

# Peer Review Summary Document

(09/11/2020)

## Peer Review Plan

<https://www.usgs.gov/atom/99372> [105 KB PDF].

## Title and Authorship of Information Product Disseminated

Common insecticide disrupts aquatic communities: A mesocosm to field ecological risk assessment of fipronil and its degradates in U.S. streams, By Janet L. Miller, Travis S. Schmidt, Peter C. Van Metre, Barbara J. Mahler, Mark W. Sandstrom, Lisa H. Nowell, Daren M. Carlisle, Patrick W. Moran.

## Peer Reviewers Expertise and Credentials

**Reviewer #1:** The reviewer is a Research Hydrologist with a bachelor's degree in Chemistry and Biology from the University of Alabama in Huntsville (1998) and a master's degree in Environmental Health Science from the University of South Carolina, School of Public Health. The reviewer's focus for the past 15 years has been on the health implications of environmental exposure of humans, wildlife, and fish to contaminants and pathogens. Most of the reviewer's current research is on the exposure and potential effects of contaminants including pesticides, metals, endocrine disruptors, and brines from oil and gas production on fish and wildlife in a diverse range of habitats. The reviewer's studies also include contaminant drivers of amphibian declines, the effects of endocrine disrupting compounds on fish in the Chesapeake Bay, and the exposure and effects of pesticides on wildlife including native pollinators. The reviewer is primary author or co-author on over 65 publications in the peer-reviewed literature.

**Reviewer #2:** The reviewer is a Research Toxicologist with a bachelor's degree in Biochemistry and a PhD in Pharmacology and Toxicology from the University of Mississippi. The reviewer's research activities focus on assessing the bioavailability and toxicity of environmental contaminants in water and sediments.

**Reviewers #3-4:** These two anonymous reviewers were selected by the journal *Science Advanced* for their expertise in the subject matter.

## Charge Submitted to Peer Reviewers

The reviewers were asked to make an objective evaluation of the research, with emphasis on the interpretation and discussion of results. They were notified that the subject matter could receive attention on a nationwide scale and be scrutinized at a high level.

## Summary of Peer Reviewers 1 and 2 Comments

**Reviewer #1:** The reviewer made several comments and suggestions on the first version they reviewed, but overall found the manuscript to be "well written and concise," and "a

welcome addition to the scientific literature” that should be well received. The reviewer also commented that “the utility of the mesocosms, the Species Sensitivity Distribution (SSD) approach and the field data is unique, and highly useful to both the scientific and management communities”. Further the reviewer praised the authors explanation of the importance of their approach and how it could be expanded and incorporated for regulatory decision making. The reviewer recommended the authors be careful about tone and over interpretation of the data. The reviewer expressed concern about over stating the finding that “aquatic communities declined in U.S. streams” and inquired if literature or other regional stream quality assessment studies supported such a finding. The reviewer was unfamiliar with SPEAR<sub>pesticides</sub> but noted that SPEAR<sub>pesticides</sub> could also be related to other stressors and asked the authors to discuss the possibility of other stressors affecting SPEAR<sub>pesticides</sub>.

**Reviewers #2:** The reviewer commented that “this is going to be an important paper”. The reviewer had four main comments and suggestions. The first suggestion was to add clarity on analytical chemistry and toxicity modeling, specifically to include tables of more quality control and quality assurance data on fipronil measurements, a plot of the planned concentrations of exposure verses measured concentrations, and an addition of uncertainty to the dose response plots and tables of EC50s/EC20s. Secondly, the reviewer expressed concern about mixing exposure durations in the Species Sensitivity Distributions and mixing lab toxicity organisms responses with insect responses from the mesocosm study and as a solution, the reviewer offered a more comprehensive filtering process of data prior to inclusion into the SSD and trimming of the SSD dataset to only include insects. Third, the reviewer believed comparisons between laboratory cultured organisms’ verses mesocosm organism sensitivity comparisons should be made more carefully. Lastly, the reviewer recommended further reviews to include a statistician and/or researcher from the U.S. Environmental Protection Office (EPA) Office of Pesticides.

