plants from each population were exposed to the following combined treatments of salinity (mg L^{-1}) and pH: 8,000/10 (values found in the CW); 8,000/7; 200/10 and 200/7 (typical values found in the NW). Relative growth rates (RGR) andchlorophyll concentration were measured. Images of roots and leaves by scanning electronic microscopy (SEM) were obtained. In all treatments, the RGR and chlorophyll increase were significantly lower in the plants from the NW than in the plants from the CW. Evident damage in roots and leaves tissues were observed when the plants from the CW were exposed to treatment 200/7. In treatment 8,000/10 the tissues of the plants from the NW showed severe damages. The CW population already possesses physiological and morphological adaptations due to the extreme conditions of pH and salinity. Although *T. domingensis* is not a halophyte species and does not possess anatomical structures to tolerate and excrete salts, it is capable of modifying its morphology in order to adapt to extreme

conditions, such as the exposition to an industrial effluent. These results denote that a suitable acclimation is necessary to favour the adaptability of *T. domingensis* to survive in saline environments.

CHARACTERIZATION OF THE AMOUNT OF WATER IN A SECTION OF THE DULCE RIVER AT CORDOBA

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The Wetlands of Dulce River, with a maximum flooded area of 4500 km2, are located northeast of the province of Córdoba and south of Santiago del Estero. The need for conservation of this unique system of wetlands (Wetlands of Dulce River) and salt lake (Mar Chiquita Lake) is attributed, among other things, their character as protected area at the interprovincial, national and international level (RAMSAR sites) and to their relatively low local human alteration. This situation implies the need to improve knowledge of hydroecological behavior complete with different themes that develop in their environment, many related to ecological parameters and consumptive uses of the region. It is stressed that the Dulce River is the main source of water supply of this system whose body endorheic receiver is the Mar Chiquita Lake, being of great interest for future planning quantification in quantity and quality of this contribution. In this study, we present a preliminary assessment of the amount of water entering through the Wetlands to the Province of Córdoba. Recently an agreement was signed between the Ministry of Environment and FCEFyN of the UNC, for a two-year hydrometeorological monitoring system water Wetlands Dulce River - Mar Chiquita Lake. In this framework, seasonal campaigns were conducted in the towns of Paso de los Oscares (Santiago del Estero) and Paso de la Cina (Córdoba), performing tasks and data collection of two limnimeters installed at these stations. Among the outcomes highlights the updated height curve – flow of the Dulce River, for these two sections of the river, which are 80 km distant. Thus it has been quantified the main parameters that influence the hydrodynamics of the system. We performed a frequency analysis of hydrological data available to determine the amount of water to be dispensed from the Rio Hondo dam to the downstream system maintenance.

PROGRESS IN EXTRACTION OF LITHIUM RESOURCES FROM SALT LAKES IN CHINA

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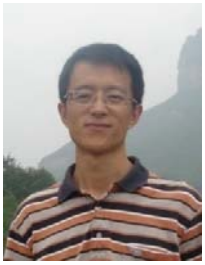

Lithium, as an energy metal of 21st century, is of great significance to domestic economy and national security. Exploitation of Li resources has become more and more attractive recently because that wide uses of lithium compounds are more important, especially in information industry and new energy. Production of lithium compounds is transforming from resources of hard rock into brines. There are a few

process routes of lithium extraction from brines on treat now. Salt lakes are well developed in China, which possess 85% of the total industrial lithium reserves. The Quaternary salt lakes, which have good exploitation prospects, are mainly distributed in northwestern China regions such as Qinghai, Tibet, Xinjiang and Inner Mongolia. Through years of scientific research, the extraction of lithium products from salt lake brine has been achieved industrially in the Xitaijinaier Salt Lake and the Zabuye Salt Lake located in Qinghai and Tibet respectively. The resources, geography and climatic conditions as well as climate-dependant exploitation process flows of the two salt lakes are summarized and compared with each other in this paper, with a discussion on their optimized processing flows. Though the two salt lakes have the superiority of big reserves and high content of lithium resources, their process flows still need to be improved because of limitation of salt lake types and geographic and climatic conditions. The support to the process optimization of salt lake exploitation and salt lake-based lithium industry should be further emphasized.

OCEANOGRAPHIC EQUIPMENT USED IN DEAD SEA EXPLORATIONS IN THE MIDDLE OF THE 19TH CENTURY

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The first scientific exploration of the Dead Sea was held in April-May 1848 and led by Lt. William Francis Lynch, U.S. Navy. Soundings in the deepest part yielded values of 336-357 m, but one single sounding showed 218 fathoms (399 m). To collect deep water and sediments, Lynch used a sampler developed a few years earlier by Henry Stellwagen. It consisted of a conical steel cup with a valve lined with leather that sealed the cup as the line was hauled in. The Lynch expedition measured temperatures in the water column using a "self-registering thermometer", and reported the existence of a temperature minimum at a depth of 10 fathoms (18 m). No information was provided about the make and the mode of action of the instrument. "Registering thermometers" or minimum-maximum thermometers were invented by James Six in 1780. However, it is not clear how such an instrument could monitor a cold water layer between two warmer layers. Reversing thermometers became popular in oceanographic studies only in the end of the 19th century. The prototype was constructed in 1841 by George Aimé, and an instrument for routine oceanographic use was not developed until the 1870s. State-of-the-art instrumentation was used on the Dead Sea in March-April 1864 by the duc de Luynes, accompanied by geologist Louis Lartet. The especially designed sampler consisted of an iron tube containing a test tube filled with mercury, and connected to a conical cup which collects the mercury from the tube when it is inverted by operation of a triggering device. The sampler was deployed from a 9.5-meter sailing yacht. Using this instrument the first density profile of the Dead Sea water column was measured (from 1.160 g/ml at the surface to 1.230 g/l near the bottom). Some samples recovered were also subjected to chemical analysis.

