

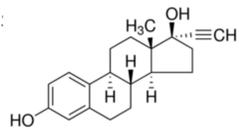
# A Systematic Review: The Effects of 17-alpha ethinylestradiol on Plasma Vitellogenin Levels in male *Pimephales promelas*

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## Introduction

- Xenoestrogens, specifically 17 alpha-ethinylestradiol (EE2), are of concern as they are typically in WWTP effluent due to their limited ability to degrade throughout the WWTP process and are flushed into streams.
- EE2 is a synthetic estrogen commonly found in oral contraceptives and hormone replacement therapy. Plasma vitellogenin levels can confirm the presence of environmental estrogens.
- In the United States WWTP effluent have been analyzed and the maximum concentration of EE2 was 4.3 ng/L and in streams up to 0.58 ng/L.
- At concentrations below 5 ng/L, multiple reproductive effects such as male fish were observed.

Figure 1: Chemical structure of EE2



## Objective

How does 17alpha-ethinylestradiol (EE2) affect the plasma vitellogenin levels of male fathead minnows?

The effects of EE2 on Plasma Vitellogenin levels in male fathead minnows in 21-days

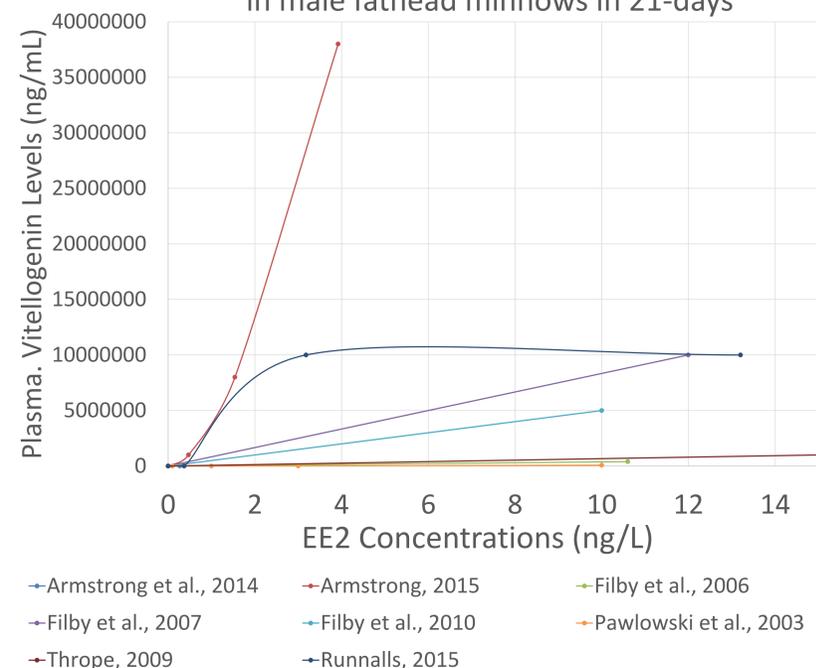


Figure 4: The effects of EE2 on male fathead minnow's plasma vitellogenin levels.

## Methods

The Navigation Guide methodology (Larn et al., 2017) was adapted with Koustas et al. to examine toxicological studies. Using this methodology, three steps were completed 1). Specify the study question, 2). Select the evidence, 3). Rate the quality and strength of evidence

The "Population", "Exposure", "Comparator", and "Outcome" (PECO) statement:

- Population:** Male *Pimephales promelas* or fathead minnows
- Exposure:** 17alpha-ethinylestradiol (EE2)
- Comparator:** Fathead minnows not exposed to EE2
- Outcome:** Plasma Vitellogenin levels

