Use of the 1st vs. 5th UCD percentile for the protection of aquatic life from pyrethroid toxicity

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Merits of the 1st percentile

1. **The 1st vs. 5th issue is not just about Hyalella. The species is not unique in its sensitivity to pyrethroids as is often argued.**

2.

3.

4.

Hyalella is not unique in its pyrethroid sensitivity: Other species with comparable bifenthrin LC50s

Eohaustorius estuarius (amphipod)
Sediment LC50 = 1.03 µg/gOC
(Hyalella = 0.52 µg/gOC)

Austrochiltonia subtenuis (amphipod)
Sediment LC50 = 0.74 µg/gOC
(Hyalella = 0.52 µg/gOC)

Mysidopsis bahia (mysid shrimp)
Water LC50 = 3.8 ng/L
(Hyalella = 0.5-7.7 ng/L)

Amweg et al., 2005; Anderson et al., 2008; Bradley, 2013; Jeppe et al., in review; Weston and Jackson, 2009

Given the pyrethroid sensitivity of Hyalella, it would be reasonable to look for other comparably sensitive species among the amphipods. Yet even for all pyrethroids taken together, we only have water LC50 data for 4 amphipod species within 2 genera (Hyalella and Gammarus).

There are nearly 10,000 species of amphipods in 1700 genera, meaning we have tested 0.04% of them.

It is absurd to adopt a water quality criteria that is not protective of Hyalella, and assume it is the only species being placed at risk.

Merits of the 1st percentile

1. The 1st vs. 5th issue is not just about Hyalella. The species is not so unique in its sensitivity to pyrethroids as is often argued.
2. **The very limited data on aquatic toxicity of pyrethroids requires we take a very conservative approach in their use.**
3.
4.

Species used in derivation of UCD bifenthrin criteria

5 Arthropods and 3 Fish = Total of 8 species

The EPA method for derivation of water quality criteria uses the 5th percentile, but EPA uses data sets with more species and more taxonomically diverse species. The UCD approach already departs from EPA protocol by attempting criteria with data from very few species.

When we only have data on 8 species for the pyrethroid of greatest environmental concern, is it reasonable to find one of those species "just too sensitive to protect"?

It is foolish to expect 8 species to accurately reflect the species sensitivity distribution of natural communities containing hundreds of species, or to expect any arbitrary percentile of that distribution to accurately reflect the level of protection afforded those communities.

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3. **Of all the invertebrates, Hyalella is one that we can least afford not to protect.**

4.

- Hyalella “azteca” is a common species found in freshwater environments all over California.
- In many locations where found, it is extremely abundant, dominating the macroinvertebrate community.
- It has been reported to be a major item in the diet of several fish species, including chinook salmon and Delta smelt.
- It has been one of the key species used to test environmental quality for decades, including in California monitoring programs such as SWAMP.
- Dozens of studies, in California and worldwide, have documented toxicity to the species, and attributed that toxicity to pyrethroids.

