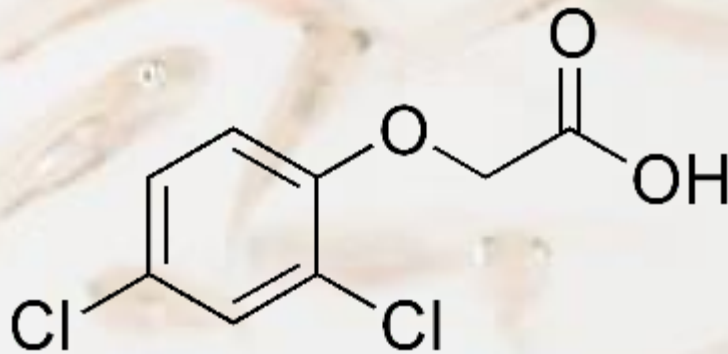
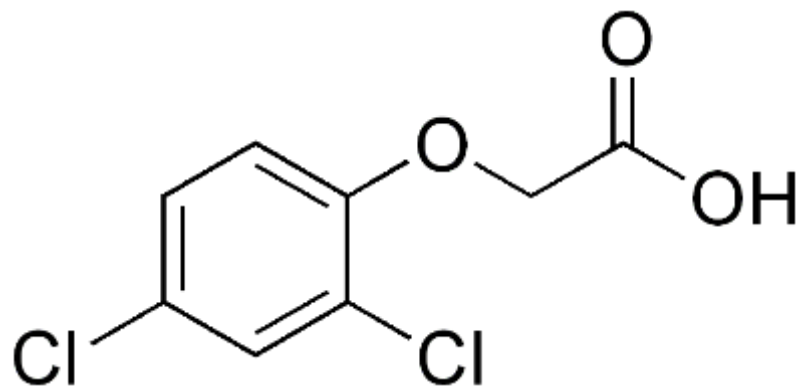


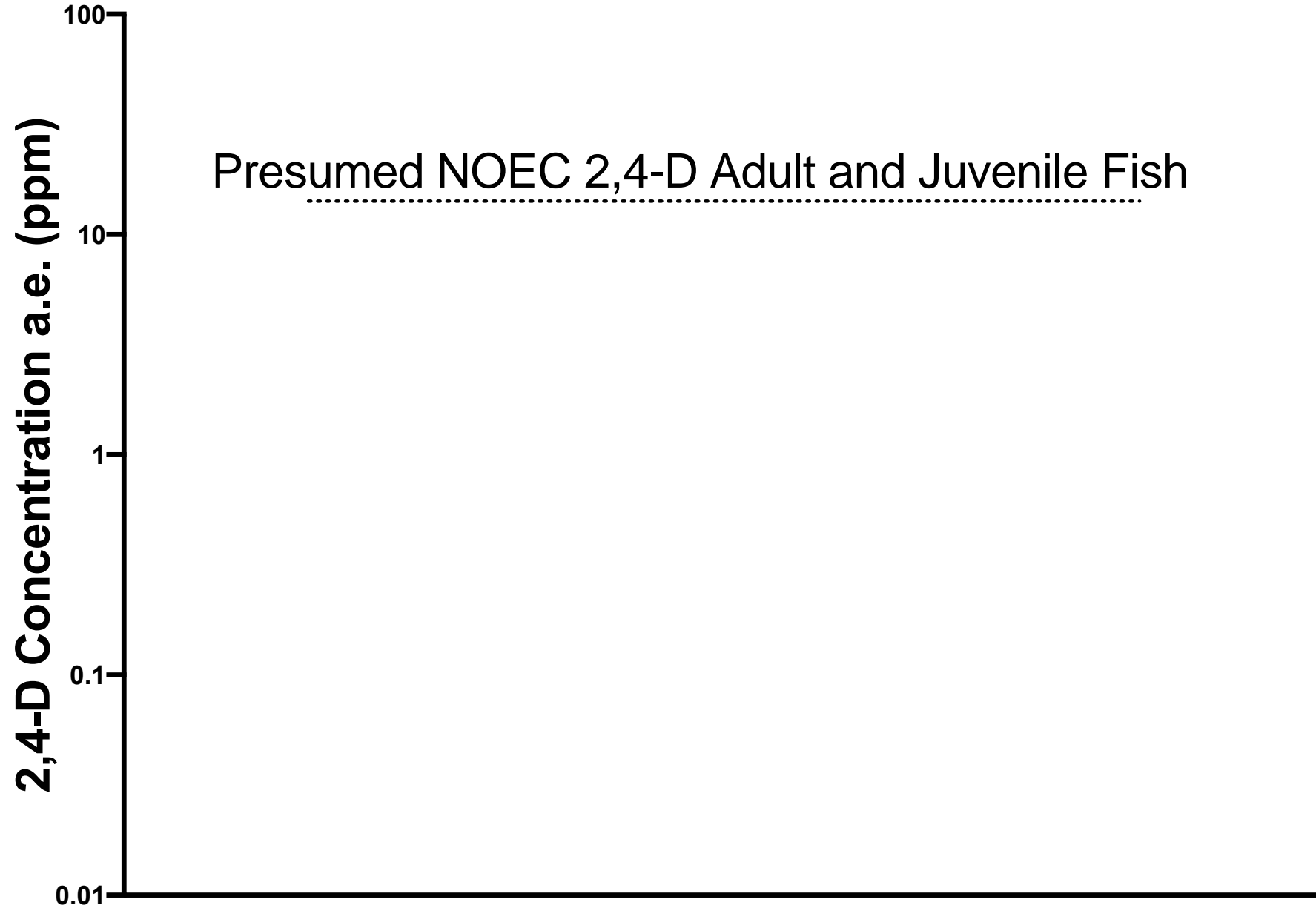
Impacts of 2,4-Dichlorophenoxyacetic acid (2,4-D) on early developmental life stages of freshwater fish

