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Ecotoxicity Thresholds for Ametryn, Diuron, Hexazinone and Simazine in Fresh and Marine Waters

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Abstract

Triazine and urea herbicides are two groups of photosystem II inhibiting herbicides frequently detected in surface, ground and marine waters. Yet there are few water quality guidelines for herbicides. Ecotoxicity thresholds (ETs) for ametryn, hexazinone and simazine (triazine herbicides) and diuron (a urea herbicide) were calculated using the Australian and New Zealand method for deriving guideline values to protect fresh and marine ecosystems. Four ETs were derived for each chemical and ecosystem that should theoretically protect 99, 95, 90 and 80 percent of species (i.e., PC99, PC95, PC90 and PC80, respectively). For all four herbicides, the phototrophic species were significantly more sensitive than non-phototrophic species and therefore only the former data were used to calculate the ETs. Comparison of the ET values to measured concentrations in 2606 samples from 15 waterways that discharge to the Great Barrier Reef (2011 – 2015) found three exceedances of the simazine PC99, regular exceedances (up to30%) of the PC99 in a limited number of rivers for ametryn and hexazinone, and frequent (>40%) exceedances of the PC99 and PC95 ETs in at least four waterways for diuron. There were no exceedances of the marine ETs in inshore Reef areas. Further ecotoxicity data are required for ametryn and hexazinone to fresh and marine phototrophic species,

for simazine to marine phototrophic species, for tropical phototrophic species, repeated pulse exposures and long-term (2 to 12 month) exposures to environmentally relevant concentrations.

Introduction

Annual global usage of pesticides has been relatively stable at greater than 2.27 billion kg (5 billion pounds) per year since 1997 (Donaldson et al. 2002; Kiely et al. 2004; Grube et al. 2011). Global annual herbicide usage has been approximately 900 million kg over the same period (Donaldson et al. 2002; Kiely et al. 2004; Grube et al. 2011), or approximately 40% of total pesticide usage. Herbicides that inhibit photosystem II (PSII inhibitors) are widely used. The PSII group includes amides, benzothiadiazinones, nitriles, phenylcarbamates, phenyl-pyridazines, pyridazinones, triazines, triazinones, triazolinones, uracils and ureas (HRAC, 2010). Since 1997 figures supplied by Australia to the FAO indicate that between 20 and 25 million kg of herbicides are applied annually of which approximately 8 million kg was PSII herbicides (Australian Academy of Technological Sciences and Engineering 2002).

Given the amounts of PSII herbicides applied annually to land and the amounts of diuron used as an anti-fouling agent, it is not surprising that triazine and urea herbicides have frequently been detected globally in rivers and lakes (e.g. Solomon et al. 1996; Gfrerer et al. 2002; Claver et al. 2006; Konstantinou et al. 2006), groundwater (e.g. Guzzella et al. 2006; Hildebrandt et al. 2008), oceans (e.g. Konstantinou and Albani 2004 and references therein) and sediments (e.g. Thomas et al. 2000; Konstantinou and Albani 2004). Within Australia, they have been frequently detected in rivers discharging to the Great Barrier Reef (GBR) (e.g. Smith et al. 2012; O'Brien et al. 2016; Wallace et al. 2016), in rivers of northern New South Wales draining cotton growing farmland (e.g. Muschal and Warne 2003), in Victoria (Wightwick and Allinson 2007 and references therein) and in groundwater in the states of New South Wales, Queensland, South Australia and Western Australia (Wightwick and Allinson 2007 and references therein). In addition, triazine and urea herbicides have been detected regularly at essentially every monitoring site in the GBR since 2005, when monitoring began (Kennedy et al. 2010a, 2010b, 2011; Bentley et al. 2012; Gallen et al. 2013; 2014; 2016).

The GBR is a World Heritage Listed site that runs approximately 2,500 kilometres along the east coast of Queensland, Australia. It is the world's largest reef ecosystem and is a bioversity hotspot, but like most reefs, it faces a number of human and natural stressors that have the potential to adversely affect its health and resilience (e.g., Commonwealth of Australia 2015). The main water quality stressors impacting the GBR have been identified as suspended solids (eroded agricultural soil), nutrients (dissolved and total nitrogen and phosphorus) and pesticides (Baker 2003; Brodie et al, 2008, 2013; Department of Premier and Cabinet 2008). Consequently, the Australian and Queensland governments developed and implemented the Reef Water Quality Protection Plan (Australian Government and Queensland Government 2009; 2013) that included land management and water quality targets to reduce the loads (total mass) of each of these major pollutants being transported to the Reef.

To assess the hazard and risk that pesticides pose to reef ecosystems and to develop pollution reduction targets (refer to Smith et al. 2017) it is essential to have estimates of the "safe environmental concentrations" such as water quality guidelines (WQGs, also referred to as criteria, standards, objectives) preferably derived using species sensitivity distributions, for all the pesticides present in the Reef. Yet, despite pesticides being used globally, some for many decades, there is still a general lack of WQGs and/or SSDs for pesticides.

In Australia and New Zealand the current Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ 2000) are being revised. As part of the revision, numerical limits, are being derived for 17 pesticides, predominantly to protect freshwater ecosystems. These pesticides were selected based on the priorities of government departments and stakeholders. However, even with this revision, there are still numerous pesticides regularly detected in rivers discharging to the Reef and/or in the Reef lagoon itself that will not have numerical limits. Therefore, the Queensland Department of Science, Information Technology and Innovation is deriving the numerical limits for a further 28 pesticides to protect both, fresh and marine ecosystems.

Limits calculated using the Australian and New Zealand method for deriving water quality guideline values for ecosystem protection (Batley et al. 2014; Warne et al. 2015) are technically reviewed and then approved by a series of committees until they are nationally endorsed and become Default Guideline Values (DGVs). The approval process can take a considerable length of time and hence the limits derived in the current study are termed ecotoxicity thresholds (ETs) to make it clear that they have not yet been nationally endorsed, but in all other senses they are DGVs. The DGVs provide four levels of environmental protection that should theoretically protect 99, 95, 90 and 80 percent of species. The concentrations corresponding to these levels of protection are termed the PC99, PC95, PC90 and PC80 which are equivalent to the concentrations harmful to 1% (HC1), 5% (HC5), 10% (HC10) and 20% (HC20), respectively. In the current Australian and New

Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ 2000) the numerical limits are termed Trigger Values (TVs) but in all other senses they are identical to DGVs.

The aim of this paper was to develop ETs for four herbicides (ametryn, diuron, hexazinone and simazine) that are commonly detected in Queensland waterways and in the marine waters of the GBR, that either do not have TVs or only have low reliability TVs. Low reliability TVs and DGVs are based on ecotoxicity data for a limited number of species and taxa (Warne 2001; Warne et al. 2015).

Ametryn and simazine are both triazine herbicides (Group C1 (HRAC 2010) and Class 5 (WSSA 2016)), hexazinone is a triazinone herbicide but belongs to the same HRAC and WSSA classifications, while diuron is a urea herbicide belonging to Group C2 (HRAC 2010) and Class 7 (WSSA 2016)). The mode of action for all four herbicides is inhibition of photosystem II.

Methods

The revised method for the derivation of DGVs for the Australian and New Zealand Water Quality Guidelines (Batley et al. 2014 and Warne et al. 2015) were followed. A thorough literature review was conducted for ecotoxicity data in both fresh and marine waters for the four herbicides. This search included the USEPA ECOTOX database (USEPA 2015a), the Office of the Pesticide Programs (USEPA 2015b), the Australasian Ecotoxicity Database (Warne et al. 1998) and the Australian and New Zealand Water Quality Guidelines toxicant database (Sunderam et al. 2000). In addition, physicochemical properties that are relevant to the environmental fate of the herbicides were collected (Table 1). Each publication was read and each datum was screened and their quality assessed using the methods set out in Warne et al. (2015), as the methods can vary within a paper. The data quality assessment process consists of answering 20 questions on how the data were generated (e.g., test organism, experimental design, chemical and statistical analysis) based on the information provided in the articles. This method is based on Hobbs et al. (2005) and is similar to other data evaluation methods (e.g., Klimisch et al. 1997; Durda and Preziosi 2000; Schneider et al. 2009; Brady 2011; Agerstrand et al. 2014). Data assessments were conducted and recorded using an electronic data quality assessment and reporting spreadsheet (Zhang et al. 2015). Toxicity data were classed as 'high' quality (score of 80 to 100), 'acceptable' quality (score of 51 to 79), or 'unacceptable' quality (score of 50 or less). 'Unacceptable' quality data were not used to derive ET values.

Often multiple ecotoxicity values for more than one endpoint and measure of toxicity were available for species. In such cases, a data reduction process was used to generate a single value for each species (Warne et al. 2015). The remaining data were then tested, based on the chemical's mode of action, to determine if they were uni- bi- or multi-modal. As the selected chemicals are all herbicides, tests were conducted to determine if there were significant differences in the sensitivity of phototrophic species (species that photosynthesize) and non-phototrophic species. When the data were normally distributed and had equal variances, the parametric two-sample *t*-test was used and when the data were not, the non-parametric Mann-Whitney two-tailed test was used. When the data were not uni-modal only ecotoxicity data for the most sensitive group of organisms (i.e. phototrophs in the case of herbicides) were used to derive ETs. In cases where there were insufficient data to permit a statistical comparison then the fresh and marine ecotoxicity data were combined.

Many measures of ecotoxicity are reported in the literature. The revised Australian and New Zealand method for deriving guideline values has an order of preference for using ecotoxicity data. For chronic ecotoxicity data the order is: no effect concentration (NEC) values; effect, inhibition or lethal concentration (EC/IC/LCx) values where x is less than 10; 10 per cent bounded effect concentration (BEC10) values; 15 to 20 per cent effect, inhibition or lethal concentration (EC/IC/LC15–20) values and no observed effect concentration (NOEC) values (Warne et al. 2015). There is considerable criticism of the generation and use of NOEC and lowest observed effect concentration (LOEC) values to derive environmental quality standards (e.g., van Dam et al. 2012 and references therein), although this is not universal (Green et al. 2012). Much of the existing chronic ecotoxicity data are NOEC values and this will continue to be the case for the immediate future. To encourage the generation of EC/IC/LC10 type data and phase out the use of NOEC data, the revised method for deriving the Australian and New Zealand guideline values (Warne et al. 2015) states that when there are EC/IC/LC10 type data for at least eight species that belong to at least four taxonomic groups NOEC values should not be used. However, the impact that this would have on the reliability of the DGVs should be considered (Warne et al. 2015).

Species sensitivity distributions for each chemical in fresh and marine waters were derived using the Burrlioz 2.0 software (CSIRO 2016). This software selects the log-logistic distribution that best fits the ecotoxicity data when there are less than eight values and selects the best Burr type III statistical distribution when there are eight or more ecotoxicity data. The software then calculates four different levels of protection (PCx values).

These PCx values are applied to ecosystems in different conditions for each chemical in each ecosystem type (Table 2). The reliability of the derived ET values was determined based on the number of species and taxa for which there were data, the type of data (chronic, a mixture of chronic and converted acute or only converted acute data) and the fit of the statistical distribution to the ecotoxicity data (good or poor) (Table 3). The resulting ET values were classed as very high, high, moderate, low and very low reliability (Table 3).

Results and Discussion

The logarithms of the octanol-water partition coefficient and the logarithms of the bioconcentration factor for all four herbicides were well below 4 (Table 1) and therefore the ET values did not need to consider secondary poisoning (Warne et al. 2015).

Phototrophic species were significantly ($p = 0.005$ for simazine and $p = <0.0001$ for ametryn, diuron and hexazinone) more sensitive than non-phototrophic species for all four herbicides. Therefore, only ecotoxicity data for phototrophic species were used in all subsequent calculations of ETs as prescribed in Warne et al. (2015). The ETs should therefore theoretically protect set percentages of phototrophic species and as the phototrophs are more sensitive than non-phototrophs, the ETs should provide an even higher level of protection to species overall.

Ametryn

Freshwater

There were 39 acceptable and high quality acute and chronic toxicity data from 10 sources (Supplementary Material Table 1). The removal of non-phototrophic species and the conversion of the data to a single value per species resulted in resulted in chronic ecotoxicity data for two phototrophic species that belonged to two phyla (freshwater data in Table 4). This dataset did not meet the minimum data requirements to derive ET values using a SSD method i.e., data for at least five species belonging to at least four phyla (Warne et al., 2015). In cases, where there are insufficient chronic ecotoxicity data Warne et al. (2015) recommend two methods to address this. The first converts acute toxicity data to estimates of chronic toxicity (i.e., chronic NOEC/EC10 type values). The second method permits the combination of ecotoxicity data for organic chemicals tested in freshwater and marine conditions, provided the two sets of data are not significantly different or knowledge of the properties or mode of action of the chemical does not indicate there should be differences. So acute ecotoxicity data were converted to estimates of chronic NOEC/EC10 values (Table 4). This resulted in a dataset for eight species that belonged to three phyla (Table 4), which still did not meet the minimum requirements. There was only chronic ecotoxicity data for a single marine species, so chronic and estimated chronic data for marine species were combined and compared to the freshwater data – with no significant differences being found ($p>0.05$). The fresh and marine ecotoxicity data were therefore combined, resulting in data for 17 species (eight freshwater and nine marine) that belonged to five phyla. The resulting dataset met the minimum data requirements to use a SSD method (Warne et al. 2015). The statistical distribution selected by Burrlioz (CSIRO 2016) provided a 'good' fit to the data (Figure 1a). This combined with the number and type of toxicity data (Table 3) available resulted in a 'moderate' reliability set of ET values (Table 5).

Marine

There were 26 acceptable and high quality acute and chronic data from four sources (Supplementary Material, Table 2). The removal of non-phototrophic species, conversion of the acute to estimated chronic values and conversion of data to a single value per species resulted in chronic ecotoxicity data for nine phototrophic species that belonged to four phyla (marine data in Table 4). This dataset met the minimum data requirements (i.e., at least five species belonging to at least four phyla) to use a SSD method (Warne et al. 2015). The statistical distribution selected by Burrlioz (CSIRO 2016) provided a 'good' fit (Figure 1b). This combined with the number and type of toxicity data available (Table 3) resulted in a set of 'moderate' reliability ET values (Table 5).

Diuron

Fresh

There were 243 acceptable and high quality acute and chronic data from 43 sources (Supplementary Material, Table 3). The removal of non-phototrophic species and the conversion of the data to a single value per species resulted in chronic ecotoxicity data for 26 phototrophic species that belonged to four phyla (Table 6). This dataset met the minimum data requirements to derive ecotoxicity threshold values using a SSD method (Warne et al. 2015). The distribution selected by Burrlioz (CSIRO 2016) provided a 'good' fit (Figure 2a) which combined with the number and type of ecotoxicity data available (Table 3) resulted in a set of 'very high' reliability ET values (Table 5).

Marine

There were 97 acceptable and high quality acute and chronic data from 28 sources (Supplementary Material, Table 4). The removal of non-phototrophic species and the conversion of the data to a single value per species resulted in chronic EC10/NOEC ecotoxicity data for seven phototrophic species that belonged to five phyla (Table 7). This dataset met the minimum data requirements to use a SSD method (Warne et al. 2015). The distribution selected by Burrlioz (CSIRO 2016) provided a 'poor' fit (Figure 2b), which combined with the number and type of ecotoxicity data available (Table 3) resulted in a set of 'low' reliability ET values (Table 5 and Supplementary Material, Table 5). The resulting PC99 and PC95 values (the most widely used ecotoxicity numerical limits) differed from the corresponding freshwater values by factors between 3- and 5-fold, which raised concerns about the marine ET values. Therefore, the dataset was expanded by including single species ecotoxicity values based on chronic estimated values (chronic LOEC or EC50 data converted to chronic EC10/NOEC values using the conversion factors stated in Warne et al. 2015) (Table 7). This increased the dataset to 20 phototrophic species that belonged to six phyla (Table 7) and the resulting SSD was used to derive ET values. The distribution selected by Burrlioz (CSIRO 2016) for the expanded dataset (chronic and chronic estimated EC10/NOEC values) provided a 'good' fit (Figure 2c) which combined with the number and type of ecotoxicity data available (Table 3) resulted in a set of 'very high' reliability ET values (Table 5). The resulting ET values (Table 5) were similar to those based solely on chronic EC10/NOEC data, but the second set of ET values were adopted as they were based on a larger dataset and the fit of the distribution was better resulting in greater confidence in these values.

Hexazinone

Fresh

There were 57 acceptable and high quality acute and chronic data from eight sources (Supplementary Material, Table 6). The removal of non-phototrophic species and the conversion of the data to a single value per species resulted in chronic ecotoxicity data for five species that belonged to four phyla (freshwater data in Table 8). This dataset met the minimum data requirements to use a SSD method (Warne et al. 2015). The distribution selected by Burrlioz (CSIRO 2016) provided a 'poor' fit (Figure 3a) which combined with the number and type of ecotoxicity data (Table 3) available resulted in a set of 'low' reliability ET values (Table 5).

Marine

There were 13 acceptable and high quality acute and chronic data from four sources (Supplementary Material, Table 7). The removal of non-phototrophic species and the conversion of the data to a single value per species resulted in chronic ecotoxicity data for three species that belonged to three phyla (Table 8). This dataset did not meet the minimum data requirements to derive ET values using a SSD method (Warne et al. 2015). The distributions of the ecotoxicity data for marine and freshwater species were not significantly different ($p > 0.05$). As per the methods for dealing with insufficient ecotoxicity data (Warne et al. 2017) chronic toxicity data for freshwater and marine phototrophic species were therefore combined, resulting in data for eight species (five freshwater and three marine) that belonged to five phyla (Table 8). The resulting dataset met the minimum data requirements to use a SSD method (Warne et al. 2015). The distribution selected by Burrlioz (CSIRO 2016) provided a 'poor' fit (Figure 3b) which combined with the number and type of data (Table 3) available resulted in a set of 'low' reliability ET values (Table 5).

Simazine

Fresh

There were 229 acceptable and high quality acute and chronic data from 33 sources (Supplementary Material, Table 8). The removal of non-phototrophic species and the conversion of the data to a single value per species resulted in chronic and chronic estimated EC10/NOEC data for 17 phototrophic species that belonged to four phyla (freshwater data in Table 9). This dataset met the minimum data requirements to use a SSD method (Warne et al. 2015). The distribution selected by Burrlioz (CSIRO 2016) provided a 'good' fit (Figure 4a), which combined with the number and type of data (Table 3) available resulted in a set of 'high' reliability ET values (Table 5).

Marine

There were 23 acceptable and high quality acute and chronic data from five sources (Supplementary Material, Table 9). The removal of non-phototrophic species and the conversion of the data to a single value per species resulted in chronic ecotoxicity data for six phototrophic species that belonged to four phyla (marine data in Table 9). This dataset met the minimum data requirements to use a SSD method (Warne et al. 2015). However, the distribution selected by Burrlioz (CSIRO 2016) provided a 'poor' fit to the ecotoxicity data (Figure 4b), which combined with the number and type of data (Table 3) available resulted in a set of 'low' reliability ET values (Supplementary Material, Table 10). Despite the limited amount of marine ecotoxicity data, it was not combined with the ecotoxicity data for freshwater species as the two datasets had significantly markedly different distributions (p = 0.02, compare Figures 4a and 4b).

Comparison to International Water Quality Guidelines for the Same Chemicals

A review of international water quality guidelines (including Australia and New Zealand, Canada, China, England, European Union (EU), France, Germany, Japan, Singapore, South Africa, South Korea and the USA) was conducted for the four herbicides. While comparing the numerical values of guidelines from different countries is not particularly useful (as different methods are used, different levels of protection are provided, and they are derived at different times with different ecotoxicity data available), this comparison clearly highlights the general paucity of guidelines for pesticides. In some countries, the lack of WQGs is due to some of the herbicides no longer being used e.g. ametryn, hexazinone and simazine are not approved for use in the EU. In other countries such as the USA, WQGs are limited to the chemicals which were viewed as the major pollutants at the time the guidelines were derived (1980s) with few guidelines derived for additional chemicals since then. Given the amounts of pesticides used globally and that they are designed to kill pest species, this lack of guidelines is surprising.

There is a guideline for ametryn in Germany (an annual average (AA) concentration of 0.5 µg/L) (Federal Ministry of Justice and Customer Protection 2016) which is very similar to the PC95 value in marine waters derived by the current study (0.54 µg/L, Table 10). However, the ametryn PC99 for marine waters (0.087 µg/L) and the PC99 and PC95 values for fresh waters (0.013 and 0.16 µg/L, respectively) derived in the current study are considerably lower.

Despite being calculated using slightly different methods, the Swiss proposed maximum acceptable concentration (PMAC) and proposed annual average (PAA) values (0.25 and 0.07 µg/L, respectively (EAWAG 2016b) for diuron are essentially identical to the PC95 and PC99 values (0.23 and 0.08 µg/L) for diuron that were derived in the current project. Both sets of these numerical limits for diuron are considerably smaller than the current EU AA and maximum acceptable concentration (MAC) values of 1.9 and 0.2 µg/L, respectively. The difference in the EU (EU 2005a) and Swiss guidelines (EAWAG 2016b) for diuron is most likely due to availability of new ecotoxicity data as they were derived using the same method (EC 2011).

The only other WQGs available for hexazinone were from Germany (AA of 0.07 µg/L) which is at least one order of magnitude lower than the guidelines derived in the current project (Table 10). This most probably relates to the German value being derived by a conservative assessment factor method.

The simazine ETs (freshwater PC99 and PC95 of 3.4 and 9.9 µg/L, respectively and marine PC99 and PC95 of 4.4 and 12 µg/L, respectively) derived in this study are higher than the EU guideline values (AA and MAC of 1 and 4 µg/L, respectively, Table 10) (EU 2005b), again reflecting the availability of new data but also the fact that in the EU derivation method, the final HC values are divided by an assessment factor while those of Australia and New Zealand are not (Warne et al. 2015).

Comparison of the ecotoxicity thresholds to measured herbicide concentrations

Environmental concentrations of these four herbicides in rivers that discharge to the GBR and in the GBR lagoon were compared to the derived ET values to illustrate the risk these herbicides can pose. Grab samples collected from 15 waterways since 2011, as part of the Great Barrier Reef Catchment Loads Monitoring Program (Turner et al. 2012, 2013; Wallace et al. 2014, 2015; Garzon-Garcia et al. 2015; Wallace et al. 2016), were used for this assessment. Information about the location and characteristics of the sites and upstream catchments can be obtained from the original references. This assessment reveals that more than 50% of the 2606 samples did not contain concentrations of ametryn, hexazinone or simazine that exceeded the PC95 ET values (Table 11), while more than 40% of samples did not exceed the corresponding PC99 ET values. For example, there have been only three exceedances of the simazine freshwater PC99 ET value and no exceedances of the PC95 ET value, only Sandy Creek had exceedances of the hexazinone freshwater PC95 ET value and no waterway had more than 10% of samples exceeding the ametryn PC95 ET value (Table 11). In contrast, there are seven waterways where more than 30% of the samples exceeded the freshwater PC99 ET value for diuron and four waterways where more than 30% of samples exceeded the freshwater PC95 ET value. Exceedances of the diuron ETs pose by far the greatest environmental threat of these four herbicides – with Sandy Creek and the Herbert River both having more than 50% of the samples exceeding the PC95 ET value. Monitoring (using passive samplers replaced monthly) of inshore waters of the GBR lagoon since 2009 has recorded no exceedances of the marine ET values, and only one instance where the marine concentration was equal to the ET — for diuron (Gallen et al. 2016). This is not surprising given the extent of dilution of river waters discharged to the reef.

Limitations of the existing ecotoxicity data

It is preferred to have ecotoxicity data for at least 15 species in order to derive GVs using the SSD approach in Australia and New Zealand but five is the minimum (Warne et al. 2015). There were sufficient chronic IC/EC/LC10 and NOEC type ecotoxicity data to reach the preferred status (ecotoxicity data for ≥ 15 species) for only diuron in fresh and marine water and simazine in freshwater. Diuron in freshwater ecosystems had chronic ecotoxicity data for 26 species, and for 20 marine species when chronic and chronic estimated data were combined. Simazine had ecotoxicity data for 17 freshwater species when chronic and chronic estimated data were combined. For the two other herbicides, ametryn and hexazinone, there is a need for more ecotoxicity data to fresh and marine phototrophic species that have not yet been tested. For the purpose of the current study and to protect the ecosystems in the catchments and lagoon of the GBR, there is a specific need for additional ecotoxicity data on tropical phototrophic species that inhabit these ecosystems - particularly corals, macrophytes (including sea-grasses) and microalgae. While the concentrations in the rivers and creeks that discharge to the GBR are highly variable both spatially and temporarily (e.g. Smith et al. 2012; O'Brien et al. 2016) the concentrations of these herbicides, away from estuaries of the waterways, are fairly uniform throughout the GBR (e.g. Gallen et al. 2016). Therefore, in addition to the above it is recommended that:

- repeated exposure ecotoxicity tests are conducted to mimic the episodic exposure in rivers and the inshore marine ecosystems; and
- long-term exposure ecotoxicity tests of up to one year in duration, are conducted.

Only with such data will it be possible to accurately assess the risk posed by pesticides to the ecosystems of the waterways that discharge to the GBR and the ecosystems that compose the GBR.

Conclusions

Ecotoxicity threshold values were derived for ametryn, diuron, hexazinone and simazine to protect freshwater and marine ecosystems using the revised method to derive Australian and New Zealand water quality guideline values for toxicants. The reliability of the ET values ranged from low (hexazinone in freshwater and hexazinone and simazine in marine water) to very high (diuron in freshwater and marine water). The derived ET values to protect 99 and 95 per cent of species in freshwater ecosystems were: 0.07 and 0.33 µg/L, 0.08 and 0.23 µg/L, 0.31 and 1.1 µg/L, and 3.2 and 10 µg/L for ametryn, diuron, hexazinone and simazine, respectively. The derived ET values to protect 95 and 99 per cent of species in marine ecosystems were: 0.10 and 0.61 µg/L, 0.43 and 0.67 µg/L, 1.8 and 2.5 µg/L, and 28 and 63 µg/L, for ametryn, diuron, hexazinone and simazine, respectively. The PC99 ET values for ametryn and hexazinone were exceeded in upto 30% of samples in a limited number of Queensland waterways that discharge to the GBR, while the PC99 and PC95 ET values for diuron are regularly exceeded (>40% of samples) in five and four waterways that discharge to the GBR, respectively. Only three exceedances of the PC99 ET value occurred for simazine. In six years of monitoring, there have been no exceedances of the marine ET values in the inshore waters of the GBR and only once was a marine ET value equalled. Despite these herbicides being widely used for many decades, there are limited amounts of high quality ecotoxicity data publically available for hexazinone and to a lesser extent ametryn and there is a general lack of marine ecotoxicity data for all four herbicides, but particularly for simazine. Future research should address this knowledge gap and this would permit the derivation of higher reliability ET values.

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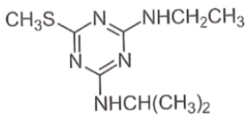
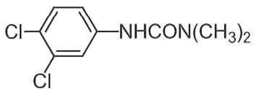
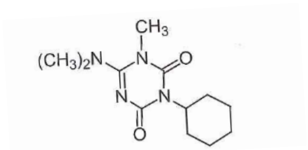
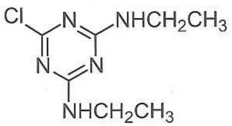
Tables

Table 1. Chemical structure, Chemical Abstract Service number (CAS no.) and selected physicochemical properties of the selected herbicides

Herbicide and CAS no.	Molec. wgt (amu)	Aqueous sol. (mg/L)	Log Kow	Log Koc	Log BCF	Half-life in freshwater (days)	Half-life in marine water (days)
Ametryn 834-12-8 	227.3[a]	200 (pH 7.1, 22°C)	2.63 (pH 7, 20°C)	1.98 – 2.97[a], 2.5[b]	1.52[b]	> 7[c] Stable at normal aquatic pH[d]	
Diuron 330-54-1 	233.1[a]	37.4 (25°C)[a] 35.6 (20°C)[b]	2.85 (25°C)[a] 2.87 (20°C)[b]	2.60[a], 2.91[b]	0.975[b]	175 (lagoon prediction) with majority of diuron (90%) residing in sediment[e]	
Hexazinone 51235-04-2 	252.3[a]	29.8[a] (pH 7, 25°C)	1.17[b] (pH 7, 25°C)	1.72[b] – 2.79[f]	0.85[b]	≥ 56[b, f] (pH 7, 25 C)	
Simazine 122-34-9 	201.7[a]	6.2[a]	2.1[a]	2.2[a]	>2.0[g]	8.8[a] (pH 1), 96[a] (pH 5), 3.7[a] (pH 13)	579 ± 294[g] (dark, 25°C)

[a.] BCPC (2012). [b.] University of Hertfordshire (2013). [c.] USEPA (1987). [d.] USEPA (2013). [e.] Peterson and Batley (1991). [f.] DPR (1996). [g.] Mercurio et al. (2015).

Table 2. The guideline values that correspond to the four levels of protection and examples of where they would apply (Modified from ANZECC and ARMCANZ 2000)

Level of protection	Equivalent HC value	Ecosystems applied to
PC99	HC1	High conservation value systems e.g. National Parks
PC95	HC5	Slightly to moderately disturbed sites e.g. most urban and rural waterways
PC90	HC10	Highly disturbed sites e.g., waterways receiving many industrial discharges, channelized waterways
PC80	HC20	

Table 3. Classification scheme for the reliability of ecotoxicity threshold values derived using the species sensitivity distribution method (Modified from Warne et al. 2015)

No. species	Data type	Adequacy of distributions fit	Reliability
≥15	Chronic	Good	Very high
		Poor	Moderate
8–14		Good	High
		Poor	Moderate
5–7		Good	Moderate
		Poor	Low
≥15	Combined chronic and converted acute or Combined fresh and marine	Good	Moderate
		Poor	Low
8–14		Good	Moderate
		Poor	Low
5–7		Good	Moderate
		Poor	Low
≥15	Converted acute	Good	Moderate
		Poor	Low
8–14		Good	Moderate
		Poor	Low
5–7		Good	Low
		Poor	Very low

Table 4. Summary of the single toxicity values for each species used to derive the freshwater and marine ecotoxicity threshold values for ametryn. Data are arranged in alphabetical order for the media and then test species.