LOURENS BAAS BECKING – A PIONEER OF BIOLOGICAL SALT LAKE RESEARCH

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Lourens Baas Becking (1895-1963) is best known for his famous statement "*Everything is everywhere:* but, *the environment selects*". This sentence ("*alles is overal:* maar *het milieu selecteert*") is found in a little book of collected lectures, entitled "Geobiologie of Inleiding tot de Milieukunde", published in 1934. It is seldom realized that much of Baas Becking's studies dealt with hypersaline environments and their biota. The longest chapter in this 1934 book ("De Pekel" - "The brine") discusses the biota found in around 30 inland saline lakes and marine salterns on 6 continents, many of which Baas Becking has visited himself, and it contains many surprising statements and observations that, while largely forgotten today, are sure worth attention. Environments studied in-depth include marine salterns and other coastal hypersaline lakes in California, Great Salt Lake and other inland North-American lakes, and inland lakes on the Australian continent. The material collected yielded interesting observations on halophilic Archaea, on *Dunaliella*, on halophilic cyanobacteria and other prokaryotes, on halophilic protozoa, and on the brine shrimp *Artemia*. The topics discussed in the chapter on brines in the 1934 book and in journal articles include observations on gas vesicles and buoyancy in *Halobacterium salinarum*; specuations on the acidic nature of the cell envelope of *Dunaliella*; the resistance of *Dunaliella* to high concentrations of toxic anions such as chromate, cyanide, and thiocyanate (a forgotten observation, that was easily confirmed); the importance of benthic *Microcoleus* mats in solar salterns; observations on the effect of divalent cations on the growth of halophilic microorganisms, and elucidation of the sulfur cycle and its role in the formation of sulfur nodules in Lake Eyre, South Australia. Although his work was largely forgotten, Lourens Baas Becking should be considered as a pioneer of biological studies in salt lakes.

DEAD SEA - RED SEA AND DEAD SEA - MEDITERRANEAN SEA CONNECTIONS ON 17TH-19TH CENTURY MAPS OF THE HOLY LAND

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Since the planning of a connection between the Mediterranean and the Dead Sea in the 1970s-1980 and the current plans to connect the Red Sea with the Dead Sea, we are familiar with the idea of using seawater to generate energy and improve the infrastructure of the Dead Sea area. However, it is little known that Dead Sea – Red Sea and Dead Sea – Mediterranean Sea connections already featured on maps in the 17th-19th century. A map published in 1664 by the Jesuit priest Athanasius Kircher in his 'Mundus subterraneus' shows an underground connection ("Canalis subterranea bituminosa") between the Dead Sea and the Red Sea. It also shows a connection ("Canalis subterraneus") between the northern Red Sea and the Mediterranean Sea, the site of the Suez Canal. Kircher never visited the area, but the accompanying text provides intriguing information to support his speculations. A map showing the Dead Sea connected with both the Mediterranean Sea and the Red Sea was presented in 1855 by Captain William Allen, British Royal Navy, in his book "The Dead Sea, a new route to India". As alternative to the planned Suez Canal, Allen proposed

two canals, from Haifa bay eastward and from Aqaba northward, so that the Dead Sea, the Jordan Valley and the Arava Valley would fill up, opening a “means of communication with our East Indian possessions”. The idea of a Mediterranean – Dead Sea connection to produce hydroelectric energy, exploiting the difference in elevation (then 394 m, currently 424 m), first appeared on a map drawn in 1899 by the Swiss engineer Abraham Max Bourcart who surveyed the area to advance the Zionist idea. Bourcart’s concepts were used by Theodor Herzl in his novel “Altneuland” (1902) and form the basis for the recent plans for the restoration of the Dead Sea water level.

LIMNOLOGY OF A SALT LAKE ENDORHEIC: LAGUNA DEL PLATA - MAR CHIQUITA, CORDOBA

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In limnology, salt lakes are less frequently considered. This work contributesto knowing water quality conditions of Laguna del Plata. It is located northeast of Cordoba, at the SW area of Lake Mar Chiquita, the largest South America salt lake and fifth of the world. This area has an important ecological value. It was declared a "Wetland of International Importance” (RAMSAR, 2002) and Province Reserve. The lagoon’s surface is around 20 km². A single tributary, SuquíaRiver is the main source of nutrients inflow to the lagoon. The aim of the present study is to provide limnological knowledge of the system. Seasonal water quality monitoring was conducted during 2006 -2007 at four sites in Laguna del Plata and one site in Lake Mar Chiquita. The parameters measured were: major ions, salinity, total phosphorus (TP), soluble reactive phosphorus (SRP), inorganic nitrogen series, suspended matter (MES), Secchi depth, chlorophyll-a and phytoplankton. Water was characterized by major ions and salinity. Average of TP, total nitrogen (TN), chlorophyll-a and Secchi disk were used to estimate trophic condition of resource. N / P ratio was used to determine limiting nutrient of algal biomass. Abundance and composition of phytoplankton were analyzed. The water of the lake was classified as chloride - sodium. The average values were: PT 174.5 mg / L, NT 0.4 µg / L, chlorophyll a 138.9 mg / L and Secchi depth 0.32 m. The lagoon was categorized as hypereutrophic. The N / P ratio suggests that N may be the element that most limits primary productivity. The overall system had high productivity according with high abundance of algae and chlorophyll-*a* concentration. The dominant taxonomic group corresponds to the Chrysophytes. Chlorophytes and Cyanobacteria were secondary group. Cyanobacterial genera observed include *Anabaenopsis* sp, *Microcystis* sp, *Anabaena* sp and *Nodularia* sp. Another genera presents were the Pyrrophyta *Prorocentrum* sp and the Bacyllarophycea *Chaetoceros* sp.

CHILEAN SALT LAKES: TOWARDS THE IMPLEMENTATION OF A CONSERVATION STRATEGY

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Chile has several salt lakes situated at the north regions of the country along the high Andes plateau or Altiplano, Tarapacá, Antofagasta and Atacama. Chaxa, Puilar, Barros negros, Cejar, los Salares de Tara, Pujsa y Huasco lagoons are outstanding areas from National Reserve Los Flamencos. Also, Chile has the southern salt lake of the world named Lago Budi at the 9th Region of Araucania. All three Neotropical Flamingo´s species are well adapted to saline condition and the most common Neartic migrant are *Phalaropus tricolor* y *Calidris bairdii.* There are some other species tipical for Altiplano biome like Horned Coot (*Fulica cornuta*) and Puna Teal (*Anas puna*). On 2003 Chile approved a National Strategy for Biodiversity that recognized the importance for biological diversity of the wetlands. These key ecosystems need to be adequately protected along the country and it is time to get involved into the Ramsar Convention mainly for aquatic bird conservation. The goal of this strategy is to promote the conservation of priority wetlands of Chile. CODEFF recently identified Important Bird Areas (IBA) for wetland and other continental sites. On that basis, there are some activities that are crucial for that goal: a) Publish an inventory of Chilean Salt Lake with geographical and land registry information, biodiversity and threats, etc.; b) Environmental education and informative strategies for social valorization of goods and services of wetlands (i.e., salt lakes); c) Identify common threats for Salt Lakes and their biodiversity in Chile; d) make strategic alliances with national and international organization for advocacy and e) generate participatory approaches for developing and implementing conservation plans for sustainable use of resources and wetlands.