Dehnert, G.K.
dehnert2@wisc.edu

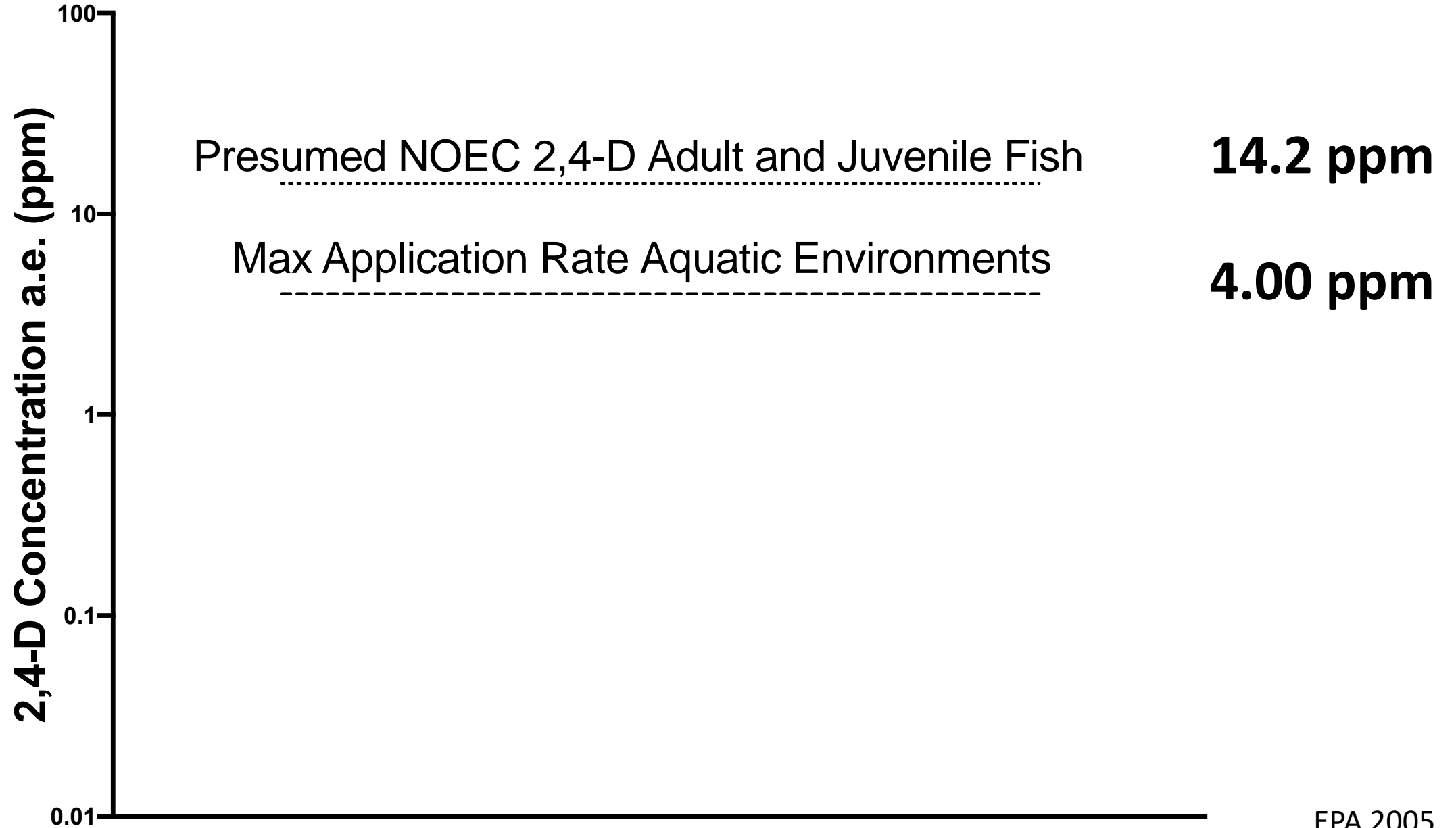


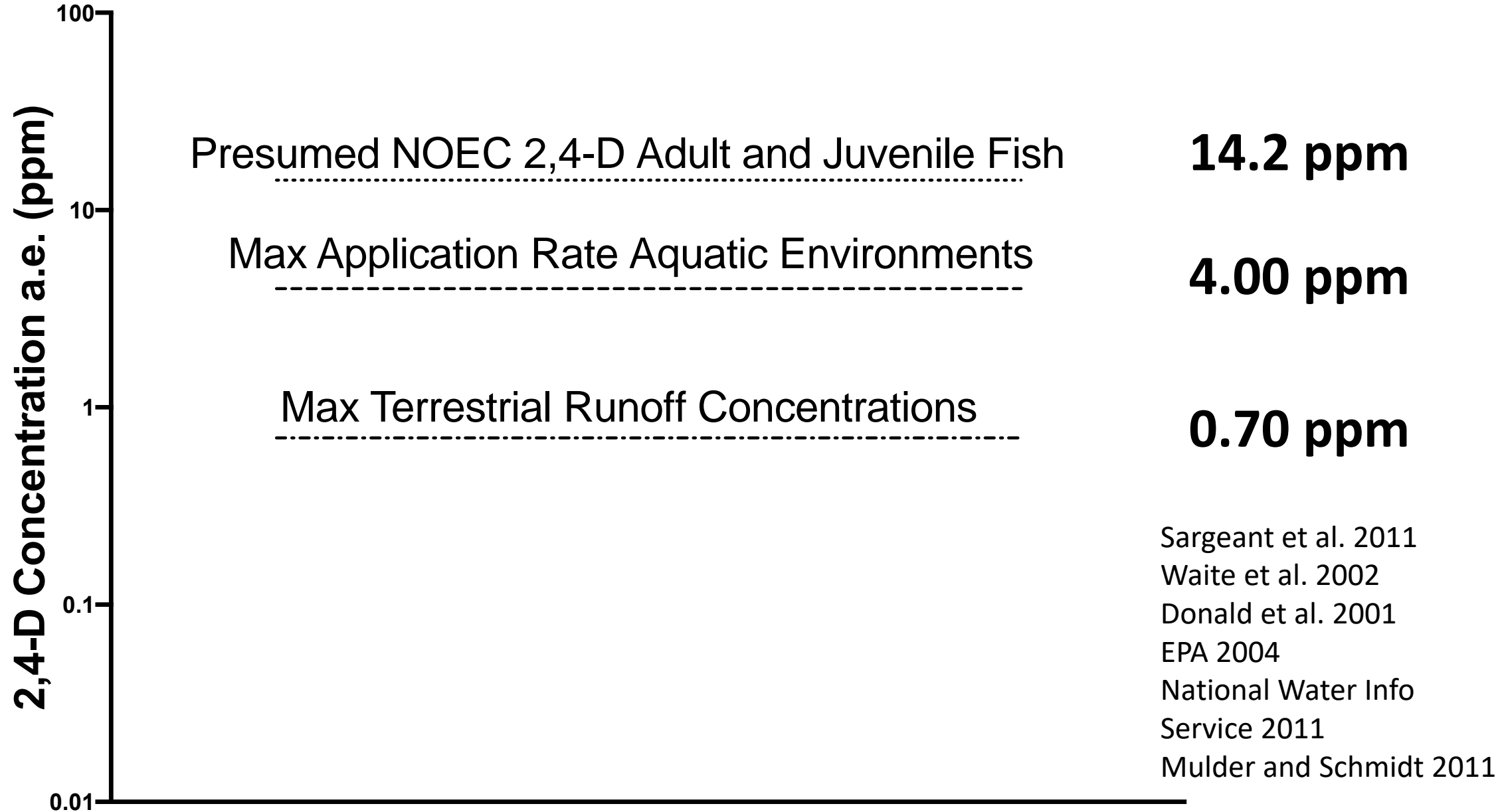
2,4-Dichlorophenoxyacetic acid (2,4-D)