Media	Taxonomic group	Species	Phyla	Duration (days)	Type (acute/ chronic)	Toxicity endpoint	Toxicity value used (µg/L)
Freshwater	Microalgae	*Chlorella pyrenoidosa*	Chlorophyta	4	Chronic estimated NOEC	Population (Abundance)	0.06[a]
Freshwater	Microalgae	*Chlorococcum sp.*	Chlorophyta	10	Chronic estimated NOEC	Biomass yield	2,000[a]
Freshwater	Macrophyte	*Lemna gibba*	Tracheophyta	7	Chronic NOEC	Total frond number, growth rate, mortality	2
Freshwater	Microalgae	*Neochloris* sp.	Chlorophyta	3	Chronic estimated NOEC	Biomass yield	7.2[a]
Freshwater	Microalgae	*Platymonas sp.*	Chlorophyta	3	Chronic estimated NOEC	Biomass yield	4.8[a]
Freshwater	Microalgae	*Scenedesmus quadricauda*	Chlorophyta	4	Chronic estimated NOEC	Population (Abundance)	30[a]
Freshwater	Microalgae	*Selenastrum capricornutum*[b]	Chlorophyta	7	Chronic NOEC	Biomass yield	1.14
Freshwater	Microalgae	*Stauroneis amphoroides*	Bacillariophyta	3	Chronic estimated NOEC	Biomass yield	5.2 [a]
Marine	Microalgae	*Achnanthes brevipes*	Bacillariophyta	3	Chronic estimated NOEC	Biomass yield	3.8[a]
Marine	Microalgae	*Dunaliella tertiolecta*	Chlorophyta	4–10	Chronic estimated NOEC	Biomass yield	1.89[a]
Marine	Microalgae	*Isochrysis galbana*	Haptophyta	3	Chronic NOEC	Population (Abundance)	1.31
Marine	Microalgae	*Monochrysis lutheri*	Ochrophyta	3	Chronic estimated NOEC	Biomass yield	2.8[a]
Marine	Microalgae	*Navicula incerta*	Bacillariophyta	3	Chronic estimated NOEC	Biomass yield	19.4[a]
Marine	Microalgae	*Nitzschia closterium*[c]	Bacillariophyta	3	Chronic estimated NOEC	Biomass yield	12.4[a]
Marine	Microalgae	*Phaeodactylum tricornutum*	Bacillariophyta	10	Chronic estimated NOEC	Biomass yield	6.32[a]

Marine	Microalgae	*Thalassiosira fluviatilis*	Bacillariophyta	3	Chronic estimated NOEC	Biomass yield	11.6 [a]
Marine	Microalgae	*Thalassiosira guillardii*	Bacillariophyta	3	Chronic estimated NOEC	Biomass yield	11 [a]

[a.] The chronic EC/LC50 values were converted to estimates of chronic NOEC/EC10 values. Chronic EC/LC50 values were divided by 5 (Warne 2001). [b.] This species has also been called *Raphidocelis subcapitata* and is currently called *Pseudokirchneriella subcapitata*. [c.] This species has previously been called *Ceratoneis closterium.*

Table 5. Derived ecotoxicity threshold values for the four selected herbicides in fresh and marine ecosystems

Chemical	Media	Reliability	Ecotoxicity threshold values (µg/L)			
			PC99	PC95	PC90	PC80
Ametryn	Freshwater	Moderate	0.07	0.33	0.66	1.4
	Marine	Moderate	0.10	0.61	1.3	2.8
Diuron	Freshwater	Very high	0.08	0.23	0.42	0.9
	Marine	Very high	0.43	0.67	0.86	1.2
Hexazinone	Freshwater	Low	0.31	1.1	1.9	3.4
	Marine	Low	1.8	2.5	3.1	4.0
Simazine	Freshwater	High	3.2	10	17	29
	Marine	Low	28	63	89	130

Table 6. Summary of the single toxicity values for each species used to derive the freshwater ecotoxicity threshold values for diuron

Taxonomic group	Species	Phyla	Class	Duration (days)	Type (acute/ chronic)	Toxicity endpoint	Toxicity value (µg/L)
Microalgae	*Achnanthidium minutissimum*	Bacillariophyta	Bacillariophyceae	4	Chronic EC05	Cell density	3.15
Bacteria	*Anabaena variabilis*	Cyanobacteria	Cyanophyceae	12	Chronic estimated NOEC	Chlorophyll-a	16[a]
Microalgae	*Chlorella pyrenoidosa*[b]	Chlorophyta	Trebouxiophyceae	4	Chronic estimated NOEC	Cell count	0.47[a]
Cyanobacteria	*Chroococcus minor*	Cyanobacteria	Cyanophyceae	7	Chronic estimated NOEC	Cell density	0.94[a]
Microalgae	*Craticula accomoda*	Bacillariophyta	Bacillariophyceae	4	Chronic EC05	Cell density	261
Microalgae	*Cyclotella meneghiniana*	Bacillariophyta	Mediophyceae	4	Chronic EC05	Cell density	1.59
Microalgae	*Cyclotella nana*	Bacillariophyta	Mediophyceae	3	Chronic estimated NOEC	Biomass yield, Growth rate, AUC[c]	7.8[a]
Microalgae	*Encyonema silesiacum*	Bacillariophyta	Bacillariophyceae	4	Chronic EC05	Cell density	3.11
Microalgae	*Eolimna minima*	Bacillariophyta	Bacillariophyceae	4	Chronic EC05	Cell density	3007
Microalgae	*Fragilaria capucina var vaucheriae*	Bacillariophyta	Fragilariophyceae	4	Chronic EC05	Cell density	0.069
Microalgae	*Fragilaria rumpens*	Bacillariophyta	Fragilariophyceae	4	Chronic EC10	Cell density	4.77
Microalgae	*Fragilaria ulna*[d]	Bacillariophyta	Fragilariophyceae	4	Chronic EC05	Cell density	12.6
Microalgae	*Gomphonema parvulum*	Bacillariophyta	Bacillariophyceae	4	Chronic EC10	Chlorophyll-a	232.1
Macrophyte	*Lemna gibba*	Tracheophyta	Liliopsida	7	Chronic NOEL	Total frond number, Growth rate, Mortality	2.49
Macrophyte	*Lemna minor*	Tracheophyta	Liliopsida	7	Chronic estimated NOEC	Total chlorophyll	3.16[a]

Macrophyte	*Lemna paucicostata*	Tracheophyta	Liliopsida	8	Chronic estimated NOEC	Frond cover area	2.19[a]
Microalgae	*Mayamaea fossalis*	Bacillariophyta	Bacillariophyceae	4	Chronic EC05	Cell density	74
Microalgae	*Nitzschia palea*	Bacillariophyta	Bacillariophyceae	3	Chronic EC05	Cell density	106
Microalgae	*Scenedesmus acutus*	Chlorophyta	Chlorophyceae	8	Chronic estimated NOEC	Cell count	2.66[a]
Microalgae	*Scenedesmus obliquus*	Chlorophyta	Chlorophyceae	4	Chronic estimated NOEC	Cell count	0.82[a]
Microalgae	*Scenedesmus quadricauda*	Chlorophyta	Chlorophyceae	4	Chronic estimated NOEC	Cell count	0.54[a]
Microalgae	*Scenedesmus subspicatus*[e]	Chlorophyta	Chlorophyceae	3	Chronic NOEC	Cell count	10
Microalgae	*Scenedesmus vacuolatus*	Chlorophyta	Chlorophyceae	2	Chronic estimated NOEC	Cell density	2.86[a]
Microalgae	*Selenastrum capricornutum*[f]	Chlorophyta	Chlorophyceae	4	Chronic NOEL	Biomass yield, Growth rate, AUC[c]	0.44
Microalgae	*Sellaphora minina*	Bacillariophyta	Bacillariophyceae	4	Chronic EC10	Chlorophyll-a	1493.3
Microalgae	*Stauroneis amphoroides*	Bacillariophyta	Bacillariophyceae	4	Chronic estimated NOEC	Biomass yield, Growth rate, AUC[c]	6.2[a]

[a] Chronic NOEC/NOEL = no conversions applied; Chronic est. NOEC = chronic LOEC values that were converted to chronic NOEC/NOEL/EC10 values by dividing by 5 (Warne et al. 2015).
[b.] This species has also been called *Chlorella vulgaris* and *Chlorella pyrenoidosa*. [c.] AUC = area under the growth curve. [d.] This species has also been called *Ulnaria ulna*. [e.] This species has also been called *Desmodesmus subspicatus*. [f.] This species has also been called *Raphidocelis subcapitata* and *Pseudokirchneriella subcapitata*.

Table 7. Summary of the single toxicity values for each species used to derive the marine ecotoxicity threshold values for diuron

Taxonomic group	Species	Phyla	Class	Duration (days)	Type (acute/ chronic)	Toxicity endpoint	Toxicity value (µg/L)
Microalgae	*Achnanthes brevipes*	Bacillariophyta	Bacillariophyceae	3	Chronic estimated NOEC	Biomass yield, growth rate, AUC[a]	4.8[b]
Microalgae	*Amphora exigua*	Bacillariophyta	Bacillariophyceae	3	Chronic estimated NOEC	Biomass yield, growth rate, AUC	6.2[b]
Macroalgae	*Ceramium tenuicorne*	Rhodophyta	Florideophyceae	7	Chronic estimated NOEC	Final length	0.68[b]
Microalgae	*Chaetoceros gracilis*	Bacillariophyta	Mediophyceae	3	Chronic estimated NOEC	Cell number	7.2[b]
Microalgae	*Dunaliella tertiolecta*	Chlorophyta	Chlorophyceae	4	Chronic estimated NOEC	Cell density	1.52[b]
Microalgae	*Emiliania huxleyi*	Haptophyta	Coccolithophyceae	3	Chronic NOEC	Mortality	0.54
Microalgae	*Entomoneis punctulata*	Bacillariophyta	Bacillariophyceae	3	Chronic NOEC	Cell density	2.0
Microalgae	*Isochrysis galbana*	Haptophyta	Coccolithophyceae	3	Chronic EC10	Cell density	1.09
Microalgae	*Monochrysis lutheri*	Ochrophyta	Chrysophyceae	3	Chronic estimated NOEC	Biomass yield, growth rate, AUC	3.6[b]
Microalgae	*Navicula forcipata*	Bacillariophyta	Bacillariophyceae	4	Chronic estimated NOEC	Cell density	5.4[b]
Microalgae	*Navicula incerta*	Bacillariophyta	Bacillariophyceae	3	Chronic estimated NOEC	Biomass yield, growth rate, AUC	18.6[b]
Microalgae	*Nephroselmis pyriformis*	Chlorophyta	Nephrophyceae	3	Chronic EC10	Cell density	2.2
Microalgae	*Nitzschia closterium*[c]	Bacillariophyta	Bacillariophyceae	3	Chronic NOEC	Cell density	2.0
Microalgae	*Phaeodactylum tricornutum*	Bacillariophyta	Bacillariophyta incertae sedis	10	Chronic estimated NOEC	Biomass yield, growth rate, AUC	2.0[b]
Microalgae	*Porphyridium cruentum*	Rhodophyta	Porphyridiophyce-ae	3	Chronic estimated NOEC	Biomass yield, growth rate, AUC	4.8[b]
Macroalgae	*Saccharina japonica*	Ochrophyta	Phaeophyceae	15	Chronic EC10	Fresh weight	2.3

Microalgae	*Skeletonema costatum*	Bacillariophyta	Mediophyceae	4	Chronic estimated NOEC	Cell density	1.18[b]
Microalgae	*Thalassiosira fluviatilis*	Bacillariophyta	Mediophyceae	3s	Chronic estimated NOEC	Biomass yield, growth rate, AUC	19[b]
Microalgae	*Thalassiosira pseudonana*	Bacillariophyta	Mediophyceae	4	Chronic estimated NOEC	Cell density	0.86[b]
Macrophyte	*Zostera marina*	Tracheophyta	Liliopsida	10	Chronic NOEC	Biomass (Old and new growth)	2.5

[a.] AUC = area under the growth curve. [b.] Chronic NOEC/NOEL = no conversions applied; Chronic est. NOEC = chronic LOEC values that were converted to chronic NOEC/NOEL/EC10 values by dividing by 5 (Warne et al. 2015). [c.] This species has previously been called *Ceratoneis closterium.*

Table 8. Summary of the single toxicity values for each species used to derive the freshwater and marine ecotoxicity threshold values for hexazinone

Media	Taxonomic group	Species	Phyla	Class	Duration (days)	Type (acute/ chronic)	Toxicity endpoint	Toxicity value (µg/L)
Freshwater	Cyanobacteria	*Anabaena flosaquae*	Cyanobacteria	Cyanophyceae	5	Chronic NOEC	Population (Abundance)	150
Marine	Microalgae	*Isochrysis galbana*	Haptophyta	Coccolithophyceae	3	Chronic NOEC	Population (Abundance)	19.34
Freshwater	Macrophyte	*Lemna gibba*	Tracheophyta	Liliopsida	14	Chronic NOEC	Population (Abundance)	8.82
Freshwater	Macrophyte	*Lemna minor*	Tracheophyta	Liliopsida	7	Chronic estimated NOEC	Population (Growth)	14.4[a]
Freshwater	Microalgae	*Navicula pelliculosa*	Bacillariophyta	Bacillariophyceae	5	Chronic NOEC	Population (Abundance)	3.5
Marine	Microalgae	*Nephroselmis pyriformis*	Chlorophyta	Nephrophyceae	3	Chronic NOEC	Population (Abundance)	3.8
Freshwater	Microalgae	*Pseudokirchneriella subcapitata*[b]	Chlorophyta	Chlorophyceae	5	Chronic NOEC	Population (Abundance)	4
Marine	Microalgae	*Skeletonema costatum*	Bacillariophyta	Mediophyceae	5	Chronic NOEC	Population (Abundance)	4.1

[a.] The chronic EC/LC50 values were converted to estimates of chronic NOEC/EC10 values. Chronic LOEC values were divided by 2.5 while chronic EC/LC50 values were divided by 5 (Warne 2001). [b]. Previously this species has been called *Rhaphidocelis subcapitata* and *Selenastrum capricornutum*.

Table 9. Summary of the single toxicity values for each species used to derive the freshwater and marine ecotoxicity threshold values for simazine. Data are arranged alphabetically by media and then species name.

Media	Taxonomic group	Species	Phyla	Life stage	Duration (days)	Type (acute/ chronic)	Toxicity endpoint	Toxicity value (µg/L)
Freshwater	Microalga	*Chlamydomonas geitleri*	Chlorophyta	Exponential growth	3	Chronic estimated NOEC	Chlorophyll-a content	171[a]
Freshwater	Microalga	*Chlorella vulgaris*	Chlorophyta	-	4	Chronic estimated NOEC	Growth rate	84.4[a]
Freshwater	Microalga	*Pseudokirchneriella subcapitata*[b]	Chlorophyta	-	3	Chronic NOEC	Growth rate	32
Freshwater	Microalga	*Scenedesmus obliquus*	Chlorophyta	Exponential growth	*	Chronic estimated NOEC	Growth rate	51.4[a]
Freshwater	Microalga	*Scenedesmus quadricauda*	Chlorophyta	-	4	Chronic estimated NOEC	Abundance	30[a]
Freshwater	Microalga	*Anabaena flosaquae*	Cyanobacteria	-	5	Chronic estimated NOEC	Cell density	7.2[a]
Freshwater	Microalga	*Navicula pelliculosa*	Ochrophyta	-	5	Chronic estimated NOEC	Cell density	18[a]
Freshwater	Macrophyte	*Acorus gramineus*	Tracheophyta	-	7	Chronic NOEC	Fresh weight	100
Freshwater	Macrophyte	*Elodea canadensis*	Tracheophyta	-	*	Chronic NOEC	*	83
Freshwater	Macrophyte	*Glyceria maxima*	Tracheophyta	-	*	Chronic NOEC	*	83
Freshwater	Macrophyte	*Lemna gibba*	Tracheophyta	-	14	Chronic estimated NOEC	Biomass yield	28[a]
Freshwater	Macrophyte	*Myriophyllum aquaticum*	Tracheophyta	2 weeks old	7	Chronic estimated NOEC	Fresh weight	20
Freshwater	Macrophyte	*Myriophyllum spicatum*	Tracheophyta	-	*	Chronic NOEC	*	83
Freshwater	Macrophyte	*Persicaria amphibia*	Tracheophyta	-	*	Chronic NOEC	*	83
Freshwater	Macrophyte	*Pontederia cordata*	Tracheophyta	-	7	Chronic NOEC	Fresh weight	100
Freshwater	Macrophyte	*Typha latifolia*	Tracheophyta	-	7	Chronic NOEC	Fresh weight	300

Freshwater	Macrophyte	*Vallisneria americana*	Tracheophyta	-	13	Chronic NOEC	Fresh weight and length	58
Marine	Microalgae	*Ceratoneis closterium*[c]	Bacillariophyta	Exponential growth	3	Chronic NOEC	Growth rate	310
Marine	Microalgae	*Chlorococcum sp.*	Chlorophyta	-	10	Chronic estimated NOEC	Cell density	400[a]
Marine	Microalgae	*Dunaliella tertiolecta*	Chlorophyta	-	10	Chronic estimated NOEC	Cell density	1000[a]
Marine	Microalgae	*Isochrysis galbana*	Haptophyta	-	10	Chronic estimated NOEC	Cell density	100[a]
Marine	Microalgae	*Phaeodactylum tricornutum*	Bacillariophyta	Exponential growth	3	Chronic NOEC	Growth rate	100
Marine	Microalgae	*Skeletonema costatum*	Ochrophyta	-	5	Chronic estimated NOEC	Cell density	250[a]

[a.] The chronic EC/LC50 values were converted to estimates of chronic NOEC/EC10 values. Chronic LOEC values were divided by 2.5 while chronic EC/LC50 values were divided by 5 (Warne 2001). *Refer to Supplementary Material Table 8 for information, as there are multiple durations and endpoints that apply to this species toxicity value. [b.] Previously this species has been called *Rhaphidocelis subcapitata* and *Selenastrum capricornutum*. [c.] This species has also been called *Nitzschia closterium.*

Table 10. Comparison of ecotoxicity thresholds from this study and international water quality guidelines/standards/criteria.

Country	Reference	Published	Media	Ametryn	Diuron	Hexazinone	Simazine
This study		2016	Freshwater	MR PC99: 0.074 MR PC95: 0.33	VHR PC99: 0.08 VHR PC95: 0.23	LR PC99: 0. 31 LR PC95: 1.1	HR PC99: 3.2 HR PC95: 10
			Marine	MR PC99: 0.10 MR PC95: 0.61	VHR PC99: 0.43 VHR PC95: 0.67	LR PC99: 1.8 LR PC95: 2.5	LR PC99: 28 LR PC95: 63
Australia and New Zealand	1	2000	Freshwater	-	LR (AF) 0.2	LR (AF) 75	MR PC99 = 0.2 MR PC95 = 3.2
			Marine	-	LR (AF) 1.8	= Freshwater value	= Freshwater PC95
Canada	2	1999	Freshwater	-	-	-	(AF) 10
			Marine	-	-	-	-
EU	3,4	2005	Freshwater	-	MAC: 1.8 AA: 0.2	-	MAC: 4 AA: 1
			Marine		EU Freshwater values		EU freshwater values
Germany	5, 6	2016 – ametryn 1993 - simazine	Freshwater	AA: 0.5	EU Freshwater values	AA: 0.07	0.1
			Marine	AA: 0.5	EU freshwater values	AA: 0.07	-
Switzerland	7	2016	Freshwater	-	PMAC: 0.25 PAA: 0.07	-	-
China, Japan, Korea, Singapore, South Africa and USA	8, 9, 10, 11, 12 and 13		Freshwater and marine	-	-	-	-

VHR = very high reliability, HR = high reliability, MR = moderate reliability, LR = low reliability, PC99 = the concentration that should protect 99 percent of species, PC95 = the concentration that should protect 95 percent of species, AF = derived by an assessment factor method, MAC = maximum acceptable concentration, AA = annual average concentration, PMAC = proposed maximum acceptable concentration, PAA = proposed annual average concentration.

[1.] ANZECC and ARMCANZ (2000). [2.] CCME (1999). [3.] EU (2005a). [4.] EU (2005b). [5.] Federal Ministry of Justice and Customer Protection (2016). [6.] IKSR (1993). [7.] EAWAG (2016a; 2016b). [8.] https://www.env.go.jp/en/water/wq/wp.pdf. Accessed 30/11/2016. [9.] *Pers. Comm.* Prof. Youn-Joo An, Konkuk University, Republic of Korea. [10] http://www.nea.gov.sg/anti-pollution-radiation-protection/water-pollution-control/recreational-water-quality Accessed 30/11/2016. [11.] file:///C:/Users/ac2458/Downloads/AQUATIC%20ecosystems.pdf Accessed 30/11/2016 [12.] USEPA (2016). [13.] *Pers. Comm*. Prof. Liu Zhengtao, China Academy of Environmental Sciences.

Table 11. Percentage of monitoring samples collected from 15 waterways by the Great Barrier Reef Catchment Loads Monitoring Program[a] between 2011 and 2015 that exceeded the ecotoxicity threshold values (protective concentration values for 99 and 95 percent of species) derived by the current project. Data presented in descending order of exceedances.

Herbicide	% Exceedances of Freshwater PC99 (no. samples[b])	Waterway and long-term mean annual flow (GL [b, c])	% Exceedances of freshwater PC95 (no. samples[b])	Waterway
Ametryn	18.6 (140)	Sandy Creek (170)	6.4 (140)	Sandy Creek
	9.6 (335)	Pioneer River (810)	3.0 (336)	Barratta Creek
	3.9 (336)	Barratta Creek (160)	1.5 (335)	Pioneer River
	0.3 (346)	Tully River (3100)	0.0 (1795)	All others
	0.0 (1449)	All others		
Diuron	82.6 (140)	Sandy Creek (170)	68.6 (140)	Sandy Creek
	63.0 (335)	Pioneer River (810)	54 (243)	Herbert River
	53.4 (148)	Russell River (1200)	48.3 (236)	Barratta Creek
	47.5 (236)	Barratta Creek (160)	43.3 (335)	Pioneer River
	40.5 (346)	Tully River (3100)	22.0 (59)	O'Connell River
	36.8 (136)	Tinana Creek (270)	21.6 (148)	Russell River
	33.9 (59)	O'Connell River (700)	14.7 (136)	Tinana Creek
	17.1 (146)	Mulgrave River (1800)	14.2 (346)	Tully River
	16.9 (243)	Herbert River (3400)	4.1 (146)	Mulgrave River
	5.6 (18)	Theresa Creek (310)	2.3 (44)	Comet River
	3.2 (126)	Burdekin River (9400)	0.8 (126)	Burdekin River
	2.3 (176)	Burnett River (1400)	0.0 (647)	All others
	2.3 (44)	Comet River (910)		
	1.7 (175)	Mary River (1500)		
	0.9 (113)	North Johnstone River (1800)		
	0.0 (165)	All others		
Hexazinone	30.0 (140)	Sandy Creek (170)	12.1 (140)	Sandy Creek
	10.2 (335)	Pioneer River (810)	0 (2466)	All others
	5.1 (59)	O'Connell River (700)		
	0.4 (243)	Herbert River (3400)		
	0.3 (346)	Tully River (3100)		
	0.0 (1205)	All others		
Simazine	1.7 (175)	Mary River (1500)	0.0 (2606)	All waterways
	0.0 (2603)	All others		

[a.] Turner et al. 2012, 2013; Wallace et al. 2014, 2015; Garzon-Garcia et al. 2015; Wallace et al. 2016.
[b.] Wallace et al. 2016. [c] GL = 1 x 10^9 L.

Figures

Figure 1. Species sensitivity distribution plot of the toxicity data used to derive the (a) freshwater and (b) marine ecotoxicity threshold values for ametryn.

(a) (b)

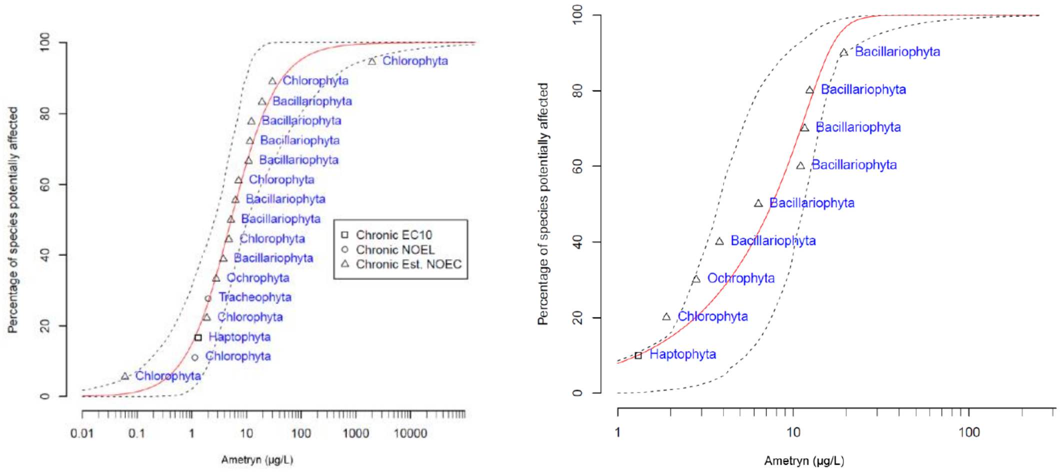


Figure 2. Diuron species sensitivity distribution plots of (a) chronic freshwater ecotoxicity data, (b) chronic marine ecotoxicity data for seven species and (c) chronic EC10/NOEC and chronic estimated EC10/NOEC data for 20 marine species. The SSDs of (a) and (c) were used to generate the ecotoxicity thresholds.

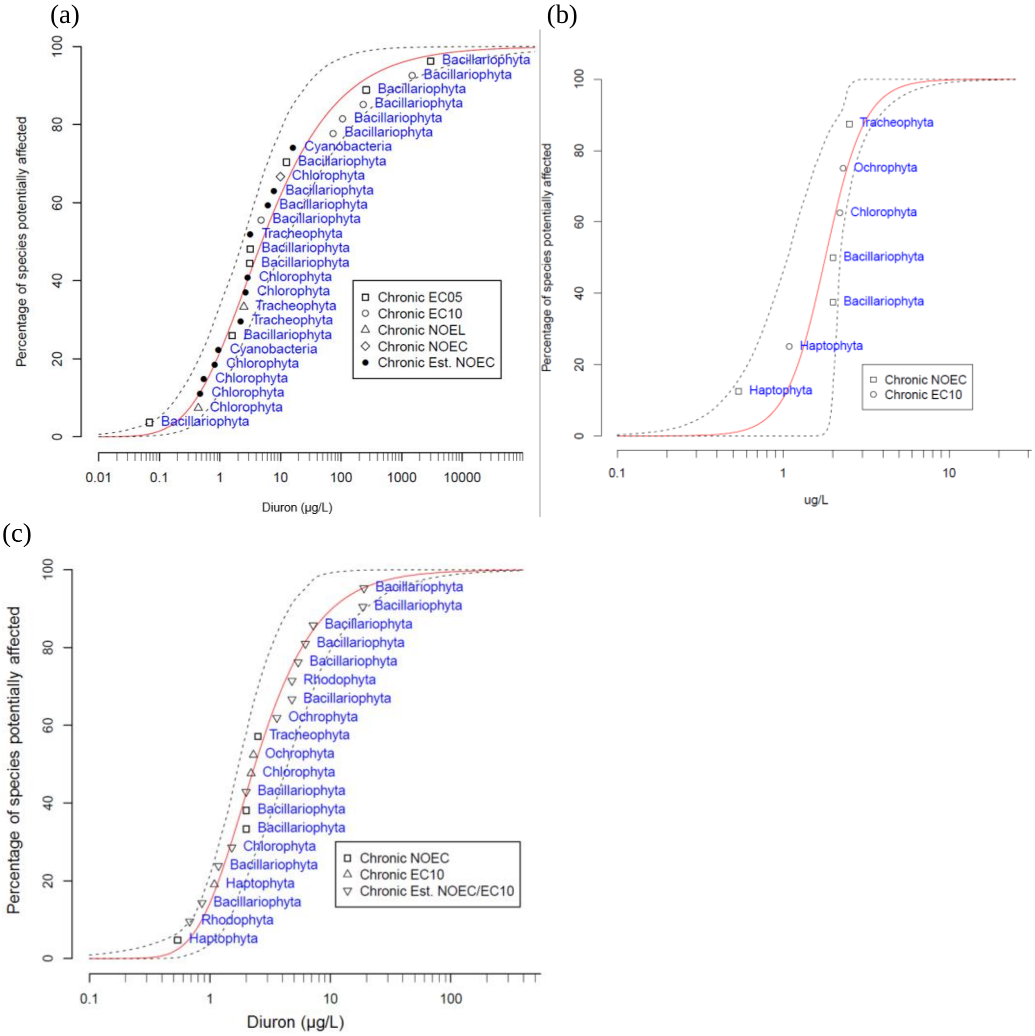


Figure 3. Species sensitivity distribution plot of the toxicity data used to derive the (a) freshwater and (b) marine ecotoxicity threshold values for hexazinone.

(a) (b)

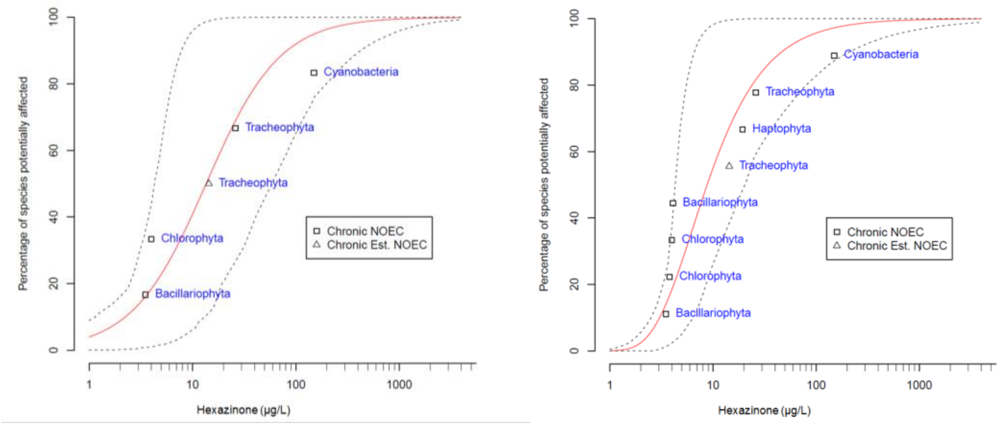
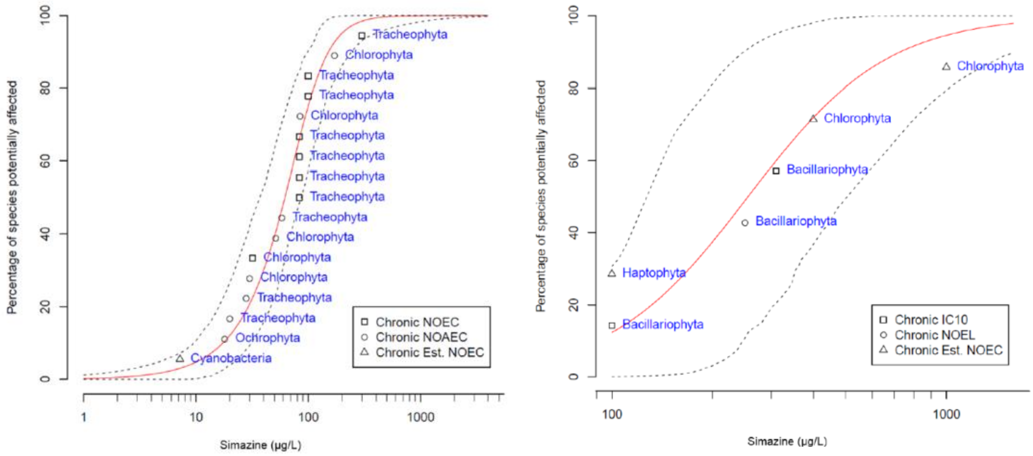


Figure 4. Simazine species sensitivity distribution plots of (a) the chronic and chronic estimated toxicity data for freshwater species, (b) chronic and chronic estimated ecotoxicity data for marine species.

(a) (b)



Supplementary Material

Table S1. Summary of the key characteristics of the freshwater ametryn toxicity data (acute and chronic) that passed the screening and quality assurance processes. It includes both phototrophic and non-phototrophic species for freshwaters only. Not all the data were used to derive the freshwater ecotoxicity threshold values for ametryn.

Phyla or Division	Class	Species	Life stage	Duration (hr)	Test type	Measure (Endpoint)	Test medium	Salinity (‰)	Temp. (°C)	pH	Concentration (µg/L)	Reference
Arthropoda	Branchiopoda	Freshwater Flea (*Daphnia magna*)	< 24hr	24	Acute	EC50 (Immob)	Dechlorinated tap water	N/A	21 ± 1	8.4	73 000	Marchini et al. (1988)
											73 000	*GEOMETRIC MEAN*
Arthropoda	Branchiopoda	Freshwater Flea (*Daphnia magna*)	< 24hr	48	Acute	EC50 (Immob)	Surface or ground water, reconstituted or dechlorinated tap water	N/A	20 ± 2	-	28 000	U.S. EPA (2015)
Arthropoda	Branchiopoda	Freshwater Flea (*Daphnia magna*)	< 24hr	48	Acute	EC50 (Immob)	Dechlorinated tap water	N/A	21 ± 1	8.4	40 000	Marchini et al. (1988)
											33 466	*GEOMETRIC MEAN*
Arthropoda	Branchiopoda	Freshwater Flea (*Daphnia magna*)	< 24hr	48	Acute	NOEL (Immob)	Surface or ground water, reconstituted or dechlorinated tap water	N/A	20 ± 2	-	12 000	Marchini et al. (1988)
											12 000	*GEOMETRIC MEAN*
Arthropoda	Branchiopoda	Freshwater Flea (*Daphnia magna*)	Life cycle	504	Chronic	NOEL (Immob)	Surface or ground water, reconstituted or dechlorinated tap water	N/A	20 ± 1	-	240	U.S. EPA (2015)
											240	*GEOMETRIC MEAN*
Arthropoda	Branchiopoda	Freshwater Flea (*Daphnia magna*)	Life cycle	504	Chronic	LOEC (Immob)	Surface or ground water, reconstituted or dechlorinated tap water	N/A	20 ± 1	-	320	U.S. EPA (2015)

											320	*GEOMETRIC MEAN*
Arthropoda	Branchiopoda	Freshwater Flea (*Daphnia similis*)	Neonates	24	Acute	EC50 (Immob)	Dechlorinated water and OECD medium	N/A	20 ± 2	7.5	63 230	Clemente et al. (2013)
											63 230	*GEOMETRIC MEAN*
Arthropoda	Branchiopoda	Freshwater Flea (*Daphnia similis*)	Neonates	48	Acute	EC50 (Immob)	Dechlorinated water and OECD medium	N/A	20 ± 2	7.5	38 860	Clemente et al. (2013)
											38 860	*GEOMETRIC MEAN*
Bacillariophyta	Bacillariophyceae	Microalgae (*Stauroneis amphoroides*)	-	72	Chronic	EC50 (Biomass yield)	ASTM Type I water	N/A	24 ± 2	7.5 ± 0.1	26	U.S. EPA (2015)
											26	*GEOMETRIC MEAN*
											5.2[@]	***VALUE USED IN SSD***
Chlorophyta	Chlorophyceae	Microalgae (*Pseudokirchne-riella subcapitata*[2])	-	96	Chronic	EC50 (Abundanc e)	ASTM Type I water	N/A	20 ± 1	7.7	6.2	Gaggi et al. (1995)
											6.2	*GEOMETRIC MEAN*
Chlorophyta	Chlorophyceae	Microalgae (*Raphidocelis subcapitata*[2])	-	96	Chronic	EC50 (Cell count)	HB-4 medium	N/A	25	-	11.6	Ma et al. (2006)
											11.6	*GEOMETRIC MEAN*
Chlorophyta	Chlorophyceae	Microalgae (*Selenastrum capricornutum*)	-	168	Chronic	NOEL (Biomass yield)	ASTM Type I water	N/A	24 ± 2	7.5 ± 0.1	1.14	U.S. EPA (2015)
											1.14	*GEOMETRIC MEAN*
											1.14	***VALUE USED IN SSD***
Chlorophyta	Chlorophyceae	Microalgae (*Selenastrum capricornutum*)	-	168	Chronic	EC50 (Biomass yield)	ASTM Type I water	N/A	24 ± 2	7.5 ± 0.1	3.67	U.S. EPA (2015)
											3.67	*GEOMETRIC MEAN*

Chlorophyta	Chlorophyceae	Microalgae (*Scenedesmus quadricauda*)	-	96	Chronic	EC50 (Abundance)	HB-4 medium	N/A	-	-	150	Ma et al. (2003)
											150	*GEOMETRIC MEAN*
											30@	***VALUE USED IN SSD***
Chlorophyta	Trebouxiophyceae	Microalgae (*Chlorella pyrenoidosa*)	-	96	Chronic	EC50 (Abundance)	Liquid HB-4 medium	N/A	25	-	0.3	Ma et al. (2001)
Chlorophyta	Trebouxiophyceae	Microalgae (*Chlorella pyrenoidosa*)	-	96	Chronic	EC50 (Abundance)	Liquid HB-4 medium	N/A	25	-	0.3	Ma et al. (2002)
											0.3	*GEOMETRIC MEAN*
											0.06@	***VALUE USED IN SSD***
Chordata	Actinopterygii	Bluegill (*Lepomis macrochirus*)	Juvenile	96	Acute	LC50 (Mortality)	Clean surface or ground water and reconstituted water	N/A	22 ± 2	>6.0 and < 8.0	4100	U.S. EPA (2015)
											4100	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Bluegill (*Lepomis macrochirus*)	-	96	Acute	LC50 (Mortality)	Clean surface or ground water and reconstituted water	N/A	22 ± 2	>6.0 and < 8.0	3700	U.S. EPA (2015)
Chordata	Actinopterygii	Bluegill (*Lepomis macrochirus*)	-	96	Acute	LC50 (Mortality)	Clean surface or ground water and reconstituted water	N/A	22 ± 2	>6.0 and < 8.0	8500	U.S. EPA (2015)
											5608	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Bluegill (*Lepomis macrochirus*)	-	96	Acute	NOEL (Mortality)	Clean surface or ground water and reconstituted water	N/A	22 ± 2	>6.0 and < 8.0	6400	U.S. EPA (2015)
											6400	*GEOMETRIC MEAN*

