

# Risks to Human Health from Mercury in Gold Mining in the Coastal Region of Ecuador

## PROBLEM

The exposure to mercury (Hg) is of toxicological concern. Artisanal and small-scale gold mining (ASGM) emits about 880 tons of mercury annually. ASGM is associated with negative impacts from the use of Hg, which causes extensive environmental degradation during and after the development of mining activities.

## GENERAL OBJECTIVE

To evaluate the concentration of mercury (Hg) in fresh surface water within the gold mining regions located in the coastal zone of Ecuador. In addition, it seeks to analyze the potential risk to human health associated with these concentrations by applying deterministic and probabilistic methods.

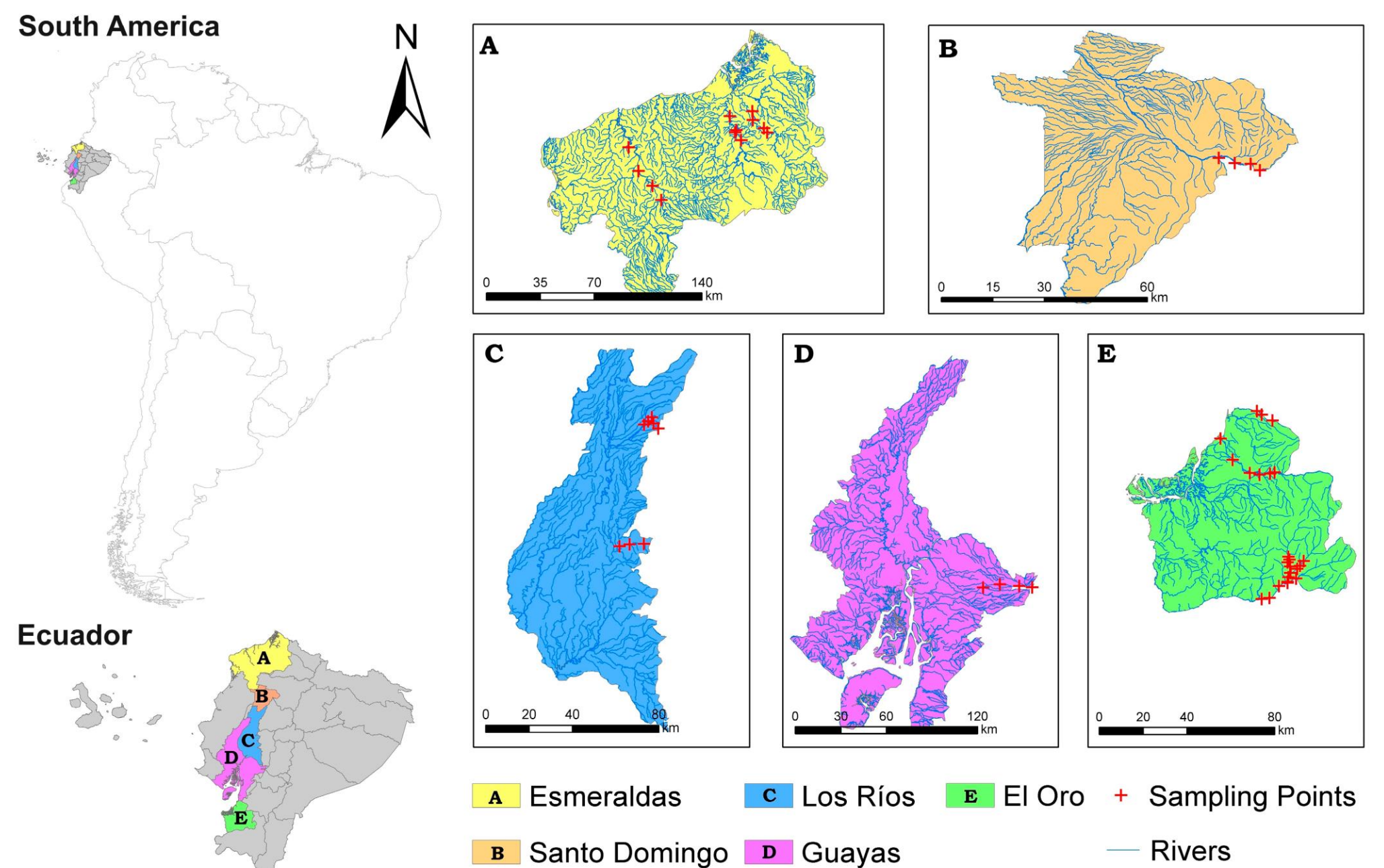
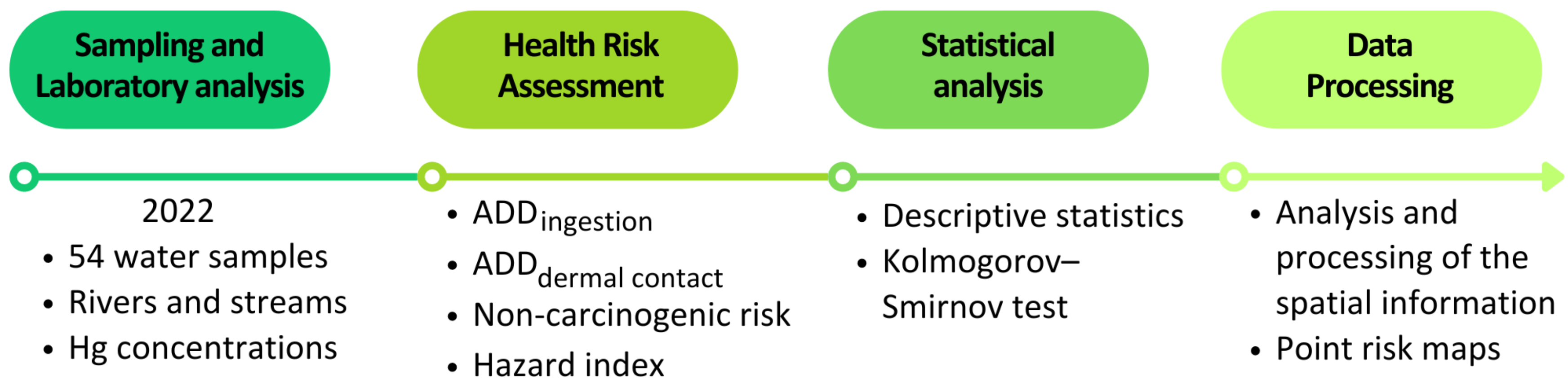


