Keynote lecture

Nuevas luces sobre la eutrofización del Lago Titicaca, perspectivas de remediación y monitoreo

New lights on Lake Titicaca eutrophication process and perspectives about monitoring and remediation.

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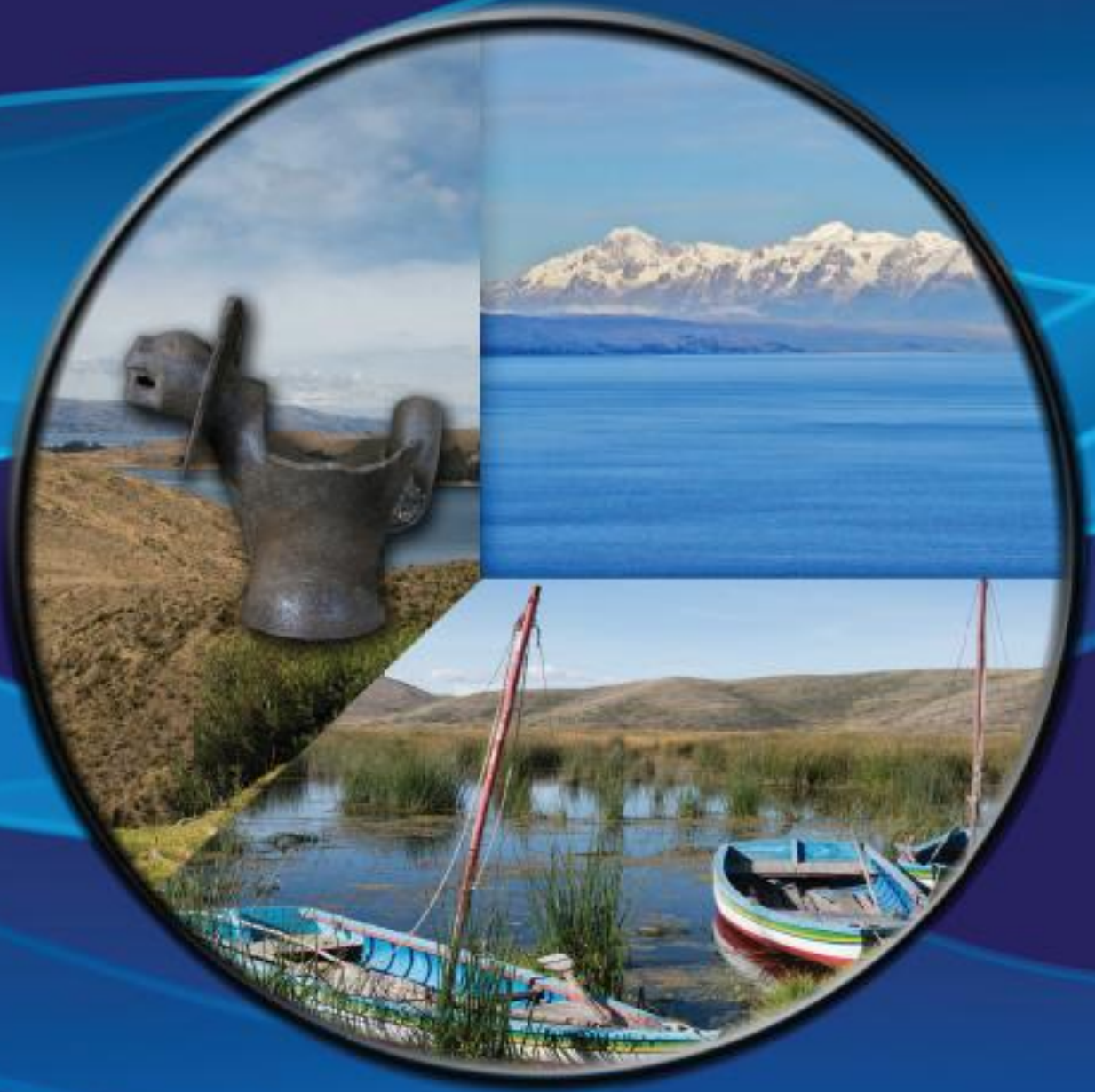
Abstract:

