A decision support system for the **E**nvironmental **R**isk **A**ssessment of veterinary medicines applied in pond **AQUA**culture

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1. Introduction

A wide range of veterinary medicines are used in aquaculture production for treating and preventing bacterial diseases and parasitic infestations in the cultured species [1]. Veterinary medicines might pose a potential risk for the cultured species (e.g. when they are not used according to recommendations), for human health and trade (e.g. due to the presence of residues in the cultured species), and for the environment (e.g. due to the discharge of untreated aquaculture effluents).

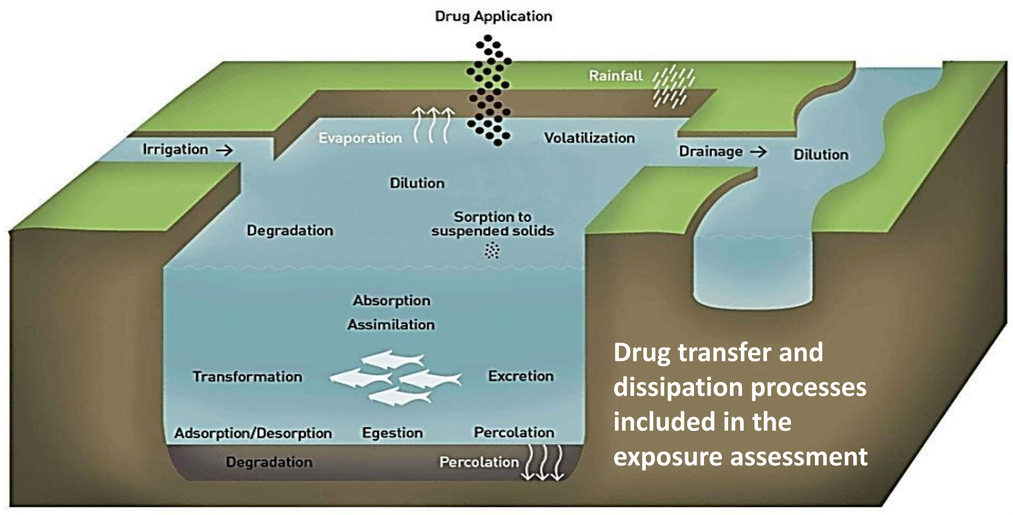
The ERA-AQUA Decision Support System (DSS) was developed to assess the potential risks posed by the use of veterinary medicines in pond aquaculture production systems for 1) the cultured species, 2) aquatic ecosystems receiving aquaculture effluents (acute and chronic), 3) consumers, and 4) trade.



2. The ERA-AQUA model

The ERA-AQUA DSS combines information on environmental characteristics of the pond under study, aquaculture management practices, and physico-chemical and toxicological properties of veterinary medicines to perform risk calculations.

Exposure assessment: Concentrations of aquaculture drugs applied mixed with feed or directly to water are modelled by mass balance equations in four different compartments: pond water, pond sediment, cultured species, and the effluent discharge point. The differential equations are numerically solved in time steps of one minute during the simulation period.



Effect assessment: Safe drug concentrations for each of the studied endpoints are derived based on safety factors applied to toxicity data or food safety standards.

Risk assessment: Risks are calculated by following a risk quotient approach, by dividing the predicted exposure concentration in the environment (peak or time weighted average concentrations) or in the cultured species (at harvest) by the predicted safe concentration for each of the included endpoints. If risk quotients are larger than one, the estimated exposure exceeds the calculated safe concentration and is indicated by the model.

3. Example of model output

Risk assessment for oxytetracycline (antibiotic) applied mixed with feed at a dose of 50 mg/kg BW for a period of 7 days in a pond scenario representing the intensive *Pangasius* catfish (*Pangasianodon hypophthalmus)* production in the Mekong Delta (Vietnam). The scenario represents the last period of the culture cycle (initial fish weight: 0.8kg) and assumes a daily water exchange of 30%. Fish is harvested 21 d after the last drug application.

PWC: Predicted pond Water Concentration; PEC: Predicted Environmental Concentration; EDI: Estimated Daily Intake; PCC: Predicted Cultured species Concentration; PNEC: Predicted No Effect Concentration; ADI: Acceptable Daily Intake; MRL: Maximum Residue Limit; RQ: Risk Quotient

4. Outlook

The ERA-AQUA DSS was designed to perform prospective risk assessment studies for a wide range of aquaculture medicines applied to different aquatic species and pond scenarios.

The ERA-AQUA DSS version 2.0 is implemented in a GUI in Microsoft EXCEL and is freely available at www.era-aqua.wur.nl.

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