Figure 1. Study area and location of the sampling sites.

## METHODOLOGY



## RESULTS

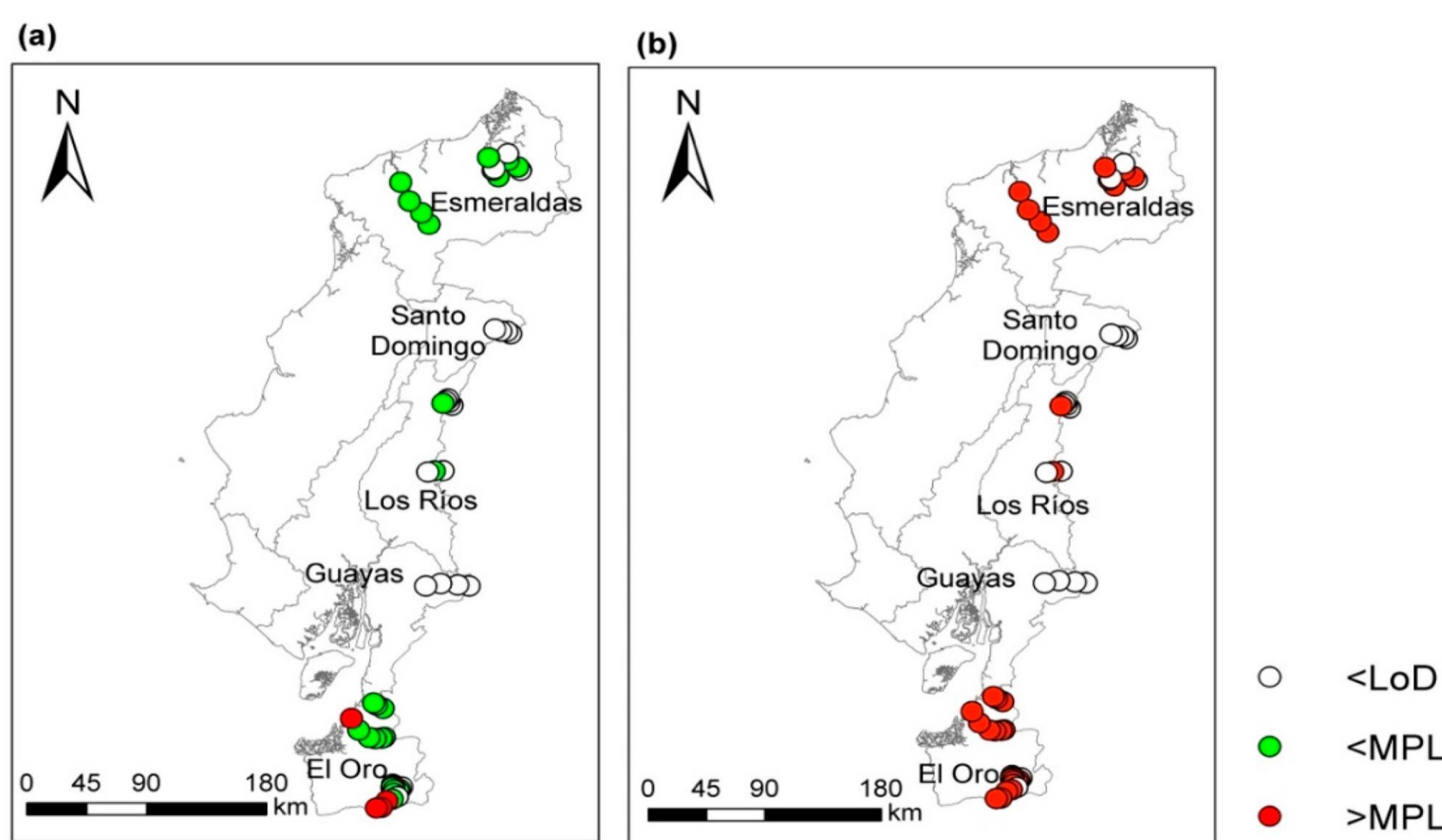


Figure 2: Sampling points and Hg concentration. Results compared with the MPL according to the Ecuadorian Water Quality Guidelines for (a) drinking water and (b) for the preservation of aquatic life.

