SHORT TITLE:	**TAPAS**
COORDINATOR:	**Prof. Trevor Telfer**
ORGANISATION:	**University of STIRLING, UK**
TOPIC:	**H2020- SFS-11b-2015**
PROJECT NUMBER:	**678396**

DELIVERABLE: 3.7

Delivery of environmental quality standard database and risk scenarios

Contributing Authors:

Paul van den Brink, Wageningen Environmental Research (The Netherlands)
John Deneer, Wageningen Environmental Research (The Netherlands)

History of changes:

Ver	Date	Changes	Author
1	05/11/2019	First draft	All
2	01/12/2019	Final version for submission	All

Internal review

Date	Name
29/11/2019	Trevor Telfer

Refer to this document as:

Van den Brink, P.J.,and J. Deneer. 2019. Delivery of environmental quality standard database and risk scenarios. EU H2020 TAPAS Deliverable 3.7. Report. 8 pp.

Please be aware this document may be updated as the critical evaluation continues throughout the TAPAS project (2016- 2020).

This project has received funding from the EU H2020 research and innovation programme under Grant Agreement No 678396

Table of Contents

This project has received funding from the EU
H2020 research and innovation programme
under Grant Agreement No 678396

1. Introduction

This deliverable is a result of the EU funded TAPAS project (Tools for Assessment and Planning of Aquaculture Sustainability). One of the work packages of this project is on Environmental Risk Assessment (ERA) of potentially toxic substances used in aquaculture and aims, amongst other things, to validate ecotoxicological models and risk scenarios through case studies. In this respect the deliverable builds on deliverable 3.5 which describes the scenarios and models used. As deliverable 3.5 already provides the risk scenarios, this deliverable will only focus on the environmental quality standard database. Deliverable 3.4 also presented Predicted No Effect Concentrations (PNECs) for some chemicals used in European aquaculture based on the Species Sensitivity Distribution (SSD) concept. In order to provide a complete overview of the safe standards, these PNECs are also presented in this deliverable.

2. Description of the toxicity data search procedure

Toxicity data were retrieved from the EPA ECOTOX database (https://cfpub.epa.gov/ecotox). The searches were performed for individual compounds, retrieving aquatic toxicity data only. Searches were performed using both the simple query and the advanced database query. Settings for the simple database query were:

- Taxonomic name entry: Both; search item left blank
- Chemical entry: Contains; search item set to name of chemical, e.g. 'florfenicol'
- Effect Measurements: ticked boxes for 'Endpoint Reported', 'Growth', 'Mortality', 'Physiology', 'Population', 'Reproduction'
- Publication Years: 1915 – 2018
- Report Format: both aquatic and terrestrial set to Excel format.

After providing the name of an individual chemical in the 'Chemical entry' field, the 'Perform Query for Aquatic Data' was pressed, and the resulting Excel sheet was saved under the name of the chemical. The search for emamectin benzoate was performed for both 'emamectin benzoate' and 'emamectin-benzoate', but the latter did not yield any results.

The search was performed for the chemicals listed in Table 1 of Rico et al. (2018) which are also given in Table 3, and focussed on the data requirements (Table 1) specified (recommended) by VICH under the framework set by the International Cooperation on Harmonization of Technical Requirements for Registration of Veterinary Products (VICH 2004) for Tier A and Tier B environmental risk assessments of the 'Aquaculture branch' of 'Phase II', applicable to chemicals with an expected environmental concentration of 1 µg/L or higher.

The distinction between acute and chronic toxicity was made according to the ranges for acute toxicity data as given by Maltby et al. (2009). Test durations for acute toxicity data used were 2 – 21 d for vertebrates, 1-7 d for invertebrates, 2-28 d for macrophytes and 1-7 d for algae. Toxicity tests with

This project has received funding from the EU H2020 research and innovation programme under Grant Agreement No 678396

longer durations were considered to be chronic in nature. For acute tests LC50/EC50 data were used, for chronic tests NOEC or EC10 values were used (the latter were preferred if both were available).

The assumption was made that salmonids consisted of trout and salmon species only, and that all trout and salmon species were part of the salmonids group. Amphibians were included in the 'other vertebrates' category. Crustaceans, spiders and insects were all considered to belong to the arthropods. Ciliates and rotifers (categorized in Acquire as 'invertebrates' were included in the non-arthropods category.