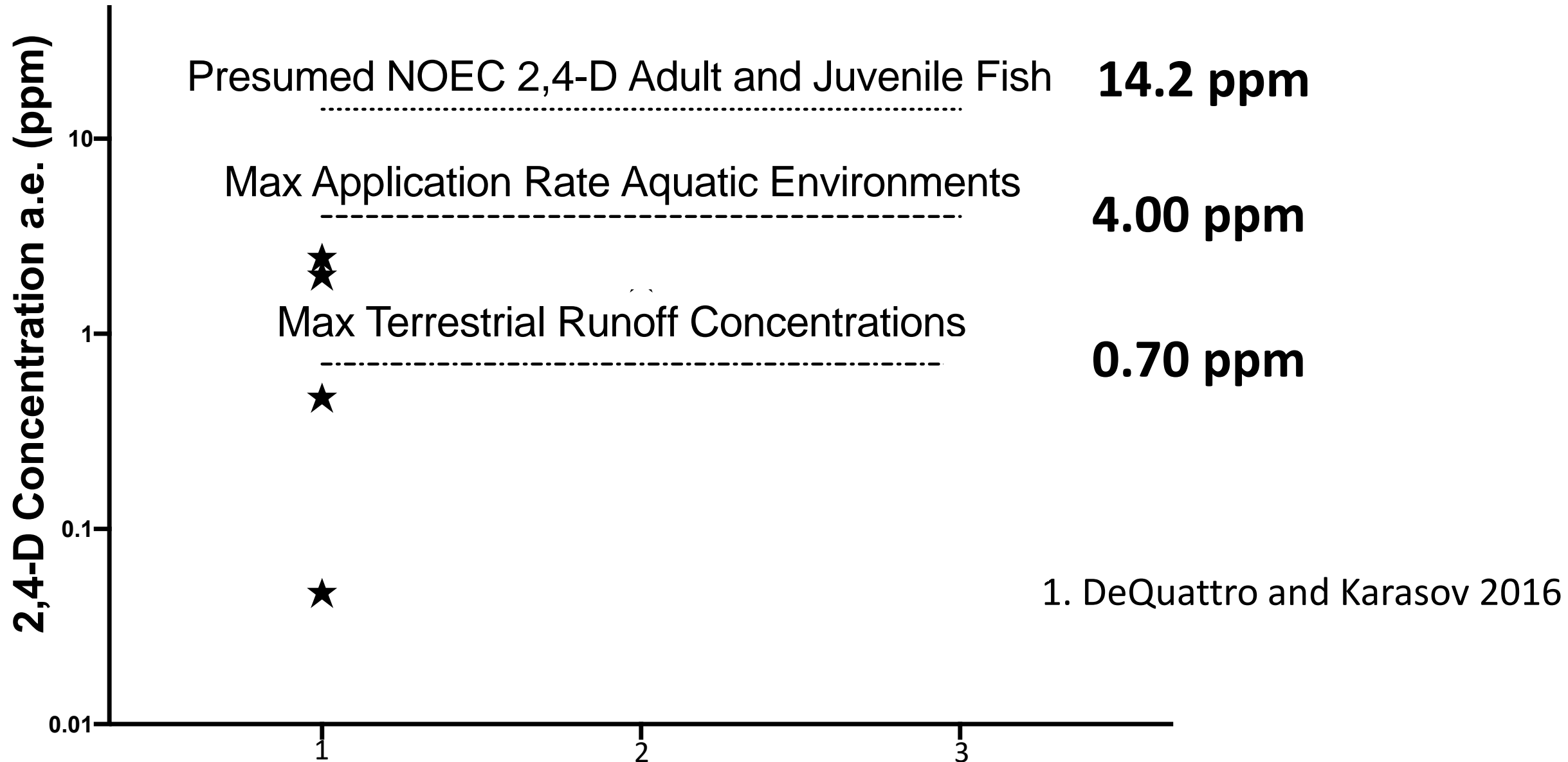


14.2 ppm

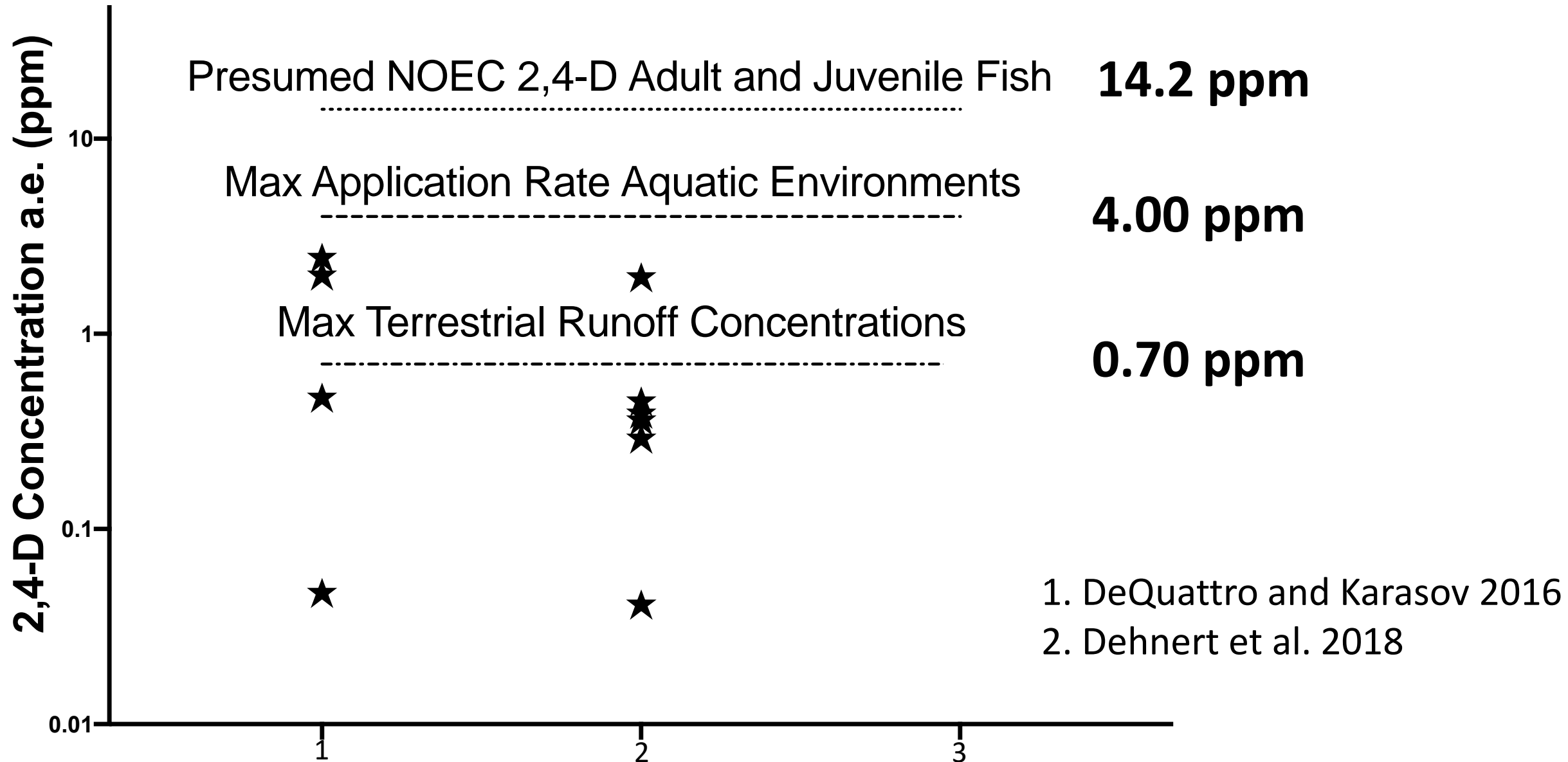




