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Identification and Quantification of Antimicrobials in Water Bodies Near Wild Cat Habitats in Costa Rica

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Abstract

Antimicrobial resistance (AMR) threatens human survival and will be the leading cause of death in the world by 2050, surpassing cancer and traffic accidents. AMR is the ability of bacteria to resist the effects of an antibiotic to which they were previously sensitive. Bacteria become resistant due to exposure to antimicrobials, causing genetic mutations and the acquisition of resistance genes (ARGs). The main sources of contamination are hospitals and veterinary clinics, where bacteria are exposed to high concentrations of antibiotics, as well as households, treatment plants, and agricultural activities. The disproportionate use of these products could explain the finding of ARGs in felines in Costa Rica. Angulo et al., 2023 quantified sixteen ARGs in feline feces and detected at least one ARG in all samples. Objective: This work aims to demonstrate the presence of antimicrobials in conserved areas of Costa Rica, specifically in rivers close to feline habitats, by identifying and quantifying antimicrobials in river water samples in which contact with felines has been confirmed. Sampling: 22 water samples were taken from rivers where feline sightings and feces have been previously reported and collected. The study area includes Braulio Carrillo National Park, Los Quetzales National Park, and surrounding farms. Analysis of antimicrobial residues A targeted analysis was performed by the direct injection method, using UPLC-MS/MS. Results Antibiotics were detected in 47% of the samples, with ciprofloxacin and norfloxacin being the most frequent. All antibiotic concentrations were reported to be below 8 ng/L. The following antimicrobials were reported: Erythromycin (6.0-2.3 ng/L), Roxithromycin (3.8-2.8 ng/L), Ciprofloxacin (8.2-2.1 ng/L) Norfloxacin (7.5-5.1 ng/L) Sulfamethoxazole (3.8-1.4 ng/L) Trimethoprim (1.5-0.8 ng/L) and Furaltadone (2.2-1.7 ng/L). In Braulio Carrillo National Park, a protected area known for the presence of felines, the following were reported: Ciprofloxacin, Norfloxacin, Erythromycin, and Sulfamethoxazole. Conclusions The analytical method is so sensitive that it allowed levels as low as 0.8 ng/L to be reported. Antibiotics were reported in rural areas with anthropogenic influence and in national parks. Although the concentrations reported are relatively low, they could be sufficient to generate resistance, further threatening an endangered species such as felines.