

Swimming in medicated waters: Understanding and mitigating the impacts of pharmaceutical pollutants on aquatic wildlife

Asst. Prof. Eli S.J. Thoré – Biologists@100 Conference, Liverpool, March 2025

Freshwater ecosystems are experiencing an unprecedented biodiversity crisis, with already one-quarter of freshwater fauna threatened by extinction. One key driver is chemical pollution—and pharmaceuticals play an increasingly recognised role. At the *Biologists@100* conference, I highlighted how pharmaceuticals, even at very low concentrations, can trigger subtle but ecologically meaningful behavioural changes in aquatic wildlife.

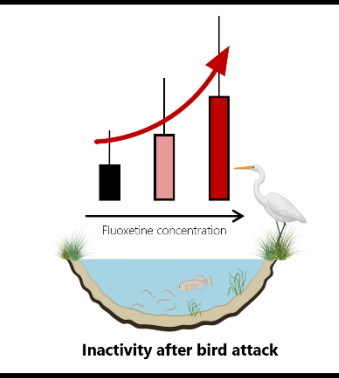
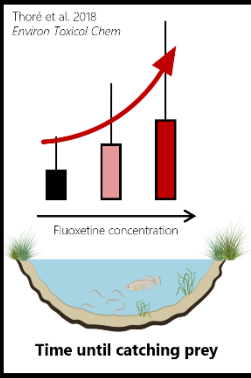
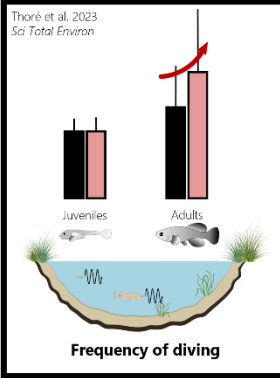
Using case studies, including our research on fluoxetine (the active ingredient of Prozac) exposure in fish, I showed that important behaviours such as foraging and anti-predator responses are disrupted in the presence of pharmaceutical pollution. These effects often occur at concentrations far below those causing traditional toxic outcomes like mortality or impaired reproduction. Importantly, the effects can differ across life stages and can persist or change over long-term exposures, as our 12-week chronic exposure study demonstrates.

Despite the growing evidence for behavioural disruption, current regulatory frameworks seldom integrate behavioural endpoints into environmental risk assessments. Instead, regulatory tests focus on short-term, acute toxicity without accounting for subtle, chronic, and life-stage-dependent impacts.

This gap underscores the urgent need to refine our risk assessment paradigms—an objective closely aligned with the goals of the *OneHealthdrugs* COST Action. By advocating for the early integration of environmental considerations into drug development pipelines and emphasising the importance of incorporating complex biological responses such as behaviour, our work helps promote the Action's vision of eco-friendlier pharmaceuticals.

To support the integration of behavioural ecotoxicology into regulation, I also introduced the EthoCRED framework: a new tool we developed to guide the evaluation and reporting of behavioural studies, aiming to enhance their scientific quality and regulatory utility.

Through advanced technological methods, including high-resolution behavioural tracking and field-based telemetry, we can now quantify ecological effects at an unprecedented scale, detail, and realism. Embracing these innovations will be key to achieving sustainable pharmaceutical use and regulation that protects both environmental and human health—a core tenet of the One Health approach promoted by *OneHealthdrugs*.



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EthoCRED: a framework to guide reporting and evaluation of the relevance and reliability of behavioural ecotoxicity studies

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