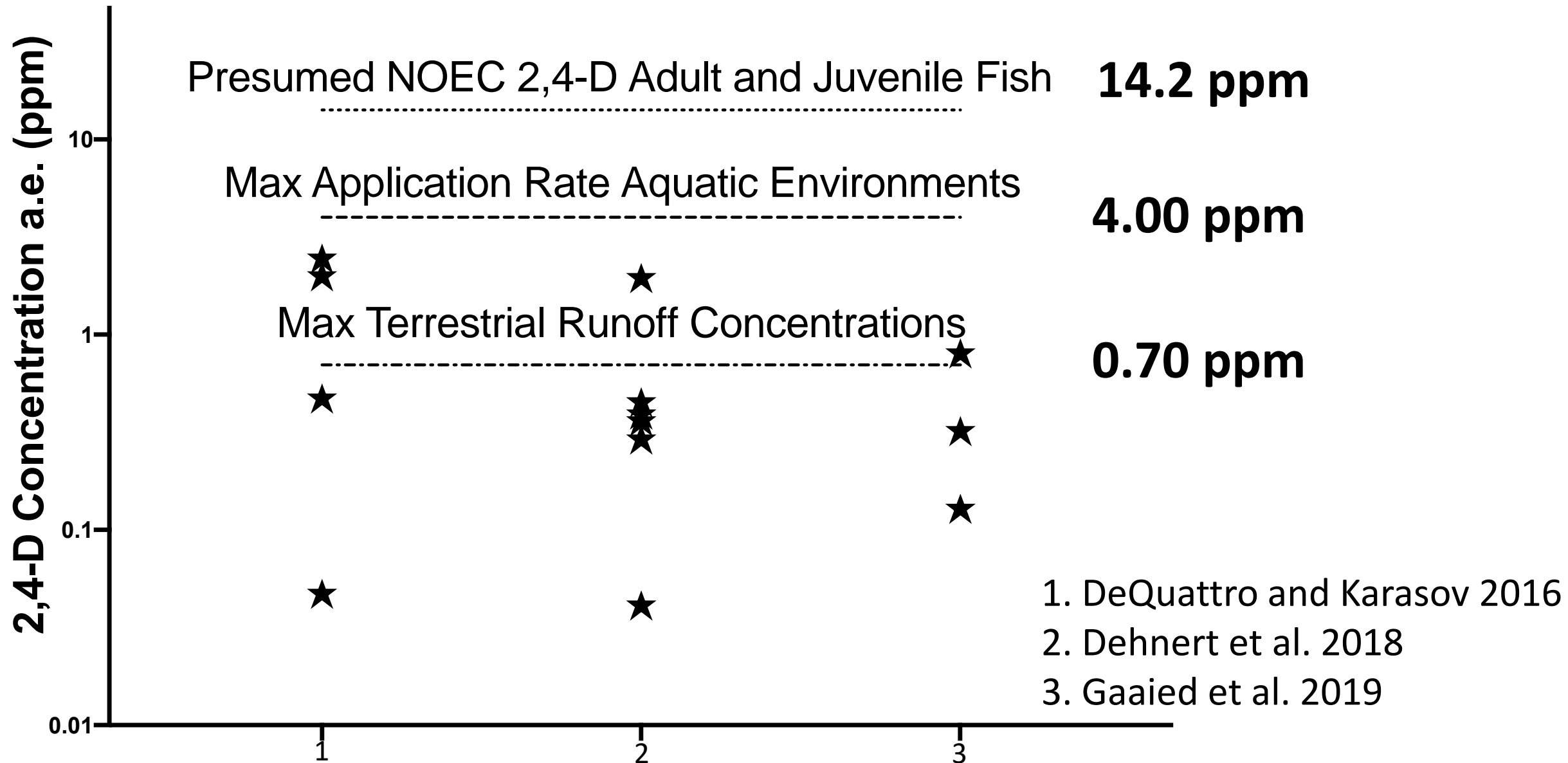
Recent studies show 2,4-D impacts on early life stages of fish