Chordata	Actinopterygii	Fathead Minnow (*Pimephales promelas*)	Early life	840	Chronic	NOEL (Mortality)	Clean surface or ground water and reconstituted water	N/A	23 ± 2	>6.0 and < 8.0	700	U.S. EPA (2015)
											700	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Fathead Minnow (*Pimephales promelas*)	Early life	840	Chronic	LOEC (Mortality)	Clean surface or ground water and reconstituted water	N/A	23 ± 2	>6.0 and < 8.0	1400	U.S. EPA (2015)
											1400	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Fathead Minnow (*Pimephales promelas*)	Juvenile	96	Acute	LC50 (Mortality)	Clean surface or ground water and reconstituted water	N/A	23 ± 2	>6.0 and < 8.0	5700	U.S. EPA (2015)
											5700	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Fathead Minnow (*Pimephales promelas*)	-	96	Acute	NOEL (Mortality)	Clean surface or ground water and reconstituted water	N/A	23 ± 2	>6.0 and < 8.0	9000	U.S. EPA (2015)
											9000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Fathead Minnow (*Pimephales promelas*)	-	96	Acute	LC50 (Mortality)	Clean surface or ground water and reconstituted water	N/A	23 ± 2	>6.0 and < 8.0	16 000	U.S. EPA (2015)
											16 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Goldfish (*Carassius auratus*)	-	96	Acute	LC50 (Mortality)	Clean surface or ground water and reconstituted water	N/A	22 ± 2	>6.0 and < 8.0	14 000	U.S. EPA (2015)
											14 000	*GEOMETRIC MEAN*

Chordata	Actinopterygii	Rainbow Trout (*Oncorhynchus mykiss*)	-	48	Acute	NOEL (Mortality)	Clean surface or ground water and reconstituted water	N/A	12 ± 2	>6.0 and < 8.0	2500	U.S. EPA (2015)
											2500	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Rainbow Trout (*Oncorhynchus mykiss*)	-	48	Acute	LC50 (Mortality)	Clean surface or ground water and reconstituted water	N/A	12 ± 2	>6.0 and < 8.0	5100	U.S. EPA (2015)
											5100	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Rainbow Trout (*Oncorhynchus mykiss*)	-	96	Acute	NOEL (Mortality)	Clean surface or ground water and reconstituted water	N/A	12 ± 2	>6.0 and < 8.0	700	U.S. EPA (2015)
											700	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Rainbow Trout (*Oncorhynchus mykiss*)	-	96	Acute	LC50 (Mortality)	Clean surface or ground water and reconstituted water	N/A	12 ± 2	>6.0 and < 8.0	3200	U.S. EPA (2015)
Chordata	Actinopterygii	Rainbow Trout (*Oncorhynchus mykiss*)	-	96	Acute	LC50 (Mortality)	Clean surface or ground water and reconstituted water	N/A	12 ± 2	>6.0 and < 8.0	3600	U.S. EPA (2015)
											3394	*GEOMETRIC MEAN*
Tracheophyta	Liliopsida	Macrophyte (*Lemna aequinoctialis*)	-	96	Acute	EC10 (Abundance)	Freshwater				1.09	Seery and Pradella (in prep)
											1.09	*GEOMETRIC MEAN*
Tracheophyta	Liliopsida	Macrophyte (*Lemna aequinoctialis*)	-	96	Acute	EC50 (Abundance)	Freshwater				6.74	Seery and Pradella (in prep)
											6.74	*GEOMETRIC MEAN*

Tracheophyta	Liliopsida	Macrophyte (*Lemna gibba*)	-	168	Chronic	NOEL (Total frond number, growth rate, mortality)	M-Hoagland's or 20X-AAP media. ASTM Type I water	N/A	25 ± 2	4.8-5.2 (M-Hoagland's) and 7.5 ± 0.1 (20X-AAP)	2	U.S. EPA (2015)
											2	*GEOMETRIC MEAN*
											2	***VALUE USED IN SSD***
Tracheophyta	Liliopsida	Macrophyte (*Lemna gibba*)	-	168	Chronic	EC50 (Total frond number, growth rate, mortality)	M-Hoagland's or 20X-AAP media. ASTM Type I water	N/A	25 ± 2	4.8-5.2 (M-Hoagland's) and 7.5 ± 0.1 (20X-AAP)	13	U.S. EPA (2015)
											13	*GEOMETRIC MEAN*
Tracheophyta	Liliopsida	Macrophyte (*Lemna minor*)	-	72	Acute	EC20 (Growth rate)	Steinberg medium	N/A	25 ± 2	5.5 ± 0.2	12.27	Drost et al. (2003)
Tracheophyta	Liliopsida	Macrophyte (*Lemna minor*)	-	72	Acute	EC20 (Growth rate)	Steinberg medium	N/A	25 ± 2	5.5 ± 0.2	27.50	Drost et al. (2003)
											18.37	*GEOMETRIC MEAN*
Tracheophyta	Liliopsida	Macrophyte (*Lemna minor*)	-	144	Acute	EC20 (Growth rate)	Steinberg medium	N/A	25 ± 2	5.5 ± 0.2	8.41	Drost et al. (2003)
Tracheophyta	Liliopsida	Macrophyte (*Lemna minor*)	-	144	Acute	EC50 (Growth rate)	Steinberg medium	N/A	25 ± 2	5.5 ± 0.2	18.18	Drost et al. (2003)
											12.37	*GEOMETRIC MEAN*

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Supplementary Material

Table S2. Summary of the key characteristics of the marine ametryn toxicity data (acute and chronic) for all species that passed the screening and quality assurance processes. Not all the data were used to derive the marine ecotoxicity threshold values for ametryn.

Phyla/Division	Class	Species	Life stage	Duration (hr)	Test type	Measure (Endpoint)	Test medium	Salinity (‰)	Temp. (°C)	pH	Concentration (µg/L)	Reference
Arthropoda	Branchiopoda	Macroinvertebrate (*Artemia salina*)	II - III instar larvae	24	Acute	EC50 (Immob)	Marine	-	25 ± 1	7.5 - 8.3	33000	Gaggi et al. (1995)
											33000	*GEOMETRIC MEAN*
Arthropoda	Malacostraca	Macroinvertebrate (*Americamysis bahia*)	<24 hr	672	Chronic	NOEL (Mortality)	Natural filtered (<20µm) or artificial seawater	20 ± 3	25 ± 2	-	50	U.S. EPA (2015)
											50	*GEOMETRIC MEAN*
Arthropoda	Malacostraca	Macroinvertebrate (*Americamysis bahia*)	<24 hr	672	Chronic	LOEC (Mortality)	Natural filtered (<20µm) or artificial seawater	20 ± 3	25 ± 2	-	97	U.S. EPA (2015)
											97	*GEOMETRIC MEAN*
Arthropoda	Malacostraca	Macroinvertebrate (*Americamysis bahia*)	Juveni-le	96	Acute	LC50 (Mortality)	Natural filtered (<20µm) or artificial seawater	20 ± 3	25 ± 2	-	2300	U.S. EPA (2015)
											2300	*GEOMETRIC MEAN*
Bacillariophyta	Bacillariophyceae	Microalgae (*Achnanthes brevipes*)	-	72	Chronic	EC50 (Biomass yield)	ASTM Type I water with synthetic salt water or filtered natural salt water	30 ± 5	20 ± 2	8 ± 0.1	19	U.S. EPA (2015)
											19	*GEOMETRIC MEAN*
											3.8[@]	***VALUE USED IN SSD***
Bacillariophyta	Bacillariophyceae	Microalgae (*Navicula incerta*)	-	72	Chronic	EC50 (Biomass yield)	ASTM Type I water with synthetic salt water or filtered natural salt water	30 ± 5	20 ± 2	8 ± 0.1	97	U.S. EPA (2015)
											97	*GEOMETRIC MEAN*
											19.4[@]	***VALUE USED IN SSD***
Bacillariophyta	Bacillariophyceae	Microalge (*Nitzschia closterium*)	-	72	Chronic	EC50 (Biomass yield)	ASTM Type I water with synthetic salt water or filtered natural salt water	30 ± 5	20 ± 2	8 ± 0.1	62	U.S. EPA (2015)
											62	*GEOMETRIC MEAN*

											12.4@	***VALUE USED IN SSD***
Bacillariophyta	Bacillariophyta incertae sedis	Microalgae (*Phaeodactylum tricornutum*)	-	240	Chronic	EC50 (Biomass yield)	ASTM Type I water with synthetic salt water or filtered natural salt water	30 ± 5	20 ± 2	8 ± 0.1	20	U.S. EPA (2015)
Bacillariophyta	Bacillariophyta incertae sedis	Microalgae (*Phaeodactylum tricornutum*)	-	240	Chronic	EC50 (Biomass yield)	ASTM Type I water with synthetic salt water or filtered natural salt water	30 ± 5	20 ± 2	8 ± 0.1	50	U.S. EPA (2015)
											31.6	*GEOMETRIC MEAN*
											6.32@	***VALUE USED IN SSD***
Bacillariophyta	Mediophyceae	Microalgae (*Thalassiosira fluviatilis*)	-	72	Chronic	EC50 (Biomass yield)	ASTM Type I water with synthetic salt water or filtered natural salt water	30 ± 5	20 ± 2	8 ± 0.1	58	U.S. EPA (2015)
											58	*GEOMETRIC MEAN*
											11.6@	***VALUE USED IN SSD***
Bacillariophyta	Mediophyceae	Microalgae (*Thalassiosira guillardii*)	-	72	Chronic	EC50 (Biomass yield)	ASTM Type I water with synthetic salt water or filtered natural salt water	30 ± 5	20 ± 2	8 ± 0.1	55	U.S. EPA (2015)
											55	*GEOMETRIC MEAN*
											11@	***VALUE USED IN SSD***
Chlorophyta	Chlorophyceae	Microalgae (*Dunaliella tertiolecta*)	Log growth phase	96	Chronic	LOEC (Cell count)	F/2 marine media	20	25	-	3.8	DeLorenzo et al. (2011)
											3.8	*GEOMETRIC MEAN*
Chlorophyta	Chlorophyceae	Microalgae (*Dunaliella tertiolecta*)	Log growth phase	96	Chronic	EC50 (Cell count)	F/2 marine media	20	25	-	7	DeLorenzo et al. (2011)
											7	*GEOMETRIC MEAN*
											1.46@	***VALUE USED IN SSD***
Chlorophyceae	Chlorophyceae	Microalgae (*Dunaliella tertiolecta*)	-	96	Chronic	EC50 (Abundance)	Sterilised offshore marine water	-	20 ± 1	7.5 - 8.3	16	Gaggi et al. (1995)
											16	*GEOMETRIC MEAN*
Chlorophyta	Chlorophyceae	Microalgae (*Dunaliella tertiolecta*)	-	240	Chronic	EC50 (Biomass yield)	ASTM Type I water with synthetic salt water or filtered	30 ± 5	20 ± 2	8 ± 0.1	40	U.S. EPA (2015)

							natural salt water					
Chlorophyta	Chlorophyceae	Microalgae (*Dunaliella tertiolecta*)	-	240	Chronic	EC50 (Biomass yield)	ASTM Type I water with synthetic salt water or filtered natural salt water	30 ± 5	20 ± 2	8 ± 0.1	20	U.S. EPA (2015)
											28.3	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Sheepshead Minnow (*Cyprinodon variegatus*)	Juveni-le	96	Acute	NOEL (Mortality)	Seawater	20 ± 5	22 ± 2	>7.5 and <8.5	2800	U.S. EPA (2015)
											2800	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Sheepshead Minnow (*Cyprinodon variegatus*)	Juveni-le	96	Acute	LC50 (Mortality)	Seawater	20 ± 5	22 ± 2	>7.5 and <8.5	5800	U.S. EPA (2015)
											5800	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Spot (*Leiostomus xanthurus*)	Juveni-le	48	Acute	LC50 (Mortality)	Seawater	20 ± 5	-	>7.5 and <8.5	1000	U.S. EPA (2015)
											1000	*GEOMETRIC MEAN*
Haptophyta	Coccolithophyceae	Microalgae (*Isochrysis galbana*)	-	72	Chronic	EC10 (Abundance)	Marine				1.31	Seery and Pradella (in prep)
											1.31	*GEOMETRIC MEAN*
											1.31	***VALUE USED IN SSD***
Haptophyta	Coccolithophyceae	Microalgae (*Isochrysis galbana*)	-	72	Chronic	EC50 (Abundance)	Marine				2.32	Seery and Pradella (in prep)
											2.32	*GEOMETRIC MEAN*
Haptophyta	Coccolithophyceae	Microalgae (*Isochrysis galbana*)	-	240	Chronic	EC50 (Biomass yield)	ASTM Type I water with synthetic salt water or filtered natural salt water	30 ± 5	20 ± 2	8 ± 0.1	10	U.S. EPA (2015)
Haptophyta	Coccolithophyceae	Microalgae (*Isochrysis galbana*)	-	240	Chronic	EC50 (Biomass yield)	ASTM Type I water with synthetic salt water or filtered natural salt water	30 ± 5	20 ± 2	8 ± 0.1	10	U.S. EPA (2015)
											10	*GEOMETRIC MEAN*
Mollusca	Bivalvia	Quahog Clam (*Mercenaria mercenaria*)	Embr-yo/Lar-vae	48	Acute	EC50 (Mortality)	Good quality unfiltered seawater	>12	25	-	11000	U.S. EPA (2015)
											11000	*GEOMETRIC MEAN*
Ochrophyta	Chrysophyceae	Microalgae	-	72	Chronic	EC50	ASTM Type I water	30 ± 5	20 ± 2	8 ± 0.1	14	U.S. EPA (2015)

		(*Monochrysis lutheri*)				(Biomass yield)	with synthetic salt water or filtered natural salt water					
											14	*GEOMETRIC MEAN*
											2.8[@]	***VALUE USED IN SSD***
Rhodophyta	Porphyridiophyce-ae	Macroalgae (*Porphyridium cruentum*)	-	72	Acute	EC50 (Biomass yield)	ASTM Type I water with synthetic salt water or filtered natural salt water	30 ± 5	20 ± 2	8 ± 0.1	36	U.S. EPA (2015)
											36	*GEOMETRIC MEAN*
											7.2[@]	***VALUE USED IN SSD***

@ Values were chronic EC/LC50 values that were converted to chronic NOEC/EC10 values by dividing by 5 (Warne, 2001).

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Supplementary Information

Table S3. Summary of the key characteristics of the freshwater diuron toxicity data (acute and chronic) that passed the screening and quality assurance processes. It includes both phototrophic and non-phototrophic species for freshwaters only. Not all the data were used to derive the freshwater guideline values for diuron.

Phyla or Division	Class	Species	Life stage	Duration	Test type	Measure (Endpoint)	Test medium	Temp. (°C)	pH	Concentration (µg/L)	Reference
Annelida	Clitellata	Blackworm *(Lumbriculus variegatus)*	Small adults	10 d	Acute	NOAEL (Survival)	0.45 um filtered well water	23	6.8 ± 0.1	29 100	Nebeker and Schuytema (1998)
										29 100	*GEOMETRIC MEAN*
Annelida	Clitellata	Blackworm *(Lumbriculus variegatus)*	Small adults	10 d	Acute	NOAEL (Blotted wet weight)	0.45 um filtered well water	23	6.8 ± 0.1	1800	Nebeker and Schuytema (1998)
										1800	*GEOMETRIC MEAN*
Annelida	Clitellata	Blackworm *(Lumbriculus variegatus)*	Small adults	10 d	Acute	LOAEL (Blotted wet weight)	0.45 um filtered well water	23	6.8 ± 0.1	3500	Nebeker and Schuytema (1998)
										3500	*GEOMETRIC MEAN*
Arthropoda	Insecta	Yellow Fever Mosquito *(Aedes aegypti)*	-	4 d	Acute	LC50 (Mortality)	*	*	*	1200	Knapek and Lakota (1974)
										1200	*GEOMETRIC MEAN*
Arthropoda	Malacostraca	Aquatic Sowbug *(Asellus brevicaudus)*	-	4 d	Acute	LC50 (Mortality)	Well water, reconstitued water	15 ± 1	6.5–8.5	15 500	Johnson and Finley (1980)
										15 500	*GEOMETRIC MEAN*
Arthropoda	Branchiopoda	Freshwater Flea *(Ceriodaphnia dubia)*	<24 hour old neonates	1 d	Acute	EC50 (Immob)	Soft diluted mineral water	25 ± 1	-	2300	Foster et al. (1998)
Arthropoda	Branchiopoda	Freshwater Flea *(Ceriodaphnia dubia)*	<24 hour old neonates	1 d	Acute	EC50 (Immob)	Soft diluted mineral water	25 ± 1	-	1200	Foster et al. (1998)
										1661	*GEOMETRIC MEAN*
Arthropoda	Branchiopoda	Freshwater Flea *(Ceriodaphnia dubia)*	<24 hour old neonates	2 d	Acute	EC50 (Immob)	Soft diluted mineral water	25 ± 1	-	1700	Foster et al. (1998)
Arthropoda	Branchiopoda	Freshwater Flea *(Ceriodaphnia dubia)*	<24 hour old neonates	2 d	Acute	EC50 (Immob)	Soft diluted mineral water	25 ± 1	-	1000	Foster et al. (1998)
										1304	*GEOMETRIC MEAN*

Arthropoda	Insecta	Midge *(Chironomus tentans)*	1st instar larvae (2 days old)	10 d	Chronic	NOAEL (Mortality)	0.45 um filtered well water	24	6.9 ± 0.1	1900	Nebeker and Schuytema (1998)
										1900	*GEOMETRIC MEAN*
Arthropoda	Insecta	Midge *(Chironomus tentans)*	1st instar larvae (2 days old)	10 d	Chronic	LOAEL (Mortality)	0.45 um filtered well water	24	6.9 ± 0.1	3400	Nebeker and Schuytema (1998)
										3400	*GEOMETRIC MEAN*
Arthropoda	Insecta	Midge *(Chironomus tentans)*	1st instar larvae (2 days old)	10 d	Chronic	NOAEL (Larval weight)	0.45 um filtered well water	24	6.9 ± 0.1	3400	Nebeker and Schuytema (1998)
										3400	*GEOMETRIC MEAN*
Arthropoda	Insecta	Midge *(Chironomus tentans)*	1st instar larvae (2 days old)	10 d	Chronic	LOAEL (Larval weight)	0.45 um filtered well water	24	6.9 ± 0.1	7100	Nebeker and Schuytema (1998)
										7100	*GEOMETRIC MEAN*
Arthropoda	Insecta	Midge *(Chironomus tentans)*	1st instar larvae (2 days old)	10 d	Chronic	LC50 (Mortality)	0.45 um filtered well water	24	6.9 ± 0.1	3300	Nebeker and Schuytema (1998)
										3300	*GEOMETRIC MEAN*
Arthropoda	Branchiopoda	Freshwater Flea *(Daphnia magna)*	< 24 hours	2 d	Acute	LOEC (Immob)	Natural or reconstituted water	20 ± 1	-	3500	Fernandez-Alba et al. (2002a)
										3500	*GEOMETRIC MEAN*
Arthropoda	Branchiopoda	Freshwater Flea *(Daphnia magna)*	< 24 hours	2 d	Acute	EC50 (Immob)	Natural or reconstituted water	20 ± 1	-	8600	Fernandez-Alba et al. (2002a)
Arthropoda	Branchiopoda	Freshwater Flea *(Daphnia magna)*	< 24 hours	2 d	Acute	EC50 (Immob)	Natural or reconstituted water	20 ± 1	-	8600	Fernandez-Alba et al. (2002b)
Arthropoda	Branchiopoda	Freshwater Flea *(Daphnia magna)*	<24 hour old neonates	2 d	Acute	EC50 (Immob)	Non-chlorinated tap water and spring water (1:1 ratio)	20 ± 1	-	8600	Hernando et al. (2003)
										8600	*GEOMETRIC MEAN*
Arthropoda	Branchiopoda	Freshwater Flea *(Daphnia magna)*	-	4 d	Acute	LC50 (Mortality)	*	*	*	400	Knapek and Lakota (1974)
										400	*GEOMETRIC MEAN*
Arthropoda	Branchiopoda	Freshwater Flea *(Daphnia magna)*	Life Cycle	21 d	Chronic	LOEC (Body length/Dry weight)	Surface or ground, reconstituted or dechlorinated	20 ± 1	-	113	US EPA (2015a)

							tap water				
										113	*GEOMETRIC MEAN*
Arthropoda	Branchiopoda	Freshwater Flea *(Daphnia magna)*	Life Cycle	21 d	Chronic	NOEL (Body length/Dry weight)	Surface or ground, reconstituted or dechlorinated tap water	20 ± 1	-	57	US EPA (2015a)
										57	*GEOMETRIC MEAN*
Arthropoda	Branchiopoda	Freshwater Flea *(Daphnia magna)*	Life Cycle	28 d	Chronic	LOEC (Body length/Dry weight)	Surface or ground, reconstituted or dechlorinated tap water	20 ± 1	-	200	US EPA (2015a)
										200	*GEOMETRIC MEAN*
Arthropoda	Branchiopoda	Freshwater Flea *(Daphnia magna)*	Life Cycle	28 d	Chronic	NOEL (Body length/Dry weight)	Surface or ground, reconstituted or dechlorinated tap water	20 ± 1	-	200	US EPA (2015a)
										200	*GEOMETRIC MEAN*
Arthropoda	Branchiopoda	Freshwater Flea *(Daphnia pulex)*	1st Instar larvae	2 d	Acute	EC50 (Body length/Dry weight)	Surface or ground, reconstituted or dechlorinated tap water	20 ± 2	-	1400	US EPA (2015a)
										1400	*GEOMETRIC MEAN*
Arthropoda	Branchiopoda	Freshwater Flea *(Daphnia pulex)*	-	2 d	Acute	EC50 (Immob)	Reconstituted de-ionised water	18	6.5–8.5	1400	Sanders and Cope (1966)
Arthropoda	Branchiopoda	Freshwater Flea *(Daphnia pulex)*	-	2 d	Acute	EC50 (Immob)	Well water, reconstitued water	15 ± 1	7.4–7.8	1400	Johnson and Finley (1980)
										1400	*GEOMETRIC MEAN*
Arthropoda	Branchiopoda	Freshwater Flea *(Daphnia pulex)*	Adults (5 days old)	4 d	Acute	LC50 (Mortality)	0.45 um filtered well water	-	6.9 ± 0.1	17900	Nebeker and Schuytema (1998)
										17900	*GEOMETRIC MEAN*
Arthropoda	Branchiopoda	Freshwater Flea *(Daphnia pulex)*	Adults (5 days old)	7 d	Chronic	NOAEL (Mortality)	0.45 um filtered well water	-	6.9 ± 0.1	4000	Nebeker and Schuytema (1998)
										4000	*GEOMETRIC MEAN*

Arthropoda	Branchiopoda	Freshwater Flea *(Daphnia pulex)*	Adults (5 days old)	7 d	Chronic	LOAEL (Mortality)	0.45 um filtered well water	-	6.9 ± 0.1	7700	Nebeker and Schuytema (1998)
										7700	*GEOMETRIC MEAN*
Arthropoda	Branchiopoda	Freshwater Flea *(Daphnia pulex)*	Adults (5 days old)	7 d	Chronic	NOAEL (Progeny)	0.45 um filtered well water	-	6.9 ± 0.1	4,000	Nebeker and Schuytema (1998)
										4,000	*GEOMETRIC MEAN*
Arthropoda	Branchiopoda	Freshwater Flea *(Daphnia pulex)*	Adults (5 days old)	7 d	Chronic	LOAEL (Progeny)	0.45 um filtered well water	-	6.9 ± 0.1	7,700	Nebeker and Schuytema (1998)
										7,700	*GEOMETRIC MEAN*
Arthropoda	Branchiopoda	Freshwater Flea *(Daphnia pulex)*	Adults (5 days old)	7 d	Chronic	LC50 (Mortality)	0.45 um filtered well water	-	6.9 ± 0.1	7,100	Nebeker and Schuytema (1998)
										7,100	*GEOMETRIC MEAN*
Arthropoda	Malacostraca	Shrimp *(Gammarus fasciatus)*	-	2 d	Acute	LC50 (Mortality)	Untreated well water	15.5 ± 0.5	7.4	1,800	Sanders (1970)
										1,800	*GEOMETRIC MEAN*
Arthropoda	Malacostraca	Shrimp *(Gammarus fasciatus)*	-	4 d	Acute	LC50 (Mortality)	Well water, reconstitued water	21 ± 1	6.5–8.5	160	Johnson and Finley (1980)
Arthropoda	Malacostraca	Shrimp *(Gammarus fasciatus)*	-	4 d	Acute	LC50 (Mortality)	Untreated well water	15.5 ± 0.5	7.4	700	Sanders (1970)
										334.66	*GEOMETRIC MEAN*
Arthropoda	Malacostraca	Amphipod *(Gammarus lacustris)*	-	2 d	Acute	LC50 (Mortality)	*	*	*	380	Sanders (1969)
										380	*GEOMETRIC MEAN*
Arthropoda	Malacostraca	Amphipod *(Gammarus lacustris)*	-	4 d	Acute	LC50 (Mortality)	*	*	*	160	Sanders (1969)
										160	*GEOMETRIC MEAN*
Arthropoda	Malacostraca	Amphipod *(Hyalella azteca)*	2 day old young	4 d	Acute	LC50 (Mortality)	0.45 um filtered well water	22	6.9 ± 0.1	19,400	Nebeker and Schuytema (1998)
										19,400	*GEOMETRIC MEAN*
Arthropoda	Malacostraca	Amphipod *(Hyalella azteca)*	2 day old young	10 d	Acute	NOAEL (Mortality)	0.45 um filtered well water	22	6.9 ± 0.1	7,900	Nebeker and Schuytema

											(1998)
										7,900	*GEOMETRIC MEAN*
Arthropoda	Malacostraca	Amphipod *(Hyalella azteca)*	2 day old young	10 d	Acute	LOAEL (Mortality)	0.45 um filtered well water	22	6.9 ± 0.1	15 700	Nebeker and Schuytema (1998)
										15 700	*GEOMETRIC MEAN*
Arthropoda	Malacostraca	Amphipod *(Hyalella azteca)*	2 day old young	10 d	Acute	NOAEL (Length)	0.45 um filtered well water	22	6.9 ± 0.1	22 900	Nebeker and Schuytema (1998)
										22 900	*GEOMETRIC MEAN*
Arthropoda	Malacostraca	Amphipod *(Hyalella azteca)*	2 day old young	10 d	Acute	NOAEL (Blotted wet weight)	0.45 um filtered well water	22	6.9 ± 0.1	22 900	Nebeker and Schuytema (1998)
										22 900	*GEOMETRIC MEAN*
Arthropoda	Malacostraca	Amphipod *(Hyalella azteca)*	2 day old young	10 d	Acute	LC50 (Mortality)	0.45 um filtered well water	22	6.9 ± 0.1	18 400	Nebeker and Schuytema (1998)
										18 400	*GEOMETRIC MEAN*
Arthropoda	Malacostraca	Australian Glass Shrimp *(Paratya australiensis)*	-	4 d	Acute	LC50 (Mortality)	-	23 ± 1	7–8.5	8 800	Kumar et al. (2010)
										8 800	*GEOMETRIC MEAN*
Arthropoda	Malacostraca	Australian Glass Shrimp *(Paratya australiensis)*	-	4 d	Acute	LC10 (Mortality)	-	23 ± 1	7–8.5	4 700	Kumar et al. (2010)
Arthropoda	Malacostraca	Australian Glass Shrimp *(Paratya australiensis)*	-	4 d	Acute	NOEC (Mortality)	-	23 ± 1	7–8.5	5000	Kumar et al. (2010)
										4848	*GEOMETRIC MEAN*
Arthropoda	Insecta	Stonefly *(Pteronarcys californica)*	-	2 d	Acute	LC50 (Mortality)	Reconstituted water	15.5 ± 0.5	7.1	2800	Sanders and Cope (1968)
										2800	*GEOMETRIC MEAN*
Arthropoda	Insecta	Stonefly *(Pteronarcys californica)*	-	4 d	Acute	LC50 (Mortality)	Reconstituted water	15.5 ± 0.5	7.1	1200	Sanders and Cope (1968)
Arthropoda	Insecta	Stonefly *(Pteronarcys californica)*	-	4 d	Acute	LC50 (Mortality)	Reconstituted water	15.5 ± 0.5	7.1	1200	Sanders and Cope (1968)
										1200	*GEOMETRIC MEAN*

Arthropoda	Branchiopoda	Freshwater Flea *(Simocephalus serrulatus)*	-	2 d	Acute	EC50 (Immob)	Reconstituted water	10.0 - 26.66	7.4–7.8	2000	Sanders and Cope (1966)
Arthropoda	Branchiopoda	Freshwater Flea *(Simocephalus serrulatus)*	-	2 d	Acute	EC50 (Immob)	Well water, reconstitued water	15 ± 1	6.5–8.5	2000	Johnson and Finley (1980)
										2000	*GEOMETRIC MEAN*
Bacillariophyta	Bacillariophyceae	Microalgae *(Achnanthidium minutissimum)*	Exponential Growth Phase	4 d	Chronic	EC05 (Cell density)	DV culture medium	21 ± 2	-	3.15	Larras et al. (2012)
										3.15	*GEOMETRIC MEAN*
										3.15	***VALUE USED IN SSD***
Bacillariophyta	Bacillariophyceae	Microalgae *(Achnanthidium minutissimum)*	-	4 d	Chronic	EC10 (Growth Rate/Chlorophyll-a fluorescence)	DV culture medium	-	-	45	Larras et al. (2013)
Bacillariophyta	Bacillariophyceae	Microalgae *(Achnanthidium minutissimum)*	Exponential Growth Phase	4 d	Chronic	EC10 (Growth Rate/Chlorophyll-a fluorescence)	DV culture medium	-	-	7.67	Larras et al. (2013)
										18.58	*GEOMETRIC MEAN*
Bacillariophyta	Bacillariophyceae	Microalgae *(Achnanthidium minutissimum)*	Exponential Growth Phase	4 d	Chronic	EC50 (Cell density)	DV culture medium	21 ± 2	-	108	Larras et al. (2012)
										108	*GEOMETRIC MEAN*
Bacillariophyta	Bacillariophyceae	Microalgae *(Achnanthidium minutissimum)*	-	4 d	Chronic	EC50 (Growth Rate/Chlorophyll-a fluorescence)	DV culture medium	-	-	56	Larras et al. (2013)
										56	*GEOMETRIC MEAN*
Bacillariophyta	Bacillariophyceae	Microalgae *(Craticula accomoda)*	Exponential Growth Phase	4 d	Chronic	EC05 (Cell density)	DV culture medium	21 ± 2	-	261	Larras et al. (2012)
										261	*GEOMETRIC MEAN*
										261	***VALUE USED IN SSD***
Bacillariophyta	Bacillariophyceae	Microalgae *(Craticula accomoda)*	-	4 d	Chronic	EC10 (Growth Rate/Chlorophyll-a fluorescence)	DV culture medium	-	-	185	Larras et al. (2013)
Bacillariophyta	Bacillariophyceae	Microalgae	Exponential	4 d	Chronic	EC10	DV culture	-	-	644	Larras et al.