Table 1: Aquatic effect studies recommended by VICH for Tier A and Tier B environmental risk assessment for veterinary chemicals (aquatic branch) (VICH, 2004).

Medium	Studies	Toxicity endpoint	Guideline
Aquatic effects studies required in Tier A			
Freshwater	Algal growth inhibition[1]	EC50	OECD 201
Freshwater	Daphnia immobilization	EC50	OECD 202
Freshwater	Fish acute toxicity	LC50	OECD 203
Saltwater	Algal growth inhibition	EC50	ISO 10253
Saltwater	Crustacean acute toxicity	EC50	ISO 14669
Saltwater	Fish acute toxicity	LC50	-
Aquatic effects studies required in Tier B			
Freshwater	Algal growth inhibition[2]	NOEC	OECD 201
Freshwater	D. magna reproduction	NOEC	OECD 211
Freshwater	Fish, early life stage[3]	NOEC	OECD 210
Freshwater	Sediment invertebrate species toxicity	NOEC	OECD 218, 219[4]
Saltwater	Algal growth inhibition[2]	NOEC	ISO 10253
Saltwater	Crustacean chronic toxicity of reproduction	NOEC	-
Saltwater	Fish chronic toxicity	NOEC	-
Saltwater	Sediment invertebrate species toxicity	NOEC	-

[1] For substances with anti-microbial activity, some regulatory authorities prefer a blue-green algae rather than a green algae species be tested.

[2] Using the same study and species as in Tier A but the NOEC is used in Tier B

[3] Alternative studies for fish: fish short term toxicity test on embryo and sac-fry stage (OECD TG 212) and fish juvenile growth test (OECD TG 215) are not favoured, noting inter alia that the first page of the former suggests why this may not be the first-choice guideline and that OECD TG 210 is preferable.

[4] It is suggested that if entry into the environment is through water, OECD TG 219 is used, if exposure is through sediment or adsorbed to soil in run-off, OECD TG 218 should be used.

The results for cypermethrin include results for one of the specific isomers (alpha). Results for formaldehyde (formalin) contained results for 5 other compounds (1,1'-[methylenebis(oxy)]bis[2-chlorethane], cas-nr 111911; 1-hydroxymethanesulfonic acid sodium slat (1:1), cas-nr 870724; 1,1'-[methylenebis(oxymethylene)]bisbenzene, cas-nr 2749704; naphthalenesulfonic acid polymer with

This project has received funding from the EU H2020 research and innovation programme under Grant Agreement No 678396

formaldehyde, cas-nr 9084064; paraformaldehyde, cas-nr 30525989) which were excluded when extracting toxicity data.

Results for hydrogen peroxide contained results for 3 other compounds (carbonic acid sodium salt (1:2) compd. With hydrogen peroxide (2:3), cas-nr 15630894; acetic acid mixt. with hydrogen peroxide, cas-nr 39277935; ethaneperoxoic acid mixt. with acetic acid and hydrogen peroxide, cas-nr 61116072) which were excluded when extracting toxicity data.

3. Overview of resulting data sets

The number of species for which results were obtained differed widely between compounds, species group, type of water (fresh/salt) and effect (acute/chronic) studied. SSD curves are generated only if data for at least 6 taxa were available. This criterion was met for at least one species group for 7 of the 18 compounds (cypermethrin, deltamethrin, diflubenzuron, emamectin benzoate, formaldehyde, hydrogen peroxide and trimethoprim). Table 2 gives an overview of number of taxa for species groups for these compounds where data for at least 6 taxa were available.

Table 2: Summary of toxicity data found, i.e. number of taxa for species groups per compound.