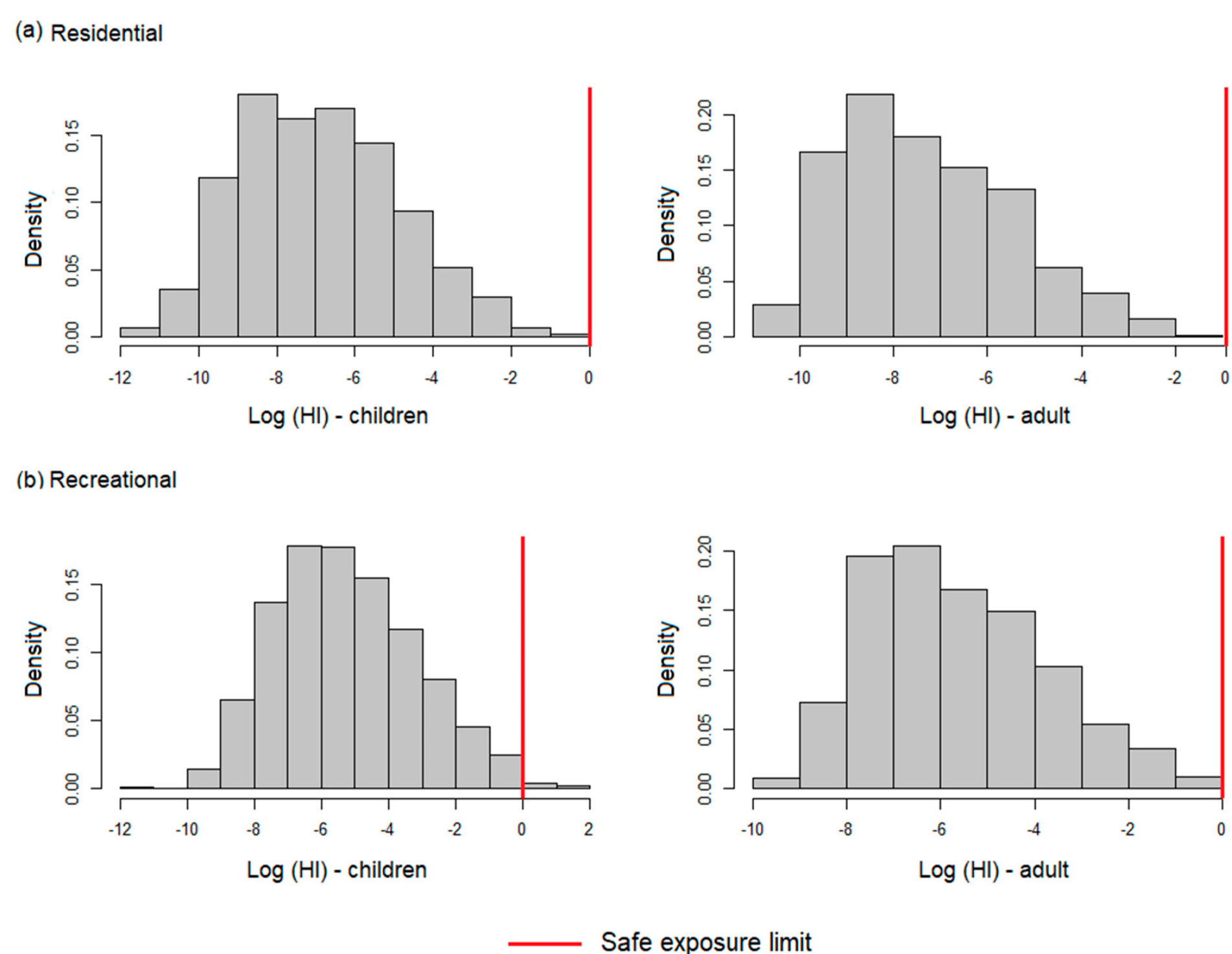


Figure 4. Histogram of HI related to Hg in contaminated surface waters in (a) residential and (b) recreational settings

## CONCLUSIONS

- At least 63% of the samples met the water quality standards for the protection of aquatic life according to Ecuadorian regulations.
- The possibility of experiencing negative effects on human health due to Hg exposure was below the permissible limits for both receptors in the residential setting according to the probabilistic risk analysis.