LINKING COMMUNITIES, WETLANDS AND MIGRATORY BIRDS PROGRAM

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In 1996 conservationist from three countries, Canada, USA and Mexico came together in an effort to work on conservation for a particular suite of birds and their range-wide needs. The Linking Communities, Wetlands and Migratory Birds Initiative (Linking) was created with assistance from a North American Fund for Environmental Cooperation grant. The original idea, that still remains the core goal, was to tie three Western Hemisphere Shorebird Reserve Network sites together that also are BirdLife Important Bird Areas through cooperative conservation partnerships; these are the Chaplin Lake/ Quill Lakes complex in Canada, the Great Salt Lake in the U.S., and the Marismas Nacionales area of Mexico. Each of the sites plays an important role in the life history of specific shorebird species that occur at each site during different seasons. In a broader context they are important habitats for many other shared aquatic and Land birds. Since 1996, many conservation activities have occurred through the Linking partnership. They include bird festivals, shared environmental education activities including the Shorebird Sister Schools Program (SSSP), nature friendly tourism initiatives, birding trail programs and other community based collaborations. Numerous science and management based communications have occurred these have included shared information on land use and wetland management, aquaculture especially shrimp farming and the associated brine shrimp industry at Chaplin and Great Salt Lake. There has been collaboration on

shorebird plan development and migratory bird conservation techniques. Partnerships have and are being developing between community leaders at the three sites, between school administration and teachers, NGOs, government agencies and professional nature guides.
In recent years BirdLife International has been developing a Western Hemisphere Flyways Program to increase conservation coverage of Neotropical birds in Latin America, especially for aquatic birds occurring from or passing through the Central and Pacific flyways into Central and South America. Starting in 2009 The Rio Tinto - BirdLife International Partnership Action Fund and Rio Tinto business partners have teamed up to bolster the Rio Tinto - BirdLife Western Hemisphere Flyways Program. Significant funds have been extended for the Flyways Program in 2009 and 2010. The Flyways Program objective is to advance range-wide bird conservation through local community action associated with sites of significant importance to migratory and resident birds. The Utah-based Rio Tinto business, Kennecott Utah Copper is a major partner. They are committed to assist with the Great Salt Lake; it is a component of their business operation. The Lake is a key migratory bird habitat in the Americas and Kennecott is interest in its biodiversity and long-term conservation of migratory birds. The Linking Communities, Wetlands and Migratory Birds program has a decade of experience with community focused migratory bird conservation and has been invited to partner with the Flyways Program. Currently the Flyways Program is focusing on four South American sites one of which is Laguna Mar Chiquita, Argentina and its shared resource of Wilson's Phalaropes and other migrants with the Great Salt Lake.

NUTRIENT LIMITATION IN MAR CHIQUITA (CORDOBA, ARGENTINA)

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Mar Chiquita is the largest salt lake in Argentina. However, knowledge about the lake's nutrient dynamics is very limited. Here we report a preliminary assessment of how algal growth varies in the South coast of Mar Chiquita. Four sites were sampled in spring of 2010: Laguna del Plata (Rio Primero estuary), Bird Observatory (Rio Segundo delta); Miramar (lake shore on Miramar city), and Pelagic (offshore) (2 km off Miramar coast). At each site we measured nutrient concentration and conducted nutrient limitation bioassays. TN: TP molar ratios did not show significant differences among sites (ranging from 1.4 to 1.9). Dissolved N:P molar ratio was relatively low in Laguna del Plata (2.7), intermediate in Bird Observatory (36.0), and high in open waters: 72.0 in Miramar shore and 77.0 in the Pelagic site. Chlorophyll values in sites under the influence of incoming freshwater ranged from 40–213 µg/L, whereas in open water sites averaged 22 µg/L (SD ± 1.0). Two-day in-vitro nutrient limitation bioassays indicated that Laguna del Plata was clearly N-limited, whereas Miramar shore and Bird Observatory were N-limited, but also showed a secondary P limitation. The Pelagic site appeared to be co-limited by N and P because both nutrients were required to stimulate algal growth. Results at the Pelagic site were confirmed with a 6-day *in-situ* incubation experiment in summer 2011. Although Redfield ratios (TN:TP) indicate a strong N limitation at all sites, our results suggest that -with the exception of Laguna del Plata- P may also be important in controlling algal growth in Mar Chiquita. This finding contrasts with the widespread assumption of strict N-limitation in salt lakes.

DETERMINATION OF AREAS OF SPECIAL PROTECTION FOR THE CONSERVATION OF MIGRANTS SHOREBIRDS IN THE MAR CHIQUITA RESERVE

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Due to the current environmental crisis, many populations of different species are declining rapidly, especially Nearctic shorebirds, being the habitat and stopper sites loss the main reasons for this reduction. The aim of this work was to identify and propose specific sites to conserve these shorebirds in the Mar Chiquita Reserve. The work was divided in two phases: 1) species selection, 2) identification of areas to conservancy. Firstly, the species to work were identified and selected. Secondly, habitat suitability models (HSM) were developed to create habitat maps using satellite imagery. The species selected for this study were *Calidris melanotos, C. bairdii, C. melanotos, Tringa flavipes* and *Falaropus tricolor,* which were grouped into foraging guilds. Three foraging guilds were identified, and on this basis three habitat suitability models and three cartographic models were created, being these last ones verified and calibrated through population censuses. The results based on the mapping models, indicate that the habitat of high suitability occupy a 15% of the study area, the habitats of medium suitability is a 17% and a 33% of study area for habitats of minimum suitability. Although these areas are distributed throughout the study area, based on population censuses and spatial configuration analysis, they were identified and proposed areas for the southern coast of the Laguna as special key areas for conservation.