Compound	Species category	Fresh / Salt water (F/S)	Acute or Chronic (A/C)	Number of taxa
Cypermethrin	Arthropods	F	A	43
	Arthropods	S	A	18
	Non-arthropods	F	A	6
	Algae	F	A	8
Deltamethrin	Other vertebrates	F	A	15
	Arthropods	F	A	17
	Arthropods	S	A	9
	Non-arthropods	F	A	9
Diflubenzuron	Other vertebrates	F	A	7
	Arthropods	F	A	15
	Arthropods	F	C	7 (2 genera)
	Arthropods	S	A	8
Emamectin benzoate	Arthropods	S	A	6
Formaldehyde	Salmonids	F	A	7
	Other vertebrates	F	A	16
	Arthropods	S	A	10
Hydrogen peroxide	Algae	F	A	7
Trimethoprim	Algae	F	A	9

This project has received funding from the EU H2020 research and innovation programme under Grant Agreement No 678396

4. Derivation of Tier A and Tier B PNEC values for freshwater and salt water species

Only toxicity data for standard test species specified in guidelines mentioned in Table 1 were used. Toxicity data were taken from the summary data sheets provided in Annex 1 of this deliverable. In instances where more than a single value was available for a specific species/endpoint, the available data was summarized into a single value by taking the geometric mean. Where data for more than a single species was available for a specific endpoint, only the data for the most sensitive species was used. Data reported as 'greater than' or 'smaller than' were included in the overview of available data but were not used in the derivation of a PNEC.

For flumequine and hydrogen peroxide the acute toxicity data for *Artemia* sp. was used as data for saltwater crustacean acute toxicity, even though *Artemia* sp. is not noted as a standard test species in Annex 1.

Complete Tier A data sets for freshwater species (i.e. at least 1 toxicity value for each of the freshwater endpoints used in Tier A) were only retrieved for chlortetracycline, deltamethrin, diflubenzuron, formaldehyde and oxytetracycline. Complete Tier A data sets for saltwater species were only found for cypermethrin and formaldehyde. Complete Tier B data sets for either freshwater or saltwater species were available for none of the compounds. For azamethiphos, florfenicol and teflubenzuron no suitable toxicity data were available for any of the endpoints used in either Tier A nor Tier B and no values for PNEC could be established for these compounds.

For all compounds the lowest values for both Tier A and Tier B PNECs established for either freshwater or saltwater species are given below.

This project has received funding from the EU H2020 research and innovation programme under Grant Agreement No 678396

Table 3: Overview of lowest Tier A and Tier B PNEC values established for freshwater and saltwater species.

Compound	Freshwater PNEC (µg/L)		Saltwater PNEC (µg/L)		SSD based PNEC (µg/L)
	Tier A	Tier B	Tier A	Tier B	HC5
Amoxicillin	563				
Azamethiphos					
Bronopol	1.6	194	5.04		
Chlortetracycline	1.8	41			
Cypermethrin	0.000223	3.16 · 10-7			0.00316
Deltamethrin	0.000566	6.35 · 10-6	2.51 · 10-6	0.3	0.000454
Diflubenzuron	0.001136	0.021	0.002476	0.0078	0.00735
Emamectin benzoate	0.001	0.0088	0.00004		0.00378
Florfenicol					
Flumequine	59		96.4		
Formaldehyde	5.8		32.9		8034
Hydrogen peroxide	2.32	63	150		351
Oxolinic acid	4.6	38			
Oxytetracycline	10.4	308	17.3		
Sulfadiazine	21.9	880	1.1		
Teflubenzuron					
Trimethoprim	113	433			8238

5. References

Maltby, L., T.C.M. Brock, P.J. van den Brink (2009). Fungicide risk assessment for aquatic ecosystems: Importance of interspecific variation, toxic mode of action, and exposure regime. Environ. Sci. Technol. 43, 7556-7563.

Rico, A., M. Vighi, P.J. van den Brink, M. ter Horst, A. Macken, A. Lillicrap, L. Falconer, T.C. Telfer (2018). Use of models for the environmental risk assessment of veterinary medicines in European aquaculture: current situation and future perspectives. Rev. in Aquaculture x, 1 – 20.

VICH (2004). International Cooperation on Harmonisation of Technical Requirements for Registration of Veterinary Products. Topic GL38: Environmental Impact Assessment (EIAs) for Veterinary Medicinal Products (VMPs) – Phase II. VICH, London, U.K. CVMP/VICH/790/03.

This project has received funding from the EU H2020 research and innovation programme under Grant Agreement No 678396

This project has received funding from the EU
H2020 research and innovation programme
under Grant Agreement No 678396