

The Drying Up of Lake Poopó in the Bolivian Altiplano as a Result of Multiple Interactions of Different Stressors

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Why did Lake Poopó fall dry in December 2015?

When Lake Poopó dried up completely in December 2015, the governor of Oruro declared a departmental emergency.

Explanations in the **public debate** about the causes involved five main factors:

- natural climate variability
- the occurrence of an El Niño event
- climate change
- water withdrawal for mining
- water withdrawal for the expansion of irrigation

However, **very little research** has been done since. Thus, the aim of our study was to analyze how a vulnerable socio-ecological system is impacted by various stressors and their multiple interactions.



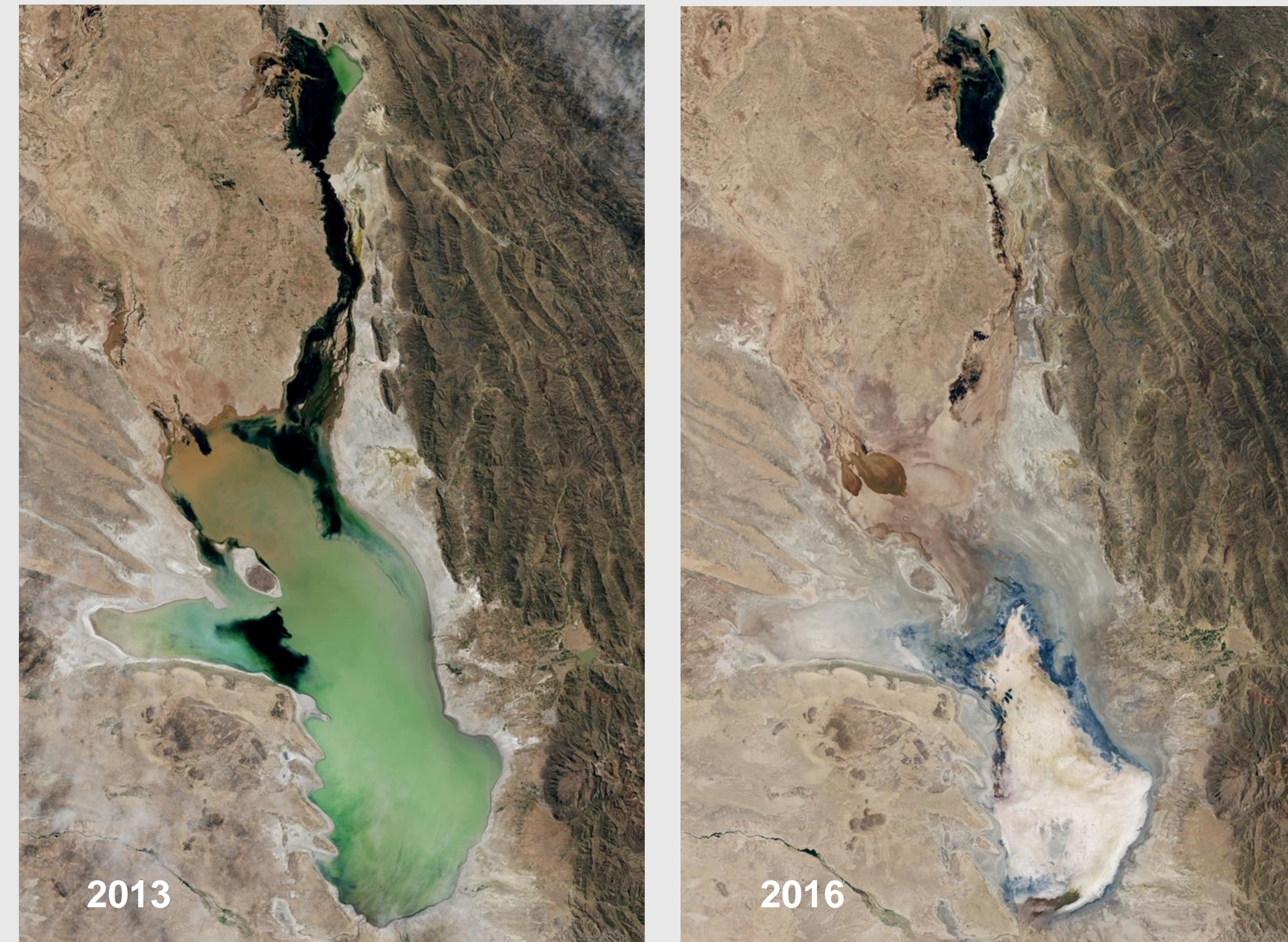
Fishing boats belonging to the community of Untuavi in the middle of the dried-out Lake Poopó, January 31, 2016. Photo: Dirk Hoffmann