SALT LAKE CHANGES AND THEIR OBSERVATION IN CHINA

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There are about 2018 lakes (>1 km^2) in Western China, mainly distributed in Qinghai, Xizang, Xinjiang and Inner Mongolia. According to lake level observation data, historical documents, and MSS, TM and ETM remote sensing images from 1970's, most lakes in Xinjiang, Xizang Plateau and northern Inner Mongolia are expanding, but more lakes in Qinghai, western Xizang Plateau and most part of Inner Mongolia are shrinking. Lake level changes are affected by, and coincide with the change of precipitation and evaporation (which is controlled by air temperature, humidity etc.). Human activity significantly affected the existence of some lakes, such as Nop Nur, Juyanhai, etc. We have established several field stations at the remote western lakes, including Zabuye Salt Lake (4421 a.s.l.), Danxiongco Lake (4450 a.s.l.) etc. for the long-term monitoring and studying of climate, hydrology, ecology and resources. Real-time data can be transferred back to Beijing by GPRS wireless network.

COMBINING REMOTE SENSING TECHNIQUES AND FIELD SAMPLING DATA TO STUDY THE SPATIAL AND TEMPORAL DYNAMICS OF AQUATIC ECOSYSTEMS AT THE HIGH ANDEAN SALT FLATS AND ITS RELATIONSHIP WITH ANDEAN FLAMINGS (*PHENICOPARRUS ANDINUS*) HABITAT

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High Andean region at the northern Chile have many shallow salty waterbodiesused as habitat by the Andean Flamingo (*Phenicoparrus andinus)*. In order to establish the importance of these ecosystems over the flamingo population, we have identified different scales of spatial patterns and temporal dynamics using Remote Sensing techniques and Field Sampling data. This study has evaluated the Punta Negra salt flat defined as feeding and reproduction area, and the Aguas Calientes IV salt flat defined as feeding area. Results of water quality indicate that both locations presented moderately alkaline properties and a sodium-chloride composition. It was found that elements of the flamingo diet are available in both salt flats, but with different benthic and planktonic assemblages: At Punta Negra there is a predominancy of benthic diatoms (*Surilella sella)* and at Aguas Calientes IV planktonic copepods *(Nauplius)*. The analysis of Hyperspectral images indicates differences in the microalgae spatial distribution and suspended solids patterns among systems. The spatial distribution of periphyton showed a greater development of chlorophyll at Aguas Calientes IV system, where there identified higher concentrations (chlorophyll range up to 70 µg/cm^2) and also a wider coverage (60 hectares with chlorophyll range higher than 40 µg/cm^2). Difference of flamingos density among systems was not registered which could potentially be understood as a self-regulated population mechanism depending on carrying capacity of both ecosystems.

THE AMPHIBIANS AND REPTILES OF SALINAS AND BAÑADOS IN THE BOLIVIAN CHACO

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The Chaco ecoregion is a vast woodland savanna that covers more than 1,2 million km^2 in South America, including portions of Argentina, Bolivia and Paraguay. The Salinas and Bañados region in Bolivian Chaco is one of the biggest remnant patches of native woodland savanna and dry forest and most of this region are legally protected by The Kaa-Iya National Park (about of 34412 km^2). In this study we present a synthesis of herpetofauna of the region and their possible relationships with human modifications (i.e. deforestation and forest fragmentation). After about 3 years (2008-2010) of research in different areas of the Chaco ecoregion in Santa Cruz-Bolivia and review of specimen data and records in the Museo NKM (1991 to 2005), we obtain about of 718 records of herpetofauna (262 amphibians and 456 of reptiles). In general terms we recorded and identified 52 amphibian species and 100 of reptiles, where 4 species were endemic for Bolivia, indicating that the Salinas and Bañados region represent the most diverse and richest sites in Bolivian Chaco. Although the human modifications are relatively low in the region, we present some relationships between abundance and richness of amphibians and reptiles whit the deforestation. In conclusion the present analyses shown the temporal variations of the herpetofauna and their status of conservation, demonstrate that the Salinas and Bañados are important for the conservation of this group in the Bolivian Chaco.

CHARACTERIZATION AND ECOLOGICAL IMPORTANCE OF THE BRAZILIAN SOLAR SALTWORK PONDS: A REVIEW

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The largest saltwork ponds in Brazil are located along the northern coast of Rio Grande do Norte State, more specifically on the shores of estuaries. Currently, saltwork ponds are studied not only in their geological aspect and engineering, but also as intermediary biotope between marine ecosystems and inland waters. The Brazilian saltwork ponds are characterized by frequent changes of management and the strong daily fluctuations of highly interrelated factors (e.g. salinity, oxygen, nutrients, etc). In these saltwork ponds, nutrients are not limiting, even showing determinant changes or fluctuations, especially in their ionic composition, due to shallow and ongoing water flow, where the dynamics of these nutrients is heavily influenced by the state of development of benthic biota. The ecosystem analysis and characterization of solar saltponds are translated as critical to improving the national production of sea salt.

THE USE OF SALINE COASTAL WETLANDS AS INDICATORS OF WATERSHED ENVIRONMENTAL STATE

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Estuaries are watershed terminals wetlands, in which the mixing of freshwater and marine inland tributaries from the ocean is produced. They are water bodies that support high biodiversity, particularly because of the presence of many migratory bird species. Coastal lagoons, or bar built estuaries, are water bodies closed to the sea because the existence of a sand barrier in its mouth. Those water bodies are connected to the Ocean through one or more narrow channels, generating mass exchange between them. Usually, the connection is not permanent, and depends mainly on the river flow regime and the meteorological conditions. From an environmental point of view, this characteristic define them as a sensitive and unstable estuaries, since they have higher retention times and greater storage capacity than most of estuaries. Because estuaries act as a watershed sink, estuaries trophic state is a consequence of watershed management. We studied the physical, chemical and biological characteristics of three estuarine systems, given their importance for biodiversity, social and economic issues, mainly fishing. The systems are located in the central-southern region of Chile. Results indicated high water quality degradation, especially in the brackish lagoons, due to high concentration of nitrogen, phosphorus and/or chlorophyll *a*. Because of the high trophic state of the studied estuaries, in a second part of the study, three new field campaigns were developed in more than 30 estuaries in the north central and south central Chile during dry season, in order to assess their water quality state for

extreme conditions. This information will generate a baseline of the trophic conditions of Chilean estuaries, as a result of watershed management. Understanding the consequences that river basin management have on the estuary trophic state, is essential to prevent undesirable effects on economic activities and wildlife supported by these water bodies.