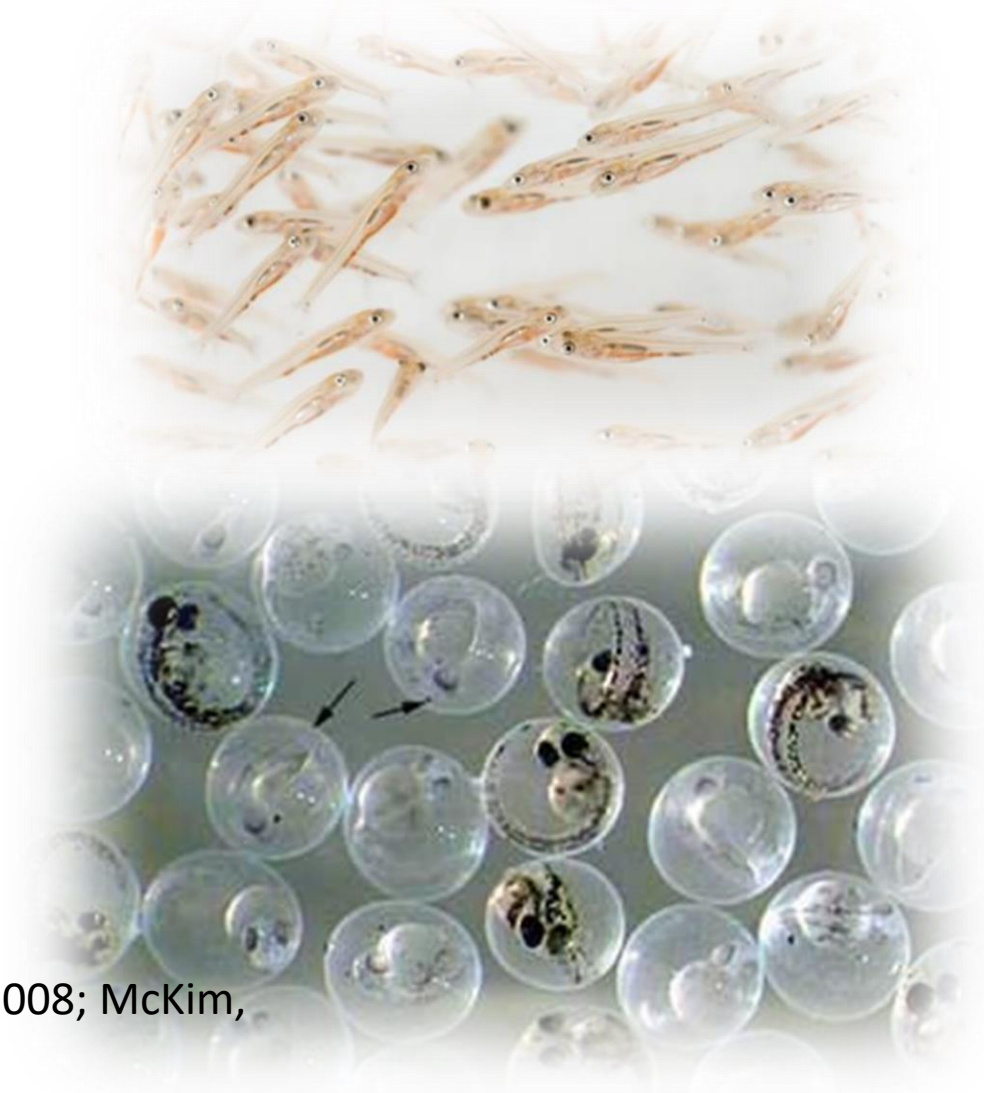
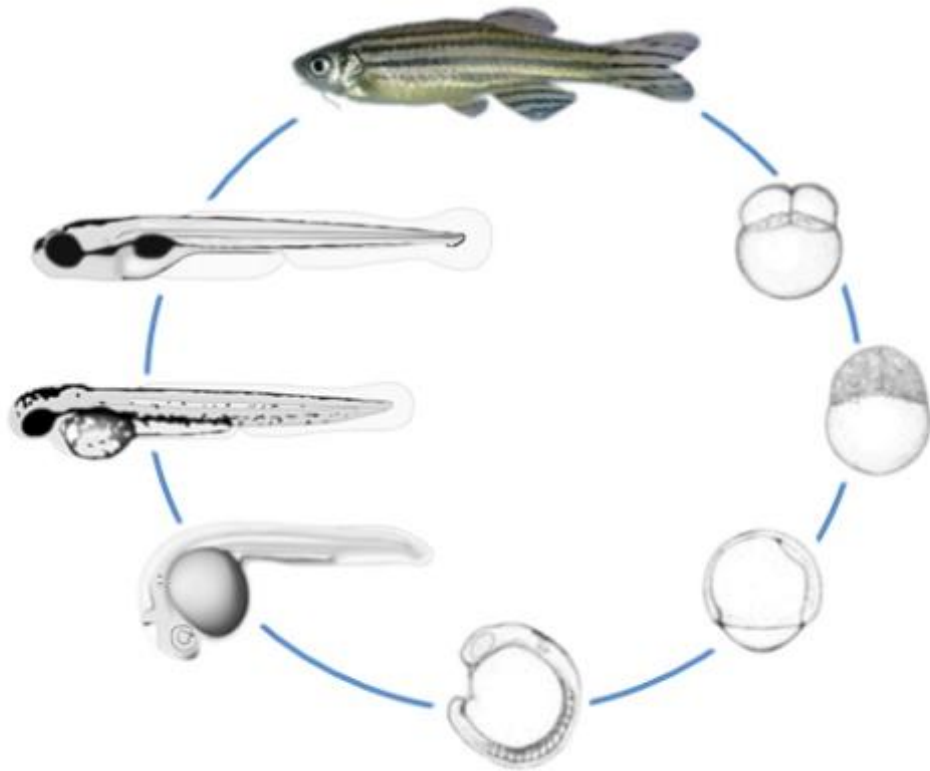
Recent studies show 2,4-D impacts on early life stages of fish