Titicaca Lake is among the largest and most important lakes of the world, its tropical latitude and high altitude (3850 m.a.s.l) makes it a unique ecosystem and a conservation priority. However, the shallow part of the lake (Lago menor) collects sewage water from about two million people and there is little information about the extent of the contamination or degree of disturbance caused to the ecosystem. We investigated different abiotic and biotic markers of eutrophication in a transect from the main source of contamination at Bahia Cohana to an apparently less impacted area. We investigated the largest bloom ever recorded in the lake, monitored closely physicochemical and biological changes in the ecosystem for more than four years and explored some of the major factors controlling carbon biogeochemistry. We found a natural succession of macrophytes limiting dispersion of contaminants out of Bahia Cohana and attenuating ecosystem impacts such as a change in pH, which changed more than two units in the most impacted area. Using this gradient we identified nitrogen and carbon isotope fractionation as the most reliable and sensitive markers for eutrophication. Attenuation of light penetration, pH and oxygen close to the sediments were also good indicators of eutrophication. We found that areas not directly affected by Katari river discharges are also polluted and that significant amount of pollution could be attributed to local communities' discharges. Physicochemical analysis revealed that the ecosystem is naturally enriched with sulfate, making it prompt to hydrogen sulfide production. The dominant algae during the bloom was identified as *Carteria sp.* a Chlorophyte genus closely related to *Clamidomonas* with no report of toxicity, but which may have caused significant water toxicity (indicated by the death of large numbers of amphibians, fish and even birds) by indirectly promoting an increase in hydrogen sulfide production. Our continuous monitoring program revealed that the ecosystem has suffered significant changes in the las 15 years. It also showed that small algae blooms were continuously occurring causing picks of oxygen production during the day and unusual low concentrations during the night. Our analysis also showed that Charophytes have a significant role in the lake. They produce oxygen in the bottom of the water column preventing H_2S dispersion and making the lake a sink for CO_2. In polluted areas Characeae die off and the lake becomes a source of CO_2 to the atmosphere. Now we are starting two pilot studies to identify the best alternatives for continuous monitoring of the lake and to generate sustainable alternatives to mitigate the impact of local communities on the lake. We will test macrophyte and periphyton associated ability to reduce or contain the nutrient enrichment of the lake in two different scenarios. The first will be directly at the lake with a floating island with containing the macrophytes and the second a more traditions wetland approach at the Katari river.

COLOQUIO INTERNACIONAL SOBRE LA CONTAMINACIÓN ACTUAL E HISTÓRICA EN LOS ECOSISTEMAS ACUÁTICOS ANDINOS



La Paz, 3 al 5 de mayo de 2016
Universidad Mayor de San Andrés, Cota Cota, La Paz

Proceedings

International colloquium on current and ancient contamination in Andes aquatic ecosystems

Coloquio internacional sobre la contaminación actual y histórica en los ecosistemas acuáticos Andinos

Colloque international sur la contamination actuelle et historique des écosystèmes aquatiques andins

La Paz – May 3rd – 5th 2016

Universidad Major de San Andrès – Campus de Cota-cota, La Paz

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General Planning

- **May 3rd 2016: Contamination and eutrophication of Lake Titicaca**

AM session: Mercury biogeochemistry and contamination of aquatic ecosystems of the Andes region
Keynote Lecture: Hg contamination in Latin America: the past is not what we think, nor the future (J.-R. Davee Guimarães).

PM session: Chemical contamination, eutrophication and monitoring of Lake Titicaca and its watershed
Keynote Lecture: Eutrophication of the Cohana Bay (D. Acha).

- **May 4th 2016: Arsenic issues in the Andes**

AM session: Arsenic biogeochemistry and contamination of aquatic ecosystems of the Andes region
Keynote Lecture: Arsenic contamination of groundwater (Chile) (G. Lobos).

PM session:
Workshop 1: Arsenic and mercury speciation.
Workshop 2: Paleoenvironmental studies in the Andean altiplano.

- **May 5th 2016: Historical reconstructions of the human-climate interactions in the altiplano: implication of archeological purposes**

AM session: Paleo-environmental reconstruction of Altiplano's archives
Keynote Lecture: Holocene Paleoclimatic and Paleoenvironmental History of the Lake Titicaca Basin (S. Fritz & P. Baker).

PM session: Archeology: historical human – environment interactions
Keynote Lecture: Recent contribution of terrestrial and subaquatic archeological investigation in Lake Titicaca (C. Delaere & M-A. Vella).