## **Summary of USGS Response to Peer Reviewers 1 and 2 Comments**

In response to comments from Reviewers 1 and 2, the authors held a briefing with the EPA’s Office of Pesticides. EPA subject matter experts made further suggestions about displaying uncertainty of the mesocosm organism responses and recommended the authors address exposure durations differences in data used in the SSDs.

Revisions made in the manuscript as a result of comments from Reviewers 1 and 2 and the EPA briefing experts were as follows:

- 1) Editorial changes were made to be more precise about the degree to which fipronil compounds impaired streams of the U.S.
- 2) Added stipulations that SPEAR<sub>pesticides</sub> was affected by multiple stressors and included a discussion of what those stressors could be and a discussion that fipronils were not the only pesticide measured in these streams.
- 3) Added multiple quality assurance/quality control (QA/QC) tables to text and are now associated with the data release.
- 4) Included three additional SSDs with the existing data resources. The first SSD included only the organism responses derived from the mesocosm experiment. The second SSD included mesocosm derived organism responses and literature derived toxicity responses included in EPA’s ECOTOX database, and thus used for regulatory purposes. The third SSD included all the data in the second SSD, however, all short-term toxicity data were adjusted for exposure duration. The purpose of comparisons for the second and third SSDs added

was to determine if there was any bias resulting from exposure durations, insects, or the particulars of the mesocosm experiment; and the end result confirmed no differences in the conclusions made with any of these approaches to the SSDs.

5) Edited the discussion of the sensitivity of laboratory toxicity organisms versus mesocosm organisms to focus on data driven contrasts created in the different SSDs described above.

## **Summary of Peer Reviewers 3 and 4 Comments**

The revised manuscript incorporating reconciliation of comments from Reviewers 1 and 2 and the EPA briefing, was submitted to the journal who subsequently selected two anonymous reviewers. Comments from these two reviewers are below.

**Reviewers #3 and #4:** The reviewers commented that the experimental background of the study is sound; the data analysis has largely been conducted following current standards, and the manuscript is relatively easy to read and understand. Reviewer 3 suggested the authors could reduce the length of the manuscript by moving methods descriptions to supporting information and by streamlining the information about the multiple SSDs. The reviewer also requested a more complete description of SPEAR<sub>pesticides</sub> and offered a suggestion about the use of a transformation of SPEAR<sub>pesticide</sub>. and questioned why the field data was analyzed by individual region and instead of together in a single plot. Reviewer 4 remarked that the manuscript is well written, the study is well designed, and addresses a very important topic. Reviewer 4 also commented that the findings support a similar comprehensive high-quality study they led, but did not publish, particularly on the effect levels on benthic communities. Reviewer 4 also noted that “given the widespread use of this insecticide across the southern U.S., and the lack of peer-reviewed studies of this quality, the manuscript covers very important information; and they highly recommended it be published with minor revisions, and that the publisher provide press releases on the product. Reviewer 4 suggested adding QA/QC data, study design, field data, and noted the data analysis were “good.” Reviewer 4 also suggested expanding the discussion of other stressors and co-occurring stressors observed in streams and including a discussion of the “Urban Stream Syndrome”. Reviewers 3 and 4 provided numerous editorial suggestions to improve the manuscript.

## **Summary of USGS Response to Peer Reviewers 3 and 4 Comments**

In response to comments from Reviewers 3 and 4, approximately 20 percent of the manuscript text was deleted to shorten the length. The authors expanded the description of SPEAR<sub>pesticides</sub> in supporting information section and added discussion of multiple stressors or co-occurring stressors as well as a new paragraph about the “Urban Stream Syndrome”. We argued that because species distributions change across regions SPEAR<sub>pesticides</sub> is expected to change among regions and thus it was necessary to account for different SPEAR<sub>pesticides</sub> values at sites without pesticides to detect regional changes. The authors accepted the editorial suggestions from the reviewers as they deemed appropriate to do so.

## **The Dissemination**

The product will be published by the journal *Science Advances* and will be available at <https://advances.sciencemag.org/>.