Recent studies show 2,4-D impacts on early life stages of fish



Early life stages are more sensitive to 2,4-D



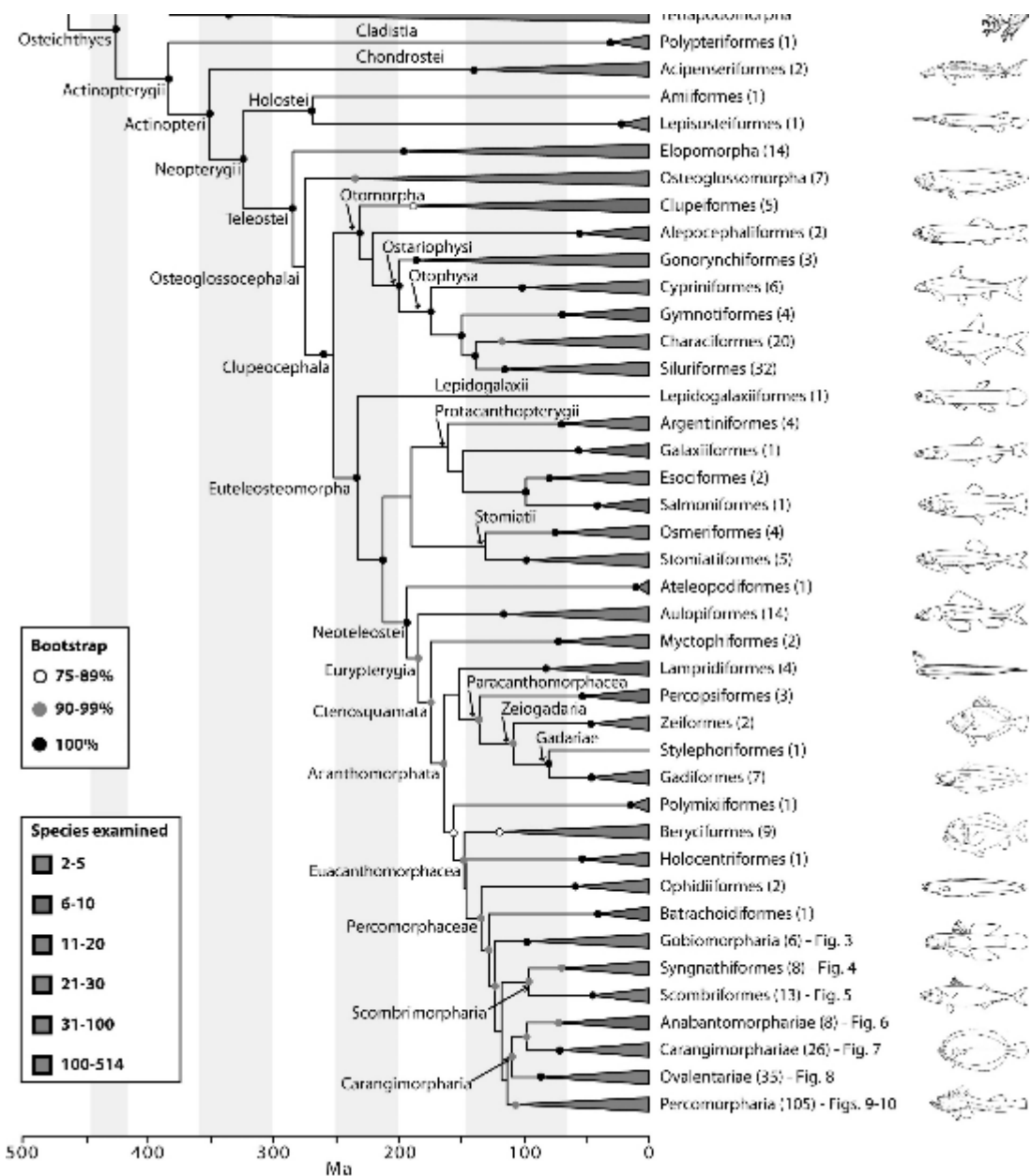
Bentivegna and Piatkowski, 1998; Lotufo