		(Craticula accomoda)	Growth Phase			(Growth Rate/Chlorophyll-a fluorescence)	medium				(2013)
										345.17	*GEOMETRIC MEAN*
Bacillariophyta	Bacillariophyceae	Microalgae *(Craticula accomoda)*	Exponential Growth Phase	4 d	Chronic	EC50 (Cell density)	DV culture medium	21 ± 2	-	1734	Larras et al. (2012)
										1734	*GEOMETRIC MEAN*
Bacillariophyta	Bacillariophyceae	Microalgae *(Craticula accomoda)*	-	4 d	Chronic	EC50 (Growth Rate/Chlorophyll-a fluorescence)	DV culture medium	-	-	1426	Larras et al. (2013)
										1426	*GEOMETRIC MEAN*
Bacillariophyta	Mediophyceae	Microalgae *(Cyclotella meneghiniana)*	Exponential Growth Phase	4 d	Chronic	EC05 (Cell density)	DV culture medium	21 ± 2	-	1.59	Larras et al. (2012)
										1.59	*GEOMETRIC MEAN*
										1.59	***VALUE USED IN SSD***
Bacillariophyta	Mediophyceae	Microalgae *(Cyclotella meneghiniana)*	-	4 d	Chronic	EC10 (Growth Rate/Chlorophyll-a fluorescence)	DV culture medium	-	-	27	Larras et al. (2013)
Bacillariophyta	Mediophyceae	Microalgae *(Cyclotella meneghiniana)*	Exponential Growth Phase	4 d	Chronic	EC10 (Growth Rate/Chlorophyll-a fluorescence)	DV culture medium	-	-	2.74	Larras et al. (2013)
										8.6	*GEOMETRIC MEAN*
Bacillariophyta	Mediophyceae	Microalgae *(Cyclotella meneghiniana)*	Exponential Growth Phase	4 d	Chronic	EC50 (Cell density)	DV culture medium	21 ± 2	-	23	Larras et al. (2012)
										23	*GEOMETRIC MEAN*
Bacillariophyta	Mediophyceae	Microalgae *(Cyclotella meneghiniana)*	-	4 d	Chronic	EC50 (Growth Rate/Chlorophyll-a fluorescence)	DV culture medium	-	-	49	Larras et al. (2013)
										49	*GEOMETRIC MEAN*
Bacillariophyta	Mediophyceae	Microalgae *(Cyclotella nana)*	-	3 d	Chronic	EC50 (Biomass Yield, Growth Rate, AUC)	ASTM Type 1 water	24 ± 2	7.5 ± 0.1	39	US EPA (2015a)
										39	*GEOMETRIC*

											MEAN
										39@	***VALUE USED IN SSD***
Bacillariophyta	Bacillariophyceae	Microalgae *(Encyonema silesiacum)*	Exponential Growth Phase	4 d	Chronic	EC05 (Cell density)	DV culture medium	21 ± 2	-	3.11	Larras et al. (2012)
										3.11	*GEOMETRIC MEAN*
										3.11	***VALUE USED IN SSD***
Bacillariophyta	Bacillariophyceae	Microalgae *(Encyonema silesiacum)*	-	4 d	Chronic	EC10 (Growth Rate/Chlorophyll-a fluorescence)	DV culture medium	-	-	90	Larras et al. (2013)
Bacillariophyta	Bacillariophyceae	Microalgae *(Encyonema silesiacum)*	Exponential Growth Phase	4 d	Chronic	EC10 (Growth Rate/Chlorophyll-a fluorescence)	DV culture medium	-	-	3.98	Larras et al. (2013)
										18.93	*GEOMETRIC MEAN*
Bacillariophyta	Bacillariophyceae	Microalgae *(Encyonema silesiacum)*	Exponential Growth Phase	4 d	Chronic	EC50 (Cell density)	DV culture medium	21 ± 2	-	8.79	Larras et al. (2012)
										8.79	*GEOMETRIC MEAN*
Bacillariophyta	Bacillariophyceae	Microalgae *(Encyonema silesiacum)*	-	4 d	Chronic	EC50 (Growth Rate/Chlorophyll-a fluorescence)	DV culture medium	-	-	286	Larras et al. (2013)
										286	*GEOMETRIC MEAN*
Bacillariophyta	Bacillariophyceae	Microalgae *(Eolimna minima)*	Exponential Growth Phase	4 d	Chronic	EC05 (Cell density)	DV culture medium	21 ± 2	-	3007	Larras et al. (2012)
										3007	*GEOMETRIC MEAN*
										3007	***VALUE USED IN SSD***
Bacillariophyta	Bacillariophyceae	Microalgae *(Eolimna minima)*	Exponential Growth Phase	4 d	Chronic	EC50 (Cell density)	DV culture medium	21 ± 2	-	4236	Larras et al. (2012)
										4236	*GEOMETRIC MEAN*
Bacillariophyta	Fragilariophyceae	Microalgae *(Fragilaria capucina var vaucheriae)*	Exponential Growth Phase	4 d	Chronic	EC05 (Cell density)	DV culture medium	21 ± 2	-	0.069	Larras et al. (2012)

										0.069	*GEOMETRIC MEAN*
										0.069	***VALUE USED IN SSD***
Bacillariophyta	Fragilariophyceae	Microalgae *(Fragilaria capucina var vaucheriae)*	-	4 d	Chronic	EC10 (Growth Rate/Chlorophyll-a fluorescence)	DV culture medium	-	-	21	Larras et al. (2013)
Bacillariophyta	Fragilariophyceae	Microalgae *(Fragilaria capucina var vaucheriae)*	Exponential Growth Phase	4 d	Chronic	EC10 (Growth Rate/Chlorophyll-a fluorescence)	DV culture medium	-	-	0.11	Larras et al. (2013)
										1.52	*GEOMETRIC MEAN*
Bacillariophyta	Fragilariophyceae	Microalgae *(Fragilaria capucina var vaucheriae)*	Exponential Growth Phase	4 d	Chronic	EC50 (Cell density)	DV culture medium	21 ± 2	-	4.03	Larras et al. (2012)
										4.03	*GEOMETRIC MEAN*
Bacillariophyta	Fragilariophyceae	Microalgae *(Fragilaria capucina var vaucheriae)*	-	4 d	Chronic	EC50 (Growth Rate/Chlorophyll-a fluorescence)	DV culture medium	-	-	44	Larras et al. (2013)
										44	*GEOMETRIC MEAN*
Bacillariophyta	Fragilariophyceae	Microalgae *(Fragilaria rumpens)*	Exponential Growth Phase	4 d	Chronic	EC05 (Cell density)	DV culture medium	21 ± 2	-	18	Larras et al. (2012)
										18	*GEOMETRIC MEAN*
Bacillariophyta	Fragilariophyceae	Microalgae *(Fragilaria rumpens)*	-	4 d	Chronic	EC10 (Growth Rate/Chlorophyll-a fluorescence)	DV culture medium	-	-	0.76	Larras et al. (2013)
Bacillariophyta	Fragilariophyceae	Microalgae *(Fragilaria rumpens)*	Exponential Growth Phase	4 d	Chronic	EC10 (Growth Rate/Chlorophyll-a fluorescence)	DV culture medium	-	-	30	Larras et al. (2013)
										4.77	*GEOMETRIC MEAN*
										4.77	***VALUE USED IN SSD***
Bacillariophyta	Fragilariophyceae	Microalgae *(Fragilaria rumpens)*	Exponential Growth Phase	4 d	Chronic	EC50 (Cell density)	DV culture medium	21 ± 2	-	122	Larras et al. (2012)
										122	*GEOMETRIC MEAN*

Bacillariophyta	Fragilariophyceae	Microalgae *(Fragilaria rumpens)*	-	4 d	Chronic	EC50 (Growth Rate/Chlorophyll-a fluorescence)	DV culture medium	-	-	8.89	Larras et al. (2013)
										8.89	*GEOMETRIC MEAN*
Bacillariophyta	Fragilariophyceae	Microalgae *(Fragilaria ulna)*	Exponential Growth Phase	4 d	Chronic	EC05 (Cell density)	DV culture medium	21 ± 2	-	12.6	Larras et al. (2012)
										12.6	*GEOMETRIC MEAN*
										12.6	***VALUE USED IN SSD***
Bacillariophyta	Fragilariophyceae	Microalgae *(Ulnaria ulna)*	-	4 d	Chronic	EC10 (Growth Rate/Chlorophyll-a fluorescence)	DV culture medium	-	-	24	Larras et al. (2013)
Bacillariophyta	Fragilariophyceae	Microalgae *(Ulnaria ulna)*	Exponential growth phase	4 d	Chronic	EC10 (Growth Rate/Chlorophyll-a fluorescence)	DV culture medium	-	-	18	Larras et al. (2013)
										20.78	*GEOMETRIC MEAN*
Bacillariophyta	Fragilariophyceae	Microalgae *(Fragilaria ulna)*	Exponential Growth Phase	4 d	Chronic	EC50 (Cell density)	DV culture medium	21 ± 2	-	51	Larras et al. (2012)
										51	*GEOMETRIC MEAN*
Bacillariophyta	Fragilariophyceae	Microalgae *(Ulnaria ulna)*	-	4 d	Chronic	EC50 (Growth Rate/Chlorophyll-a fluorescence)	DV culture medium	-	-	42	Larras et al. (2013)
										42	*GEOMETRIC MEAN*
Bacillariophyta	Bacillariophyceae	Microalgae *(Gomphonema parvulum)*	Exponential Growth Phase	4 d	Chronic	EC05 (Cell density)	DV culture medium	21 ± 2	-	904	Larras et al. (2012)
										904	*GEOMETRIC MEAN*
Bacillariophyta	Bacillariophyceae	Microalgae *(Gomphonema parvulum)*	-	4 d	Chronic	EC10 (Growth Rate/Chlorophyll-a fluorescence)	DV culture medium	-	-	53	Larras et al. (2013)
Bacillariophyta	Bacillariophyceae	Microalgae *(Gomphonema parvulum)*	Exponential Growth Phase	4 d	Chronic	EC10 (Growth Rate/Chlorophyll-a fluorescence)	DV culture medium	-	-	1016	Larras et al. (2013)
										232.05	*GEOMETRIC MEAN*

										232.05	***VALUE USED IN SSD***
Bacillariophyta	Bacillariophyceae	Microalgae *(Gomphonema parvulum)*	Exponential Growth Phase	4 d	Chronic	EC50 (Cell density)	DV culture medium	21 ± 2	-	2255	Larras et al. (2012)
										2255	*GEOMETRIC MEAN*
Bacillariophyta	Bacillariophyceae	Microalgae *(Gomphonema parvulum)*	-	4 d	Chronic	EC50 (Growth Rate/Chlorophyll-a fluorescence)	DV culture medium	-	-	1423	Larras et al. (2013)
										1423	*GEOMETRIC MEAN*
Bacillariophyta	Bacillariophyceae	Microalgae *(Mayamaea fossalis)*	Exponential Growth Phase	4 d	Chronic	EC05 (Cell density)	DV culture medium	21 ± 2	-	74	Larras et al. (2012)
										74	*GEOMETRIC MEAN*
										74	***VALUE USED IN SSD***
Bacillariophyta	Bacillariophyceae	Microalgae *(Mayamaea fossalis)*	-	4 d	Chronic	EC10 (Growth Rate/Chlorophyll-a fluorescence)	DV culture medium	-	-	91	Larras et al. (2013)
Bacillariophyta	Bacillariophyceae	Microalgae *(Mayamaea fossalis)*	Exponential Growth Phase	4 d	Chronic	EC10 (Growth Rate/Chlorophyll-a fluorescence)	DV culture medium	-	-	96	Larras et al. (2013)
										93.47	*GEOMETRIC MEAN*
Bacillariophyta	Bacillariophyceae	Microalgae *(Mayamaea fossalis)*	Exponential Growth Phase	4 d	Chronic	EC50 (Cell density)	DV culture medium	21 ± 2	-	463	Larras et al. (2012)
										463	*GEOMETRIC MEAN*
Bacillariophyta	Bacillariophyceae	Microalgae *(Mayamaea fossalis)*	-	4 d	Chronic	EC50 (Growth Rate/Chlorophyll-a fluorescence)	DV culture medium	-	-	139	Larras et al. (2013)
										139	*GEOMETRIC MEAN*
Bacillariophyta	Bacillariophyceae	Microalgae *(Nitzschia palea)*	Exponential Growth Phase	4 d	Chronic	EC05 (Cell density)	DV culture medium	21 ± 2	-	106	Larras et al. (2012)
										106	*GEOMETRIC MEAN*
										106	***VALUE USED IN***

											SSD
Bacillariophyta	Bacillariophyceae	Microalgae *(Nitzschia palea)*	-	4 d	Chronic	EC10 (Growth Rate/Chlorophyll-a fluorescence)	DV culture medium	-	-	380	Larras et al. (2013)
Bacillariophyta	Bacillariophyceae	Microalgae *(Nitzschia palea)*	Exponential Growth Phase	4 d	Chronic	EC10 (Growth Rate/Chlorophyll-a fluorescence)	DV culture medium	-	-	196	Larras et al. (2013)
										272.91	*GEOMETRIC MEAN*
Bacillariophyta	Bacillariophyceae	Microalgae *(Nitzschia palea)*	Exponential Growth Phase	4 d	Chronic	EC50 (Cell density)	DV culture medium	21 ± 2	-	1539	Larras et al. (2012)
										1539	*GEOMETRIC MEAN*
Bacillariophyta	Bacillariophyceae	Microalgae *(Nitzschia palea)*	-	4 d	Chronic	EC50 (Growth Rate/Chlorophyll-a fluorescence)	DV culture medium	-	-	1667	Larras et al. (2013)
										1667	*GEOMETRIC MEAN*
Bacillariophyta	Bacillariophyceae	Microalgae *(Sellaphora minina)*	-	4 d	Chronic	EC10 (Growth Rate/Chlorophyll-a fluorescence)	DV culture medium	-	-	693	Larras et al. (2013)
Bacillariophyta	Bacillariophyceae	Microalgae *(Sellaphora minina)*	Exponential growth phase	4 d	Chronic	EC10 (Growth Rate/Chlorophyll-a fluorescence)	DV culture medium	-	-	3218	Larras et al. (2013)
										1493	*GEOMETRIC MEAN*
										1493	***VALUE USED IN SSD***
Bacillariophyta	Bacillariophyceae	Microalgae *(Sellaphora minina)*	-	4 d	Chronic	EC50 (Growth Rate/Chlorophyll-a fluorescence)	DV culture medium	-	-	2606	Larras et al. (2013)
Bacillariophyta	Bacillariophyceae	Microalgae *(Sellaphora minina)*	Exponential growth phase	4 d	Chronic	EC50 (Growth Rate/Chlorophyll-a fluorescence)	DV culture medium	-	-	4236	Larras et al. (2013)
										3322.5	*GEOMETRIC MEAN*
Bacillariophyta	Bacillariophyceae	Microalgae *(Stauroneis amphoroides)*	-	3 d	Chronic	EC50 (Biomass Yield, Growth Rate, AUC)	ASTM Type 1 water	24 ± 2	7.5 ± 0.1	31	US EPA (2015a)

										31	*GEOMETRIC MEAN*
										31@	***VALUE USED IN SSD***
Chlorophyta	Trebouxiophyceae	Microalgae *(Chlorella pyrenoidosa)*	-	4 d	Chronic	EC50 (Cell count)	HB-4 media	25	-	2.3	Ma et al. (2002)
Chlorophyta	Trebouxiophyceae	Microalgae *(Chlorella pyrenoidosa)*	-	4 d	Chronic	EC50 (Cell count)	HB-4 media	25	-	1.3	Ma et al. (2001)
Chlorophyta	Trebouxiophyceae	Microalgae *(Chlorella vulgaris)*	-	4 d	Chronic	EC50 (Cell count)	HB-4 media	25	-	4.3	Ma et al. (2002)
										2.34	*GEOMETRIC MEAN*
										2.34@	***VALUE USED IN SSD***
Chlorophyta	Chlorophyceae	Microalgae *(Desmodesmus subspicatus)*	-	3 d	Chronic	EC50 (Cell density)	Inorganic medium containing sucrose	23 ± 2	8 ± 1	46.3	Masojidek et al. (2011)
										46.3	*GEOMETRIC MEAN*
										46.3@	***VALUE USED IN SSD***
Chlorophyta	Chlorophyceae	Microalgae *(Scenedesmus acutus)*	-	8 d	Chronic	EC50 (Cell count)	Inorganic medium	23	-	13.29	Grossmann et al. (1992)
										13.29	*GEOMETRIC MEAN*
										13.29@	***VALUE USED IN SSD***
Chlorophyta	Chlorophyceae	Microalgae *(Scenedesmus obliquus)*	-	4 d	Chronic	EC50 (Cell count)	HB-4 media	25	-	4.09	Ma (2002)
										4.09	*GEOMETRIC MEAN*
										4.09@	***VALUE USED IN SSD***
Chlorophyta	Chlorophyceae	Microalgae *(Scenedesmus quadricauda)*	-	4 d	Chronic	EC50 (Cell count)	HB-4 media	-	-	2.7	Ma et al. (2003)
										2.7	*GEOMETRIC MEAN*
										2.7@	***VALUE***

											USED IN SSD
Chlorophyta	Chlorophyceae	Microalgae *(Scenedesmus vacuolatus)*	Exponential growth phase	2 d	Chronic	EC50 (Cell density)	-	25	-	14.3	Copin and Chevre (2015)
										14.3	*GEOMETRIC MEAN*
										14.3@	***VALUE USED IN SSD***
Chlorophyta	Chlorophyceae	Microalgae *(Scenedesmus subspicatus)*	-	1 d	Acute	NOEC (Cell count)	Inorganic medium containing sucrose	20 ± 2	-	7	Schafer et al. (1994)
										7	*GEOMETRIC MEAN*
Chlorophyta	Chlorophyceae	Microalgae *(Scenedesmus subspicatus)*	-	3 d	Chronic	NOEC (Cell count)	Inorganic medium containing sucrose	20 ± 2	-	10	Schafer et al. (1994)
										10	*GEOMETRIC MEAN*
										10	***VALUE USED IN SSD***
Chlorophyta	Chlorophyceae	Microalgae *(Scenedesmus subspicatus)*	-	3 d	Chronic	EC50 (Cell count)	Inorganic medium containing sucrose	20 ± 2	-	36	Schafer et al. (1994)
										36	*GEOMETRIC MEAN*
Chlorophyta	Chlorophyceae	Microalgae *(Selenastrum capricornutum[2])*	24 hr-old culture	3 d	Chronic	IC50 (Cell density)	Inorganic medium	23	-	10.5	Fai et al. (2007)
Chlorophyta	Chlorophyceae	Microalgae *(Selenastrum capricornutum[2])*	Exponential growth phase	3 d	Chronic	EC50 (Cell density)	Distilled water and algal growth medium (algaltoxkit)	23 ± 2	8 ± 1	45	Fernandez-Alba et al. (2002a)
Chlorophyta	Chlorophyceae	Microalgae *(Pseudokirchneriel -la subcapitata[2])*	-	3 d	Chronic	EC50 (Cell density)	De-ionised water and growth medium (algaltoxkit)	23 ± 2	8.1 ± 0.2	45	Mezcua et al. (2002)
Chlorophyta	Chlorophyceae	Microalgae *(Selenastrum capricornutum[2])*	Exponential growth phase	3 d	Chronic	EC50 (Cell density)	Distilled water and algal growth medium (algaltoxkit)	23 ± 2	8 ± 1	23000	Fernandez-Alba et al. (2002a)
										148.71	*GEOMETRIC MEAN*
Chlorophyta	Chlorophyceae	Microalgae *(Pseudokirchneriel -la subcapitata[2])*	-	3 d	Chronic	LOEC (Cell density)	De-ionised water and growth medium	23 ± 2	8.1 ± 0.2	15	Mezcua et al. (2002)

							(algaltoxkit)				
Chlorophyta	Chlorophyceae	Microalgae *(Selenastrum capricornutum[2])*	Exponential growth phase	3 d	Chronic	LOEC (Cell density)	Distilled water and algal growth medium (algaltoxkit)	23 ± 2	8 ± 1	45	Fernandez-Alba et al. (2002b)
										25.98	*GEOMETRIC MEAN*
Chlorophyta	Chlorophyceae	Microalgae *(Pseudokirchneriel-la subcapitata[2])*	-	4 d	Chronic	EC50 (Cell count)	-	25 - 27	7.6–9.0	36.4	Schrader et al. (1998)
Chlorophyta	Chlorophyceae	Microalgae *(Raphidocelis subcapitata[2])*	-	4 d	Chronic	EC50 (Cell count)	HB-4 media	25	-	0.7	Ma et al. (2006)
										5.05	*GEOMETRIC MEAN*
Chlorophyta	Chlorophyceae	Microalgae *(Selenastrum capricornutum[2])*	-	4 d	Chronic	EC50 (Biomass yield, Growth rate, AUC)	ASTM Type 1 water	24 ± 2	7.5 ± 0.1	2.4	US EPA (2015a)
										2.4	*GEOMETRIC MEAN*
Chlorophyta	Chlorophyceae	Microalgae *(Selenastrum capricornutum[2])*	-	4 d	Chronic	NOEL (Biomass yield, Growth rate, AUC)	ASTM Type 1 water	24 ± 2	7.5 ± 0.1	0.44	US EPA (2015a)
										0.44	*GEOMETRIC MEAN*
										0.44	***VALUE USED IN SSD***
Chordata	Actinopterygii	Goldfish *(Carassius auratus)*	-	2 d	Acute	LC50 (Mortality)	*	*	*	5800	Nishiuchi and Hashimoto (1967)
										5800	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Grass Carp *(Ctenopharyngodo n idella)*	1+ years	1 d	Acute	LC50 (Mortality)	Dechlorinated tap water	13.5 ± 0.5	8.1	47 000	Tooby et al. (1980)
										47 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Grass Carp *(Ctenopharyngodo n idella)*	1+ years	2 d	Acute	LC50 (Mortality)	Dechlorinated tap water	13.5 ± 0.5	8.1	44 000	Tooby et al. (1980)
										44 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Grass Carp *(Ctenopharyngodo n idella)*	1+ years	4 d	Acute	LC50 (Mortality)	Dechlorinated tap water	13.5 ± 0.5	8.1	31 000	Tooby et al. (1980)
										31 000	*GEOMETRIC MEAN*

Chordata	Actinopterygii	Common Carp *(Cyprinus carpio)*	-	2 d	Acute	LC50 (Mortality)	*	*	*	3200	Nishiuchi and Hashimoto (1967)
										3200	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Common Carp *(Cyprinus carpio)*	-	4 d	Acute	LC50 (Mortality)	*	*	*	2900	Knapek and Lakota (1974)
										2900	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Bluegill Sunfish *(Lepomis macrochirus)*	-	2 d	Acute	LC50 (Mortality)	*	*	*	7400	Cope (1965)
										7400	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Bluegill Sunfish *(Lepomis macrochirus)*	-	4 d	Acute	LC50 (Mortality)	Clean surface or ground water, reconstituted water	22 ± 2	6.0–8.0	3200	US EPA (2015a)
Chordata	Actinopterygii	Bluegill Sunfish *(Lepomis macrochirus)*	-	4 d	Acute	LC50 (Mortality)	Clean surface or ground water, reconstituted water	22 ± 2	6.0–8.0	2800	US EPA (2015a)
Chordata	Actinopterygii	Bluegill Sunfish *(Lepomis macrochirus)*	-	4 d	Acute	LC50 (Mortality)	Reconstituted water	23.8	7.1	8900	Macek et al. (1969)
Chordata	Actinopterygii	Bluegill Sunfish *(Lepomis macrochirus)*	-	4 d	Acute	LC50 (Mortality)	Reconstituted water	23.8	7.1	5900	Macek et al. (1969)
Chordata	Actinopterygii	Bluegill Sunfish *(Lepomis macrochirus)*	-	4 d	Acute	LC50 (Mortality)	Reconstituted water	23.8	7.1	7600	Macek et al. (1969)
Chordata	Actinopterygii	Bluegill Sunfish *(Lepomis macrochirus)*	-	4 d	Acute	LC50 (Mortality)	Clean surface or ground water, reconstituted water	22 ± 2	6.0–8.0	84 000	US EPA (2015b)
Chordata	Actinopterygii	Bluegill Sunfish *(Lepomis macrochirus)*	-	4 d	Acute	LC50 (Mortality)	*	*	*	4000	Cope (1965)
Chordata	Actinopterygii	Bluegill Sunfish *(Lepomis macrochirus)*	-	4 d	Acute	LC50 (Mortality)	Well water, reconstitued water	18 ± 1	6.5–8.5	8200	Johnson and Finley (1980)
Chordata	Actinopterygii	Bluegill Sunfish *(Lepomis macrochirus)*	-	4 d	Acute	LC50 (Mortality)	Clean surface or ground water, reconstituted water	22 ± 2	6.0–8.0	3200	US EPA (2015b)
Chordata	Actinopterygii	Bluegill Sunfish *(Lepomis macrochirus)*	-	4 d	Acute	LC50 (Mortality)	Clean surface or ground water, reconstituted water	22 ± 2	6.0–8.0	2800	US EPA (2015b)
										6231	*GEOMETRIC MEAN*

Chordata	Actinopterygii	Striped Bass *(Morone saxatilis)*	-	2 d	Acute	LC50 (Mortality)	*	*	*	8000	Hughes (1973)
Chordata	Actinopterygii	Striped Bass *(Morone saxatilis)*	-	2 d	Acute	LC50 (Mortality)	*	*	*	500	Hughes (1973)
										2000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Striped Bass *(Morone saxatilis)*	-	72	Acute	LC50 (Mortality)	*	*	*	500	Hughes (1973)
Chordata	Actinopterygii	Striped Bass *(Morone saxatilis)*	-	72	Acute	LC50 (Mortality)	*	*	*	6000	Hughes (1973)
										1732	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Striped Bass *(Morone saxatilis)*	-	4 d	Acute	LC50 (Mortality)	*	*	*	6000	Hughes (1973)
Chordata	Actinopterygii	Striped Bass *(Morone saxatilis)*	-	4 d	Acute	LC50 (Mortality)	Distilled water	21	8.2	3100	Wellborn (1969)
Chordata	Actinopterygii	Striped Bass *(Morone saxatilis)*	-	4 d	Acute	LC50 (Mortality)	*	*	*	500	Hughes (1973)
										2103	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Cutthroat Trout *(Oncorhynchus clarkii)*	-	4 d	Acute	LC50 (Mortality)	Clean surface or ground water, reconstituted water	12 ± 2	6.0–8.0	1400	US EPA (2015a)
Chordata	Actinopterygii	Cutthroat Trout *(Oncorhynchus clarkii)*	-	4 d	Acute	LC50 (Mortality)	Well water, reconstituted water	10 ± 1	6.5–8.5	1400	Johnson and Finley (1980)
Chordata	Actinopterygii	Cutthroat Trout *(Oncorhynchus clarkii)*	-	4 d	Acute	LC50 (Mortality)	Clean surface or ground water, reconstituted water	12 ± 2	6.0–8.0	710	US EPA (2015a)
										1116	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Coho Salmon *(Oncorhynchus kisutch)*	-	2 d	Acute	LC50 (Mortality)	*	*	*	16 000	Hughes and Davis (1962)
										16 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Coho Salmon *(Oncorhynchus kisutch)*	-	4 d	Acute	LC50 (Mortality)	Clean surface or ground water, reconstituted water	12 ± 2	6.0–8.0	2400	US EPA (2015a)
										2400	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Rainbow Trout *(Oncorhynchus mykiss)*	-	4 d	Acute	LC50 (Mortality)	Clean surface or ground water, reconstituted water	12 ± 2	6.0–8.0	1950	US EPA (2015a)
Chordata	Actinopterygii	Rainbow Trout *(Oncorhynchus*	-	4 d	Acute	LC50 (Mortality)	Well water, reconstituted	13 ± 1	6.5–8.5	4900	Johnson and Finley (1980)

		mykiss)					water				
Chordata	Actinopterygii	Rainbow Trout *(Oncorhynchus mykiss)*	-	4 d	Acute	LC50 (Mortality)	Clean surface or ground water, reconstituted water	12 ± 2	6.0–8.0	19 600	US EPA (2015b)
Chordata	Actinopterygii	Rainbow Trout *(Oncorhynchus mykiss)*	-	4 d	Acute	LC50 (Mortality)	Clean surface or ground water, reconstituted water	12 ± 2	6.0–8.0	23 800	US EPA (2015b)
Chordata	Actinopterygii	Rainbow Trout *(Oncorhynchus mykiss)*	-	4 d	Acute	LC50 (Mortality)	Well water, reconstitued water	13 ± 1	6.5–8.5	16 000	Johnson and Finley (1980)
Chordata	Actinopterygii	Rainbow Trout *(Oncorhynchus mykiss)*	-	4 d	Acute	LC50 (Mortality)	Clean surface or ground water, reconstituted water	12 ± 2	6.0–8.0	16 000	US EPA (2015b)
										10 222	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Rainbow Trout *(Oncorhynchus mykiss)*	Juveniles (<24 hours after hatching)	7 d	Acute	LC50 (Mortality)	Dechlorinated tap water	20	-	74 000	Okamura et al. (2002)
										74 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Rainbow Trout *(Oncorhynchus mykiss)*	Juveniles (<24 hours after hatching)	14 d	Acute	LC50 (Mortality)	Dechlorinated tap water	20	-	15 000	Okamura et al. (2002)
										15 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Rainbow Trout *(Oncorhynchus mykiss)*	Juveniles (<24 hours after hatching)	21 d	Chronic	LC50 (Mortality)	Dechlorinated tap water	20	-	5900	Okamura et al. (2002)
										5900	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Rainbow Trout *(Oncorhynchus mykiss)*	Juveniles (<24 hours after hatching)	28 d	Chronic	LC50 (Mortality)	Dechlorinated tap water	20	-	230	Okamura et al. (2002)
										230	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Japanese Rice Fish *(Oryzias latipes)*	-	2 d	Acute	LC50 (Mortality)	*	*	*	3500	Nishiuchi and Hashimoto (1967)
										3500	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Rice Fish *(Oryzias melastigma)*	Larvae	4 d	Acute	LC50 (Mortality)	Culture medium prepared with filtered artificial	25 ± 1	8.1–8.4	7800	Bao et al. (2011)

							seawater (FAS)				
										7800	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Fathead Minnow *(Pimephales promelas)*	Adult	1 d	Acute	LC50 (Mortality)	Lake Superior water	24.3 ± 0.8	-	23 300	Call et al. (1987)
										23 300	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Fathead Minnow *(Pimephales promelas)*	Adult	2 d	Acute	LC50 (Mortality)	Lake Superior water	24.3 ± 0.8	-	19 900	Call et al. (1987)
										19 900	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Fathead Minnow *(Pimephales promelas)*	-	4 d	Acute	LC50 (Mortality)	Lake water	25 ± 1	6.5–8.0	14 200	Geiger et al. (1986)
Chordata	Actinopterygii	Fathead Minnow *(Pimephales promelas)*	Adult	4 d	Acute	LC50 (Mortality)	Lake Superior water	24.3 ± 0.8	-	14 200	Call et al. (1987)
										14 200	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Fathead Minnow *(Pimephales promelas)*	Embryo/larval	7 d	Chronic	NOAEL (Mortality)	0.45 um filtered well water	24	6.8 ± 0.1	8300	Nebeker and Schuytema (1998)
										8300	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Fathead Minnow *(Pimephales promelas)*	Embryo/larval	7 d	Chronic	LOAEL (Mortality)	0.45 um filtered well water	24	6.8 ± 0.1	15 100	Nebeker and Schuytema (1998)
										15 100	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Fathead Minnow *(Pimephales promelas)*	Embryo/larval	7 d	Chronic	LC50 (Mortality)	0.45 um filtered well water	24	6.8 ± 0.1	11 700	Nebeker and Schuytema (1998)
										11 700	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Fathead Minnow *(Pimephales promelas)*	Embryo/larval	7 d	Chronic	NOAEL (Number of eggs hatched)	0.45 um filtered well water	24	6.8 ± 0.1	31 200	Nebeker and Schuytema (1998)
										31 200	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Fathead Minnow *(Pimephales promelas)*	Embryo/larval	7 d	Chronic	NOAEL (Blotted wet weight)	0.45 um filtered well water	24	6.8 ± 0.1	15 100	Nebeker and Schuytema (1998)
										15 100	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Fathead Minnow *(Pimephales promelas)*	Embryo/larval	7 d	Chronic	NOAEL (Length)	0.45 um filtered well water	24	6.8 ± 0.1	4200	Nebeker and Schuytema (1998)

										4200	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Fathead Minnow *(Pimephales promelas)*	Embryo/larval	7 d	Chronic	LOAEL (Length)	0.45 um filtered well water	24	6.8 ± 0.1	8300	Nebeker and Schuytema (1998)
										8300	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Fathead Minnow *(Pimephales promelas)*	Adult	8 d	Acute	LC50 (Mortality)	Lake Superior water	24.3 ± 0.8	-	7700	Call et al. (1987)
										7700	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Fathead Minnow *(Pimephales promelas)*	Juveniles (1.5 months)	10 d	Acute	NOAEL (Mortality)	0.45 um filtered well water	24	6.8 ± 0.1	20 000	Nebeker and Schuytema (1998)
										20 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Fathead Minnow *(Pimephales promelas)*	Juveniles (1.5 months)	10 d	Acute	LOAEL (Mortality)	0.45 um filtered well water	24	6.8 ± 0.1	27 100	Nebeker and Schuytema (1998)
										27 100	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Fathead Minnow *(Pimephales promelas)*	Juveniles (1.5 months)	10 d	Acute	LC50 (Mortality)	0.45 um filtered well water	24	6.8 ± 0.1	27 100	Nebeker and Schuytema (1998)
										27 100	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Fathead Minnow *(Pimephales promelas)*	Juveniles (1.5 months)	10 d	Acute	NOAEL (Weight)	0.45 um filtered well water	24	6.8 ± 0.1	3400	Nebeker and Schuytema (1998)
										3400	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Fathead Minnow *(Pimephales promelas)*	Juveniles (1.5 months)	10 d	Acute	LOAEL (Weight)	0.45 um filtered well water	24	6.8 ± 0.1	3400	Nebeker and Schuytema (1998)
										3400	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Fathead Minnow *(Pimephales promelas)*	Juveniles (1.5 months)	10 d	Acute	NOAEL (Length)	0.45 um filtered well water	24	6.8 ± 0.1	3400	Nebeker and Schuytema (1998)
										3400	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Fathead Minnow *(Pimephales promelas)*	Juveniles (1.5 months)	10 d	Acute	LOAEL (Length)	0.45 um filtered well water	24	6.8 ± 0.1	3400	Nebeker and Schuytema (1998)
										3400	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Fathead Minnow *(Pimephales promelas)*	Early Life	60 d	Chronic	LOEC (Mortality)	Dilution water	25 ± 2	-	61.8	US EPA (2015a)