**Data sources:** PubMed, Proquest Aquatic Science Collection, Biosis, Scopus were searched using search terms.

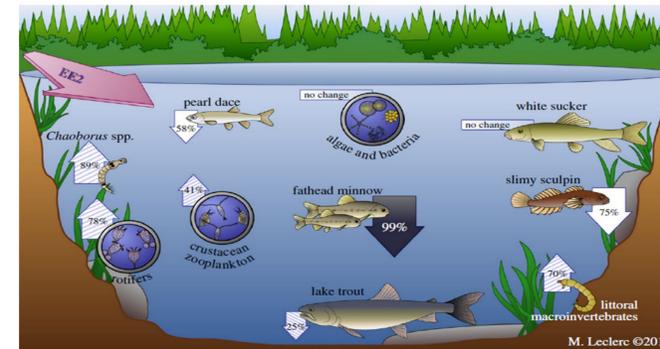


Figure 2: EE2 entering ecosystem

## Results

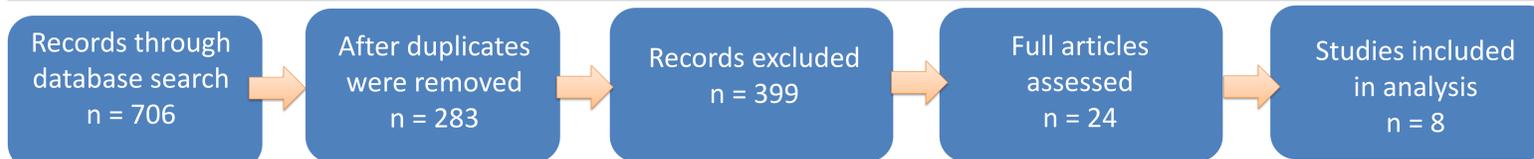


Figure 3: Summary of Risk of Bias judgements (A) and given as percentages across all included studies (B).

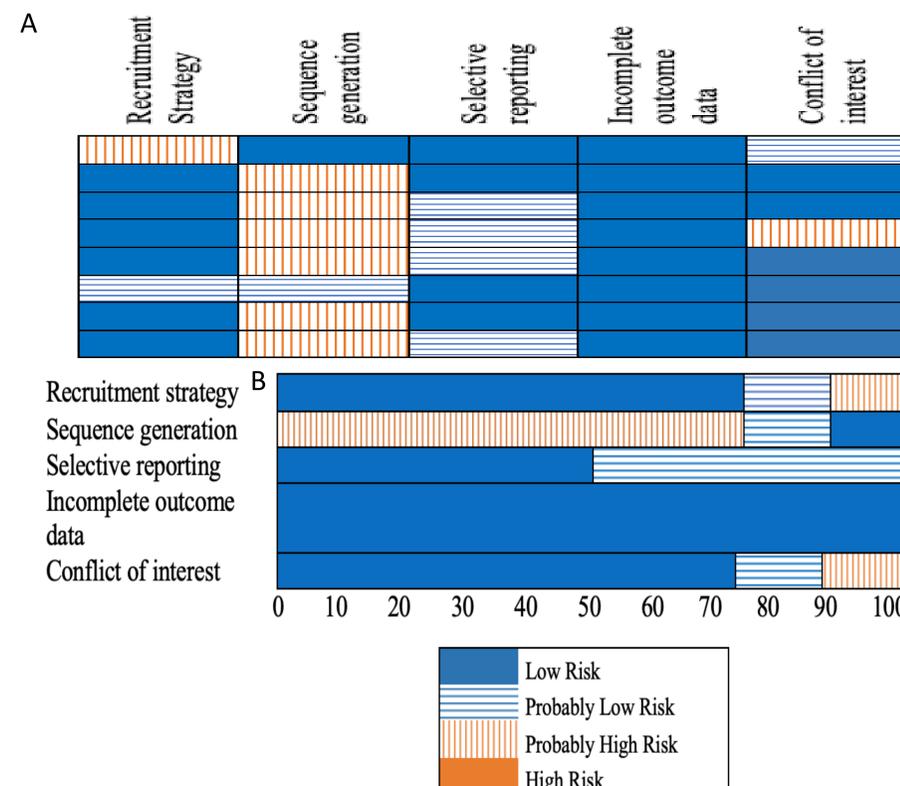


Figure 5: Summary of Risk of Bias judgements (A) and given as percentages across all included studies (B).

## Conclusion

- EE2 increases plasma vitellogenin levels in male fathead minnows
- There is a dose-response relationship between plasma vitellogenin levels in male fathead minnows and exposure of EE2
- There is a possibility that male fathead weights are decreased by exposure to EE2
- There is some evidence that GSI is lower in males when exposed to EE2
- Secondary sex characteristics may be another area of research as some studies reported lower nuptial tubercles
- The overall quality of evidence is moderate
- The overall strength of evidence is limited
- Plasma vitellogenin levels are a reliable biomarker to confirm the presence of environmental estrogens

## References

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Factor	Rating
Downgrade	
Risk of bias across studies	0
Indirectness	0
Inconsistency	0
Imprecision	-1
Upgrade	
Dose response	+1
Overall Quality of Evidence (initial rating is "moderate")	Moderate
Overall Strength of Evidence	Limited

Table 1: Summary of findings, quality of evidence, and strength of evidence.