HYDROGEOLOGICAL AND HYDROCHEMICAL EXPLORATION OF A LITHIUM-BRINE DEPOSIT: THE SALAR DE UYUNI, BOLIVIA

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Salar de Uyuni, located at an altitude of 3,653 m a.s.l. in the Bolivian Altiplano, is the world's largest salt flat with a size of 10,500 km². It consists of interbedding halite and clayey layers, referring to the alternation of humid and dry climatic periods. Pores in the salt are filled with a highly mineralized interstitial brine rich in lithium, magnesium, bromine, and potassium. Against the background of a possible future extraction of lithium the hydrochemical and hydraulic properties of the salt crust were investigated. Two field campaigns took place in 2009 and 2010, in cooperation between the TU Freiberg and the University of Potosí, Bolivia. Basic information was gathered by drillings with depths of 2 to 13 m at 11 different locations on the salt flat. The stratigraphy of the sediments was documented and core samples were transported to Germany for further mineralogical and geochemical analyses. The uppermost salt layer is mainly composed of halite with minor amounts of gypsum, the interbedding mud contains a high fraction of clay minerals. Bore holes were completed as pumping and monitoring wells and served for depth-dependent sampling of brines, which were subject to several chemical analyses including the determination of main ions and trace elements. Characterized by a high salinity of ~ 300 g/L, the brines show rising concentrations of lithium towards the delta of the main tributary Rio Grande in the south and decreasing contents of calcium and sodium due to gypsum and halite precipitation. Pumping tests revealed high, but varying hydraulic conductivities in the order of 10^{-3} - 10^{-4} m. Computer tomography (CT) was used for the determination of the salt's effective porosity showing values up to 30%. These results imply a high permeability of the salt crust for the brine and thus support the potential of the Salar de Uyuni as a lithium resource.

NATURAL MATERIALS FROM LAGUNA MAR CHIQUITA AND THEIR POSSIBLE USE IN HUMAN HEALTH

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The sludge and salts from the Laguna Mar Chiquita Lake (also named Mar de Ansenuza) have been widely used for therapy, especially during the decades of 1950 and 1960. The use of these natural materials in the field of human health significantly declined due to the increased volume of the lake after 1970.The aim of this study was to characterize the mineral components of muds and salts from the base of the lake and from the surrounding deposits, for a possible use in human therapeutics. Samples taken near the town of Miramar were analyzed with this purpose. Analyses were performed through X-ray "powder" Diffractometry (XRD), IR spectrometry and chemical analyses. A predominance of sodium chloride in the water of the lake was present, while saline deposits along the entire coastline were mostly composed of minerals like halite, gypsum, calcite, eugsterite, thenardite and other salts. The sludge, which can have a therapeutic application, was mainly composed of a mixture of detrital minerals like illite, quartz, plagioclase, feldspar, calcite, and salts like halite. Salts deposits were directly related with their solubility – products constants, Ksp. The composition of these materials, as well as that of the waters of the Laguna Mar Chiquita, is very similar to that detected by other authors on the beaches surrounding the Mar Menor, Murcia, Spain, important place for health tourism.

MAGNETOSTRATIGRAPHY OF SALINE SEDIMENT IN DALAGTAN, WESTERN QAIDAM BASIN, CHINA

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Qaidam Basin is the biggest of inland basin in Tibetan Plateau. Dalangtan in western Qaidam Basin is the Cenozoic saline lakes depocenter. This study displays the new magnetostratigraphic results of three boreholes (ZK02, ZK05, ZK06) from this region. ZK02 and ZK06 locate in the deposition depression center of Dalangtan, and ZK05 locating in edge of Qaidam Basin. Preliminary magnetostratigraphic results show that the 1000-m-thick magnetic polarity sequence from ZK02 recorded five normal chron zones Brunhes, Jaramillo, Cobb Mountain, Olduvai, and Reunion, and that the 1000-m-thick magnetic polarity sequence from ZK06 recorded three normal chron zones Brunhes, Jaramillo, and Olduvai. The study of ZK05 is more detail and accurate. Four normal chron zones Brunhes, Jaramillo, Cobb Mountain, and Olduvai are recognized from 330-m-thick magnetic polarity sequence of ZK05. The B/M boundary is located in 94 m. According to the average sedimentary rate based on magnetostratigraphic results, the age of top part of borehole is calculated to 111 ka and the bottom of borehole dates 2046 ka. Therefore, the molasse deposits of Liang ZK05 borehole terminated in 2 Ma, which indicates that the age of the uplift of

Altyn Tagh Mountains was before 2 Ma. This uplift stage of Altyn Tagh Mountains is regarded as Qingzang Movement Phase B, beginning in 2.6 Ma and terminating approximately in 2 Ma. Three magnetic excursion events have been extracted from the magnetic polarity sequence in the depth of 51-58 m, 207.5-212 m, and 249-252 m, which should be corresponding to Calabrian Ridge 2 (515-525 ka), Gardar (1465-1485 ka), and Gilsa (1567-1575 ka), respectively. Finally, the new magnetostratigraphic results of three boreholes can provide accurate chronological frameworks for the study of saline lake evolution, long-scale climate change, uplift of the Tibetan Plateau and exploration and development of saline lake resources in Qaidam Basin.

GENETIC CHARACTERIZATION OF THE BACTERIAL ENDOSYMBIONT, *WOLBACHIA*, IN SHORE FLIES FROM GREAT SALT LAKE IN UTAH, USA

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Symbiosis between unicellular and multicellular organisms is the rule not an exception on Earth and has an undisputed role in evolution. Members of the genus *Wolbachia*, endosymbiotic alphaproteobacteria, are present in a large number of arthropods and filarial nematodes, with infection rates in insects as high as 76% by some estimates. Maternal transmission of *Wolbachia* is well established but there is also evidence for horizontal transmission among hosts. The effects of infection include male killings, feminization of males, parthenogenesis and may also influence genetic variation of its host population. To date, at least eight major groups of *Wolbachia* have been identified. Great Salt Lake (GSL) is the largest saline lake in the western hemisphere and is characterized by salinity levels in some regions approaching saturation. Among the few organisms that thrive in such conditions are flies of the family Ephydridae. Brine flies are essential to the ecology of GSL because they remove organic matter and serve as a principal food source for birds. There is no description to date of *Wolbachia* in organisms inhabiting extreme environments including brine flies. DNA was isolated from three different species of brine flies and the presence of *Wolbachia* was examined with primers specific for *Wolbachia* 16S rRNA genes. DNA sequence comparisons were used to determine the phylogenetic affiliation of the brine fly *Wolbachia* samples. One interesting aspect of results is that brine fly *Wolbachia* are distict from those associated with other Diptera. The results of this study will contribute to our understanding of *Wolbachia* distribution, diversity, and evolution.