										61.8	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Fathead Minnow *(Pimephales promelas)*	Life Cycle	64 d	Chronic	NOEL (Mortality)	Dilution water	25 ± 2	-	26.4	US EPA (2015a)
Chordata	Actinopterygii	Fathead Minnow *(Pimephales promelas)*	Juveniles	64 d	Chronic	NOEC (Mortality)	Lake Superior water	24.3 ± 0.8	-	33.4	Call et al. (1987)
										29.69	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Fathead Minnow *(Pimephales promelas)*	Juveniles	64 d	Chronic	LOEC (Mortality)	Lake Superior water	24.3 ± 0.8	-	78	Call et al. (1987)
										78	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Fathead Minnow *(Pimephales promelas)*	Juveniles	64 d	Chronic	NOEC (Hatchlings)	Lake Superior water	24.3 ± 0.8	-	29	Call et al. (1987)
										29	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Fathead Minnow *(Pimephales promelas)*	Juveniles	64 d	Chronic	NOEC (Length)	Lake Superior water	24.3 ± 0.8	-	29	Call et al. (1987)
										29	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Fathead Minnow *(Pimephales promelas)*	Juveniles	64 d	Chronic	NOEC (Wet weight)	Lake Superior water	24.3 ± 0.8	-	29	Call et al. (1987)
										29	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Harlequin Rasbora *(Rasbora heteromorpha)*	-	2 d	Acute	LC50 (Mortality)	*	*	*	190 000	Tooby et al. (1975)
										190 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Lake Trout *(Salvelinus namaycush)*	-	4 d	Acute	LC50 (Mortality)	Clean surface or ground water, reconstituted water	12 ± 2	6.0–8.0	1200	US EPA (2015b)
Chordata	Actinopterygii	Lake Trout *(Salvelinus namaycush)*	-	4 d	Acute	LC50 (Mortality)	Well water, reconstitued water	10 ± 1	7.2–7.5	2700	Johnson and Finley (1980)
										1800	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Tench *(Tinca tinca)*	-	4 d	Acute	LC50 (Mortality)	*	*	*	15 500	Knapek and Lakota (1974)
										15 000	*GEOMETRIC MEAN*
Chordata	Amphibia	Pacific Tree Frog *(Pseudacris*	Embryo	10 d	Chronic	NOEC (Mortality)	Natural high-quality,	20	7.4	29 100	Schuytema and Nebeker

		regilla)					chlorine-free freshwater				(1998)
										29 100	*GEOMETRIC MEAN*
Chordata	Amphibia	Pacific Tree Frog *(Pseudacris regilla)*	Embryo	14 d	Chronic	NOEC (Length)	Natural high-quality, chlorine-free freshwater	20	7.4	29 100	Schuytema and Nebeker (1998)
Chordata	Amphibia	Pacific Tree Frog *(Pseudacris regilla)*	Larvae	14 d	Chronic	NOEC (Length)	Natural high-quality, chlorine-free freshwater	20	7.4	14 500	Schuytema and Nebeker (1998)
										20 541	*GEOMETRIC MEAN*
Chordata	Amphibia	Pacific Tree Frog *(Pseudacris regilla)*	Larvae	14 d	Chronic	NOEC (Wet weight)	Natural high-quality, chlorine-free freshwater	20	7.4	29 100	Schuytema and Nebeker (1998)
										29 100	*GEOMETRIC MEAN*
Chordata	Amphibia	Pacific Tree Frog *(Pseudacris regilla)*	Larvae	14 d	Chronic	NOEC (Dry weight)	Natural high-quality, chlorine-free freshwater	20	7.4	21 000	Schuytema and Nebeker (1998)
										21 000	*GEOMETRIC MEAN*
Chordata	Amphibia	Pacific Tree Frog *(Pseudacris regilla)*	Larvae	14 d	Chronic	LC50 (Mortality)	Natural high-quality, chlorine-free freshwater	20	7.4	10 800	Schuytema and Nebeker (1998)
Chordata	Amphibia	Pacific Tree Frog *(Pseudacris regilla)*	Larvae	14 d	Chronic	LC50 (Mortality)	Natural high-quality, chlorine-free freshwater	20	7.4	19 600	Schuytema and Nebeker (1998)
										14 549	*GEOMETRIC MEAN*
Chordata	Amphibia	Northern Red-legged Frog *(Rana aurora)*	Larvae	14 d	Chronic	NOEC (Wet weight)	Natural high-quality, chlorine-free freshwater	20	7.4	7600	Schuytema and Nebeker (1998)
										7600	*GEOMETRIC MEAN*
Chordata	Amphibia	Northern Red-legged Frog *(Rana aurora)*	Larvae	14 d	Chronic	LC50 (Mortality)	Natural high-quality, chlorine-free freshwater	20	7.4	22 200	Schuytema and Nebeker (1998)
										22 200	*GEOMETRIC MEAN*
Chordata	Amphibia	American Bullfrog *(Rana catesbeiana)*	Larvae	10 d	Chronic	NOEC (Dry weight)	Natural high-quality, chlorine-free	24	7.4	7600	Schuytema and Nebeker (1998)

							freshwater				
										7600	*GEOMETRIC MEAN*
Chordata	Amphibia	American Bullfrog *(Rana catesbeiana)*	Larvae	10 d	Chronic	NOEC (Wet weight)	Natural high-quality, chlorine-free freshwater	24	7.4	14 500	Schuytema and Nebeker (1998)
										14 500	*GEOMETRIC MEAN*
Chordata	Amphibia	American Bullfrog *(Rana catesbeiana)*	Larvae	10 d	Chronic	NOEC (Length)	Natural high-quality, chlorine-free freshwater	24	7.4	14 500	Schuytema and Nebeker (1998)
										14 500	*GEOMETRIC MEAN*
Chordata	Amphibia	American Bullfrog *(Rana catesbeiana)*	Larvae	10 d	Chronic	LC50 (Mortality)	Natural high-quality, chlorine-free freshwater	24	7.4	29 100	Schuytema and Nebeker (1998)
										29 100	*GEOMETRIC MEAN*
Chordata	Amphibia	American Bullfrog *(Rana catesbeiana)*	Larvae	14 d	Chronic	NOEC (Dry weight)	Natural high-quality, chlorine-free freshwater	24	7.4	14 500	Schuytema and Nebeker (1998)
										14 500	*GEOMETRIC MEAN*
Chordata	Amphibia	American Bullfrog *(Rana catesbeiana)*	Larvae	14 d	Chronic	NOEC (Length)	Natural high-quality, chlorine-free freshwater	24	7.4	14 500	Schuytema and Nebeker (1998)
										14 500	*GEOMETRIC MEAN*
Chordata	Amphibia	American Bullfrog *(Rana catesbeiana)*	Larvae	14 d	Chronic	NOEC (Wet weight)	Natural high-quality, chlorine-free freshwater	24	7.4	21 100	Schuytema and Nebeker (1998)
										21 100	*GEOMETRIC MEAN*
Chordata	Amphibia	American Bullfrog *(Rana catesbeiana)*	Larvae	14 d	Chronic	LC50 (Mortality)	Natural high-quality, chlorine-free freshwater	24	7.4	29 100	Schuytema and Nebeker (1998)
										29 100	*GEOMETRIC MEAN*
Chordata	Amphibia	American Bullfrog *(Rana catesbeiana)*	Larvae	21 d	Chronic	NOEC (Dry weight)	Natural high-quality, chlorine-free freshwater	24	7.4	7600	Schuytema and Nebeker (1998)

										7600	*GEOMETRIC MEAN*
Chordata	Amphibia	American Bullfrog *(Rana catesbeiana)*	Larvae	21 d	Chronic	NOEC (Wet weight)	Natural high-quality, chlorine-free freshwater	24	7.4	29 100	Schuytema and Nebeker (1998)
										29 100	*GEOMETRIC MEAN*
Chordata	Amphibia	American Bullfrog *(Rana catesbeiana)*	Larvae	21 d	Chronic	NOEC (Length)	Natural high-quality, chlorine-free freshwater	24	7.4	29 100	Schuytema and Nebeker (1998)
										29 100	*GEOMETRIC MEAN*
Chordata	Amphibia	American Bullfrog *(Rana catesbeiana)*	Larvae	21 d	Chronic	LC50 (Mortality)	Natural high-quality, chlorine-free freshwater	24	7.4	12 700	Schuytema and Nebeker (1998)
										12 700	*GEOMETRIC MEAN*
Chordata	Amphibia	African Clawed Frog *(Xenopus laevis)*	Embryo	4 d	Acute	NOEC (Dry weight)	Natural high-quality, chlorine-free freshwater	24	7.4	21 100	Schuytema and Nebeker (1998)
Chordata	Amphibia	African Clawed Frog *(Xenopus laevis)*	Embryo	4 d	Acute	NOEC (Dry weight)	Natural high-quality, chlorine-free freshwater	24	7.4	14 500	Schuytema and Nebeker (1998)
										17 491	*GEOMETRIC MEAN*
Chordata	Amphibia	African Clawed Frog *(Xenopus laevis)*	Embryo	4 d	Acute	NOEC (Length)	Natural high-quality, chlorine-free freshwater	24	7.4	7600	Schuytema and Nebeker (1998)
Chordata	Amphibia	African Clawed Frog *(Xenopus laevis)*	Embryo	4 d	Acute	NOEC (Length)	Natural high-quality, chlorine-free freshwater	24	7.4	14 500	Schuytema and Nebeker (1998)
										10 498	*GEOMETRIC MEAN*
Chordata	Amphibia	African Clawed Frog *(Xenopus laevis)*	Larvae	4 d	Chronic	LC50 (Mortality)	Natural high-quality, chlorine-free freshwater	24	7.4	29 100	Schuytema and Nebeker (1998)
										29 100	*GEOMETRIC MEAN*
Chordata	Amphibia	African Clawed Frog *(Xenopus laevis)*	Embryo	14 d	Chronic	NOEC (Dry weight)	Natural high-quality, chlorine-free freshwater	24	7.4	29 100	Schuytema and Nebeker (1998)

										29 100	*GEOMETRIC MEAN*
Chordata	Amphibia	African Clawed Frog *(Xenopus laevis)*	Embryo	14 d	Chronic	NOEC (Length)	Natural high-quality, chlorine-free freshwater	24	7.4	29 100	Schuytema and Nebeker (1998)
										29 100	*GEOMETRIC MEAN*
Chordata	Amphibia	African Clawed Frog *(Xenopus laevis)*	Larvae	14 d	Chronic	LC50 (Mortality)	Natural high-quality, chlorine-free freshwater	24	7.4	8100	Schuytema and Nebeker (1998)
Chordata	Amphibia	African Clawed Frog *(Xenopus laevis)*	Larvae	14 d	Chronic	LC50 (Mortality)	Natural high-quality, chlorine-free freshwater	24	7.4	14 500	Schuytema and Nebeker (1998)
										10 837	*GEOMETRIC MEAN*
Cyanobacteria	Cyanophyceae	Cyanobacteria *(Anabaena variabilis)*	-	12 d	Chronic	EC50 (Growth Rate/Chlorophyll-a fluorescence)	BG11 medium	25 ± 1	-	80	Singh et al. (2011)
										80	*GEOMETRIC MEAN*
										80[@]	***VALUE USED IN SSD***
Cyanobacteria	Cyanophyceae	Cyanobacteria *(Chroococcus minor)*	<10 days	7 d	Chronic	EC50 (Cell density)	MN medium without inoculants, 0.45 um filtered	25 ± 1	8.1–8.4	4.7	Bao et al. (2011)
										4.7	*GEOMETRIC MEAN*
										4.7	***VALUE USED IN SSD***
Mollusca	Gastropoda	Freshwater Snail *(Physa gyrina)*	15 day old young	10 d	Acute	NOAEL (Mortality)	0.45 um filtered well water	23	6.8 ± 0.1	29 100	Nebeker and Schuytema (1998)
										29 100	*GEOMETRIC MEAN*
Mollusca	Gastropoda	Freshwater Snail *(Physa gyrina)*	15 day old young	10 d	Acute	NOAEL (Blotted wet weight)	0.45 um filtered well water	23	6.8 ± 0.1	13 400	Nebeker and Schuytema (1998)
										13 400	*GEOMETRIC MEAN*
Mollusca	Gastropoda	Freshwater Snail *(Physa gyrina)*	15 day old young	10 d	Acute	LOAEL (Blotted wet weight)	0.45 um filtered well water	23	6.8 ± 0.1	22 800	Nebeker and Schuytema (1998)
										22 800	*GEOMETRIC*

											MEAN
Tracheophyta	Liliopsida	Macrophyte *(Lemna aequinoctialis)*	-	4 d	Acute	EC10 (Frond count)	0.45 mm filtered distilled water, autoclaved and Hoagland No. 2 Basal Salt Mixture	30 ± 1	6 ± 0.2	2.79	Seery et al. (in prep.)
										2.79	*GEOMETRIC MEAN*
Tracheophyta	Liliopsida	Macrophyte *(Lemna aequinoctialis)*	-	4 d	Acute	EC50 (Frond count)	0.45 mm filtered distilled water, autoclaved and Hoagland No. 2 Basal Salt Mixture	30 ± 1	6 ± 0.2	5.55	Seery et al. (in prep.)
										5.55	*GEOMETRIC MEAN*
Tracheophyta	Liliopsida	Macrophyte *(Lemna gibba)*	-	7 d	Chronic	NOEL (Total frond number/Growth rate/Mortality)	M-Hoaglands or 20X-AAP nutrient media. ASTM type 1 water	25 ± 2	4.8–5.2 (M-Hoaglands medium) and 7.5 ± 0.1 20X-AAP media).	2.49	US EPA (2015a)
										2.49	*GEOMETRIC MEAN*
										2.49	***VALUE USED IN SSD***
Tracheophyta	Liliopsida	Macrophyte *(Lemna gibba)*	-	7 d	Chronic	EC50 (Total frond number/Growth rate/Mortality)	M-Hoaglands or 20X-AAP nutrient media. ASTM type 1 water	25 ± 2	4.8–5.2 (M-Hoaglands medium) and 7.5 ± 0.1 20X-AAP media).	13	US EPA (2015a)
										13	*GEOMETRIC MEAN*
Tracheophyta	Liliopsida	Macrophyte *(Lemna minor)*	-	7 d	Chronic	LOEC (Total chlorophyll)	Mineral medium	25 ± 1	-	5	Teisseire et al. (1999)
										5	*GEOMETRIC MEAN*

										3.16[&]	***VALUE USED IN SSD***
Tracheophyta	Liliopsida	Macrophyte *(Lemna minor)*	-	7 d	Chronic	EC50 (Total chlorophyll)	Mineral medium	25 ± 1	-	25	Teisseire et al. (1999)
										25	*GEOMETRIC MEAN*
Tracheophyta	Liliopsida	Macrophyte *(Lemna minor)*	-	7 d	Chronic	EC50 (Frond count)	-	24 ± 1	6.5 ± 0.2	28.3	Gatidou et al. (2015)
										28.3	*GEOMETRIC MEAN*
Tracheophyta	Liliopsida	Macrophyte *(Lemna paucicostata)*	-	8 d	Chronic	EC50 (Frond cover area)	Inorganic medium containing sucrose	25	-	10.96	Grossmann et al. (1992)
										10.96	*GEOMETRIC MEAN*
										10.96[@]	***VALUE USED IN SSD***

* Data were obtained from the U.S. EPA (2015) Office of Pesticide Programs Database, with methods originating from various published studies which were unattainable, therefore detail of media, temperature and pH for those entries were unavailable. It is important to note that the U.S. EPA (2015) follows strict quality assurance and quality check procedures within their organisation to ensure only high quality ecotoxicology data are reported. It was therefore assumed the data were the equivalent of either high or acceptable quality and were therefore usable in the derivation of guideline values for diuron.

[1] This species has also been called *Chlorella vulgaris* and is currently called *Chlorella pyrenoidosa*.

[2] This species has also been called *Raphidocelis subcapitata* and is currently called *Pseudokirchneriella subcapitata*.

[@] Values were chronic EC/LC50 values that were converted to chronic NOEC/EC10 values by dividing by 5 (Warne, 2001).

[&] Value was the geometric mean of chronic LOEC and EC50 values that were converted to chronic NOEC/EC10 values by 2.5 and 5, respectively (Warne, 2001).

References for Table S3

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Supplementary Material

Table S4. Summary of the key characteristics of the marine diuron toxicity data (acute and chronic) for all species that passed the screening and quality assurance processes. Not all the data were used to derive the marine ecotoxicity threshold values for diuron.

Phyla/Division	**Class**	**Species[1]**	**Life stage**	**Exposure (d)**	**Test type[2]**	**Toxicity measure [b] (Endpoint)**	**Test medium**	**Salinity (‰)**	**Temp. (°C)**	**pH**	**Concentration (µg/L)**	**Reference**
Annelida	Polychaeta	Serpulid worm (*Hydroides elegans*)	Larvae	2	A	LC50 (Live animal count)	Marine water	33 ± 0.5	25 ± 1	8.1 – 8.4	16,000	Bao et al. (2011)
											16,000	*GEOMETRIC MEAN*
Arthropoda	Branchiopoda	Microinvert (*Artemia salina*)	II - III Instar	1	A	LC50 (Mortality)	Artificial seawater	35	25	Not stated	12,010	Koutsaftis and Aoyama (2007)
											12,010	*GEOMETRIC MEAN*
Arthropoda	Entognatha	Macroinvert (*Proisotoma minuta*)	60 d	7	A	LC50 (Mortality)	Artificial seawater	754 µS/cm	23	5.7	1,000	Park and Lees (2005)
											1,000	*GEOMETRIC MEAN*
Arthropoda	Malacostraca	Macroinvert (*Americamysis bahia*)	Not stated	4	A	LC50 (Mortality)	Natural or artificial filtered seawater	20 ± 3	23 ± 1	Not stated	1,100	U.S. EPA (2016)
											1,000	*GEOMETRIC MEAN*
Arthropoda	Malacostraca	Macroinvert (*Americamysis bahia*)	Not stated	4	A	NOEL (Mortality)	Natural or artificial filtered seawater	20 ± 3	23 ± 1	Not stated	600	U.S. EPA (2016)

											600	*GEOMETRIC MEAN*
Arthropoda	Malacostraca	Macroinvert (*Americamysis bahia*)	Life cycle	28	C	LOEC (Mortality)	Natural or artificial filtered seawater	20 ± 3	25 ± 2	Not stated	560	U.S. EPA (2016)
											560	*GEOMETRIC MEAN*
Arthropoda	Malacostraca	Macroinvert (*Americamysis bahia*)	Life cycle	28	Chronic	NOEL (Mortality)	Natural or artificial filtered seawater	20 ± 3	25 ± 2	Not stated	270	U.S. EPA (2016)
											270	*GEOMETRIC MEAN*
Arthropoda	Malacostraca	Microinvert (*Elasmopus rapax*)	Juvenile	4	A	LC50 (Mortality)	Marine water	33 ± 0.5	25 ± 1	8.1 – 8.4	3,000	Bao et al. (2011)
											3,000	*GEOMETRIC MEAN*
Arthropoda	Malacostraca	Macroinvert (*Penaeus aztecus*)	Juvenile	2	A	LC50 (Mortality)	Natural, filtered or artificial seawater	20 ± 3	23 ± 1	Not stated	1,000	U.S. EPA (2016)
											1,000	*GEOMETRIC MEAN*
Arthropoda	Maxillopoda	Macroinvert (*Balanus amphitrite*)	Larvae	1	A	LC50 (Mortality)	Marine water	33 ± 0.5	25 ± 1	8.1 – 8.4	21,000	Bao et al. (2011)
											21,000	*GEOMETRIC MEAN*
Arthropoda	Maxillopoda	Microinvert (*Nitocra spinipes*)	Not stated	4	A	LC50 (Mortality)	Artificial seawater	5	22 ± 2	Not stated	4,000	Karlsson et al. (2006)
											4,000	*GEOMETRIC MEAN*

Arthropoda	Maxillopoda	Microinvert (*Tigriopus japonicus*)	Adult	4	A	LC50 (Mortality)	Marine water	33 ± 0.5	25 ± 1	8.1 – 8.4	11,000	Bao et al. (2011)
											11,000	*GEOMETRIC MEAN*
Bacillariophyta	Bacillariophyc-eae	Microalgae (*Achnanthes brevipes*)	Not stated	3	C	EC50 (Biomass yield, growth rate, AUC)	Synthetic salt water or filtered natural salt water	30 ± 5	20 ± 2	8.0 ± 0.1	24	U.S. EPA (2016)
											24	*GEOMETRIC MEAN*
											4.8@	***VALUE USED IN SSD***
Bacillariophyta	Bacillariophyc-eae	Microalgae (*Amphora exigua*)	Not stated	3	C	EC50 (Biomass yield, growth rate, AUC)	Synthetic salt water or filtered natural salt water	30 ± 5	20 ± 2	8.0 ± 0.1	31	U.S. EPA (2016)
											31	*GEOMETRIC MEAN*
											6.2@	***VALUE USED IN SSD***
Bacillariophyta	Bacillariophyc-eae	Microalgae (*Entomoneis punctulata*)	Not stated	3	C	EC50 (Cell density)	Filtered seawater	30	21	8.1 – 8.4	24	Stauber et al. (2008)
											24	*GEOMETRIC MEAN*
Bacillariophyta	Bacillariophyc-eae	Microalgae (*Entomoneis punctulata*)	Not stated	3	C	LOEC (Cell density)	Filtered seawater	30	21	8.1 – 8.4	6	Stauber et al. (2008)
											6	*GEOMETRIC MEAN*

Bacillariophyta	Bacillariophyc-eae	Microalgae (*Entomoneis punctulata*)	Not stated	3	C	NOEC (Cell density)	Filtered seawater	30	21	8.1 – 8.4	2	Stauber et al. (2008)
											2	*GEOMETRIC MEAN*
											2	***VALUE USED IN SSD***
Bacillariophyta	Bacillariophyc-eae	Microalgae (*Navicula forcipata*)	Exponen tial growth phase	4	C	EC50 (Cell density)	F2 marine media	Not stated	20 ± 1	Not stated	27	Gatidou and Thomaidis (2007)
											27	*GEOMETRIC MEAN*
											5.4[@]	***VALUE USED IN SSD***
Bacillariophyta	Bacillariophyc-eae	Microalgae (*Navicula incerta*)	Not stated	3	C	EC50 (Biomass yield, growth rate, AUC)	Synthetic salt water or filtered natural salt water	Not stated	20 ± 2	8.0 ± 0.1	93	U.S. EPA (2016)
											93	*GEOMETRIC MEAN*
											18.6[@]	***VALUE USED IN SSD***
Bacillariophyta	Bacillariophyc-eae	Microalgae (*Nitzschia closterium*)	Not stated	3	C	EC50 (Cell density)	Filtered seawater	30	21	8.1 – 8.4	17	Stauber et al. (2008)
											17	*GEOMETRIC MEAN*
Bacillariophyta	Bacillariophyc-eae	Microalgae (*Nitzschia closterium*)	Not stated	3	C	LOEC (Cell density)	Filtered seawater	30	21	8.1 – 8.4	6	Stauber et al. (2008)
											6	*GEOMETRIC MEAN*

Bacillariophyta	Bacillariophyc-eae	Microalgae (*Nitzschia closterium*)	Not stated	3	C	NOEC (Cell density)	Filtered seawater	30	21	8.1 – 8.4	2	Stauber et al. (2008)
											2	*GEOMETRIC MEAN*
											2	***VALUE USED IN SSD***
Bacillariophyta	Bacillariophyc-eae	Microalgae (*Nitzschia closterium*)	Not stated	3	C	EC50 (Biomass Yield, growth Rate, AUC)	Synthetic salt water or filtered natural salt water	30 ± 5	20 ± 2	8.0 ± 0.1	50	U.S. EPA (2016)
											50	*GEOMETRIC MEAN*
Bacillariophyta	Bacillariophyta incertae sedis	Microalgae (*Phaeodactylum tricornutum*)	Not stated	3	C	IC50 (Cell density)	Seawater	30	20	8.4	20.98	Clarkson et al. (1998)
											20.98	*GEOMETRIC MEAN*
Bacillariophyta	Bacillariophyta incertae sedis	Microalgae (*Phaeodactylum tricornutum*)	Not stated	14	C	EC50 (Cell density)	Seawater	30	20	8.4	76.92	Clarkson et al. (1998)
											76.92	*GEOMETRIC MEAN*
Bacillariophyta	Bacillariophyta incertae sedis	Microalgae (*Phaeodactylum tricornutum*)	Not stated	10	C	EC50 (Biomass yield, growth rate, AUC)	Synthetic salt water or filtered natural salt water	30 ± 5	20 ± 2	8.0 ± 0.1	10	U.S. EPA (2016)
											10	*GEOMETRIC MEAN*

											2@	***VALUE USED IN SSD***
Bacillariophyta	Mediophyceae	Microalgae *(Chaetoceros gracilis)*	Not stated	3	C	IC50 (Cell number)	Provasoli medium	Not stated	25	Not stated	36	Koutsaftis and Aoyama (2006)
											36	*GEOMETRIC MEAN*
											7.2@	***VALUE USED IN SSD***
Bacillariophyta	Mediophyceae	Microalgae (*Skeletonema costatum*)	<7 days old	4	C	EC50 (Cell density)	Marine water	33 ± 0.5	25 ± 1	8.1 – 8.4	5.9	Bao et al. (2011)
											5.9	*GEOMETRIC MEAN*
											1.18@	***VALUE USED IN SSD***
Bacillariophyta	Mediophyceae	Microalgae (*Thalassiosira fluviatilis*)	Not stated	3	C	EC50 (Biomass yield, growth rate, AUC)	Synthetic natural salt water or filtered natural salt water	30 ± 5	20 ± 2	8.0 ± 0.1	95	U.S. EPA (2016)
											95	*GEOMETRIC MEAN*
											19@	***VALUE USED IN SSD***
Bacillariophyta	Mediophyceae	Microalgae (*Thalassiosira pseudonana*)	Not stated	4	C	EC50 (Cell density)	Marine water	33 ± 0.5	25 ± 1	8.1 – 8.4	4.3	Bao et al. (2011)
											4.3	*GEOMETRIC MEAN*
											0.86@	***VALUE USED IN SSD***

Chlorophyta	Chlorophyceae	Microalgae (*Dunaliella tertiolecta*)	Log growth phase	4	C	EC50 (Cell density)	F2 marine media	20	25	Not stated	9.8	DeLorenzo et al. (2011)
Chlorophyta	Chlorophyceae	Microalgae (*Dunaliella tertiolecta*)	Exponential growth phase	4	C	EC50 (Cell density)	F2 marine media	Not stated	20 ± 1	Not stated	5.9	Gatidou and Thomaidis (2007)
											7.60	*GEOMETRIC MEAN*
											1.52[@]	***VALUE USED IN SSD***
Chlorophyta	Chlorophyceae	Microalgae (*Dunaliella tertiolecta*)	Log growth phase	4	C	LOEC (Cell density)	F2 marine media	20	25	Not stated	3.8	DeLorenzo et al. (2011)
											3.8	*GEOMETRIC MEAN*
Chlorophyta	Chlorophyceae	Microalgae (*Dunaliella tertiolecta*)	Not stated	10	C	EC50 (Biomass yield, growth rate, AUC)	Synthetic natural salt water or filtered natural salt water	30 ± 5	20 ± 2	8.0 ± 0.1	20	U.S. EPA (2016)
											20	*GEOMETRIC MEAN*
Chlorophyta	Nephrophyceae	Microalgae (*Nephroselmis pyriformis*)	Not stated	3	C	EC10 (Biomass)	Filtered seawater	Not stated	24	Not stated	5.2	Magnusson et al. (2008)
											5.2	*GEOMETRIC MEAN*
Chlorophyta	Nephrophyceae	Microalgae (*Nephroselmis pyriformis*)	Not stated	3	C	EC10 (Cell density)	Filtered seawater	Not stated	24	Not stated	2.2	Magnusson et al. (2008)
											2.2	*GEOMETRIC MEAN*

											2.2	**VALUE USED IN SSD**
Chlorophyta	Nephrophyceae	Microalgae (*Nephroselmis pyriformis*)	Not stated	3	C	EC50 (Biomass)	Filtered seawater	Not stated	24	Not stated	8	Magnusson et al. (2008)
											8	*GEOMETRIC MEAN*
Chlorophyta	Nephrophyceae	Microalgae (*Nephroselmis pyriformis*)	Not stated	3	C	EC50 (Cell density)	Filtered seawater	Not stated	24	Not stated	5.8	Magnusson et al. (2008)
											5.8	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Sheepshead Minnow *(Cyprinodon variegatus)*	Not stated	4	A	NOEL (Mortality)	Seawater	20 ± 5	22 ± 2	7.5 – 8.5	3,600	U.S. EPA (2016)
											3,600	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Sheepshead Minnow *(Cyprinodon variegatus)*	Not stated	4	A	LC50 (Mortality)	Seawater	20 ± 5	22 ± 2	7.5 – 8.5	6,700	U.S. EPA (2016)
											6,700	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Sheepshead Minnow *(Cyprinodon variegatus)*	Early life	38	C	LOEC (Mortality)	Dilution water	Not stated	25 ± 2	Not stated	440	U.S. EPA (2016)
											440	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Flathead Grey Mullet (*Mugil cephalus*)	Juvenile	2	A	LC50 (Mortality)	Seawater	20 ± 5	23 ± 2	7.5 – 8.5	6,300	U.S. EPA (2016)

											6,300	*GEOMETRIC MEAN*
Chordata	Actinopterygii	White mullet (*Mugil curema*)	Not stated	2	A	LC50 (Mortality)	Not stated	Not stated	29	Not stated	6,300	Butler (1963)
											6,300	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Australasian Snapper (*Pagrus auratus*)	<2 hour fertilised eggs	1.5	A	NOEC (Hatching success)	Filtered seawater	40	24.5	Not stated	50	Gagnon and Rawson (2009)
											50	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Turbot (*Psetta maxima*)	Embryo	2	A	LC10 (Mortality)	Artificial seawater	34.2	18 ± 1	8.29 ± 0.1	*1,396*	Mhadhbi and Beiras (2012)
											1,396	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Turbot (*Psetta maxima*)	Embryo	2	A	LC50 (Mortality)	Artificial seawater	34.2	18 ± 1	8.29 ± 0.1	1,076	Mhadhbi and Beiras (2012)
											1,076	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Turbot (*Psetta maxima*)	Embryo	2	A	LOEC (Mortality)	Artificial seawater	34.2	18 ± 1	8.29 ± 0.1	1,250	Mhadhbi and Beiras (2012)
											1,250	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Turbot (*Psetta maxima*)	Embryo	2	A	NOEC (Hatching success)	Artificial seawater	34.2	18 ± 1	8.29 ± 0.1	5,000	Mhadhbi and Beiras (2012)
											5,000	*GEOMETRIC MEAN*

Chordata	Actinopterygii	Turbot (*Psetta maxima*)	Embryo	2	A	NOEC (Mortality)	Artificial seawater	34.2	18 ± 1	8.29 ± 0.1	625	Mhadhbi and Beiras (2012)
											625	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Turbot (*Psetta maxima*)	Larvae	6	A	LC10 (Mortality)	Artificial seawater	34.2	18 ± 1	8.29 ± 0.1	1,617	Mhadhbi and Beiras (2012)
											1,617	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Turbot (*Psetta maxima*)	Larvae	6	A	LC50 (Mortality)	Artificial seawater	34.2	18 ± 1	8.29 ± 0.1	7,826	Mhadhbi and Beiras (2012)
											7,826	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Turbot (*Psetta maxima*)	Larvae	6	A	LOEC (Mortality)	Artificial seawater	34.2	18 ± 1	8.29 ± 0.1	1,250	Mhadhbi and Beiras (2012)
											1,250	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Turbot (*Psetta maxima*)	Embryo	6	A	NOEC (Hatching success)	Artificial seawater	34.2	18 ± 1	8.29 ± 0.1	5,000	Mhadhbi and Beiras (2012)
											5,000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Turbot (*Psetta maxima*)	Larvae	6	A	NOEC (Mortality)	Artificial seawater	34.2	18 ± 1	8.29 ± 0.1	625	Mhadhbi and Beiras (2012)
											625	*GEOMETRIC MEAN*
Cnidaria	Anthozoa	Coral (*Acropora millepora*)	Larvae	4	A	NOEC (Fertilisati on rate)	Filtered seawater	Not stated	28	7	1,000	Negri et al. (2005)
											1,000	*GEOMETRIC MEAN*

Cnidaria	Anthozoa	Coral (*Acropora millepora*)	Larvae	4	A	NOEC (Survival)	Filtered seawater	Not stated	28	7	1,000	Negri et al. (2005)
											1,000	*GEOMETRIC MEAN*
Cnidaria	Anthozoa	Coral (*Acropora tumida*)	Larvae	1	A	LC10 (Live animal count)	Marine water	33 ± 0.5	25 ± 1	8.1 – 8.4	91	Bao et al. (2011)
											91	*GEOMETRIC MEAN*
Cnidaria	Anthozoa	Coral (*Acropora tumida*)	Larvae	1	A	LC50 (Live animal count)	Marine water	33 ± 0.5	25 ± 1	8.1 – 8.4	4,800	Bao et al. (2011)
											4,800	*GEOMETRIC MEAN*
Cnidaria	Anthozoa	Coral (*Acropora valida*)	Not stated	90	C	NOEC (Fecundity)	Unfiltered oceanic seawater	Not stated	26 - 29	7.2	0.91	Cantin et al. (2007)
											0.91	*GEOMETRIC MEAN*
Cnidaria	Anthozoa	Coral (*Acropora valida*)	Egg	90	C	NOEC (Size)	Unfiltered oceanic seawater	Not stated	26 - 29	7.2	8.8	Cantin et al. (2007)
											8.8	*GEOMETRIC MEAN*
Cnidaria	Anthozoa	Coral (*Pocillopora damicornis*)	Adult	4	A	NOEC (Survival)	Filtered seawater	Not stated	28	7	100	Negri et al. (2005)
											100	*GEOMETRIC MEAN*
Cnidaria	Anthozoa	Coral (*Pocillopora damicornis*)	Larvae	4	A	NOEC (Survival)	Filtered seawater	Not stated	28	7	1,000	Negri et al. (2005)

											1,000	*GEOMETRIC MEAN*
Echinodermata	Echinoidea	Macroinvert (*Paracentrotus lividus*)	Not stated	2	A	EC50 (Fertilisation rate)	Natural filtered seawater (FSW)	38	18 ± 1	8.0 ± 0.2	5,090	Manzo et al. (2006)
											5,090	*GEOMETRIC MEAN*
Echinodermata	Echinoidea	Macroinvert (*Paracentrotus lividus*)	Not stated	2	A	LOEC (Fertilisation rate)	Natural filtered seawater (FSW)	38	18 ± 1	8.0 ± 0.2	1,000	Manzo et al. (2006)
											1,000	*GEOMETRIC MEAN*
Echinodermata	Echinoidea	Macroinvert (*Paracentrotus lividus*)	Not stated	2	A	NOEC (Fertilisation rate)	Natural filtered seawater (FSW)	38	18 ± 1	8.0 ± 0.2	500	Manzo et al. (2006)
											500	*GEOMETRIC MEAN*
Echinodermata	Echinoidea	Macroinvert (*Paracentrotus lividus*)	Not stated	0.02	A	EC50 (Fertilisation rate)	Natural filtered seawater (FSW)	38	18 ± 1	8.0 ± 0.2	2,870	Manzo et al. (2008)
											2,870	*GEOMETRIC MEAN*
Haptophyta	Coccolithophyceae	Microalgae (*Emiliania huxleyi*)	Exponential Growth Phase	3	C	EC50 (Cell number)	Seawater	33	17	8.3 - 8.4	2.26	Devilla et al. (2005)
											2.26	*GEOMETRIC MEAN*
Haptophyta	Coccolithophyceae	Microalgae (*Emiliania huxleyi*)	Exponential	3	C	NOEC (Cell number)	Seawater	33	17	8.3 - 8.4	0.54	Devilla et al. (2005)

