An integrated approach for river water quality monitoring in a large scale gold mining watershed

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IS IT REALISTIC TO STOP MINING?

- High economic and technological importance
- Optimistic recycling rate = maximum 50%
- Rich ore deposits in fragile ecosystems
- Continuous social reluctance
- Water resources = a major problem

(Garcia Parra, 2013)
IS IT REALISTIC TO STOP MINING?

Open pit of 1km diameter and 600m deep.

Mine in Colombia (Hernández, 2010)
Poopó lake in Bolivia (Terrazas, J., 2017), dried out due to combined urban growth, climate change, El Niño and water demand → High complexity
WATER QUALITY MONITORING OF A LARGE-SCALE GOLD MINING WATERSHED (CAJAMARCA, PERU)

14 sites near the mine
14 sites at midstream
4 sites in Porcón tributary
8 sites in the city
= 40 sites total assessed for:
Dissolved metals, organic pollutants and benthic macroinvertebrates. Landuse and hydromorphology

(Mercado-Garcia et al., 2019)

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White background = rural and peri-urban areas

Grey background = Cajamarca City
BIOASSESSMENT
MINING SITES

Acari:

Gripopterygidae:

& others:
BIOASSESSMENT MIDSTREAM

Best quality and biodiversity, despite agricultural pollutants → good physical habitat structure (hydromorphology)
BIOASSESSMENT URBAN AREAS

Worst quality and biodiversity, degraded hydromorphology, severe pollution and nauseous smells
LESSONS FROM OUR ASSESSMENT

– Hallmark mining impacts are absent according to the selected freshwater quality indicators (conceived in different contexts)

– Acid- and metal-tolerant ‘good-quality’ bioindicators were present, and other potential ones (e.g., Acari, Grypopterygidae, ecotoxicological or microbial enzymatic activity) are uncharacterized

– A quantitative determination of freshwater quality might be a weak assessment endpoint due to the high complexity of open-pit mining
IDENTIFYING KEY ACTORS AND DECISION MAKERS ($)
CONCLUSIONS

1. More importance of ecological losses over data-driven quality thresholds is needed, since mining operations causes complex changes in the overall system.

2. A system-based understanding is urgently needed for integrating governments, scientific disciplines and mining businesses in the protection of aquatic habitats and non-mining stakeholders in the long run.
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