and Fleeger, 1997; Mácová et al., 2008; McKim, 1977; Mohammed, 2013; Oikari et al., 2002



Danio rerio (Zebrafish)



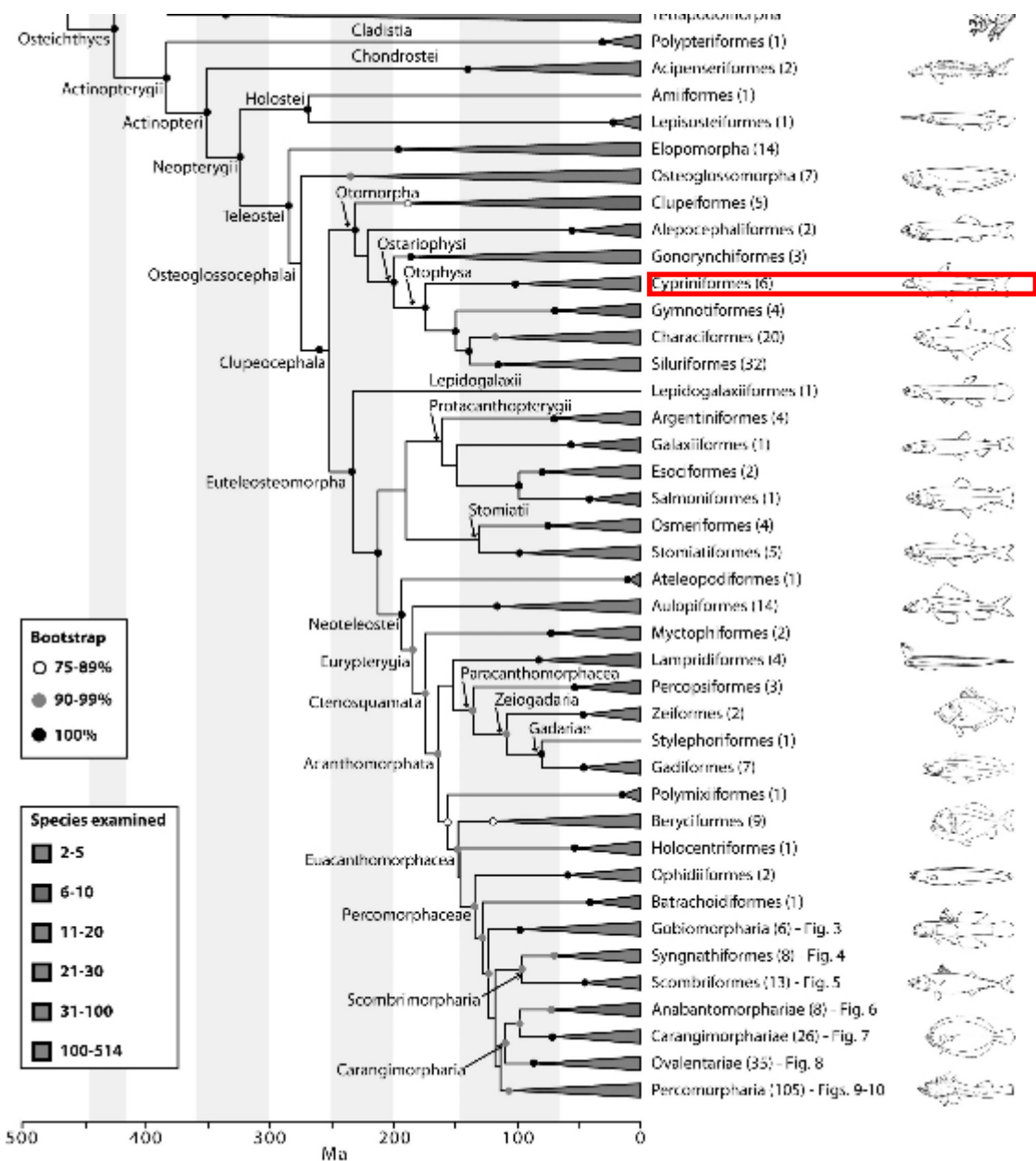
Pimephales promelas (Fathead minnow)