RIO TINTO - BIRDLIFE INTERNATIONAL WESTERN HEMISPHERE FLYWAYS PROGRAM – A MECHANISM FOR MIGRATORY BIRD AND SALINE LAKE CONSERVATION

J. Stacey
BirdLife International

BirdLife International and its Partners have been at the forefront of identifying Important Bird Areas (IBAs) around the world. The selection of Important Bird Areas (IBAs) has been a particularly effective way of identifying conservation priorities. IBAs are key sites for conservation, and are selected for one (or more) of three things: supporting significant numbers of one or more globally threatened species; one of a set of sites that together hold a suite of restricted-range species or biome-restricted species; hold exceptionally large numbers of migratory or congregatory species. Saline lake IBAs, many of which are also designated Ramsar sites, are critical sites for breeding species such as Andean and James' Flamingos but also migratory shorebirds such as Wilson's Phalarope and Western and Baird's Sandpipers

BirdLife has a strategic partnership with Rio Tinto, one of the world leading mining companies. In 2007 a concept was developed where Rio Tinto mining companies could work with BirdLife and its Partners to develop a collaborative project focusing on IBAs critical for migratory species. This concept was developed into a practical model of community-based engagement to achieve conservation action at key sites for such species. In the case of the Rio Tinto – BirdLife Flyways program, salt lakes play a critical role in supporting migratory species from Saskatchewan, Canada, through Utah in the US, to saline lakes in Argentina, including Laguna Mar Chiquita. This paper will highlight the model, and the migratory shorebirds assemblage and other species that will benefit from site-based conservation actions and associated activities at key salt lake IBAs in Canada (Chaplin and Quill lakes, the Great Salt Lake IBA complex in Utah, and in Argentina - Laguna Mar Chiquita. Rio Tinto Kennecott Utah Copper is one of the best strategically placed mining operations to support a flyway program based in North America. Great Salt Lake with its associated IBA complex was identified as a key node for developing a flyway approach to species and IBA conservation throughout the Americas. As a result a program has now been implemented addressing migratory bird conservation at over seven sites, some of which are IBA complexes, such as GSL. This program is now into its third year of implementation, with USFWS-NMBCA support contributing to the program at South American sites. Rio Tinto Kennecott Utah Copper, is committed to implementing Rio Tinto's biodiversity strategy at the local level and beyond, and flyways conservation represents an ideal opportunity to demonstrate that targeted and measured conservation action at flyway IBAs has strong relevance to the mining operation's relationship with species and sites at Great Salt Lake, a critical area for migratory birds. The company recognises that conservation actions at sites thousands of miles away that are critical for species using GSL can be an appropriate business and conservation response. The Program has also highlighted the value that High Andean saline lakes in the Puna/Altiplano have for both resident (breeding) and migratory bird species.

A REVIEW OF BRINE SHRIMPS (ANOSTRACA: ARTEMIINA) IN AUSTRALIAN SALINE LAKES

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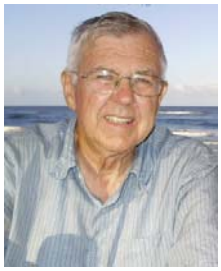

Australia has two species of *Artemia: A. franciscana* introduced to salt works and apparently not spreading and parthenogenetic *Artemia* presently spreading widely through southwestern Australia. In addition, and unique to, Australia there are 18+ species of *Parartemia.* All species of *Parartemia* use a lock and key mechanism in amplexus and hence have distinctive antennal-head features in males and thoracic modifications, including reduction/loss of the 11th thoracopod, in females. Various factors, including climatic fluctuations and isolation, contribute to a far higher diversity in the southwest of the continent. Unlike *Branchinella* in freshwaters, there are few congeneric occurrences of *Parartemia* in saline waters possibly due it eating largely uniform allochthonus organic matter rather than multisized planktonic algae. Many species are as osmotically competent as *Artemia*, e.g*. P. zietziana* is a strong hypo-osmotic regulator and lives in salinities 40-300 g/L. *P. acidiphila* and *P. contracta* live in markedly acid waters to pH 3.5, where dissolved CO_2 is unavailable, and hence they must have evolved an additional proton pump to produce ATP from endogenous CO_2. In *P. zietziana* there are 2-3 cohorts a year each persisting 3-9 months. Production of *P. zietziana* in a moderately saline lake in Victoria was 11.3 g dry weight m^2 $year^{-1}$, but only 1.1 g dry weight m^2 year in a highly saline lake. Up to 80% of assimilation is used in respiration and at times energy balance is negative, which accounts for its high mortality, inconsistent growth rates and unpredictable recruitment. *Parartemia* lacks haemoglobin, so while it can compete with *Artemia* up to ca 280 g/L, beyond that only *Artemia* can survive at oxygen concentrations below ca 2 mg O_2 l^{-1}. Occurrences of some species have recently been severely curtailed by secondary salinisation (which includes acidification and changes in hydroperiod), so that their continued existence is in doubt.