			Growth Phase									
											0.54	*GEOMETRIC MEAN*
											0.54	***VALUE USED IN SSD***
Haptophyta	Coccolithophy-ceae	Microalgae (*Isochrysis galbana*)	Not stated	3	C	EC10 (Cell density)	0.45 mm filtered seawater, autoclaved and f/2 Guillard's Marine	31 ± 2	29 ± 1	8.2 ± 0.2	1.09	Seery et al. (2014)
											1.09	*GEOMETRIC MEAN*
											1.09	***VALUE USED IN SSD***
Haptophyta	Coccolithophy-ceae	Microalgae (*Isochrysis galbana*)	Not stated	3	C	EC50 (Cell density)	0.45 mm filtered seawater, autoclaved and f/2 Guillard's Marine	31 ± 2	29 ± 1	8.2 ± 0.2	2.77	Seery et al. (2014)
											2.77	*GEOMETRIC MEAN*
Haptophyta	Coccolithophy-ceae	Microalgae (*Isochrysis galbana*)	Not stated	10	C	EC50 (Biomass yield, growth rate, AUC)	Synthetic salt water or filtered natural salt water	30 ± 5	20 ± 2	8.0 ± 0.1	10	U.S. EPA (2016)
											10	*GEOMETRIC MEAN*

Mollusca	Bivalvia	Macroinvert (*Crassostrea virginica*)	SPAT Juvenile	4	A	EC50 (Mortality/ Abnormal development)	Good quality unfiltered seawater (natural or artificial with food added)	>12	25	Not stated	4,800	U.S. EPA (2016)
Mollusca	Bivalvia	Macroinvert (*Crassostrea virginica*)	Embryo/ Larvae	4	A	EC50 (Mortality/ Abnormal development)	Good quality unfiltered seawater (natural or artificial with food added)	>12	25	Not stated	1,800	U.S. EPA (2016)
											2,940	*GEOMETRIC MEAN*
Mollusca	Bivalvia	Macroinvert (*Crassostrea virginica*)	SPAT Juvenile	4	A	NOEL (Mortality/ Abnormal development)	Good quality unfiltered seawater (natural or artificial with food added)	>12	25	Not stated	2,400	U.S. EPA (2016)
											2,400	*GEOMETRIC MEAN*
Mollusca	Bivalvia	Macroinvert (*Crassostrea virginica*)	Not stated	4	A	EC50 (Growth)	Not stated	25	22	Not stated	1,800	Butler (1964)
											1,800	*GEOMETRIC MEAN*

Mollusca	Bivalvia	Macroinvert (*Crassostrea gigas*)	Mature fertilised eggs	1	A	LC10 (Mortality)	Daigo's Artificial Seawater	Not stated	25	Not stated	1,000	Tsunemasa and Okamura (2011)
											1,000	*GEOMETRIC MEAN*
Mollusca	Bivalvia	Macroinvert (*Crassostrea gigas*)	Mature fertilised eggs	1	A	LC50 (Mortality)	Daigo's Artificial Seawater	Not stated	25	Not stated	1,000	Tsunemasa and Okamura (2011)
											1,000	*GEOMETRIC MEAN*
Mollusca	Bivalvia	Macroinvert (*Crassostrea gigas*)	Mature fertilised eggs	2	A	LC10 (Mortality)	Daigo's Artificial Seawater	Not stated	25	Not stated	1,000	Tsunemasa and Okamura (2011)
											1,000	*GEOMETRIC MEAN*
Mollusca	Bivalvia	Macroinvert (*Crassostrea gigas*)	Mature fertilised eggs	2	A	LC50 (Mortality)	Daigo's Artificial Seawater	Not stated	25	Not stated	1,000	Tsunemasa and Okamura (2011)
											1,000	*GEOMETRIC MEAN*
Ochrophyta	Chrysophyceae	Microalgae (*Monochrysis lutheri*)	Not stated	3	C	EC50 (Biomass yield, growth rate, AUC)	Synthetic salt water or filtered natural salt water	30 ± 5	20 ± 2	8.0 ± 0.1	18	U.S. EPA (2016)
											18	*GEOMETRIC MEAN*
											3.6[@]	***VALUE USED IN SSD***
Ochrophyta	Phaeophyceae	Macroalgae (*Hormosira banksii*)	Gametes	2	A	EC50 (Germination)	Seawater	30 - 32	21 - 22	8.0 – 8.5	4,650	Seery et al. (2006)
Ochrophyta	Phaeophyceae	Macroalgae (*Hormosira banksii*)	Not stated	2	A	EC50 (Germination)	Seawater	Not stated	18 ± 1	Not stated	6,290	Myers et al. (2006)

											5,408	*GEOMETRIC MEAN*
Ochrophyta	Phaeophyceae	Macroalgae (*Hormosira banksii*)	Not stated	2	A	EC50 (Length)	Seawater	Not stated	18 ± 1	Not stated	6,750	Myers et al. (2006)
											6,750	*GEOMETRIC MEAN*
Ochrophyta	Phaeophyceae	Macroalgae (*Saccharina japonica*)	Thalli	15	C	EC10 (Disc area)	Artificial seawater	Not stated	Not stated	8.4	3.9	Kumar et al. (2010)
											3.9	*GEOMETRIC MEAN*
Ochrophyta	Phaeophyceae	Macroalgae (*Saccharina japonica*)	Thalli	15	C	EC10 (Fresh weight)	Artificial seawater	Not stated	Not stated	8.4	2.3	Kumar et al. (2010)
											2.3	*GEOMETRIC MEAN*
											2.3	***VALUE USED IN SSD***
Ochrophyta	Phaeophyceae	Macroalgae (*Saccharina japonica*)	Thalli	15	C	EC50 (Disc area)	Artificial seawater	Not stated	Not stated	8.4	40	Kumar et al. (2010)
											40	*GEOMETRIC MEAN*
Ochrophyta	Phaeophyceae	Macroalgae (*Saccharina japonica*)	Thalli	15	C	EC50 (Fresh weight)	Artificial seawater	Not stated	Not stated	8.4	87.8	Kumar et al. (2010)
											87.8	*GEOMETRIC MEAN*
Ochrophyta	Phaeophyceae	Macroalgae (*Saccharina japonica*)	Thalli	15	C	LOEC (Fresh weight)	Artificial seawater	Not stated	Not stated	8.4	25	Kumar et al. (2010)
											25	*GEOMETRIC MEAN*

Ochrophyta	Phaeophyceae	Macroalgae (*Saccharina japonica*)	Thalli	15	C	LOEC (Growth rate - Chlorophyll a fluorescence)	Artificial seawater	Not stated	Not stated	8.4	6.25	Kumar et al. (2010)
											6.25	*GEOMETRIC MEAN*
Rhodophyta	Florideophyceae	Macroalgae (*Ceramium tenuicorne*)	Not stated	7	C	EC50 (Final length)	Artificial seawater	5	22 ± 2	Not stated	3.4	Karlsson et al. (2006)
											3.4	*GEOMETRIC MEAN*
											0.68[@]	***VALUE USED IN SSD***
Rhodophyta	Florideophyceae	Macroalgae (*Gracilaria tenuistipitata*)	Not stated	4	A	EC50 (Biomass - Fresh weight)	Filtered deep sea water and ultra-pure water	>5ppt	25	8	15	Hershner et al. (1982)
Rhodophyta	Florideophyceae	Macroalgae (*Gracilaria tenuistipitata*)	Not stated	4	A	EC50 (Biomass - Fresh weight)	Filtered deep sea water and ultra-pure water	>5ppt	25	8	20	Hershner et al. (1982)
											17.32	*GEOMETRIC MEAN*
Rhodophyta	Florideophyceae	Macroalgae (*Gracilaria tenuistipitata*)	Not stated	4	A	NOEC (Biomass - Fresh weight)	Filtered deep sea water and ultra-pure water	>5ppt	25	8	1.3	Hershner et al. (1982)

Rhodophyta	Florideophyceae	Macroalgae (*Gracilaria tenuistipitata*)	Not stated	4	A	NOEC (Biomass - Fresh weight)	Filtered deep sea water and ultra-pure water	>5ppt	25	8	2	Hershner et al. (1982)
											1.61	*GEOMETRIC MEAN*
Rhodophyta	Porphyridiophyceae	Microalgae (*Porphyridium cruentum*)	Not stated	3	C	EC50 (Biomass yield, Growth rate, AUC)	Synthetic salt water or filtered natural salt water	30 ± 5	20 ± 2	8.0 ± 0.1	24	U.S. EPA (2016)
											24	*GEOMETRIC MEAN*
											4.8[@]	***VALUE USED IN SSD***
Tracheophyta	Liliopsida	Macrophyte (*Halodule uninervis*)	Not stated	3	A	NOEC (Leaf length)	Filtered seawater	Not stated	25.8 ± 0.3	Not stated	87.8	Nebeker and Schuytema (1998)
											87.8	*GEOMETRIC MEAN*
Tracheophyta	Liliopsida	Macrophytye (*Zostera marina*)	Not stated	10	C	LOEC (Biomass - Old and new growth)	Seawater	Not stated	Not stated	Not stated	5	Chesworth et al. (2004)
											5	*GEOMETRIC MEAN*
Tracheophyta	Liliopsida	Macrophytye (*Zostera marina*)	Not stated	10	C	NOEC (Biomass - Old and new growth)	Seawater	Not stated	Not stated	Not stated	2.5	Chesworth et al. (2004)
											2.5	*GEOMETRIC MEAN*

											2.5	***VALUE USED IN SSD***
Tracheophyta	Liliopsida	Macrophytye (*Zostera muelleri*)	Not stated	3	A	NOEC (Leaf length)	Filtered seawater	Not stated	25.8 ± 0.3	Not stated	87.8	Nebeker and Schuytema (1998)
											87.8	*GEOMETRIC MEAN*

[1] Microinvert = microinvertebrate, Macroinvert = macroinvertebrate. [2] A = acute, C = chronic.

References for Table S4

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Supplementary Material

Table S5. Protective concentration values of diuron for the protection of marine ecosystems. These values are not the recommended ecotoxicity thresholds for diuron in marine ecosystems (refer to Table 5)

Diuron protective concentration values (marine)[a]	
Percent species protection	**Concentration (µg/L)**
99%	0.51
95%	0.8
90%	0.98
80%	1.2

Reliability classification[b]	
Criterion	**Result**
Sample size	7
Type of toxicity data	Chronic EC10 and NOEC data
SSD model fit	Poor
Reliability	Low

Supplementary Information

Table S6. Summary of the key characteristics of the freshwater hexazinone toxicity data (acute and chronic) that passed the screening and quality assurance processes. Not all the data were used to derive the freshwater ecotoxicity threshold values for hexazinone.

Phyla/Division	Class	Species	Life stage	Duration (d)	Test type[1]	Measure (Endpoint)	Test medium	Temp. (°C)	pH	Concentration[2] (µg/L)	Reference
Arthropoda	Branchiopoda	Freshwater Flea (*Daphnia magna*)	1st Instar	2	A	EC50 (Immob[4])	Surface/ground water, reconstituted water or dechlorinated water	20 ± 2	–	85 000	U.S. EPA (2015a)
										85 000	*GEOMETRIC MEAN*
Arthropoda	Branchiopoda	Freshwater Flea (*Daphnia magna*)	Life cycle	21	C	LOEC (Immob)	Surface/ground water, reconstituted water or dechlorinated water	20 ± 2	-	50 000	U.S. EPA (2015a)
Arthropoda	Branchiopoda	Freshwater Flea (*Daphnia magna*)	Life cycle	21	C	LOEC (Immob)	Surface/ground water, reconstituted water or dechlorinated water	20 ± 2	-	81 000	U.S. EPA (2015a)
										63 640	*GEOMETRIC MEAN*
Arthropoda	Malacostraca	Signal Crayfish (*Pacifastacus leniusculus*)	Juvenile (5th–8th stage)	1	A	LC50 (Mortality)	Freshwater	18.1–19.6	7.5–7.82	259 100	Velisek et al. (2013)
										259 100	*GEOMETRIC MEAN*
Arthropoda	Malacostraca	Signal Crayfish (*Pacifastacus leniusculus*)	Juvenile (5th–8th stage)	2	A	LC50 (Mortality)	Freshwater	18.1–19.6	7.5–7.82	71 600	Velisek et al. (2013)
										71 600	*GEOMETRIC MEAN*
Arthropoda	Malacostraca	Signal Crayfish (*Pacifastacus leniusculus*)	Juvenile (5th–8th stage)	3	A	LC50 (Mortality)	Freshwater	18.1–19.6	7.5–7.82	22 500	Velisek et al. (2013)
										22 500	*GEOMETRIC MEAN*
Arthropoda	Malacostraca	Signal Crayfish (*Pacifastacus leniusculus*)	Juvenile (5th–8th stage)	4	A	LC50 (Mortality)	Freshwater	18.1–19.6	7.5–7.82	13 900	Velisek et al. (2013)

										13 900	*GEOMETRIC MEAN*
Bacillariophyta	Bacillariophyceae	Microalgae (*Navicula pelliculosa*)	-	5	C	NOEC (Abundance)	ASTM Type I water	24 ± 2	7.5 ± 0.1	3.5	U.S. EPA (2015a)
										3.5	*GEOMETRIC MEAN*
										3.5	***VALUE USED IN SSD***
Bacillariophyta	Bacillariophyceae	Microalgae (*Navicula pelliculosa*)	-	5	C	EC50 (Abundance)	ASTM Type I water	24 ± 2	7.5 ± 0.1	12	U.S. EPA (2015a)
										12	*GEOMETRIC MEAN*
Bacillariophyta	Bacillariophyceae	Microalgae (*Navicula pelliculosa*)	-	5	C	EC50 (Biomass/growth rate/AUC)	ASTM Type I water	24 ± 2	7.5 ± 0.1	12	U.S. EPA (2015a)
										12	*GEOMETRIC MEAN*
Chlorophyta	Chlorophyceae	Microalgae (*Pseudokirchneriella subcapitata*[3])	-	4	C	EC50 (Abundance)	Freshwater	-	-	24.5	St.Laurent et al. (1992)
										24.5	*GEOMETRIC MEAN*
Chlorophyta	Chlorophyceae	Microalgae (*Pseudokirchneriella subcapitata*[3])	-	5	C	NOEC (Abundance)	ASTM Type I water	24 ± 2	7.5 ± 0.1	4	U.S. EPA (2015a)
										4	*GEOMETRIC MEAN*
										4	***VALUE USED IN SSD***
Chlorophyta	Chlorophyceae	Microalgae (*Pseudokirchneriella subcapitata*[3])	-	5	C	EC50 (Abundance)	ASTM Type I water	24 ± 2	7.5 ± 0.1	6.8	U.S. EPA (2015a)
										6.8	*GEOMETRIC MEAN*
Chlorophyta	Chlorophyceae	Microalgae (*Selenastrum capricornutum*)	-	5	C	EC50 (Biomass/growth rate/AUC)	ASTM Type I water	24 ± 2	7.5 ± 0.1	6.8	U.S. EPA (2015a)
										6.8	*GEOMETRIC MEAN*

Chordata	Actinopterygii	Bluegill (*Lepomis macrochirus*)	-	4	A	LC50 (Mortality)	Clean surface/ground water or reconstituted water	22 ±2	> 6.0 and < 8.0	100 000	U.S. EPA (2015a)
Chordata	Actinopterygii	Bluegill (*Lepomis macrochirus*)	-	4	A	LC50 (Mortality)	Clean surface/ground water or reconstituted water	22 ±2	> 6.0 and < 8.0	238 000	U.S. EPA (2015a)
Chordata	Actinopterygii	Bluegill (*Lepomis macrochirus*)	-	4	A	LC50 (Mortality)	Clean surface/ground water or reconstituted water	22 ±2	> 6.0 and < 8.0	420 000	U.S. EPA (2015a)
										215 415	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Brook Trout (*Salvelinus fontinalis*)	-	4	A	LC50 (Mortality)	Clean surface/ground water or reconstituted water	12 ±2	> 6.0 and < 8.0	100 000	U.S. EPA (2015a)
Chordata	Actinopterygii	Brook Trout (*Salvelinus fontinalis*)	-	4	A	LC50 (Mortality)	Clean surface/ground water or reconstituted water	12 ±2	> 6.0 and < 8.0	100 000	U.S. EPA (2015a)
										100 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Chinook Salmon (*Oncorhynchus tshawytscha*)	-	2	A	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	323 000	Wan et al. (1988)
										323 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Chinook Salmon (*Oncorhynchus tshawytscha*)	-	3	A	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	318 000	Wan et al. (1988)
										318 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Chinook Salmon (*Oncorhynchus tshawytscha*)	-	4	A	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	317 000	Wan et al. (1988)
										317 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Chum Salmon (*Oncorhynchus keta*)	-	2	A	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	288 000	Wan et al. (1988)
										288 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Chum Salmon (*Oncorhynchus keta*)	-	3	A	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	288 000	Wan et al. (1988)
										288 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Chum Salmon (*Oncorhynchus keta*)	-	4	A	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	285 000	Wan et al. (1988)

										285 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Coho Salmon (*Oncorhynchus kisutch*)	-	2	A	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	282 000	Wan et al. (1988)
										282 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Coho Salmon (*Oncorhynchus kisutch*)	-	3	A	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	265 000	Wan et al. (1988)
										265 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Coho Salmon (*Oncorhynchus kisutch*)	-	4	A	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	246 000	Wan et al. (1988)
										246 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Fathead Minnow (*Pimephales promelas*)	-	4	A	LC50 (Mortality)	Clean surface/ground water or reconstituted water	23 ±2	> 6.0 and < 8.0	274 000	U.S. EPA (2015a)
										274 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Fathead Minnow (*Pimephales promelas*)	Early Life	39	C	LOEC (Mortality)	Clean surface/ground water or reconstituted water	23 ±2	> 6.0 and < 8.0	35 500	U.S. EPA (2015a)
										35 500	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Japanese Eel (*Anguilla japonica*)	-	2	A	LC50 (Mortality)				75 000	Yokoyama et al. (1988)
										75 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Mozambique Tilapia (*Tilapia mossambica*)	-	2	A	LC50 (Mortality)	Freshwater			400 000	Liong et al. (1988)
										400 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Mozambique Tilapia (*Tilapia mossambica*)	-	4	A	LC50 (Mortality)	Freshwater			380 000	Liong et al. (1988)
										380 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Pink Salmon (*Oncorhynchus gorbuscha*)	-	2	A	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	280 000	Wan et al. (1988)

										280 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Pink Salmon (*Oncorhynchus gorbuscha*)	-	3	A	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	280 000	Wan et al. (1988)
										280 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Pink Salmon (*Oncorhynchus gorbuscha*)	-	4	A	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	236 000	Wan et al. (1988)
										236 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Rainbow Trout (*Oncorhynchus mykiss*)	-	2	A	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	286 000	Wan et al. (1988)
										286 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Rainbow Trout (*Oncorhynchus mykiss*)	-	3	A	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	271 000	Wan et al. (1988)
										271 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Rainbow Trout (*Oncorhynchus mykiss*)	-	4	A	LC50 (Mortality)	Clean surface/ground water or reconstituted water	12 ±2	> 6.0 and < 8.0	146 700	U.S. EPA (2015a)
Chordata	Actinopterygii	Rainbow Trout (*Oncorhynchus mykiss*)	-	4	A	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	257 000	Wan et al. (1988)
Chordata	Actinopterygii	Rainbow Trout (*Oncorhynchus mykiss*)	-	4	A	LC50 (Mortality)	Clean surface/ground water or reconstituted water	12 ±2	> 6.0 and < 8.0	420 000	U.S. EPA (2015a)
Chordata	Actinopterygii	Rainbow Trout (*Oncorhynchus mykiss*)	-	4	A	LC50 (Mortality)	Clean surface/ground water or reconstituted water	12 ±2	> 6.0 and < 8.0	180 000	U.S. EPA (2015a)
Chordata	Actinopterygii	Rainbow Trout (*Oncorhynchus mykiss*)	-	4	A	LC50 (Mortality)	Clean surface/ground water or reconstituted water	12 ±2	> 6.0 and < 8.0	180 000	U.S. EPA (2015a)
										219 802	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Sockeye Salmon (*Oncorhynchus nerka*)	-	2	A	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	974 000	Wan et al. (1988)

Chordata	Actinopterygii	Sockeye Salmon (*Oncorhynchus nerka*)	-	2	A	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	332 000	Wan et al. (1988)
										568 655	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Sockeye Salmon (*Oncorhynchus nerka*)	-	3	A	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	927 000	Wan et al. (1988)
Chordata	Actinopterygii	Sockeye Salmon (*Oncorhynchus nerka*)	-	3	A	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	318 000	Wan et al. (1988)
										542 942	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Sockeye Salmon (*Oncorhynchus nerka*)	-	4	A	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	925 000	Wan et al. (1988)
Chordata	Actinopterygii	Sockeye Salmon (*Oncorhynchus nerka*)	-	4	A	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	317 000	Wan et al. (1988)
										541 503	*GEOMETRIC MEAN*
Cyanobacteria	Cyanophyceae	Microalgae (*Anabaena flosaquae*)	-	5	C	NOEC (Abundance)	ASTM Type I water	24 ± 2	7.5 ± 0.1	150	U.S. EPA (2015a)
										150	*GEOMETRIC MEAN*
										150	***VALUE USED IN SSD***
Cyanobacteria	Cyanophyceae	Microalgae (*Anabaena flosaquae*)	-	5	C	EC50 (Abundance)	ASTM Type I water	24 ± 2	7.5 ± 0.1	210	U.S. EPA (2015a)
										210	*GEOMETRIC MEAN*
Cyanobacteria	Cyanophyceae	Microalgae (*Anabaena flosaquae*)	-	5	C	EC50 (Biomass/growth rate/AUC)	ASTM Type I water	24 ± 2	7.5 ± 0.1	210	U.S. EPA (2015a)
										210	*GEOMETRIC MEAN*
Tracheophyta	Liliopsida	Macrophyte (*Lemna aequinoctialis*)	-	4	A	EC10 (Abundance)	0.45 mm filtered distilled and autoclaved water	30 ± 1	6 ± 0.2	10.8	Seery et al. (2014)

Tracheophyta	Liliopsida	Macrophyte (*Lemna aequinoctialis*)	-	4	A	EC50 (Abundance)	0.45 mm filtered distilled and autoclaved water	30 ± 1	6 ± 0.2	37.8	Seery et al. (2014)
										20.2	*GEOMETRIC MEAN*
Tracheophyta	Liliopsida	Macrophyte (*Lemna gibba*)	-	14	C	NOEC (Abundance)	Glass-distilled, deionized water, or ASTM Type I water	25 ±2	4.8 and 5.2 for M-Hoaglan d's medium, 7.5 ± 0.1 for 20X-AAP medium	26	U.S. EPA (2015a)
Tracheophyta	Liliopsida	Macrophyte (Lemna gibba)	Not stated	14	C	EC50 (Abundance)	Glass-distilled, deionized water, or ASTM Type I water	25 ± 2	4.8–5.2 for M-	37.4	USEPA (2015b)
										31.18	*GEOMETRIC MEAN*
										8.82	***VALUE USED IN SSD***
Tracheophyta	Liliopsida	Macrophyte (*Lemna gibba*)	-	14	C	EC50 (Abundance)	Glass-distilled, deionized water, or ASTM Type I water	25 ±2	4.8–5.2 for M-Hoaglan d's medium, 7.5 ± 0.1 for 20X-AAP medium	37.4	U.S. EPA (2015a)
										37.4	*GEOMETRIC MEAN*
Tracheophyta	Liliopsida	Macrophyte (*Lemna gibba*)	-	14	C	EC50 (Immob)	Glass-distilled, deionized water, or ASTM Type I water	25 ±2	4.8–5.2 for M-Hoaglan d's medium, 7.5 ± 0.1 for 20X-AAP medium	37.4	U.S. EPA (2015a)
										37.4	*GEOMETRIC MEAN*

Tracheophyta	Liliopsida	Macrophyte (*Lemna minor*)	-	7	C	EC50 (Growth)	ASTM Type I water	25	8.07	72	Peterson et al. (1997)
										72	*GEOMETRIC MEAN*
										14.4[@]	***VALUE USED IN SSD***

[@] Values were chronic EC/LC50 values that were converted to chronic NOEC/EC10 values by dividing by 5 (Warne, 2001).

[1] A = acute, C = chronic. [2.] In calculating the geometric mean, censored (< or >) values were treated as absolute values (e.g. > 320 µg/L became 320 µg/L). [3.] Previously this species has been called *Rhaphidocelis subcapitata* and *Selenastrum caprincornutum*.[4.] Immob = immobilisation.

References for Table S6

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Supplementary Information

Table S7. Summary of the key characteristics of the freshwater hexazinone toxicity data (acute and chronic) that passed the screening and quality assurance processes. Not all the data were used to derive the marine guideline values for hexazinone.

Phyla/Division	Class	Species	Life stage	Duration	Test type	Measure (Endpoint)	Test medium	Temp. (°C)	pH	Conc'n (µg/L)	Reference
Arthropoda	Branchiopoda	Cladoceran (*Daphnia magna*)	1st Instar	2 d	Acute	EC50 (Immob)	Surface/ground water, reconstituted water or dechlorinated water	20 ± 2	-	85 000	U.S. EPA (2015a)
										85 000	*GEOMETRIC MEAN*
Arthropoda	Branchiopoda	Cladoceran (*Daphnia magna*)	Life cycle	21 d	Chronic	LOEC (Immob)	Surface/ground water, reconstituted water or dechlorinated water	20 ± 2	-	50 000	U.S. EPA (2015a)
Arthropoda	Branchiopoda	Cladoceran (*Daphnia magna*)	Life cycle	21 d	Chronic	LOEC (Immob)	Surface/ground water, reconstituted water or dechlorinated water	20 ± 2	-	81 000	U.S. EPA (2015a)
										63 640	*GEOMETRIC MEAN*
Arthropoda	Malacostraca	Signal Crayfish (*Pacifastacus leniusculus*)	Juvenile (5th–8th stage)	1 d	Acute	LC50 (Mortality)	Freshwater	18.1–19.6	7.5–7.82	259 100	Velisek et al. (2013)
										259 100	*GEOMETRIC MEAN*
Arthropoda	Malacostraca	Signal Crayfish (*Pacifastacus leniusculus*)	Juvenile (5th–8th stage)	2 d	Acute	LC50 (Mortality)	Freshwater	18.1–19.6	7.5–7.82	71 600	Velisek et al. (2013)
										71 600	*GEOMETRIC MEAN*
Arthropoda	Malacostraca	Signal Crayfish (*Pacifastacus leniusculus*)	Juvenile (5th–8th stage)	3 d	Acute	LC50 (Mortality)	Freshwater	18.1–19.6	7.5–7.82	22 500	Velisek et al. (2013)
										22 500	*GEOMETRIC MEAN*
Arthropoda	Malacostraca	Signal Crayfish (*Pacifastacus leniusculus*)	Juvenile (5th–8th stage)	4 d	Acute	LC50 (Mortality)	Freshwater	18.1–19.6	7.5–7.82	13 900	Velisek et al. (2013)
										13 900	*GEOMETRIC MEAN*
Bacillariophyta	Bacillariophyceae	Microalgae (*Navicula pelliculosa*)	-	5 d	Chronic	NOEC (Abundance)	ASTM Type I water	24 ± 2	7.5 ± 0.1	3.5	U.S. EPA (2015a)

										3.5	*GEOMETRIC MEAN*
										3.5	***VALUE USED IN SSD***
Bacillariophyta	Bacillariophyceae	Microalgae (*Navicula pelliculosa*)	-	5 d	Chronic	EC50 (Abundance)	ASTM Type I water	24 ± 2	7.5 ± 0.1	12	U.S. EPA (2015a)
										12	*GEOMETRIC MEAN*
Bacillariophyta	Bacillariophyceae	Microalgae (*Navicula pelliculosa*)	-	5 d	Chronic	EC50 (Biomass/growth rate/AUC)	ASTM Type I water	24 ± 2	7.5 ± 0.1	12	U.S. EPA (2015a)
										12	*GEOMETRIC MEAN*
Chlorophyta	Chlorophyceae	Microalgae (*Pseudokirchneriella subcapitata*[2])	-	4 d	Chronic	EC50 (Abundance)	Freshwater	-	-	24.5	St.Laurent et al. (1992)
										24.5	*GEOMETRIC MEAN*
Chlorophyta	Chlorophyceae	Microalgae (*Pseudokirchneriella subcapitata*[2])	-	5 d	Chronic	NOEC (Abundance)	ASTM Type I water	24 ± 2	7.5 ± 0.1	4	U.S. EPA (2015a)
										4	*GEOMETRIC MEAN*
										4	***VALUE USED IN SSD***
Chlorophyta	Chlorophyceae	Microalgae (*Pseudokirchneriella subcapitata*[2])	-	5 d	Chronic	EC50 (Abundance)	ASTM Type I water	24 ± 2	7.5 ± 0.1	6.8	U.S. EPA (2015a)
										6.8	*GEOMETRIC MEAN*
Chlorophyta	Chlorophyceae	Microalgae (*Selenastrum capricornutum*)	-	5 d	Chronic	EC50 (Biomass/growth rate/AUC)	ASTM Type I water	24 ± 2	7.5 ± 0.1	6.8	U.S. EPA (2015a)
										6.8	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Bluegill (*Lepomis macrochirus*)	-	4 d	Acute	LC50 (Mortality)	Clean surface/ground water or reconstituted water	22 ±2	> 6.0 and < 8.0	100 000	U.S. EPA (2015a)
Chordata	Actinopterygii	Bluegill (*Lepomis macrochirus*)	-	4 d	Acute	LC50 (Mortality)	Clean surface/ground water or reconstituted water	22 ±2	> 6.0 and < 8.0	238 000	U.S. EPA (2015a)

Chordata	Actinopterygii	Bluegill (*Lepomis macrochirus*)	-	4 d	Acute	LC50 (Mortality)	Clean surface/ground water or reconstituted water	22 ±2	> 6.0 and < 8.0	420 000	U.S. EPA (2015a)
										215 415	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Brook Trout (*Salvelinus fontinalis*)	-	4 d	Acute	LC50 (Mortality)	Clean surface/ground water or reconstituted water	12 ±2	> 6.0 and < 8.0	100 000	U.S. EPA (2015a)
Chordata	Actinopterygii	Brook Trout (*Salvelinus fontinalis*)	-	4 d	Acute	LC50 (Mortality)	Clean surface/ground water or reconstituted water	12 ±2	> 6.0 and < 8.0	100 000	U.S. EPA (2015a)
										100 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Chinook Salmon (*Oncorhynchus tshawytscha*)	-	2 d	Acute	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	323 000	Wan et al. (1988)
										323 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Chinook Salmon (*Oncorhynchus tshawytscha*)	-	3 d	Acute	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	318 000	Wan et al. (1988)
										318 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Chinook Salmon (*Oncorhynchus tshawytscha*)	-	4 d	Acute	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	317 000	Wan et al. (1988)
										317 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Chum Salmon (*Oncorhynchus keta*)	-	2 d	Acute	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	288 000	Wan et al. (1988)
										288 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Chum Salmon (*Oncorhynchus keta*)	-	3 d	Acute	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	288 000	Wan et al. (1988)
										288 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Chum Salmon (*Oncorhynchus keta*)	-	4 d	Acute	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	285 000	Wan et al. (1988)
										285 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Coho Salmon	-	2 d	Acute	LC50	Dechlorinated tap	7.5	5.6–6.0	282 000	Wan et al. (1988)

		(*Oncorhynchus kisutch*)				(Mortality)	water				
										282 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Coho Salmon (*Oncorhynchus kisutch*)	-	3 d	Acute	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	265 000	Wan et al. (1988)
										265 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Coho Salmon (*Oncorhynchus kisutch*)	-	4 d	Acute	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	246 000	Wan et al. (1988)
										246 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Fathead Minnow (*Pimephales promelas*)	-	4 d	Acute	LC50 (Mortality)	Clean surface/ground water or reconstituted water	23 ±2	> 6.0 and < 8.0	274 000	U.S. EPA (2015a)
										274 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Fathead Minnow (*Pimephales promelas*)	Early Life	39 d	Chronic	LOEC (Mortality)	Clean surface/ground water or reconstituted water	23 ±2	> 6.0 and < 8.0	35 500	U.S. EPA (2015a)
										35 500	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Japanese Eel (*Anguilla japonica*)	-	2 d	Acute	LC50 (Mortality)				75 000	Yokoyama et al. (1988)
										75 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Mozambique Tilapia (*Tilapia mossambica*)	-	2 d	Acute	LC50 (Mortality)	Freshwater			400 000	Liong et al. (1988)
										400 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Mozambique Tilapia (*Tilapia mossambica*)	-	4 d	Acute	LC50 (Mortality)	Freshwater			380 000	Liong et al. (1988)
										380 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Pink Salmon (*Oncorhynchus gorbuscha*)	-	2 d	Acute	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	280 000	Wan et al. (1988)
										280 000	*GEOMETRIC MEAN*