Methods

Methods used comprise an extensive literature review, including newspaper articles, technical documents, unpublished scientific reports and other grey literature, as well as a series of in-depth interviews with experts, scientists, decision-makers and NGO personnel. These interviews were complemented by a focus group of local fishermen and a number of shorter interviews with people affected by the lake's drying up. Finally, first-hand information and photographic testimony was captured during two field visits to Lake Poopó, to the western part (January 2016) and to the eastern part (July 2019).

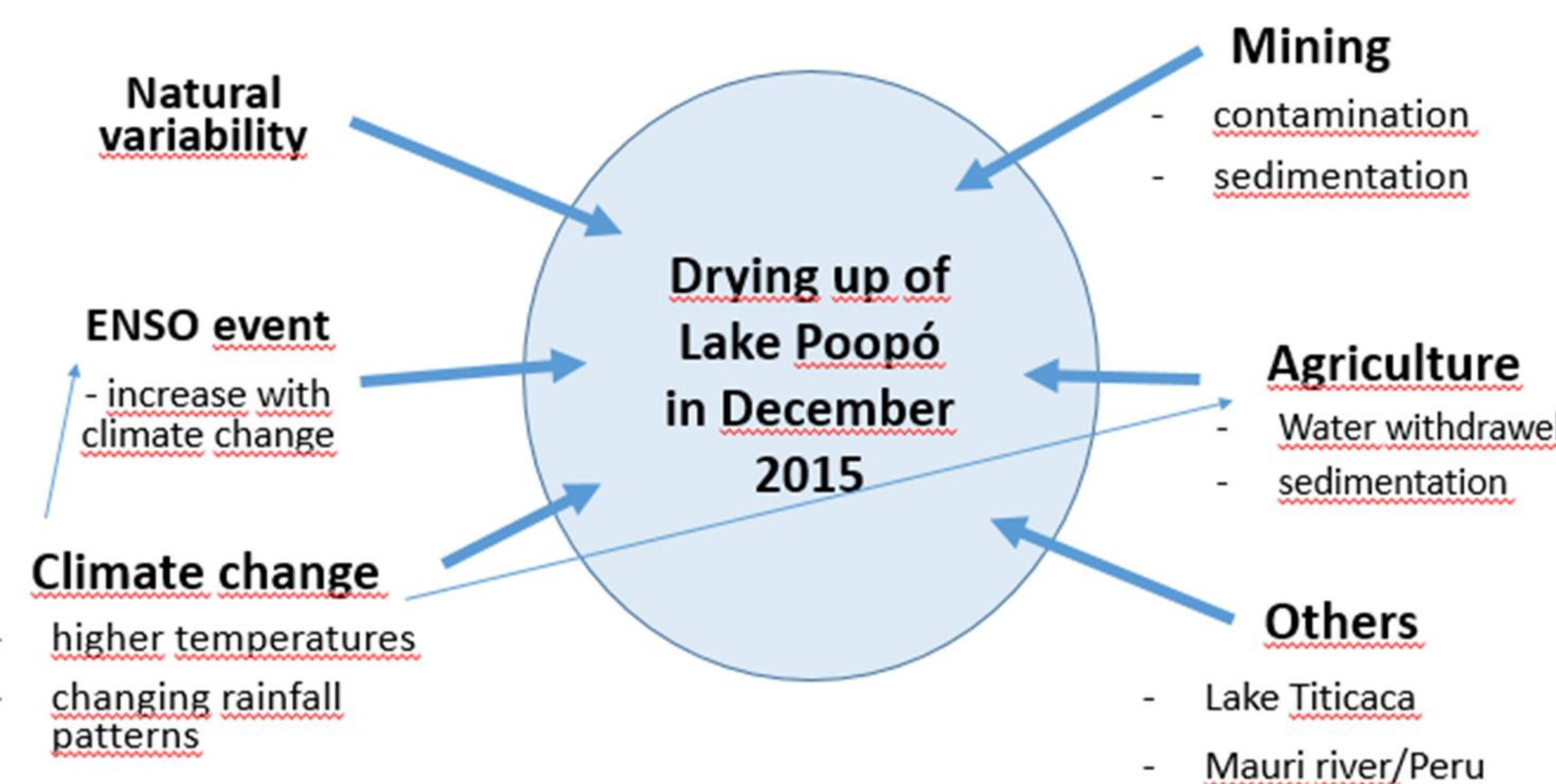
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Satellite images showing Lake Poopó before falling dry (left, image taken on 12 April, 2013), and without water (right, image taken on 15 January, 2016). Photo credit: Earth Observatory/NASA