A SPATIAL MULTI-SCALE APPROACH FOR UNDERSTANDING THE DISTRIBUTION PATTERNS AND HABITAT PREFERENCES OF FLAMINGOS IN BRACKISH SHALLOW LAKES IN SOUTHERN SANTA FE, ARGENTINA

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At the Pampean lowlands of southern Santa Fe Argentina there are numerous brackish shallow lakes embedded in an agricultural landscape. These lakes are important habitats for Austral Flamingos (*Phoenicopterus chilensis*) and key lowland habitats for Andean Flamingos (*Phoenicoparrus andinus*), especially during winter when some Andean lakes freeze. We used a spatial multi-scale approach (continental - regional - local) that takes into account literature review and field survey results to understand the distribution patterns and local habitat preferences of flamingos in these shallow lakes. At a continental scale, the literature indicates

that these Pampean lakes are very productive (hypereutrophic levels). At a regional scale, the literature suggests that physical factors such as topography, hydrology, hydrography and hydrogeology contribute to shape the water quality for each waterbody. Thus, during winter 2010 we carried out a field survey at ten shallow brackish lakes where we counted and identified flamingos and noted the location of their flocks. We also got phytoplankton/phytobenthos measurements, water physicochemical parameters and meteorological conditions. Our results show that at a regional scale there is a close relationship between groundwater chemistry and lake salinity, and that differences in phytoplankton composition between lakes are related to the spatial gradient of salinity. At a local scale and within the water boundaries, phytoplankton and phytobenthos are dynamically redistributed by winds and lake circulation. Our field observations and measurements indicate that phytobenthos concentration increases to the leeward wind direction due to processes of mass transport and settling. As a summary, our observations suggest that flamingo presence may be associated with water quality and phytoplankton/phytobenthos assemblages at a regional scale, and with hydrodynamics and lake circulation at a local scale. This multi-scale approach may be useful to elucidate habitat preferences of flamingos and the environmental factors associated with the primary productivity of their feeding areas.

DISTRIBUTION OF SALINE LAKES AND PLANKTONIC CRUSTACEANS IN THE PROVINCE OF LA PAMPA, ARGENTINA

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The province of La Pampa, located in the central region of Argentina, is characterized by a marked rainfall gradient from 850 mm in the east to 300 mm in the west, which is always exceeded by evapotranspiration. In addition, there are a large number of shallow temporary lakes with high and very variable salinity, which are arheic or endorheic and fed mainly by rainfall. The zooplankton inhabiting these lakes consists of a large number of neotropical endemisms, especially among crustaceans. Since there is relatively little information on the distribution of these lakes in the provincial territory and on the salinity ranges in which the different species have been recorded, the aim of this contribution is to present information on the geographical location, diversity of zooplanktonic crustaceans and ranges of concentrations of dissolved solids in which the different taxa have been recorded. To this end, 34 lakes were surveyed along a gradient of salinity between 3.8 and 424 $g.l^{-1}$ between 1993 and 2010. Although some changed their category along the study period, the predominant ones were mesosaline (20 - 50 $g.l^{-1}$), followed by low saline (3 - 20 $g.l^{-1}$), although no clear geographical pattern was found. We recorded 12 cladocerans, with predominance of *Moina eugeniae*, 5 copepods, among which dominated *Boeckella poopoensis,* and the anostraca *Artemia persimilis*. We found a negative relation between the number of species and salinity. Because of its filtration efficiency and its influence on the ecosystems it inhabits, it is important to point out that *Daphnia menucoensis*, a halophylic species of the genus, was present in 12 out of the 34 lakes studied.

GRAIN-SIZE COMPOSITION FROM CORE DEPOSITS IN ZABUYE SALT LAKE, TIBET, AND ITS PALEOENVIRONMENTAL SIGNIFICANCE

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This paper studied the characteristics of grain-size composition from two core (SZK01 and SZK02) deposits in Zabuye salt lake, Tibet. We discussed the environmental evolution of the lake basin since the Last Interglacial, based on the paleoclimatic sequence inferred from salt mineral, pollen, microfossil and oxygen isotope of autogenetic carbonate. During the period of about 128-95ka BP, the Zabuye salt lake area was a shallow water sedimentary basin with plenty of run-off waters flowing into the lake. Coarse grain dominated the size composition. The lake level rose in the later period of 108-95ka BP; about 95-59ka BP period, run-off water from glacial due to the warm climate in the Last Interglacial continued flowing into the lake, to make the lake to be a deep one. The high lake level kept for a long time till 59ka BP. The climate was warm and suitable for the growth of ground vegetation during this period; about 59-43ka BP period, the lake level fluctuated at a relatively high level. It was the substage of 3b in the Last Glacial with cold and wet climate. Although the run-off did not develop as well as in the former period, coarse grain again dominated the size composition of the sediments due to the poor vegetation cover around the lake; about 43-34ka BP, a warm and wet period which was in accordance with substage of 3a in the Last Glacial. The ground vegetation flourished in the catchment basin. Although the run-off developed again, fine grain dominated the size composition. The lake may reach the highest lake level since 128ka BP in this area; about 34-0.8ka BP period, few water supplement resulted in the decrease of the lake water. The lake level declined discontinuously during this period, and up to nine paleoshorelines in Chaduixiong Valley in the east were formed.

5ºC- ISOTHERMAL EVAPORATION OF AUTUMN BRINES FROM THE ZHABEI SALT LAKE, TIBET, CHINA

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The special elements Li, B and K and trace elements Rb and Cs are contained abundantly in sodium sulfate subtype Salt Lake, Tibet. It is necessary to carry out an isothermal evaporation experiment at lower temperatures to understand the crystallization path of salt minerals at ambient temperatures. The authors conducted an experiment of 5 ℃ - isothermal evaporation of autumn brines and studied the crystallization paths and precipitation regularities of salts in the process of isothermal evaporation by referring to the metastable diagram of the quinary water - salt system Na^+、K^+、Mg^{2+}/ / Cl^-、SO_4^{2-}-H_2O . The experiment and study provide an important basis for the comprehensive exploitation and use of brines of this salt lake and mineralization. The experimental results show that boron is precipitated as borax in the whole evaporation process. Potassium is precipitated as sylvite and aphthitalite until the brine is extremely concentrated.