Chordata	Actinopterygii	Pink Salmon (*Oncorhynchus gorbuscha*)	-	3 d	Acute	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	280 000	Wan et al. (1988)
										280 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Pink Salmon (*Oncorhynchus gorbuscha*)	-	4 d	Acute	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	236 000	Wan et al. (1988)
										236 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Rainbow Trout (*Oncorhynchus mykiss*)	-	2 d	Acute	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	286 000	Wan et al. (1988)
										286 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Rainbow Trout (*Oncorhynchus mykiss*)	-	3 d	Acute	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	271 000	Wan et al. (1988)
										271 000	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Rainbow Trout (*Oncorhynchus mykiss*)	-	4 d	Acute	LC50 (Mortality)	Clean surface/ground water or reconstituted water	12 ±2	> 6.0 and < 8.0	146 700	U.S. EPA (2015a)
Chordata	Actinopterygii	Rainbow Trout (*Oncorhynchus mykiss*)	-	4 d	Acute	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	257 000	Wan et al. (1988)
Chordata	Actinopterygii	Rainbow Trout (*Oncorhynchus mykiss*)	-	4 d	Acute	LC50 (Mortality)	Clean surface/ground water or reconstituted water	12 ±2	> 6.0 and < 8.0	420 000	U.S. EPA (2015a)
Chordata	Actinopterygii	Rainbow Trout (*Oncorhynchus mykiss*)	-	4 d	Acute	LC50 (Mortality)	Clean surface/ground water or reconstituted water	12 ±2	> 6.0 and < 8.0	180 000	U.S. EPA (2015a)
Chordata	Actinopterygii	Rainbow Trout (*Oncorhynchus mykiss*)	-	4 d	Acute	LC50 (Mortality)	Clean surface/ground water or reconstituted water	12 ±2	> 6.0 and < 8.0	180 000	U.S. EPA (2015a)
										219 802	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Sockeye Salmon (*Oncorhynchus nerka*)	-	2 d	Acute	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	974 000	Wan et al. (1988)
Chordata	Actinopterygii	Sockeye Salmon (*Oncorhynchus nerka*)	-	2 d	Acute	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	332 000	Wan et al. (1988)
										568 655	*GEOMETRIC*

											MEAN
Chordata	Actinopterygii	Sockeye Salmon (*Oncorhynchus nerka*)	-	3 d	Acute	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	927 000	Wan et al. (1988)
Chordata	Actinopterygii	Sockeye Salmon (*Oncorhynchus nerka*)	-	3 d	Acute	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	318 000	Wan et al. (1988)
										542 942	*GEOMETRIC MEAN*
Chordata	Actinopterygii	Sockeye Salmon (*Oncorhynchus nerka*)	-	4 d	Acute	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	925 000	Wan et al. (1988)
Chordata	Actinopterygii	Sockeye Salmon (*Oncorhynchus nerka*)	-	4 d	Acute	LC50 (Mortality)	Dechlorinated tap water	7.5	5.6–6.0	317 000	Wan et al. (1988)
										541 503	*GEOMETRIC MEAN*
Cyanobacteria	Cyanophyceae	Microalgae (*Anabaena flosaquae*)	-	5 d	Chronic	NOEC (Abundance)	ASTM Type I water	24 ± 2	7.5 ± 0.1	150	U.S. EPA (2015a)
										150	*GEOMETRIC MEAN*
										150	***VALUE USED IN SSD***
Cyanobacteria	Cyanophyceae	Microalgae (*Anabaena flosaquae*)	-	5 d	Chronic	EC50 (Abundance)	ASTM Type I water	24 ± 2	7.5 ± 0.1	210	U.S. EPA (2015a)
										210	*GEOMETRIC MEAN*
Cyanobacteria	Cyanophyceae	Microalgae (*Anabaena flosaquae*)	-	5 d	Chronic	EC50 (Biomass/growth rate/AUC)	ASTM Type I water	24 ± 2	7.5 ± 0.1	210	U.S. EPA (2015a)
										210	*GEOMETRIC MEAN*
Tracheophyta	Liliopsida	Macrophyte (*Lemna aequinoctialis*)	-	4 d	Acute	EC10 (Abundance)	0.45 mm filtered distilled and autoclaved water	30 ± 1	6 ± 0.2	10.8	Seery et al. (2014)
Tracheophyta	Liliopsida	Macrophyte (*Lemna aequinoctialis*)	-	4 d	Acute	EC50 (Abundance)	0.45 mm filtered distilled and autoclaved water	30 ± 1	6 ± 0.2	37.8	Seery et al. (2014)
										20.2	*GEOMETRIC MEAN*

Tracheophyta	Liliopsida	Macrophyte (*Lemna gibba*)	-	14 d	Chronic	NOEC (Abundance)	Glass-distilled, deionized water, or ASTM Type I water	25 ±2	4.8 and 5.2 for M-Hoagland 's medium, 7.5 ± 0.1 for 20X-AAP medium	26	U.S. EPA (2015a)
										26	*GEOMETRIC MEAN*
										26	***VALUE USED IN SSD***
Tracheophyta	Liliopsida	Macrophyte (*Lemna gibba*)	-	14 d	Chronic	EC50 (Abundance)	Glass-distilled, deionized water, or ASTM Type I water	25 ±2	4.8 - 5.2 for M-Hoagland 's medium, 7.5 ± 0.1 for 20X-AAP medium	37.4	U.S. EPA (2015a)
										37.4	*GEOMETRIC MEAN*
Tracheophyta	Liliopsida	Macrophyte (*Lemna gibba*)	-	14 d	Chronic	EC50 (Immob)	Glass-distilled, deionized water, or ASTM Type I water	25 ±2	4.8 and 5.2 for M-Hoagland 's medium, 7.5 ± 0.1 for 20X-AAP medium	37.4	U.S. EPA (2015a)
										37.4	*GEOMETRIC MEAN*
Tracheophyta	Liliopsida	Macrophyte (*Lemna minor*)	-	7 d	Chronic	EC50 (Growth)	ASTM Type I water	25	8.07	72	Peterson et al. (1997)
										72	*GEOMETRIC MEAN*
										14.4[@]	***VALUE USED IN SSD***

[@] Values were chronic EC/LC50 values that were converted to chronic NOEC/EC10 values by dividing by 5 (Warne, 2001). [2]Previously this species has been called *Rhaphidocelis subcapitata* and *Selenastrum caprincornutum*.

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Supplementary Information

Table S8. Summary of the key characteristics of the freshwater simazine toxicity data (acute and chronic) that passed the screening and quality assurance processes. It includes both phototrophic and non-phototrophic species. Not all the data were used to derive the freshwater guideline values for simazine.

Phyla or Division	Class	Species	Life stage	Duration (d)	Test type	Measure (Endpoint)	Test medium	Temp. (°C)	pH	Concentration (µg/L)	Reference
Annelida	Clitellata	Aquatic Worm (*Branchiura sowerbyi*)	-	4 d	Acute	LC50 (Mortality)	Unchlorinated borehole water	21 ± 1.4	7.5	1 897 000	Sarkar (1997)
	Clitellata	Aquatic Worm (*Branchiura sowerbyi*)	-	4 d	Acute	LC50 (Mortality)	Unchlorinated borehole water	26 ± 1.3	7.5	1 810 000	Sarkar (1997)
	Clitellata	Aquatic Worm (*Branchiura sowerbyi*)	-	4 d	Acute	LC50 (Mortality)	Unchlorinated borehole water	31 ± 1.5	7.5	1 700 000	Sarkar (1997)
	Clitellata	Aquatic Worm (*Branchiura sowerbyi*)	-	4 d	Acute	LC50 (Mortality)	Unchlorinated borehole water	36 ± 1.4	7.5	1 090 000	Sarkar (1997)
										1 588 200	*GEOMETRIC MEAN*
Arthropoda	Malacostraca	Amphipod (*Gammarus fasciatus*)	Adult	4 d	Acute	LC50 (Mortality)	Freshwater	20 ± 2	-	100 000	U.S. EPA (2015)
										100 000	*GEOMETRIC MEAN*
	Malacostraca	Amphipod (*Gammarus lacustris*)	2 months old	4 d	Acute	LC50 (Mortality)	Freshwater	20 ± 2	-	13 000	U.S. EPA (2015)
										13 000	*GEOMETRIC MEAN*
	Malacostraca	Amphipod (*Hyalella azteca*)	2 days old	4 d	Acute	LC50 (Mortality)	Fresh well water	22–23	7.5–7.6	270 000	Wan et al. (2006)
										270 000	*GEOMETRIC MEAN*
	Malacostraca	Crayfish (*Asellus brevicaudus ie., Caecidotea brevicauda*)	-	2 d	Acute	LC50 (Mortality)	Fresh well water	22–23	7.5–7.6	100 000	U.S. EPA (2015)
										100 000	*GEOMETRIC MEAN*
	Malacostraca	Marble Crayfish (*Procambarus sp.*)	-	2 d	Acute	LC50 (Mortality)	Fresh well water	22–23	7.5–7.6	100 000	U.S. EPA (2015)
										100 000	*GEOMETRIC MEAN*
	Malacostraca	Shrimp (*Palaemonetes kadiakensis*)	-	2 d	Acute	LC50 (Mortality)	Fresh well water	22–23	7.5–7.6	100 000	U.S. EPA (2015)
										100	*GEOMETRIC MEAN*
	Insecta	Forest Mosquito (*Aedes albopictus*)	Forth instar larvae	2 d	Acute	NOEC (Mortality)	Pure water	23–25	-	40 000	Suwanchaichinda and Brattsten (2001)
										40 000	*GEOMETRIC MEAN*
	Insecta	Giant Stonefly (*Pteronarcys californica*)	-	4 d	Acute	EC50 (Mortality)	Reconstituted water or dechlorinated tap water	-	-	1900	U.S. EPA (2015)
										1900	*GEOMETRIC MEAN*
	Branchiopoda	Freshwater Water Flea (*Daphnia magna*)	< 1 day old	1 d	Acute	LC50 (Mortality)	Fresh well water	20	8.1	1 000 000	Wan et al. (2006)
										1 000 000	*GEOMETRIC MEAN*
	Branchiopoda	Freshwater Water Flea (*Daphnia magna*)	< 1 day old	2 d	Acute	LC50 (Mortality)	Fresh well water	20	8.1	1 000 000	Wan et al. (2006)
										1 000 000	*GEOMETRIC MEAN*

	Branchiopoda	Freshwater Water Flea (*Daphnia magna*)	First instar	2 d	Acute	EC50 (Mortality)	Reconstituted water or dechlorinated tap water	20 ± 2	-	1100	U.S. EPA (2015)
										1100	*GEOMETRIC MEAN*
	Branchiopoda	Freshwater Water Flea (*Daphnia magna*)	First instar	21 d	Chronic	LOEC (Mortality)	Reconstituted water or dechlorinated tap water	20 ± 2	-	2500	U.S. EPA (2015)
										2500	*GEOMETRIC MEAN*
	Malocostraca	Signal Crayfish (*Pacifastacus leniusculus*)	Juvenile	2 d	Acute	LC50 (Mortality)	Freshwater	18.1–19.6	7.50–7.82	206 300	Velisek et al. (2013)
										206 300	*GEOMETRIC MEAN*
	Malocostraca	Signal Crayfish (*Pacifastacus leniusculus*)	Juvenile	3 d	Acute	LC50 (Mortality)	Freshwater	18.1–19.6	7.50–7.82	58 700	Velisek et al. (2013)
										58 700	*GEOMETRIC MEAN*
	Malocostraca	Signal Crayfish (*Pacifastacus leniusculus*)	Juvenile	4 d	Acute	LC50 (Mortality)	Freshwater	18.1–19.6	7.50–7.82	30 600	Velisek et al. (2013)
										30 600	*GEOMETRIC MEAN*
Chlorophyta	Chlorophyceae	Microalgae (*Chlamydomonas geitleri*)	Exponential Growth Phase	3 d	Chronic	EC50 (Biomass ChlA)	Freshwater	23	7.8	901	Francois and Robinson (1990)
	Chlorophyceae	Microalgae (*Chlamydomonas geitleri*)	Exponential Growth Phase	3 d	Chronic	EC50 (Biomass ChlA)	Freshwater	23	7.8	1314	Francois and Robinson (1990)
										1088	*GEOMETRIC MEAN*
	Chlorophyceae	Microalgae (*Chlamydomonas geitleri*)	Exponential Growth Phase	3 d	Chronic	EC50 (Growth Rate)	Freshwater	23	7.8	1032	Francois and Robinson (1990)
	Chlorophyceae	Microalgae (*Chlamydomonas geitleri*)	Exponential Growth Phase	3 d	Chronic	EC50 (Growth Rate)	Freshwater	23	7.8	812	Francois and Robinson (1990)
	Chlorophyceae	Microalgae (*Chlamydomonas geitleri*)	Exponential Growth Phase	3 d	Chronic	EC50 (Growth Rate)	Freshwater	23	7.8	746	Francois and Robinson (1990)
										855	*GEOMETRIC MEAN*
										171[@]	***VALUE USED IN SSD***
	Trebouxiophyceae	Microalgae (*Chlorella vulgaris*)	-	4 d	Chronic	EC50 (Abundance)	Liquid HB-4 medium	25	-	82	Ma et al. (2001)
	Trebouxiophyceae	Microalgae (*Chlorella vulgaris*)	-	4 d	Chronic	EC50 (Abundance)	Liquid HB-4 medium	25	-	2173	Ma et al. (2002b)
										422	*GEOMETRIC MEAN*
										84.4[@]	***VALUE USED IN SSD***

	Chlorophyceae	Microalgae (*Pseudokirchneriella subcapitata*)	Exponential Growth Phase	1 d	Chronic	EC50 (Growth Rate)	Marine Biological Laboratory (MBL) medium	20 ± 2	-	392	Perez et al. (2011)
										392	*GEOMETRIC MEAN*
	Chlorophyceae	Microalgae (*Pseudokirchneriella subcapitata*)	Exponential Growth Phase	2 d	Chronic	EC50 (Growth Rate)	Marine Biological Laboratory (MBL) medium	21 ± 2	-	241	Perez et al. (2011)
										241	*GEOMETRIC MEAN*
	Chlorophyceae	Microalgae (*Pseudokirchneriella subcapitata*)	-	3 d	Chronic	EC50 (Abundance)	Culture medium	24 ± 2	6.5–8.5	297	Sbrilli et al. (2005)
	Chlorophyceae	Microalgae (*Selenastrum capricornutum*)	Exponential Growth Phase	3 d	Chronic	IC50 (Abundance)	USEPA medium	24 ± 1	7.45 ± 0.05	48	Kamaya et al. (2004)
	Chlorophyceae	Microalgae (*Selenastrum capricornutum*)	Exponential Growth Phase	3 d	Chronic	IC50 (Abundance)	USEPA medium	24 ± 1	7.45 ± 0.05	57	Kamaya et al. (2004)
	Chlorophyceae	Microalgae (*Selenastrum capricornutum*)	Exponential Growth Phase	3 d	Chronic	IC50 (Abundance)	USEPA medium	24 ± 1	7.45 ± 0.05	73	Kamaya et al. (2004)
										58.4	*GEOMETRIC MEAN*
	Chlorophyceae	Microalgae (*Pseudokirchneriella subcapitata*)	-	3 d	Chronic	NOEC (Abundance)	Culture medium	24 ± 2	6.5–8.5	100	Sbrilli et al. (2005)
										100	*GEOMETRIC MEAN*
	Chlorophyceae	Microalgae (*Pseudokirchneriella subcapitata*)	Exponential Growth Phase	3 d	Chronic	EC50 (Growth Rate)	Marine Biological Laboratory (MBL) medium	22 ± 2	-	252	Perez et al. (2011)
										252	*GEOMETRIC MEAN*
	Chlorophyceae	Microalgae (*Pseudokirchneriella subcapitata*)	Exponential Growth Phase	3 d	Chronic	LOEC (Growth Rate)	Marine Biological Laboratory (MBL) medium	23 ± 2	-	100	Perez et al. (2011)
										100	*GEOMETRIC MEAN*
	Chlorophyceae	Microalgae (*Pseudokirchneriella subcapitata*)	Exponential Growth Phase	3 d	Chronic	NOEC (Growth Rate)	Marine Biological Laboratory (MBL) medium	24 ± 2	-	32	Perez et al. (2011)
										32	*GEOMETRIC MEAN*
	Chlorophyceae	Microalgae (*Selenastrum capricornutum*)	-	3 d	Chronic	EC50 (Growth Rate)	-	26	-	220	Okamura et al. (2000)
										220	*GEOMETRIC MEAN*
	Chlorophyceae	Microalgae (*Selenastrum capricornutum*)	-	3 d	Chronic	EC50 (Cell surface area)	-	25	-	100	Okamura et al. (2000)
										100	*GEOMETRIC MEAN*
	Chlorophyceae	Microalgae (*Raphidocelis subcapitata*)	-	4 d	Chronic	EC50 (Abundance)	Liquid HB-4 medium	25	-	748	Ma et al. (2006)
										748	*GEOMETRIC MEAN*

	Chlorophyceae	Microalgae (*Selenastrum capricornutum*)	5 days old	4 d	Chronic	IC50 (Biomass ChlA)	Culture medium	20	-	78	El Jay et al. (1997)
	Chlorophyceae	Microalgae (*Selenastrum capricornutum*)	-	4 d	Chronic	EC50 (Biomass ChlA)	ASTM	25	-	1240	Fairchild et al. (1997)
										311	*GEOMETRIC MEAN*
	Chlorophyceae	Microalgae (*Selenastrum capricornutum*)	-	4 d	Chronic	NOEC (Biomass ChlA)	ASTM	25	-	600	Fairchild et al. (1997)
										600	*GEOMETRIC MEAN*
	Chlorophyceae	Microalgae (*Selenastrum capricornutum*)	-	4 d	Chronic	LOEC (Biomass ChlA)	ASTM	25	-	1200	Fairchild et al. (1997)
										1200	*GEOMETRIC MEAN*
	Chlorophyceae	Microalgae (*Selenastrum capricornutum*)	-	5 d	Chronic	EC50 (Cell Density)	Freshwater	22 ± 2	8 ± 0.1	100	U.S. EPA (2015)
										100	*GEOMETRIC MEAN*
										32[@]	***VALUE USED IN SSD***
	Chlorophyceae	Microalgae (*Scenedesmus acutus*)	-	1 d	Acute	EC50 (Reproduction)	Pure medium	28	6.7 ± 0.2	56	Faust et al. (2001)
										56	*GEOMETRIC MEAN*
	Chlorophyceae	Microalgae (*Scenedesmus acutus*)	-	1 d	Acute	NOEC (Reproduction)	Pure medium	28	6.7 ± 0.2	0.65	Faust et al. (2001)
										0.65	*GEOMETRIC MEAN*
	Chlorophyceae	Microalgae (*Scenedesmus obliquus*)	-	4 d	Chronic	EC50 (Growth Rate)	Liquid HB-4 medium	25	-	257	Ma (2002)
										257	*GEOMETRIC MEAN*
	Chlorophyceae	Microalgae (*Scenedesmus obliquus*)	Exponential Growth Phase	6 d	Chronic	IC50 (Abundance)	Complete medium	23 ± 1	7.2	1498	Chan (2005)
										1498	*GEOMETRIC MEAN*
										51.4[@]	***VALUE USED IN SSD***
	Chlorophyceae	Microalgae (*Scenedesmus quadricauda*)	-	4 d	Chronic	EC50 (Abundance)	Liquid HB-4 medium	-	-	150	Ma et al. (2003)
										150	*GEOMETRIC MEAN*
										30[@]	***VALUE USED IN SSD***
Chordata	Amphibia	American Bullfrog (*Rana catesbeiana*)	4–6 months old	1 d	Acute	LC50 (Mortality)	Fresh well water	15	7.8	2 000 000	Wan et al. (2006)
										2 000 000	*GEOMETRIC MEAN*
	Amphibia	American Bullfrog (*Rana catesbeiana*)	4–6 months old	2 d	Acute	LC50 (Mortality)	Fresh well water	15	7.8	2 000 000	Wan et al. (2006)
										2 000 000	*GEOMETRIC MEAN*
	Amphibia	American Bullfrog (*Rana catesbeiana*)	4–6 months old	3 d	Acute	LC50 (Mortality)	Fresh well water	15	7.8	2 000 000	Wan et al. (2006)
										2 000 000	*GEOMETRIC MEAN*

	Amphibia	American Bullfrog (*Rana catesbeiana*)	4–6 months old	4 d	Acute	LC50 (Mortality)	Fresh well water	15	7.8	1 780 000	Wan et al. (2006)
										1 780 000	*GEOMETRIC MEAN*
	Actinopterygii	Bluegill (*Lepomis macrochirus*)	1.0 g	4 d	Acute	LC50 (Mortality)	Freshwater	22 ± 2	8 ± 0.1	100 000	U.S. EPA (2015)
										100 000	*GEOMETRIC MEAN*
	Actinopterygii	Bluegill (*Lepomis macrochirus*)	Juvenile	4 d	Acute	LC50 (Mortality)	Freshwater	22 ± 2	8 ± 0.1	16	U.S. EPA (2015)
										16	*GEOMETRIC MEAN*
	Actinopterygii	Bluegill (*Lepomis macrochirus*)	-	1 yr	Chronic	LOEC (Mortality)	Freshwater	22 ± 2	8 ± 0.1	2500	U.S. EPA (2015)
										2500	*GEOMETRIC MEAN*
	Actinopterygii	Bluegill (*Lepomis macrochirus*)	5–10 g	4 d	Acute	LC50 (Mortality)	Freshwater	22 ± 2	8 ± 0.1	35 000	U.S. EPA (2015)
										35 000	*GEOMETRIC MEAN*
	Actinopterygii	Bluntnose Minnow (*Pimephales notatus*)	-	4 d	Acute	LC50 (Mortality)	Freshwater	-	8 ± 0.1	66 000	U.S. EPA (2015)
										66 000	*GEOMETRIC MEAN*
	Actinopterygii	Channel Catfish (*Ictalurus punctatus*)	5–10 g	4 d	Acute	LC50 (Mortality)	Freshwater	22 ± 2	8 ± 0.1	85 000	U.S. EPA (2015)
										85 000	*GEOMETRIC MEAN*
	Actinopterygii	Chinook Salmon (*Oncorhynchus tshawytscha*)	4–5 months old	1 d	Acute	LC50 (Mortality)	Fresh well water	15	7.6	1 180 000	Wan et al. (2006)
										1 180 000	*GEOMETRIC MEAN*
	Actinopterygii	Chinook Salmon (*Oncorhynchus tshawytscha*)	4–5 months old	2 d	Acute	LC50 (Mortality)	Fresh well water	15	7.6	1 020 000	Wan et al. (2006)
										1 020 000	*GEOMETRIC MEAN*
	Actinopterygii	Chinook Salmon (*Oncorhynchus tshawytscha*)	4–5 months old	3 d	Acute	LC50 (Mortality)	Fresh well water	15	7.6	930 000	Wan et al. (2006)
										930 000	*GEOMETRIC MEAN*
	Actinopterygii	Chinook Salmon (*Oncorhynchus tshawytscha*)	4–5 months old	4 d	Acute	LC50 (Mortality)	Fresh well water	15	7.6	910 000	Wan et al. (2006)
										910 000	*GEOMETRIC MEAN*
	Actinopterygii	Coho Salmon (*Oncorhynchus kisutch*)	2 month	1 d	Acute	LC50 (Mortality)	Fresh well water	15	7.7	390 000	Wan et al. (2006)
										390 000	*GEOMETRIC MEAN*
	Actinopterygii	Coho Salmon (*Oncorhynchus kisutch*)	2 month	2 d	Acute	LC50 (Mortality)	Fresh well water	15	7.7	330 000	Wan et al. (2006)
										330 000	*GEOMETRIC MEAN*
	Actinopterygii	Coho Salmon (*Oncorhynchus kisutch*)	2 month	3 d	Acute	LC50 (Mortality)	Fresh well water	15	7.7	330 000	Wan et al. (2006)
										330 000	*GEOMETRIC MEAN*
	Actinopterygii	Coho Salmon (*Oncorhynchus kisutch*)	2 month	4 d	Acute	LC50 (Mortality)	Fresh well water	15	7.7	330 000	Wan et al. (2006)
										330 000	*GEOMETRIC MEAN*

	Actinopterygii	Common Carp (*Cyprinus carpio*)	1 year old	60 d	Chronic	NOEC (Mortality)	Freshwater	18.3 ± 1.5	7.6 ± 0.3	4000	Velisek et al. (2012)
										4000	*GEOMETRIC MEAN*
	Actinopterygii	Common Carp (*Cyprinus carpio*)	Adult	90 d	Chronic	EC2.71 (Height)	Filtered tap water	21.93 ± 2.08	7.81 ± 0.26	45	Oropesa et al. (2009b)
										45	*GEOMETRIC MEAN*
	Actinopterygii	Common Carp (*Cyprinus carpio*)	Adult	90 d	Chronic	EC2.52 (Length)	Filtered tap water	21.93 ± 2.08	7.81 ± 0.26	45	Oropesa et al. (2009b)
										45	*GEOMETRIC MEAN*
	Actinopterygii	Common Carp (*Cyprinus carpio*)	1 year old	90 d	Chronic	NOEC (Length)	Freshwater	18.3 ± 1.5	7.6 ± 0.3	4	Velisek et al. (2012)
										4	*GEOMETRIC MEAN*
	Actinopterygii	Common Carp (*Cyprinus carpio*)	Adult	90 d	Chronic	EC6.99 (Weight)	Filtered tap water	21.93 ± 2.08	7.81 ± 0.26	45	Oropesa et al. (2009b)
										45	*GEOMETRIC MEAN*
	Actinopterygii	Common Carp (*Cyprinus carpio*)	1 year old	90 d	Chronic	NOEC (Weight)	Freshwater	18.3 ± 1.5	7.6 ± 0.3	4	Velisek et al. (2012)
										4	*GEOMETRIC MEAN*
	Actinopterygii	Common Carp (*Cyprinus carpio*)	Adult	90 d	Chronic	NOEC (Mortality)	Filtered tap water	21.93 ± 2.08	7.81 ± 0.26	45	Oropesa et al. (2009a)
	Actinopterygii	Common Carp (*Cyprinus carpio*)	Adult	90 d	Chronic	NOEC (Mortality)	Filtered tap water	21.93 ± 2.08	7.81 ± 0.26	45	Oropesa et al. (2009b)
	Actinopterygii	Common Carp (*Cyprinus carpio*)	1 year old	90 d	Chronic	NOEC (Mortality)	Freshwater	18.3 ± 1.5	7.6 ± 0.3	4	Velisek et al. (2012)
										13.4	*GEOMETRIC MEAN*
	Actinopterygii	Emerald Shiner (*Notropis atherinoides*)	-	4 d	Acute	LC50 (Mortality)	Freshwater	-	8 ± 0.1	18	U.S. EPA (2015)
										18	*GEOMETRIC MEAN*
	Actinopterygii	Fathead Minnow (*Pimephales promelas*)	1.5 g	4 d	Acute	LC50 (Mortality)	Freshwater	23 ± 2	8 ± 0.1	6400	U.S. EPA (2015)
										6400	*GEOMETRIC MEAN*
	Actinopterygii	Fathead Minnow (*Pimephales promelas*)	0.7 g	4 d	Acute	LC50 (Mortality)	Freshwater	23 ± 2	8 ± 0.1	510 000	U.S. EPA (2015)
	Actinopterygii	Fathead Minnow (*Pimephales promelas*)	0.7 g	4 d	Acute	LC50 (Mortality)	Freshwater	23 ± 2	8 ± 0.1	5000	U.S. EPA (2015)
	Actinopterygii	Fathead Minnow (*Pimephales promelas*)	0.7 g	4 d	Acute	LC50 (Mortality)	Freshwater	23 ± 2	8 ± 0.1	100 000	U.S. EPA (2015)
										6341.3	*GEOMETRIC MEAN*
	Actinopterygii	Fathead Minnow (*Pimephales promelas*)	Early life	120 d	Chronic	LOEC (Mortality)	Freshwater	23 ± 2	8 ± 0.1	2500	U.S. EPA (2015)
										2500	*GEOMETRIC MEAN*
	Actinopterygii	Goldfish (*Carassius auratus*)	0.7 g	4 d	Acute	LC50 (Mortality)	Freshwater	22 ± 2	8 ± 0.1	32 000	U.S. EPA (2015)
										32 000	*GEOMETRIC MEAN*
	Actinopterygii	Goldfish (*Carassius auratus*)	-	1 yr	Chronic	LOEL (Mortality)	Freshwater	22 ± 2	8 ± 0.1	2500	U.S. EPA (2015)
										2500	*GEOMETRIC MEAN*
	Actinopterygii	Largemouth Bass (*Micropterus salmoides*)	5–10 g	4 d	Acute	LC50 (Mortality)	Freshwater	-	8 ± 0.1	46 000	U.S. EPA (2015)
										46 000	*GEOMETRIC MEAN*

	Actinopterygii	Striped Bass (*Morone saxatilis*)	63 mm	4 d	Acute	LC50 (Mortality)	Freshwater	-	8 ± 0.1	3000	U.S. EPA (2015)
										3000	*GEOMETRIC MEAN*
	Actinopterygii	Mrigal Carp (*Cirrhinus mrigala*)	Fry	4 d	Acute	LC50 (Mortality)	Unchlorinated borehole water	21 ± 1.4	7.5	840 000	Sarkar (1997)
	Actinopterygii	Mrigal Carp (*Cirrhinus mrigala*)	Fry	4 d	Acute	LC50 (Mortality)	Unchlorinated borehole water	26 ± 1.3	7.5	800 000	Sarkar (1997)
	Actinopterygii	Mrigal Carp (*Cirrhinus mrigala*)	Fry	4 d	Acute	LC50 (Mortality)	Unchlorinated borehole water	31 ± 1.5	7.5	765 000	Sarkar (1997)
	Actinopterygii	Mrigal Carp (*Cirrhinus mrigala*)	Fry	4 d	Acute	LC50 (Mortality)	Unchlorinated borehole water	36 ± 1.4	7.5	608 000	Sarkar (1997)
	Actinopterygii	Mrigal Carp (*Cirrhinus mrigala*)	Fingerlings	4 d	Acute	LC50 (Mortality)	Unchlorinated borehole water	21 ± 1.4	7.5	1 100 000	Sarkar (1997)
	Actinopterygii	Mrigal Carp (*Cirrhinus mrigala*)	Fingerlings	4 d	Acute	LC50 (Mortality)	Unchlorinated borehole water	26 ± 1.3	7.5	1 050 000	Sarkar (1997)
	Actinopterygii	Mrigal Carp (*Cirrhinus mrigala*)	Fingerlings	4 d	Acute	LC50 (Mortality)	Unchlorinated borehole water	31 ± 1.5	7.5	895 000	Sarkar (1997)
	Actinopterygii	Mrigal Carp (*Cirrhinus mrigala*)	Fingerlings	4 d	Acute	LC50 (Mortality)	Unchlorinated borehole water	36 ± 1.4	7.5	635 000	Sarkar (1997)
										820 378	*GEOMETRIC MEAN*
	Actinopterygii	Pumpkinseed (*Lepomis gibbosus*)	5–10 g	4 d	Acute	LC50 (Mortality)	Freshwater	-	8 ± 0.1	27 000	U.S. EPA (2015)
										27 000	*GEOMETRIC MEAN*
	Actinopterygii	Rainbow Trout (*Oncorhynchus mykiss*)	1 month old	1 d	Acute	LC50 (Mortality)	Fresh well water	15	7.7	360 000	Wan et al. (2006)
										360 000	*GEOMETRIC MEAN*
	Actinopterygii	Rainbow Trout (*Oncorhynchus mykiss*)	1 month old	2 d	Acute	LC50 (Mortality)	Fresh well water	15	7.7	350 000	Wan et al. (2006)
										350 000	*GEOMETRIC MEAN*
	Actinopterygii	Rainbow Trout (*Oncorhynchus mykiss*)	1 month old	3 d	Acute	LC50 (Mortality)	Fresh well water	15	7.7	330 000	Wan et al. (2006)
										330 000	*GEOMETRIC MEAN*
	Actinopterygii	Rainbow Trout (*Oncorhynchus mykiss*)	1 month old	4 d	Acute	LC50 (Mortality)	Fresh well water	15	7.7	330 000	Wan et al. (2006)
										330 000	*GEOMETRIC MEAN*
	Actinopterygii	Rainbow Trout (*Oncorhynchus mykiss*)	0.9 g	4 d	Acute	LC50 (Mortality)	Freshwater	12 ± 2.0	8 ± 0.1	60 000	U.S. EPA (2015)
										60 000	*GEOMETRIC MEAN*
	Actinopterygii	Rainbow Trout (*Oncorhynchus mykiss*)	0.6 g	4 d	Acute	LC50 (Mortality)	Freshwater	12 ± 2.0	8 ± 0.1	44 600	U.S. EPA (2015)
	Actinopterygii	Rainbow Trout (*Oncorhynchus mykiss*)	0.6 g	4 d	Acute	LC50 (Mortality)	Freshwater	12 ± 2.0	8 ± 0.1	40 500	U.S. EPA (2015)
										42 500	*GEOMETRIC MEAN*
	Actinopterygii	Rainbow Trout (*Oncorhynchus mykiss*)	Juvenile	4 d	Acute	LC50 (Mortality)	Freshwater	12 ± 2.0	8 ± 0.1	14 100	U.S. EPA (2015)
										14 100	*GEOMETRIC MEAN*
	Actinopterygii	Rainbow Trout (*Oncorhynchus mykiss*)	0.87 g	4 d	Acute	LC50 (Mortality)	Freshwater	12 ± 2.0	8 ± 0.1	16 400	U.S. EPA (2015)