Schematic overview of stressors



Findings

In addition to the five factors for the drying up of Lake Poopó in December, 2015, given in the public debate, other factors that surfaced during the research include diminished water supply from Lake Titicaca and the Mauri river, a main tributary of the Río Desaguadero, due to water being diverted on the Peruvian side, as well as increased sediment inflow to Lake Poopó accelerating the lake's sedimentation.

Lake Poopó dried up again at the end of both 2016 and 2017. While being reduced to a minimum extent of 250 km² at the end of 2018, the lake partially filled up during the following rainy seasons.

The Uru Murato population of the three remaining villages along the eastern shore lost their livelihoods due to the repeated cycles of the lakes' drying up and they were forced to migrate elsewhere.

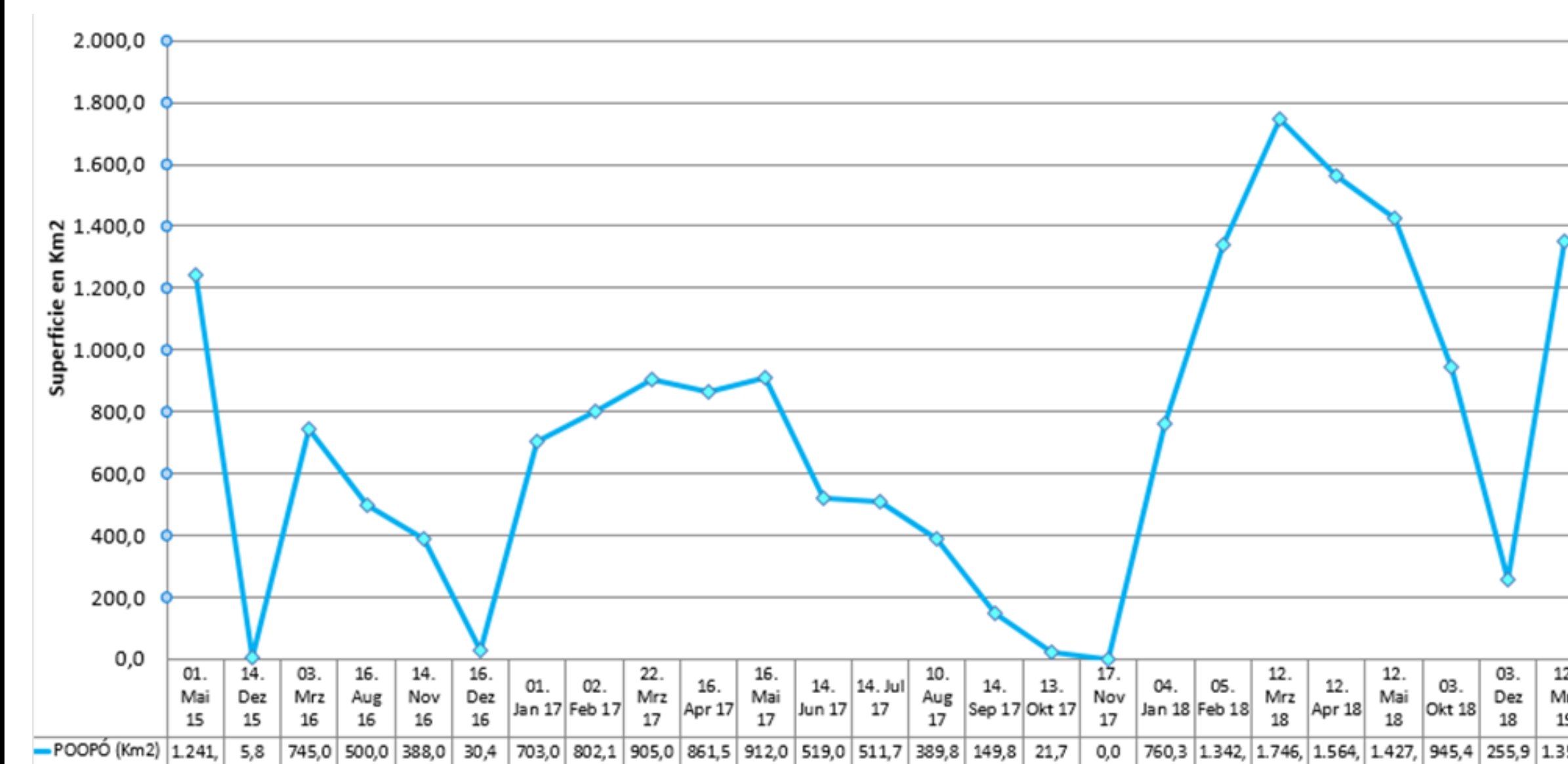
There is a lack of political will to establish a water regulation regime for the Poopó watershed, based on a water balance accounting for de facto water diversion for irrigation purposes.

More so, there is a marked hesitance of researchers to quantify the amount of water being diverted for agricultural purposes along the Desaguadero river.

The relative importance of each factor cannot be quantified in the absence of the necessary data.

Schematic overview of the main factors given for the drying up of Lake Poopó in December 2015. Elements of the left column correspond to the climate system, whereas the right had column refers mainly to the diminished water inflow into Lake Poopó via Desaguadero river and other tributaries. Own elaboration

