AN UPDATED VERSION OF THE SEPA BATHAUTO TOOL FOR ASSESSING ANTI-PARASITIC CHEMICAL TREATMENTS IN MARINE CAGE FISH FARMS

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Introduction

Marine cage fish farm operators in Scotland wishing to use anti-parasitic chemicals as bath treatments must first obtain a discharge licence from the Scottish Environment Protection Agency (SEPA). Discharge licences are granted by SEPA on a per-site basis, with the quantity of chemical that can be released from a particular fish farm determined by chemical environmental fate modelling. This exposure modelling considers the location and composition of the fish farm, along with hydrographic data measured at the site and the toxicity and environmental fate of the chemicals concerned.

Discharge quantities are typically calculated for three anti-parasitic chemicals: azamethiphos, cypermethrin and deltamethrin. Of these, cypermethrin and deltamethrin are rapidly removed from the aqueous phase *via* binding to particles, and are therefore assessed using SEPA's short-term exposure model, which calculates projected concentrations in the chemical patch up to 6 hours after its release from the fish farm (SEPA, 2008). Azamethiphos, however, remains in the aqueous phase for several days until it degrades and dissipates, and is therefore also assessed using a long-term exposure model, originally developed by Gillibrand and Turrell (1999) and recently extended by Carnall, Ericher and Hughes (2017).

Both the short-term and long-term models are utilised by the existing SEPA spreadsheet tool BathAuto, which iteratively calculates predicted chemical concentrations in the water to arrive at safe discharge limits for a particular fish farm site. In this poster we preview an updated version of BathAuto, in which the long-term model is now fully integrated into a GUI-based tool.

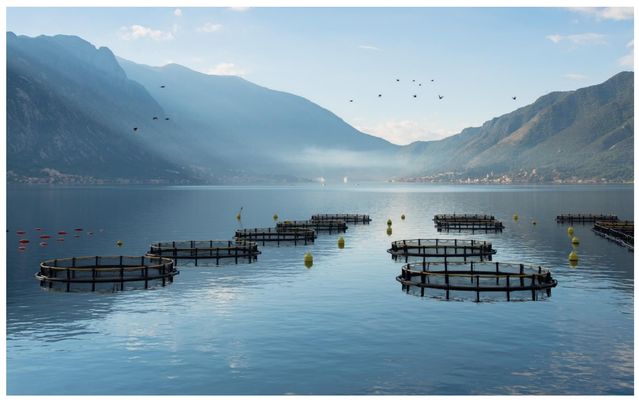

Figure 1 – A marine cage fish farm

Updated BathAuto Model – Preview of GUI

A preview of the graphical user interface for BathAuto is given in Figure 2, along with a summary report output by the model. Key features of the updated model include:

- **Improved compatibility with modern operating systems:** the standalone executable utilised previously to perform calculations with the long-term model (opendisp.exe) is no longer required.
- **Improved realism of simulated treatment regimes**: the maximum number of treatments per day and the interval between treatments are now determined by the user. Where multiple cages are treated simultaneously, irregular treatment regimes can also now be evaluated (e.g. 3 treatment events for a farm of 8 cages, treating 3, 3 and 2 cages at once).
- **Compounds, parameters and Environmental Quality Standards used in the calculations can be modified from the SEPA defaults,** making BathAuto potentially available for use in other jurisdictions and regulatory frameworks (e.g. biocides).
- **Identification of multiple compliant treatment regimes** for a particular site using new Batch mode (see also: "One Cage Or Two?").