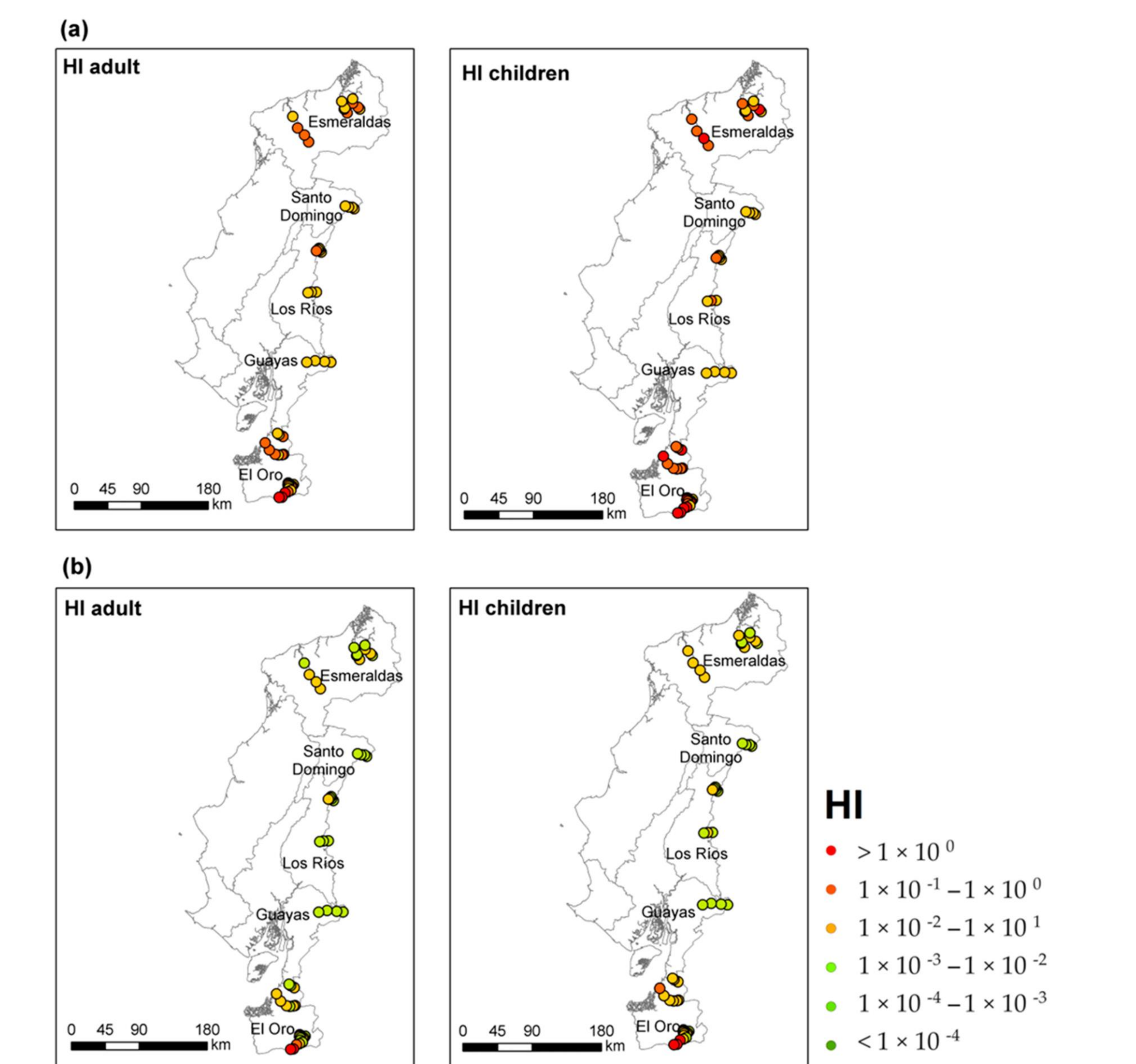


Figure 3. Hazard Index (HI) for receptors exposed to contaminated surface water in the Ecuadorian coastal zone for the following scenarios: (a) residential and (b) recreational.

- HI values  $> 1$  were reported in El Oro and Esmeraldas provinces.
- Water ingestion is the main route of entry of potentially toxic elements into the human body.
- Residential scenario**  
 $HI_{adults} = 1.74 \times 10^{-1}$      $HI_{children} = 8.71 \times 10^{-1}$   
 Children are the most vulnerable receptors, with HI values up to five times higher than in adults.
- Recreational scenario**  
 $HI_{adults} = 8.69 \times 10^{-1}$      $HI_{children} = 4.13$

- In the recreational setting, children present risk values above the safe exposure threshold.
- According to the deterministic method, both receptors presented risk values higher than the recommended limit in the provinces of El Oro and Esmeraldas.
- The study noted areas that exhibit potential systemic risk, especially for children, due to ingestion of water from surface water sources.