

# Antibiotics contamination in the Katari watershed and impact assessment in the context of the Bolivian Altiplano

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The Katari watershed (2022 km<sup>2</sup>) encompasses the biggest population of the Altiplano and has its outlet in the Cohana bay located in the Titicaca Lake (Huiñamarca Lake). This bay presents the most eutrophic waters of the Bolivian part of the Lake (Fonturbel, 2005, Duwig et al., 2014). The watershed drains the city of El Alto / La Paz with a population growth rate of 5.2% per year where most sewage is discharged untreated into the environment. The North Altiplano has unique physicochemical characteristics such as high altitude (3800 m), significant UV radiation, low oxygenated waters and semi-arid climate, with intense and highly variable rainfall, influencing the transfer, sorption and degradation processes of organic contaminants.

A screening of the main contaminants, including metallic trace elements and antibiotics was carried out during dry and wet seasons in strategic points of the river and groundwater systems of the Katari watershed. Resistance genes to the main antibiotic detected in the surface and ground waters were looked for in soils and surface waters.

The results showed the presence of high concentrations of sulfamethoxazole (SMX) and trimethoprim (TMP), antibiotics widely used for the treatment of diseases in humans and animals, usually in combination. Discharges of raw wastewater and treated wastewater from the waste water treatment plant were found to be the main source of these pollutants in the basin. Nevertheless, agricultural practices as manure application of antibiotic-treated animals could also play a role on observed concentrations. This uncontrolled use of antibiotics had not only given way to antibiotic pollution of natural ecosystems, but also to the presence of antibiotics resistances genes: SMX bacterial resistance (SulI and SulII genes) were found all over the catchment, even in areas where anthropogenic activity is almost non-existent and free of antibiotic pollution.

Discharges of antibiotics in the environment arise not only at toxicological problem but they also impact the bacterial populations which can lead to the developments resistance. It is recognized as one of the most important world while public health problem (WHO, 2015). These results are linked to consumption patterns in the study site and the lack of pharmaceutical consumption regulation policies.

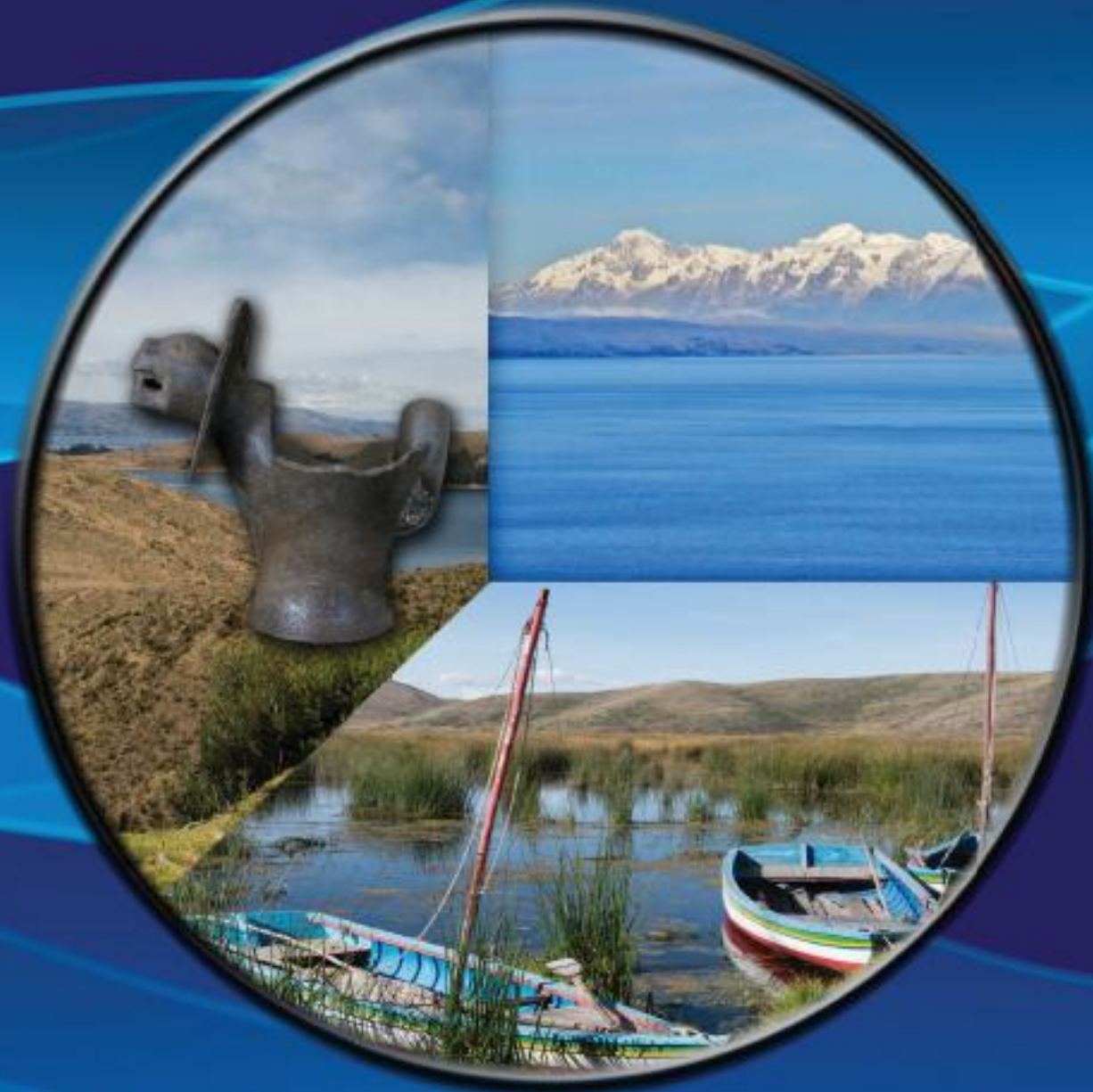
## References:

Duwig, C., Archundia, D., Lehembre, F., Spadini, L., Morel, M.C., Uzu, G., Chincheros, J., Cortez, R., Martins, J.M.F. (2014). Impacts of Anthropogenic Activities on the Contamination of a Sub Watershed of Lake Titicaca. Are Antibiotics a Concern in the Bolivian Altiplano? *Procedia Earth Planet. Sci.*, 10, 370–375.

Fonturbel, F. (2005). Indicadores fisicoquímicos y biológicos del proceso de eutrofización del Lago Titikaka (Bolivia). *Ecología Aplicada*, 4 (1-2), 135-141.

WHO (2015): <http://www.who.int/mediacentre/factsheets/fs194/en/>

# 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 3<sup>rd</sup> – 5<sup>th</sup> 2016**

**Universidad Mayor de San Andrés – Campus de Cota-cota, La Paz**

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## General Planning

- **May 3<sup>rd</sup> 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 4<sup>th</sup> 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 5<sup>th</sup> 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).