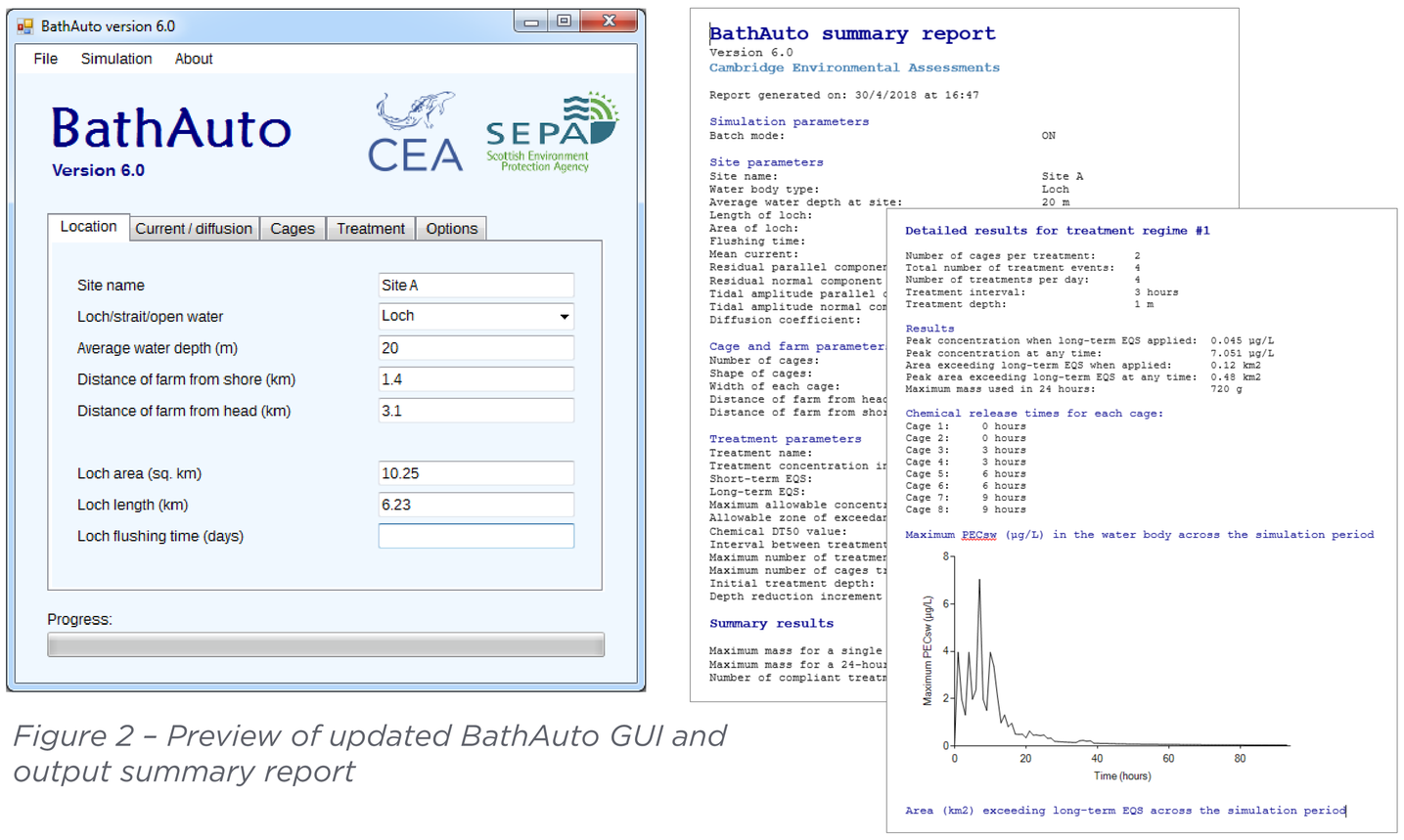

Figure 2 – Preview of updated BathAuto GUI and output summary report

One Cage Or Two?

At some sites it may be possible to achieve compliance with Environmental Quality Standards for a range of treatment regimes, e.g. different numbers of cages treated at once, or different numbers of treatment events occurring each day. With the updated version of BathAuto, multiple compliant regimes can be identified using Batch mode, thus reducing the influence of the starting values selected by the user upon the outcome of the assessment.

Figure 3 illustrates maximum concentrations of azamethiphos in water over time for 4 possible treatment regimes, as output by BathAuto, for a farm consisting of 6 cages. Each treatment regime identified is compliant with the Environmental Quality Standards set by SEPA for azamethiphos, with the maximum allowable treatment depth in the cages optimised by the model.

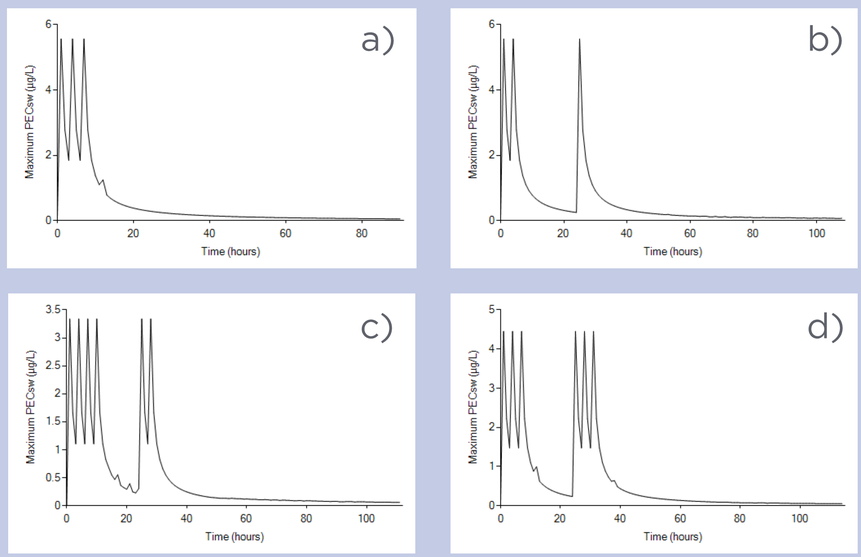

Figure 3 – Maximum concentrations of azamethiphos in water over time for 4 possible treatment regimes for a fish farm consisting of 6 cages: a) 2 cages treated at once, with 3 treatment events per day; b) 2 cages at once, with max. 2 treatment events per day; c) cages treated 1 at a time, with max. 4 treatment events per day; d) cages treated 1 at a time, with 3 treatment events per day. N.B. axes to different scales.

References:

SEPA (2008). Regulation and monitoring of marine cage fish farming in Scotland - a procedures manual. Annex G: Models for assessing the use of chemicals in bath treatments v2.2. Scottish Environment Protection Agency.

Gillibrand, P. A. & Turrell, W. R. (1999). A Management Model to Predict the Dispersion of Soluble Pesticides from Marine Fish Farms. Fisheries Research Services, Marine Laboratory, Aberdeen; Report No 2/99.

Carnall, J., Ericher, F. & Hughes, G. (2017). Environmental Exposure Following The Use Of Veterinary Medicinal Products As Bath Treatments - An Extended Version Of The MLA Model; poster presentation at SETAC Europe 2017.