



## Project Summary

# Influence of Diet and Body Lipids on the Bioconcentration of Endrin from Water in the Fathead Minnow (*Pimephales promelas*)

Goran Dave and Patricia Kosian

The purpose of this study was to quantify the importance of the fathead minnow's (*Pimephales promelas*) body lipid content and its composition in the bioconcentration of a lipophilic chemical (endrin) from water.

For three months prior to exposure, six groups of fish were fed reference research diets containing 0, 10, 15 or 20% (dry weight diet basis) lipids added as corn oil and/or salmon oil. Two other groups were fed frozen brine shrimp (*Artemia salina*) at two ration levels.

Bioconcentration tests at two concentrations of endrin in water (0.11 and 0.19  $\mu\text{g L}^{-1}$ ) produced mean bioconcentration factors (BCFs) of 15,000x after 14 days and 23,000x after 29 days when expressed on a wet weight, whole body basis. Corresponding mean BCFs expressed on a lipid, whole body basis were 190,000x and 340,000x.

Whole body BCFs expressed on a wet weight basis ranged 8,000x - 21,000x after 14 days exposure and 5,000x - 30,000x after 29 days exposure. Independent of diet composition, whole body BCFs expressed on a wet weight basis were positively correlated to the concentration of total fish body lipids. When BCFs were expressed on a lipid basis, they were instead negatively correlated to the concentration of total fish body lipids. From the limited number of samples examined for each diet group, no influence of diet lipid source (corn oil, salmon oil and brine shrimp lipids) could be found.

Results from this study were interpreted as follows: the greater the fishes' body lipid content, the more endrin it bioconcentrates rapidly and directly from the water. Thus, fatter fish take a longer time to reach equilibrium.

*This Project Summary was developed by EPA's Environmental Research Laboratory, Duluth, MN, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).*

### Introduction

In aquatic animals, bioconcentration of chemicals can take place directly from water or from food, though uptake from water appears to be the predominant route. Prediction of the bioconcentration factor, BCF (the concentration in fish divided by concentration in water at steady state), from the partition coefficient between octanol and water has given good correlations for a wide variety of chemicals, but for certain chemicals, unexplained variations have been found.

The purpose of this study was to estimate the relative importance of some nutritional factors on the ability of the fathead minnow to bioconcentrate a lipophilic chemical, endrin, from water. The nutritional factors studied were dietary lipid content, composition, and ration level.

Month-old fathead minnows were kept in separate tanks for three months prior to exposure to endrin. Eight groups were

fed reference research diets with varying lipid compositions (0 to 20% lipids) with lipids coming from corn oil, salmon oil or brine shrimp. Groups were exposed to endrin under controlled conditions for 14 or 29 days. Whole fish samples were homogenized with Na<sub>2</sub>SO<sub>4</sub>, placed in a chromatography column and the endrin eluted from the column with hexane. Lipid content was determined by evaporation of the solvent from the fraction and weighing the residue. The lipid content was calculated by equation 1. Endrin content was determined by gas chromatography.

$$\text{Lipid (\%)} = \frac{(\text{gross weight} - \text{tare}) (100)}{(\text{tissue weight}) (0.96)}$$

Results showed that the fatter the fish were the more endrin was bioconcentrated. Bioconcentration factors after 29 days increased from 5 to 30 times when expressed on whole-body weight, and 250 to 450 times when expressed on a whole-body lipid basis.

### Conclusions

Body lipid content had a significant effect on the bioconcentration of a lipophilic chemical, endrin, in the fathead minnow:

1. The fatter the fish was, the more endrin it bioconcentrated directly from water.
2. Bioconcentration factors (BCFs) after 29 days exposure ranged 5,000x - 30,000x (6-fold difference), when expressed on a whole body wet weight basis.
3. When expressed on a lipid basis, BCFs after 29 days exposure ranged 250,000x - 450,000x (2-fold difference).
4. BCFs calculated on a wet weight basis were positively correlated to the lipid content of the fish, but BCFs calcu-

lated on a lipid basis were negatively correlated to the lipid content, indicating that the fatter the fish was, the longer was the time needed to reach a steady state.

5. The source of dietary lipid did not influence the results. It might have affected lipid composition of fish, but this was not investigated.

### Recommendations

1. Bioconcentration factors (BCFs) for lipophilic chemicals should be ex-

pressed on a lipid as well as a wet weight basis, since BCFs for lipophilic chemicals such as endrin can be expected to be significantly affected by the lipid content of the fish. A fatter fish is expected to show a higher residue than a lean fish.

2. Since BCFs expressed on a lipid basis are more uniform than those expressed on whole body weight, the use of lipid-based BCFs would reduce variations observed within a species as well as between species.

*Goran Dave is with the Department of Zoophysiology, University of Goteberg, Sweden, and Patricia Kosian is with the University of Wisconsin, Superior, WI. James McKim is the EPA Project Officer (see below).*

*The complete report, entitled "Influence of Diet and Body Lipids on the Bioconcentration of Endrin from Water in the Fathead Minnow (Pimephales promelas)," (Order No. PB 83-254 300; Cost: \$8.50, subject to change) will be available only from:*

*National Technical Information Service  
5285 Port Royal Road  
Springfield, VA 22161  
Telephone: 703-487-4650*

*The EPA Project Officer can be contacted at:  
Environmental Research Laboratory  
U.S. Environmental Protection Agency  
6201 Congdon Blvd.  
Duluth, MN 55804*

☆ U.S. GOVERNMENT PRINTING OFFICE: 1983-659-017/7211



United States  
Environmental Protection  
Agency

Center for Environmental Research  
Information  
Cincinnati OH 45268

Official Business  
Penalty for Private Use \$300

PS 0000329  
U S ENVIR PROTECTION AGENCY  
REGION 5 LIBRARY  
230 S DEARBORN STREET  
CHICAGO IL 60604