MERCURY AND SELENIUM BIOACCUMULATION IN THE STROMATOLITE COMMUNITY IN THE GREAT SALT LAKE, UTAH

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The Great Salt Lake has a salinity near 15% and is critical habitat for more than 200 bird species that account for 85 million bird-use days annually. The diet of many of these birds is dependent on the food webs developing on stromatolite biostromes that grow profusely at depths < 3m and cover 23% of the lake's littoral zone. These reef-like structures are the only solid substrate in the lake and they are consequently the dominant area where periphyton and benthic invertebrates grow. We investigated this community to understand its importance for production processes that support the bird assemblage and to assess whether they are an important vector for the extremely high mercury levels that have been found in three duck species that utilize the lake.. The periphyton community growing on (and building) the biostromes is >99% colonial cyanobacteria (*Aphanothece sp.*). Periphyton chlorophyll levels averaged 800 mg/m^2or about seven times that of the lake's phytoplankton. Lake-wide estimates of chlorophyll suggest that production on the stromatolites rivals that of the phytoplankton. The stromatolites are the principal habitat for brine fly (*Ephydra gracilis*) larvae and pupae that are fed upon by many of the birds utilizing the lake. A pumped-bucket sampler operated by SCUBA divers was used to quantify densities and the size structure of larvae and pupae. There was no significant difference between larval abundance at shallow (1 m) and deep (2.5 m) sites ($p = 0.27$), and densities increased from 7000/m^2 in June to over 20,000/m^2 in December. Preliminary estimates of total mercury concentrations in the periphyton, fly larvae, fly pupae, and adult flies were 170, 166, 344, 551 ug Hg / kg dry weight, suggesting that biomagnification is relatively limited in this short food web. However, the dominant bird feeding heavily on the brine fly larvae, the goldeneye duck (*Anas clypeata*), had concentrations near 60000 ug Hg / kg dry weight (Vest et al. 2008), indicating either very high biomagnification or that the ducks obtained their mercury loads elsewhere. The relatively unstudied stromatolite community apparently is extremely important in the lake's food web dynamics. However, additional work is needed to understand the transport of mercury, selenium and other contaminants into ducks and shorebirds utilizing the lake.

PALEOLIMNOLOGICAL ANALYSIS OF EUTROPHICATION AND ARTEMIA CRYPTOBIOLOGY IN THE GREAT SALT LAKE (USA)

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The watershed of the Great Salt Lake has over one million inhabitants, with most clustered on the southeastern edge of the lake. Inputs of nutrients and other contaminants to the lake are high and one bay that receives most of the nutrient loading is hypereutrophic and has high mercury concentrations. To assess the long-term trend in contamination on populations of *Artemiafranciscana*we collected 12 to 38-cm long sediment cores in two southern bays. Most eutrophication metrics (nitrogen, phosphorus, ^{13}C, ^{15}N, and algal pigments) changed markedly

over the last 50-70 years, coincident with rapid population growth in the Salt Lake City area. However, the most distinct changes were largely coincident with the construction of a railway causeway that divided the lake in two, and resulted in salinities in the southern part decreasing from >>200 g/L to as low as 60 g/L. Brine shrimp cyst densities were low in deeper sediment strata but increased to >2000/g dry weight in superficial sediments. The most significant increase in cyst densities also coincided with the construction of the railway causeway and the change in salinities which may have modified *Artemia* production, as well as the tendency for cysts to sink to the sediments. *Artemia* cysts from different sediment strata were extracted and hatched in the lab. Cysts as old as 290 years hatched from the cores, although hatching rates declined to <2% for cysts older than 140 years. We conclude that both nutrient discharges, as well as causeway construction have had marked impacts on the Great Salt Lake on the Great Salt during the past century.

VERTICAL STRATIFICATION OF PHYSICAL, CHEMICAL AND BIOLOGICAL COMPONENTS IN TWO SALINE MEROMICTIC LAKES SHIRA AND SHUNET, (SOUTH SIBERIA, RUSSIA)

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The water column in meromictic lakes is divided by gradients of physical and chemical factors into several spatially separated meta-niches. Contrasting environmental conditions affect the vertical distribution of different species. Notably, meromictic lakes provide unique opportunities for studying the mechanisms of adaptation of living matter to abruptly changing environmental conditions. We studied the vertical stratification of physical, chemical and biological components in two saline fishless meromictic lakes Shira and Shunet (Siberia, Russia) which are quite different mainly due to different mean and maximum depth of lakes as well as to their salinity levels. These differences lead to different stability of permanent stratification and marked differences in food web structure. We also developed complex mathematical model of meromictic lake ecosystem which was used to test the effect of external factors on ecosystem dynamics and behaviour. There are several important findings and implication which are relevant not only for saline but for other stratified aquatic ecosystems. Having considered the mechanisms involved in formation of vertical inhomogeneities of both physicochemical parameters and various species differing by their size and position in the food web, we demonstrate that biological and physical factors equally contribute to maintain these inhomogeneities. We conclude that the stratified distributions of major components of food web will have several implications for ecosystem structure and dynamics. Trophic interactions and mass and energy flows can be significantly impacted by such distributions. Species spatially separated even by relatively short distances (from centimeters to meters) will not directly compete. We demonstrated that stratified distributions are typical for species ranging in size and complexity (from bacteria to amphipods) and this is not so easy to detect with traditional sampling techniques. Thus, the vertical structures of many stratified lake ecosystems most probably are under investigated.

DISCOVERY OF TERMINAL LATE PLEISTOCENE-EARLY HOLOCENE STROMATOLITES ON THE TIBETAN PLATEAU

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This paper reports terminal late Pleistocene-early Holocene stromatolites found at Damxung Co (co means lake in Tibetan) on the Tibetan Plateau (referred to as the 'world's third pole'). Their discovery has great significance for the elucidation of Late Quaternary paleoclimatic and paleoenvironmental evolution on the plateau and the life evolution in the salty environment. Damxung Co is located on the southwestern side of the interior of the northern Tibetan Plateau and the modern lake surface has an elevation of 4,475 m. A stromatolite assemblage occurs on terrace T1-2 on the northwest and west banks of the lake. It stretches discontinuously for up to 9 km and is ~9 m higher than the modern lake surface. 14C age dating of this stromatolite assemblage has been performed and two phases are broadly recognized. The first phase started at 13,068±446 a BP and the second phase largely at 11,000 to 8,931±325 a BP. The first phase corresponded to the Bölling and Allevöd warm events. There was a small break between the two warm events, which was probably the Older Dryas. The second phase was roughly equivalent to the initial Holocene Warm Period. Between the first and second phases there was a break during roughly the interval 12,000 to 11,000 a BP, which was the Younger Dryas. The stromatolites consist predominantly of calcified thallophytic fragments with small amounts of MgCO3 and silicate detritus, occasionally fine feather being observed. The optimum temperatures for stromatolite development were 20 to 30℃, and when the highest temperatures were lower than 12 to 15℃, the growth of blue algae stopped. Now the yearly mean temperatures at Damxung Co are 2 to 3℃, suggesting that: then the temperatures there were >10℃ higher than today, the environment was warm and wet and birds flourished.

INDEX