Lake level 2015-19

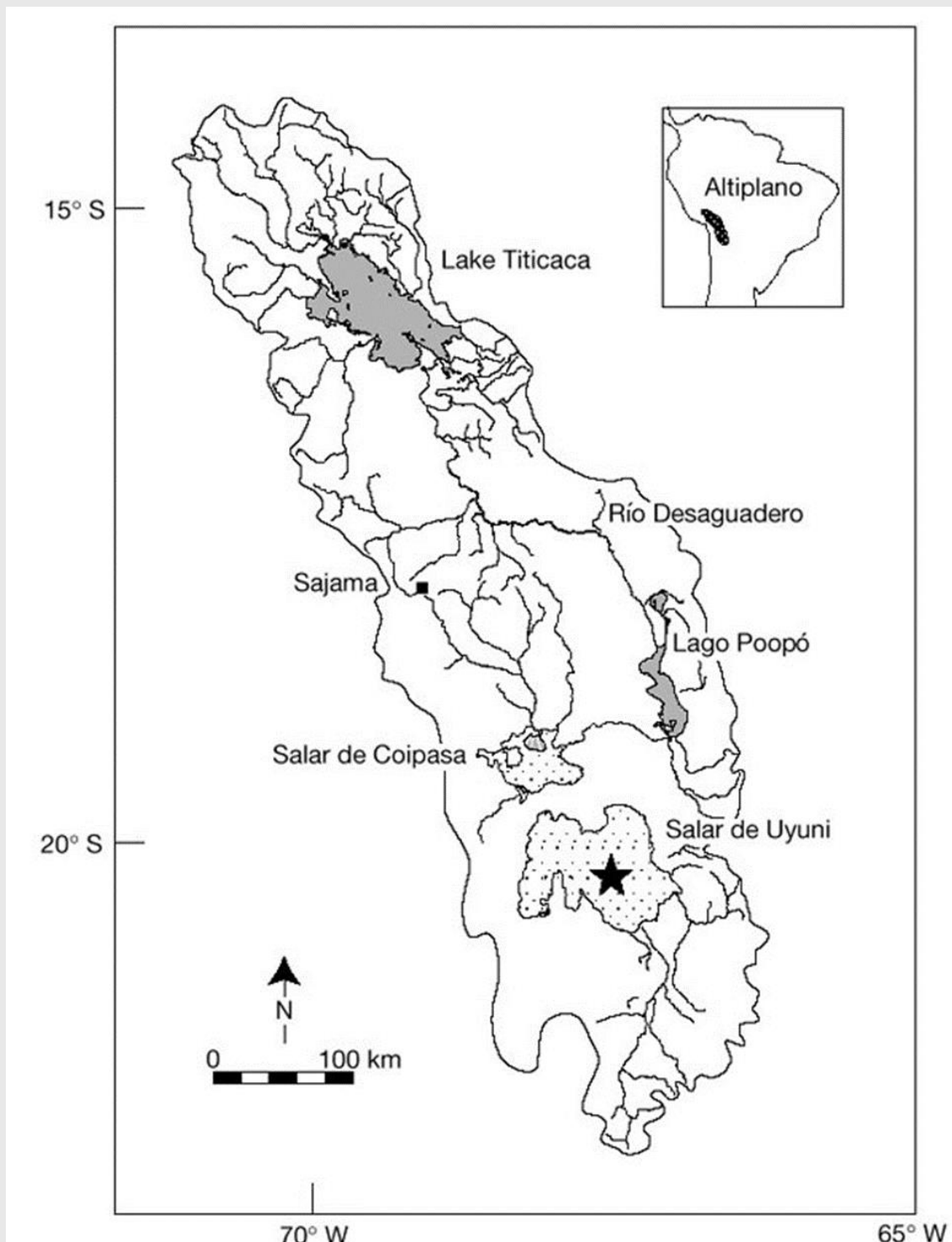


Measurements of the size of Lake Poopó undertaken by the authorities of the department of Oruro. Source: Gobierno Autónomo Departamental de Oruro

Acknowledgements

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On the right: **Map** of the Lake Titicaca – Río Desaguadero – Lake Poopó – Salt Lake Coipasa endhoreic watershed on the Altiplano. Source: Baker *et al.*, 2001.



Artificial dam in the Desaguadero river (yellow arrow indicating direction of river flow) diverting water into an irrigation canal (red arrow, to the left). Photo: Dirk Hoffmann

Conclusions

We conclude that even though the complete drying up of Lake Poopó at the end of 2015 was triggered by a very strong El Niño in combination with an unusually late start of the rainy season, only the interactions of these climatic stressors with the other socio-economic factors can fully explain the drying event.

Our investigation fully confirms the conclusion of Satgé *et al.* (2017), stating that "Agricultural activity is one of the major factors contributing to the regional desertification and recent disappearance of Lake Poopó."

In the continued absence of a dedicated political response, the demise of Lago Poopó as a proper lake within the next decade or two seems inevitable.

The impact on the ethnic Uru's population can be described as "genocide in slow motion", given the intimate relationship between Lake Poopó, its aquatic resources and Uru Murato culture.



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