										16 400	*GEOMETRIC MEAN*
	Actinopterygii	Rainbow Trout (*Oncorhynchus mykiss*)	1.0 g	4 d	Acute	LC50 (Mortality)	Freshwater	12 ± 2.0	8 ± 0.1	2000	U.S. EPA (2015)
										2000	*GEOMETRIC MEAN*
	Actinopterygii	Rainbow Trout (*Oncorhynchus mykiss*)	1.2 g	4 d	Acute	LC50 (Mortality)	Freshwater	12 ± 2.0	8 ± 0.1	20 000	U.S. EPA (2015)
										20 000	*GEOMETRIC MEAN*
	Actinopterygii	Rainbow Trout (*Oncorhynchus mykiss*)	25–40 g	28 d	Chronic	LC50 (Mortality)	Freshwater	12 ± 2.0	8 ± 0.1	500	U.S. EPA (2015)
										500	*GEOMETRIC MEAN*
Cyanobacter-ia	Cyanophyceae	Microalgae (*Anabaena flosaquae*)	-	5 d	Chronic	EC50 (Cell Density)	Algal nutrient medium	20 – 24 ± 2	Same as media	36	U.S. EPA (2015)
										36	*GEOMETRIC MEAN*
										7.2#	***VALUE USED IN SSD***
Mollusca	Gastropoda	Snail (*Viviparus bengalensis*)	-	4 d	Acute	LC50 (Mortality)	Unchlorinated borehole water	21 ± 1.4	7.5	2 280 000	Sarkar (1997)
	Gastropoda	Snail (*Viviparus bengalensis*)	-	4 d	Acute	LC50 (Mortality)	Unchlorinated borehole water	26 ± 1.3	7.5	2 070 000	Sarkar (1997)
	Gastropoda	Snail (*Viviparus bengalensis*)	-	4 d	Acute	LC50 (Mortality)	Unchlorinated borehole water	31 ± 1.5	7.5	1 676 000	Sarkar (1997)
	Gastropoda	Snail (*Viviparus bengalensis*)	-	4 d	Acute	LC50 (Mortality)	Unchlorinated borehole water	36 ± 1.4	7.5	986 000	Sarkar (1997)
										1 671 144	*GEOMETRIC MEAN*
Ochrophyta	Bacillariophyc-eae	Freshwater Diatom (*Navicula pelliculosa*)	-	5 d	Chronic	EC50 (Cell Density)	Algal nutrient medium	20 – 24 ± 2	Same as media	90	U.S. EPA (2015)
										90	*GEOMETRIC MEAN*
										18#	***VALUE USED IN SSD***
Tracheophyta	Liliopsida	Aquatic Macrophyte (*Acorus gramineus*)	-	7 d	Chronic	LOEC (Fresh Weight)	Hoagslands Nutrient Solution	25 ± 2	-	300	Wilson et al. (2000b)
										300	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Acorus gramineus*)	-	7 d	Chronic	NOEC (Fresh Weight)	Hoagslands Nutrient Solution	25 ± 2	-	100	Wilson et al. (2000b)
										100	*GEOMETRIC MEAN*
										100	***VALUE USED IN SSD***
	Liliopsida	Aquatic Macrophyte (*Elodea canadensis*)	-	14 d	Chronic	NOEC (Dry Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	8470	Vervliet-Scheebaum et al. (2010)
										8470	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Elodea canadensis*)	-	14 d	Chronic	NOEC (Fresh Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	8470	Vervliet-Scheebaum et al. (2010)
										8470	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Elodea canadensis*)	-	14 d	Chronic	LOEC (Length)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	8470	Vervliet-Scheebaum et al. (2010)
										8470	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Elodea canadensis*)	-	14 d	Chronic	NOEC (Length)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	1110	Vervliet-Scheebaum et al. (2010)
										1110	*GEOMETRIC MEAN*

	Liliopsida	Aquatic Macrophyte (*Elodea canadensis*)	-	14 d	Chronic	LOEC (Number of Shoots)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	8470	Vervliet-Scheebaum et al. (2010)
										8470	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Elodea canadensis*)	-	14 d	Chronic	NOEC (Number of Shoots)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	1110	Vervliet-Scheebaum et al. (2010)
										1110	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Elodea canadensis*)	-	28 d	Chronic	LOEC (Dry Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	1110	Vervliet-Scheebaum et al. (2010)
										1110	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Elodea canadensis*)	-	28 d	Chronic	NOEC (Dry Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	83	Vervliet-Scheebaum et al. (2010)
										83	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Elodea canadensis*)	-	28 d	Chronic	LOEC (Fresh Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	1110	Vervliet-Scheebaum et al. (2010)
										1110	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Elodea canadensis*)	-	28 d	Chronic	NOEC (Fresh Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	83	Vervliet-Scheebaum et al. (2010)
										83	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Elodea canadensis*)	-	28 d	Chronic	LOEC (Length)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	83	Vervliet-Scheebaum et al. (2010)
										83	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Elodea canadensis*)	-	28 d	Chronic	NOEC (Length)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	<83	Vervliet-Scheebaum et al. (2010)
										<83	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Elodea canadensis*)	-	28 d	Chronic	LOEC (Number of Shoots)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	1110	Vervliet-Scheebaum et al. (2010)
										1110	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Elodea canadensis*)	-	28 d	Chronic	NOEC (Number of Shoots)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	83	Vervliet-Scheebaum et al. (2010)
										83	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Elodea canadensis*)	-	56 d	Chronic	LOEC (Dry Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	1110	Vervliet-Scheebaum et al. (2010)
										1110	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Elodea canadensis*)	-	56 d	Chronic	NOEC (Dry Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	83	Vervliet-Scheebaum et al. (2010)
										83	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Elodea canadensis*)	-	56 d	Chronic	LOEC (Fresh Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	1110	Vervliet-Scheebaum et al. (2010)
										1110	*GEOMETRIC MEAN*

	Liliopsida	Aquatic Macrophyte (*Elodea canadensis*)	-	56	Chronic	NOEC (Fresh Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	83	Vervliet-Scheebaum et al. (2010)
										83	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Elodea canadensis*)	-	56 d	Chronic	LOEC (Length)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	1110	Vervliet-Scheebaum et al. (2010)
										1110	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Elodea canadensis*)	-	56 d	Chronic	NOEC (Length)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	83	Vervliet-Scheebaum et al. (2010)
										83	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Elodea canadensis*)	-	56 d	Chronic	NOEC (Number of Shoots)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	1110	Vervliet-Scheebaum et al. (2010)
										1110	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Elodea canadensis*)	-	84 d	Chronic	NOEC (Dry Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	1110	Vervliet-Scheebaum et al. (2010)
										1110	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Elodea canadensis*)	-	84 d	Chronic	LOEC (Fresh Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	1110	Vervliet-Scheebaum et al. (2010)
										1110	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Elodea canadensis*)	-	84 d	Chronic	NOEC (Fresh Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	83	Vervliet-Scheebaum et al. (2010)
										83	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Elodea canadensis*)	-	84 d	Chronic	LOEC (Length)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	1110	Vervliet-Scheebaum et al. (2010)
										1110	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Elodea canadensis*)	-	84 d	Chronic	NOEC (Length)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	83	Vervliet-Scheebaum et al. (2010)
										83	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Elodea canadensis*)	-	84 d	Chronic	NOEC (Number of Shoots)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	1110	Vervliet-Scheebaum et al. (2010)
										1110	*GEOMETRIC MEAN*
										83	***VALUE USED IN SSD***
	Liliopsida	Aquatic Macrophyte (*Glyceria maxima*)	-	14 d	Chronic	NOEC (Dry Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	8470	Vervliet-Scheebaum et al. (2010)
										8470	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Glyceria maxima*)	-	14 d	Chronic	NOEC (Fresh Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	8470	Vervliet-Scheebaum et al. (2010)
										8470	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Glyceria maxima*)	-	14 d	Chronic	NOEC (Length)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	8470	Vervliet-Scheebaum et al. (2010)
										8470	*GEOMETRIC MEAN*

	Liliopsida	Aquatic Macrophyte (*Glyceria maxima*)	-	14 d	Chronic	NOEC (Number of Shoots)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	8470	Vervliet-Scheebaum et al. (2010)
										8470	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Glyceria maxima*)	-	28 d	Chronic	NOEC (Dry Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	8470	Vervliet-Scheebaum et al. (2010)
										8470	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Glyceria maxima*)	-	28 d	Chronic	NOEC (Fresh Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	8470	Vervliet-Scheebaum et al. (2010)
										8470	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Glyceria maxima*)	-	28 d	Chronic	LOEC (Length)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	8470	Vervliet-Scheebaum et al. (2010)
										8470	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Glyceria maxima*)	-	28 d	Chronic	NOEC (Length)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	1110	Vervliet-Scheebaum et al. (2010)
										1110	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Glyceria maxima*)	-	28 d	Chronic	LOEC (Number of Shoots)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	1110	Vervliet-Scheebaum et al. (2010)
										1110	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Glyceria maxima*)	-	28 d	Chronic	NOEC (Number of Shoots)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	83	Vervliet-Scheebaum et al. (2010)
										83	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Glyceria maxima*)	-	56 d	Chronic	LOEC (Dry Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	1110	Vervliet-Scheebaum et al. (2010)
										1110	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Glyceria maxima*)	-	56 d	Chronic	NOEC (Dry Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	83	Vervliet-Scheebaum et al. (2010)
										83	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Glyceria maxima*)	-	56 d	Chronic	LOEC (Fresh Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	1110	Vervliet-Scheebaum et al. (2010)
										1110	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Glyceria maxima*)	-	56 d	Chronic	NOEC (Fresh Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	83	Vervliet-Scheebaum et al. (2010)
										83	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Glyceria maxima*)	-	56 d	Chronic	LOEC (Length)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	1110	Vervliet-Scheebaum et al. (2010)
										1110	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Glyceria maxima*)	-	56 d	Chronic	NOEC (Length)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	83	Vervliet-Scheebaum et al. (2010)
										83	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Glyceria maxima*)	-	56 d	Chronic	LOEC (Number of Shoots)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	1110	Vervliet-Scheebaum et al. (2010)

										1110	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Glyceria maxima*)	-	56 d	Chronic	NOEC (Number of Shoots)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	83	Vervliet-Scheebaum et al. (2010)
										83	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Glyceria maxima*)	-	84 d	Chronic	LOEC (Dry Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	1110	Vervliet-Scheebaum et al. (2010)
										1110	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Glyceria maxima*)	-	84 d	Chronic	NOEC (Dry Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	83	Vervliet-Scheebaum et al. (2010)
										83	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Glyceria maxima*)	-	84 d	Chronic	LOEC (Fresh Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	1110	Vervliet-Scheebaum et al. (2010)
										1110	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Glyceria maxima*)	-	84 d	Chronic	NOEC (Fresh Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	83	Vervliet-Scheebaum et al. (2010)
										83	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Glyceria maxima*)	-	84 d	Chronic	LOEC (Length)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	1110	Vervliet-Scheebaum et al. (2010)
										1110	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Glyceria maxima*)	-	84 d	Chronic	NOEC (Length)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	83	Vervliet-Scheebaum et al. (2010)
										83	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Glyceria maxima*)	-	84 d	Chronic	LOEC (Number of Shoots)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	1110	Vervliet-Scheebaum et al. (2010)
										1110	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Glyceria maxima*)	-	84 d	Chronic	NOEC (Number of Shoots)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	83	Vervliet-Scheebaum et al. (2010)
										83	*GEOMETRIC MEAN*
										83	***VALUE USED IN SSD***
	Liliopsida	Aquatic Macrophyte (*Lemna gibba*)	-	14 d	Chronic	EC50 (Number of fronds)	Hutner 1/2 medium	23 ± 2	6.5	570	Mazzeo et al. (1998).
										570	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Lemna gibba*)	-	14 d	Chronic	EC50 (Dry Weight)	Hutner 1/2 medium	23 ± 2	6.5	420	Mazzeo et al. (1998).
										420	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Lemna gibba*)	-	14 d	Chronic	LOEC (Dry Weight)	Hutner 1/2 medium	23 ± 2	6.5	100	Mazzeo et al. (1998).
										100	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Lemna gibba*)	-	14 d	Chronic	EC50 (Biomass Yield)	20X-AAP medium	25 ± 2	7.5 ± 0.1	140	U.S. EPA (2015)
										140	*GEOMETRIC MEAN*
										28[#]	***VALUE USED IN SSD***

	Magnoliopsida	Aquatic Macrophyte (*Myriophyllum aquaticum*)	2 weeks old	7 d	Chronic	LOEC (Fresh Weight)	Hoagslands Nutrient Solution	24 ± 4	-	50	Knuteson et al. (2002)
										50	*GEOMETRIC MEAN*
										20[&]	***VALUE USED IN SSD***
	Magnoliopsida	Aquatic Macrophyte (*Myriophyllum spicatum*)	-	14 d	Chronic	NOEC (Dry Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	8470	Vervliet-Scheebaum et al. (2010)
										8470	*GEOMETRIC MEAN*
	Magnoliopsida	Aquatic Macrophyte (*Myriophyllum spicatum*)	-	14 d	Chronic	NOEC (Fresh Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	8470	Vervliet-Scheebaum et al. (2010)
										8470	*GEOMETRIC MEAN*
	Magnoliopsida	Aquatic Macrophyte (*Myriophyllum spicatum*)	-	14 d	Chronic	LOEC (Length)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	8470	Vervliet-Scheebaum et al. (2010)
										8470	*GEOMETRIC MEAN*
	Magnoliopsida	Aquatic Macrophyte (*Myriophyllum spicatum*)	-	14 d	Chronic	NOEC (Length)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	1110	Vervliet-Scheebaum et al. (2010)
										1110	*GEOMETRIC MEAN*
	Magnoliopsida	Aquatic Macrophyte (*Myriophyllum spicatum*)	-	14 d	Chronic	NOEC (Number of Shoots)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	8470	Vervliet-Scheebaum et al. (2010)
										8470	*GEOMETRIC MEAN*
	Magnoliopsida	Aquatic Macrophyte (*Myriophyllum spicatum*)	-	28 d	Chronic	LOEC (Dry Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	1110	Vervliet-Scheebaum et al. (2010)
										1110	*GEOMETRIC MEAN*
	Magnoliopsida	Aquatic Macrophyte (*Myriophyllum spicatum*)	-	28 d	Chronic	NOEC (Dry Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	83	Vervliet-Scheebaum et al. (2010)
										83	*GEOMETRIC MEAN*
	Magnoliopsida	Aquatic Macrophyte (*Myriophyllum spicatum*)	-	28 d	Chronic	LOEC (Fresh Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	1110	Vervliet-Scheebaum et al. (2010)
										1110	*GEOMETRIC MEAN*
	Magnoliopsida	Aquatic Macrophyte (*Myriophyllum spicatum*)	-	28 d	Chronic	NOEC (Fresh Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	83	Vervliet-Scheebaum et al. (2010)
										83	*GEOMETRIC MEAN*
	Magnoliopsida	Aquatic Macrophyte (*Myriophyllum spicatum*)	-	28 d	Chronic	LOEC (Length)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	1110	Vervliet-Scheebaum et al. (2010)
										1110	*GEOMETRIC MEAN*
	Magnoliopsida	Aquatic Macrophyte (*Myriophyllum spicatum*)	-	28 d	Chronic	NOEC (Length)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	83	Vervliet-Scheebaum et al. (2010)
										83	*GEOMETRIC MEAN*
	Magnoliopsida	Aquatic Macrophyte (*Myriophyllum spicatum*)	-	28 d	Chronic	LOEC (Number of Shoots)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	1110	Vervliet-Scheebaum et al. (2010)
										1110	*GEOMETRIC MEAN*

	Magnoliopsida	Aquatic Macrophyte (*Myriophyllum spicatum*)	-	56 d	Chronic	NOEC (Number of Shoots)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	83	Vervliet-Scheebaum et al. (2010)
										83	*GEOMETRIC MEAN*
	Magnoliopsida	Aquatic Macrophyte (*Myriophyllum spicatum*)	-	56 d	Chronic	NOEC (Dry Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	83	Vervliet-Scheebaum et al. (2010)
										83	*GEOMETRIC MEAN*
	Magnoliopsida	Aquatic Macrophyte (*Myriophyllum spicatum*)	-	56 d	Chronic	NOEC (Fresh Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	83	Vervliet-Scheebaum et al. (2010)
										83	*GEOMETRIC MEAN*
	Magnoliopsida	Aquatic Macrophyte (*Myriophyllum spicatum*)	-	56 d	Chronic	NOEC (Length)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	1110	Vervliet-Scheebaum et al. (2010)
										1110	*GEOMETRIC MEAN*
	Magnoliopsida	Aquatic Macrophyte (*Myriophyllum spicatum*)	-	56 d	Chronic	NOEC (Number of Shoots)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	83	Vervliet-Scheebaum et al. (2010)
										83	*GEOMETRIC MEAN*
	Magnoliopsida	Aquatic Macrophyte (*Myriophyllum spicatum*)	-	84 d	Chronic	NOEC (Dry Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	1110	Vervliet-Scheebaum et al. (2010)
										1110	*GEOMETRIC MEAN*
	Magnoliopsida	Aquatic Macrophyte (*Myriophyllum spicatum*)	-	84 d	Chronic	NOEC (Fresh Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	1110	Vervliet-Scheebaum et al. (2010)
										1110	*GEOMETRIC MEAN*
	Magnoliopsida	Aquatic Macrophyte (*Myriophyllum spicatum*)	-	84 d	Chronic	NOEC (Length)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	8470	Vervliet-Scheebaum et al. (2010)
										8470	*GEOMETRIC MEAN*
	Magnoliopsida	Aquatic Macrophyte (*Myriophyllum spicatum*)	-	84 d	Chronic	NOEC (Number of Shoots)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	1110	Vervliet-Scheebaum et al. (2010)
										1110	*GEOMETRIC MEAN*
										83	***VALUE USED IN SSD***
	Magnoliopsida	Aquatic Macrophyte (*Persicaria amphibia*)	-	14 d	Chronic	NOEC (Dry Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	8470	Vervliet-Scheebaum et al. (2010)
										8470	*GEOMETRIC MEAN*
	Magnoliopsida	Aquatic Macrophyte (*Persicaria amphibia*)	-	14 d	Chronic	NOEC (Fresh Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	8470	Vervliet-Scheebaum et al. (2010)
	Magnoliopsida	Aquatic Macrophyte (*Persicaria amphibia*)	-	14 d	Chronic	NOEC (Fresh Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	8470	Vervliet-Scheebaum et al. (2010)
										8470	*GEOMETRIC MEAN*
	Magnoliopsida	Aquatic Macrophyte (*Persicaria amphibia*)	-	14 d	Chronic	NOEC (Number of Shoots)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	8470	Vervliet-Scheebaum et al. (2010)
										8470	*GEOMETRIC MEAN*

	Magnoliopsida	Aquatic Macrophyte (*Persicaria amphibia*)	-	28 d	Chronic	LOEC (Dry Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	83	Vervliet-Scheebaum et al. (2010)
										83	*GEOMETRIC MEAN*
	Magnoliopsida	Aquatic Macrophyte (*Persicaria amphibia*)	-	28 d	Chronic	NOEC (Dry Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	<83	Vervliet-Scheebaum et al. (2010)
										<83	*GEOMETRIC MEAN*
	Magnoliopsida	Aquatic Macrophyte (*Persicaria amphibia*)	-	28 d	Chronic	NOEC (Fresh Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	8470	Vervliet-Scheebaum et al. (2010)
										8470	*GEOMETRIC MEAN*
	Magnoliopsida	Aquatic Macrophyte (*Persicaria amphibia*)	-	28 d	Chronic	NOEC (Length)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	8470	Vervliet-Scheebaum et al. (2010)
										8470	*GEOMETRIC MEAN*
	Magnoliopsida	Aquatic Macrophyte (*Persicaria amphibia*)	-	28 d	Chronic	NOEC (Number of Shoots)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	8470	Vervliet-Scheebaum et al. (2010)
										8470	*GEOMETRIC MEAN*
	Magnoliopsida	Aquatic Macrophyte (*Persicaria amphibia*)	-	56 d	Chronic	NOEC (Dry Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	8470	Vervliet-Scheebaum et al. (2010)
										8470	*GEOMETRIC MEAN*
	Magnoliopsida	Aquatic Macrophyte (*Persicaria amphibia*)	-	56 d	Chronic	NOEC (Fresh Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	8470	Vervliet-Scheebaum et al. (2010)
	Magnoliopsida	Aquatic Macrophyte (*Persicaria amphibia*)	-	56 d	Chronic	NOEC (Fresh Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	8470	Vervliet-Scheebaum et al. (2010)
										8470	*GEOMETRIC MEAN*
	Magnoliopsida	Aquatic Macrophyte (*Persicaria amphibia*)	-	56 d	Chronic	NOEC (Number of Shoots)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	8470	Vervliet-Scheebaum et al. (2010)
										8470	*GEOMETRIC MEAN*
	Magnoliopsida	Aquatic Macrophyte (*Persicaria amphibia*)	-	84 d	Chronic	NOEC (Dry Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	8470	Vervliet-Scheebaum et al. (2010)
										8470	*GEOMETRIC MEAN*
	Magnoliopsida	Aquatic Macrophyte (*Persicaria amphibia*)	-	84 d	Chronic	NOEC (Fresh Weight)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	8470	Vervliet-Scheebaum et al. (2010)
										8470	*GEOMETRIC MEAN*
	Magnoliopsida	Aquatic Macrophyte (*Persicaria amphibia*)	-	84 d	Chronic	LOEC (Length)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	1110	Vervliet-Scheebaum et al. (2010)
										1110	*GEOMETRIC MEAN*
	Magnoliopsida	Aquatic Macrophyte (*Persicaria amphibia*)	-	84 d	Chronic	NOEC (Length)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	83	Vervliet-Scheebaum et al. (2010)
										83	*GEOMETRIC MEAN*
	Magnoliopsida	Aquatic Macrophyte (*Persicaria amphibia*)	-	84 d	Chronic	LOEC (Number of Shoots)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	1110	Vervliet-Scheebaum et al. (2010)

										1110	*GEOMETRIC MEAN*
	Magnoliopsida	Aquatic Macrophyte (*Persicaria amphibia*)	-	84 d	Chronic	NOEC (Number of Shoots)	Aged tap water	15.0–22.7 ± 0.2	7.5–8.5	83	Vervliet-Scheebaum et al. (2010)
										83	*GEOMETRIC MEAN*
										83	***VALUE USED IN SSD***
	Liliopsida	Aquatic Macrophyte (*Pontederia cordata*)	-	7 d	Chronic	LOEC (Fresh Weight)	Hoagslands Nutrient Solution	25 ± 2	-	300	Wilson et al. (2000b)
										300	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Pontederia cordata*)	-	7 d	Chronic	NOEC (Fresh Weight)	Hoagslands Nutrient Solution	25 ± 2	-	100	Wilson et al. (2000b)
										100	*GEOMETRIC MEAN*
										100	***VALUE USED IN SSD***
	Liliopsida	Aquatic Macrophyte (*Typha latifolia*)	-	7 d	Chronic	LOEC (Fresh Weight)	Hoaglands Aqueous Nutrient Media	25 ± 2	-	1000	Wilson et al. (2000a)
										1000	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Typha latifolia*)	-	7 d	Chronic	NOEC (Fresh Weight)	Hoaglands Aqueous Nutrient Media	25 ± 2	-	300	Wilson et al. (2000a)
										300	*GEOMETRIC MEAN*
										300	***VALUE USED IN SSD***
	Liliopsida	Aquatic Macrophyte (*Vallisneria americana*)	-	13 d	Chronic	EC50 (Fresh Weight)	Reconstituted very hard water	25	8.2 ± 0.2	67	Wilson and Wilson (2010)
										67	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Vallisneria americana*)	-	13 d	Chronic	LOAEC (Fresh Weight)	Reconstituted very hard water	25	8.2 ± 0.2	58	Wilson and Wilson (2010)
										58	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Vallisneria americana*)	-	13 d	Chronic	NOAEC (Fresh Weight)	Reconstituted very hard water	25	8.2 ± 0.2	<58	Wilson and Wilson (2010)
										<58	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Vallisneria americana*)	-	13 d	Chronic	EC50 (Length)	Reconstituted very hard water	25	8.2 ± 0.2	81	Wilson and Wilson (2010)
										81	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Vallisneria americana*)	-	13 d	Chronic	LOAEC (Length)	Reconstituted very hard water	25	8.2 ± 0.2	116	Wilson and Wilson (2010)
										116	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Vallisneria americana*)	-	13 d	Chronic	NOAEC (Length)	Reconstituted very hard water	25	8.2 ± 0.2	58	Wilson and Wilson (2010)
										58	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Vallisneria americana*)	-	13 d	Chronic	EC50 (New leaves)	Reconstituted very hard water	25	8.2 ± 0.2	154	Wilson and Wilson (2010)
										154	*GEOMETRIC MEAN*

	Liliopsida	Aquatic Macrophyte (*Vallisneria americana*)	-	13 d	Chronic	LOAEC (New leaves)	Reconstituted very hard water	25	8.2 ± 0.2	344	Wilson and Wilson (2010)
										344	*GEOMETRIC MEAN*
	Liliopsida	Aquatic Macrophyte (*Vallisneria americana*)	-	13 d	Chronic	NOAEC (New leaves)	Reconstituted very hard water	25	8.2 ± 0.2	229	Wilson and Wilson (2010)
										229	*GEOMETRIC MEAN*
										58	***VALUE USED IN SSD***

[#] Values were acute LC/EC50 data that were converted to chronic NOEC\EC10 values by dividing by 10 (Warne, 2001). [$] Values were acute NOEC data that were converted to chronic NOEC/EC10 values by dividing by 2 (Warne, 2001). [@] Values were chronic EC/LC50 values that were converted to chronic NOEC/EC10 values by dividing by 5 (Warne, 2001). [&] Values were chronic LOEC values that were converted to chronic NOEC/EC10 values by dividing by 2.5 (Warne, 2001).

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Supplementary Information

Table S9. Summary of the key characteristics of the marine simazine toxicity data (acute and chronic) that passed the screening and quality assurance processes. Not all the data was used to derive the marine ecotoxicity threshold values for simazine.

Phyla or Division	Class	Species	Life stage	Duration	Test type	Measure (Endpoint)	Test medium	Salinity (‰)	Temp. (°C)	pH	Concentration (µg/L)	Reference
Arthropoda	Malacostraca	Mud Crab (*Neopanope texana*)	15 mm	4 d	Acute	LC50 (Mortality)	*	*	*	*	1 000 000	U.S. EPA (2015)
											1 000 000	*GEOMETRIC MEAN*[#]
	Malacostraca	Pink Shrimp (*Penaeus duorarum*)	55 mm	4 d	Acute	LC50 (Mortality)	Natural or artificial seawater	20 ± 3	23 ± 1	-	11 300	U.S. EPA (2015)
											11 300	*GEOMETRIC MEAN*[#]
	Malacostraca	Shrimp (*Palaemonetes kadiakensis*)	-	2 d	Acute	LC50 (Mortality)	Natural or artificial seawater	20 ± 3	23 ± 1	-	10 000	U.S. EPA (2015)
											10 000	*GEOMETRIC MEAN*[#]
	Entognatha	Springtail (*Proisotoma minuta*)	60-day old	7 d	Chronic	LC50 (Mortality)	Salt solution (synthetic sea salt in nanopure water)	-	23 ± 1	5.7	>200 000	Park and Lees (2005)
											>200 000	*GEOMETRIC MEAN*[@]
Bacillariophyta	Fragilariophyceae	Diatom (*Ceratoneis closterium*)	Exponential growth phase	3 d	Chronic	IC10 (Growth rate)	Filtered (0.45 µm) seawater	35 ± 2	21 ± 2	8.2 ± 0.1	310	Hook and Osborn (2014)
											310	*GEOMETRIC MEAN*
											310	***VALUE USED IN SSD***
	Fragilariophyceae	Diatom (*Ceratoneis closterium*)	Exponential growth phase	3 d	Chronic	IC50 (Growth rate)	Filtered (0.45 µm) seawater	35 ± 2	21 ± 2	8.2 ± 0.1	>1000	Hook and Osborn (2014)
											>1000	*GEOMETRIC*

												MEAN[@]
	Bacillariophyceae	Diatom (*Phaeodactylum tricornutum*)	-	10 d	Chronic	EC50 (Cell density)	Algal nutrient medium	30 ± 5	20 – 24 ± 2	Same as media	100	U.S. EPA (2015)
											100	*GEOMETRIC MEAN*[@]
	Bacillariophyceae	Diatom (*Phaeodactylum tricornutum*)	Exponential growth phase	3 d	Chronic	IC10 (Growth rate)	Filtered (0.45 µm) seawater	35 ± 2	21 ± 2	8.2 ± 0.1	100	Osborn and Hook (2013)
											100	*GEOMETRIC MEAN*
											100	***VALUE USED IN SSD***
	Bacillariophyceae	Diatom (*Phaeodactylum tricornutum*)	Exponential growth phase	3 d	Chronic	IC50 (Growth rate)	Filtered (0.45 µm) seawater	35 ± 2	21 ± 2	8.2 ± 0.1	580	Osborn and Hook (2013)
											580	*GEOMETRIC MEAN*[@]
Chlorophyta	Chlorophyceae	Microalgae (*Chlorococcum* sp.)	-	10 d	Chronic	EC50 (Cell density)	Algal nutrient medium	30 ± 5	20 – 24 ± 2	Same as media	400	U.S. EPA (2015)
											400	*GEOMETRIC MEAN*[@]
											400	***VALUE USED IN SSD***
	Chlorophyceae	Microalgae (*Dunaliella tertiolecta*)	-	10 d	Chronic	EC50 (Cell density)	Algal nutrient medium	30 ± 5	20 – 24 ± 2	Same as media	1000	U.S. EPA (2015)
											1000	*GEOMETRIC MEAN*[@]
											1000	***VALUE USED IN SSD***
Chordata	Actinopterygii	Gilt-head bream (*Sparus aurata*)	3h – 5h post-hatch larvae	3 d	Acute	LC10 (Mortality)	Natural and filtered (0.45 µm) sea water	37 ± 1	19 ± 1	8 ± 0.1	2360	Arufe et al. (2004)
											2360	*GEOMETRIC MEAN*[%]
	Actinopterygii	Gilt-head bream	3h – 5h post-hatch	3 d	Acute	LC50	Natural and filtered	37 ± 1	19 ± 1	8 ± 0.1	4190	Arufe et al. (2004)

		(*Sparus aurata*)	larvae			(Mortality)	(0.45 µm) sea water					
											4190	*GEOMETRIC MEAN*[#]
	Actinopterygii	Gilt-head bream (*Sparus aurata*)	3h – 5h post-hatch larvae	3 d	Acute	NOEC (Mortality)	Natural and filtered (0.45 µm) sea water	37 ± 1	19 ± 1	8 ± 0.1	2250	Arufe et al. (2004)
											2250	*GEOMETRIC MEAN*[$]
	Actinopterygii	Gilt-head bream (*Sparus aurata*)	3h – 5h post-hatch larvae	3 d	Acute	LOEC (Mortality)	Natural and filtered (0.45 µm) sea water	37 ± 1	19 ± 1	8 ± 0.1	4500	Arufe et al. (2004)
											4500	*GEOMETRIC MEAN*[^]
	Actinopterygii	Gilt-head bream (*Sparus aurata*)	3h – 5h post-hatch larvae	3 d	Acute	NOEC (Dry weight)	Natural and filtered (0.45 µm) sea water	37 ± 1	19 ± 1	8 ± 0.1	4500	Arufe et al. (2004)
	Actinopterygii	Gilt-head bream (*Sparus aurata*)	3h – 5h post-hatch larvae	3 d	Acute	NOEC (Dry weight)	Natural and filtered (0.45 µm) sea water	37 ± 1	19 ± 1	8 ± 0.1	>4500	Arufe et al. (2004)
											4500	*GEOMETRIC MEAN*[$]
	Actinopterygii	Sheepshead Minnow (*Cyprinodon variegatus*)	0.36 g	4 d	Acute	LC50 (Mortality)	Seawater	20 ± 5	22 ± 2	>7.5 and <8.5	430	U.S. EPA (2015)
											430	*GEOMETRIC MEAN*[#]
	Actinopterygii	Striped Bass (*Morone saxatilis*)	63 mm	4 d	Acute	LC50 (Mortality)	Seawater	20 ± 5	-	>7.5 and <8.5	300	U.S. EPA (2015)
											300	*GEOMETRIC MEAN*[#]
Haptophyta	Prymnesiophyceae	Microalgae	-	10 d	Chronic	EC50 (Cell	Algal nutrient	30 ± 5	20 – 24	Same as	100	U.S. EPA (2015)

		(*Isochrysis galbana*)				density)	medium		± 2	media		
											100	*GEOMETRIC MEAN*@
											100	***VALUE USED IN SSD***
Mollusca	Bivalvia	Eastern Oyster (*Crassostrea virginica*)	16–29g	7 d	Acute	EC50 (Mortality)	Natural or artificial seawater	>12 ± 2 (similar to environm ent)	20 ± 5	-	200	U.S. EPA (2015)
											200	*GEOMETRIC MEAN*#
	Bivalvia	Eastern Oyster (*Crassostrea virginica*)	SPAT	4 d	Acute	EC50 (Mortality)	Natural or artificial seawater	>12 ± 2 (similar to environm ent)	20 ± 5	-	370	U.S. EPA (2015)
											370	*GEOMETRIC MEAN*#
Ochrophyta	Coscinodiscophyc-eae	Diatom (*Skeletonema costatum*)	-	5 d	Chronic	EC50 (Cell density)	Algal nutrient medium	30 ± 5	20 – 24 ± 2	Same as media	120	U.S. EPA (2015)
											120	*GEOMETRIC MEAN*@
											120	***VALUE USED IN SSD***

* Conducted using USEPA methods – exact values cannot be located. # Values were acute LC/EC50 data that were converted to chronic NOEC/EC10 values by dividing by 10 (Warne, 2001). $ Values were acute NOEC data that were converted to chronic NOEC/EC10 values by dividing by 2 (Warne, 2001). @ Values were chronic EC/LC50 values that were converted to chronic NOEC/EC10 values by dividing by 5 (Warne, 2001). & Values were chronic LOEC values that were converted to chronic NOEC/EC10 values by dividing by 2.5 (Warne, 2001). % Values were acute LC/EC10 data that were converted to chronic NOEC/EC10 values by dividing by 2 (Warne, 2001). ^ Values were acute LOEC that were converted to chronic NOEC/EC10 values by dividing by 5 (Warne, 2001).

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Supplementary Material

Table S10. Protective concentration values of simazine for the protection of marine ecosystems. These values are not the recommended ecotoxicity thresholds for simazine in marine ecosystems (refer to Table 5).

Simazine default guideline values (marine)[a]	
Percent species protection	**Concentration (*μg/L*)**
99%	20
95%	47
90%	96
80%	105

Reliability classification[b]	
Criterion	**Result**
Sample size	6 species
Type of toxicity data	Chronic EC10/NOEC and chronic estimated EC10/NOEC data
SSD model fit	Poor
Reliability	Low