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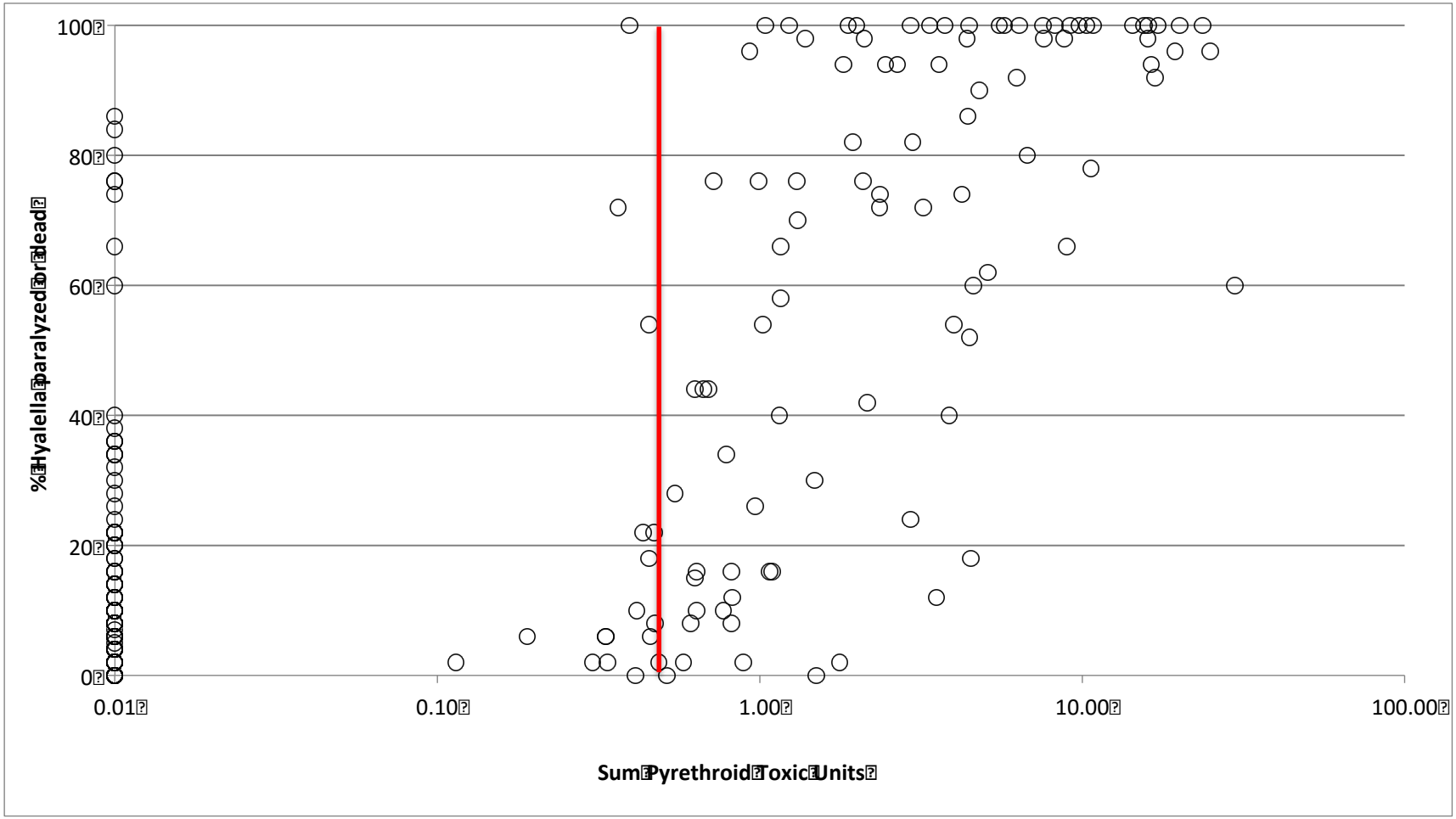
2. The very limited data set on aquatic toxicity of pyrethroids requires we take a very conservative approach in its use.
3. Of all the invertebrates, Hyalella is one that we can least afford not to protect.
4. **Simply testing sample toxicity is a straightforward approach, but if compliance is to be based on a concentration, then the measure of its success should be how well it predicts toxicity.**


100
80
60
40
20
0
% Hyalella paralyzed or dead
0.01
0.10
1.00
10.00
100.00
Sum Pyrethroid Toxic Units

Accuracy of the whole water concentration approach in predicting toxicity

(does not address bioavailability; assumes no toxicants but pyrethroids)

	Predicted non-toxic (<0.5 TU)	Predicted toxic (>0.5 TU)
Found to be non-toxic when tested	59%	4%
Found to be toxic when tested	10%	27%

When tested with 326 samples, toxicity, or lack thereof, was correctly predicted 86% of the time.

Equal or better performance needs to be demonstrated for the bioavailability-based approach using UCD criteria.