Danio rerio (Zebrafish)



Pimephales promelas (Fathead Minnow)



Danio rerio (Zebrafish)

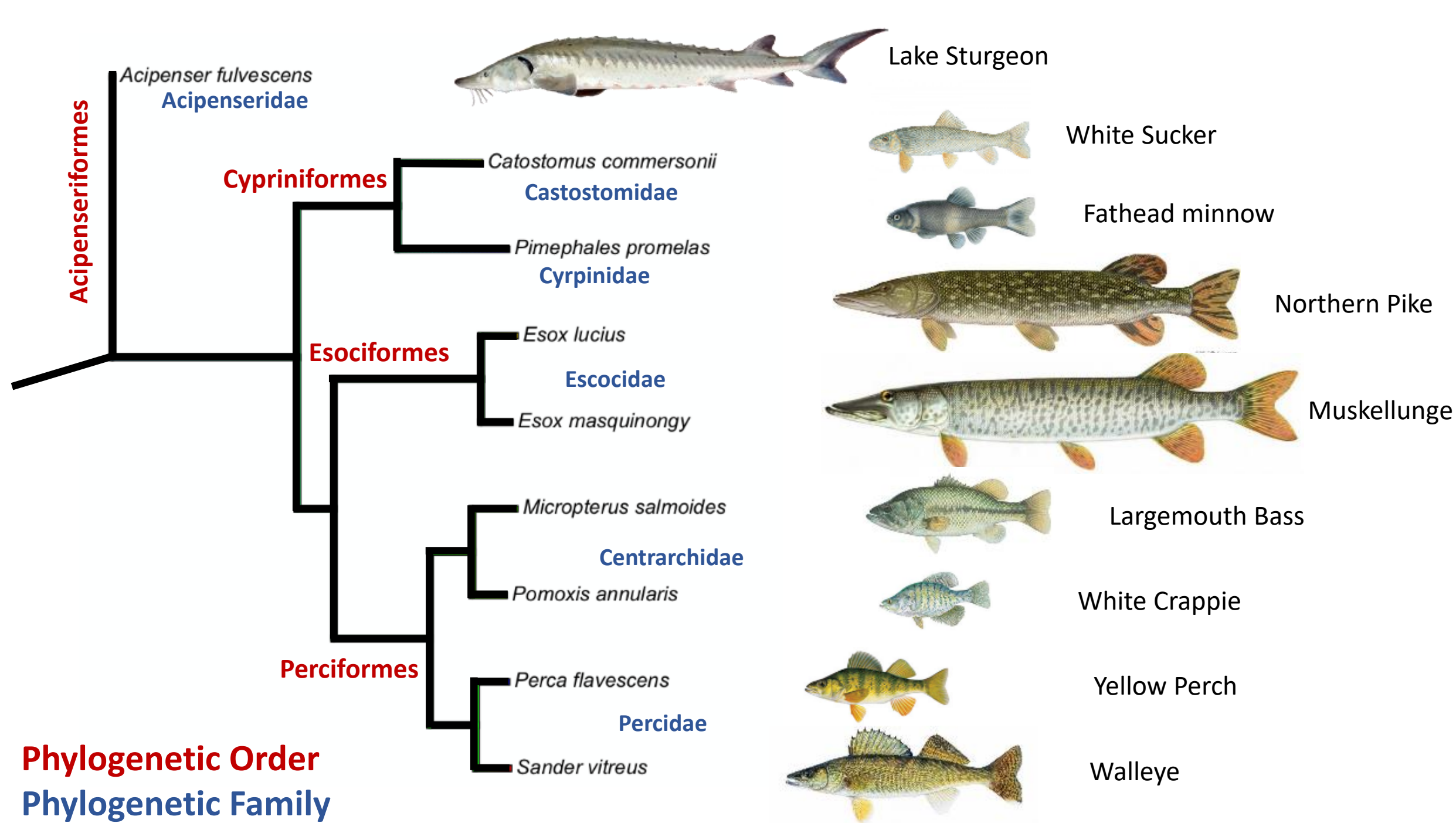


Pimephales promelas (Fathead Minnow)

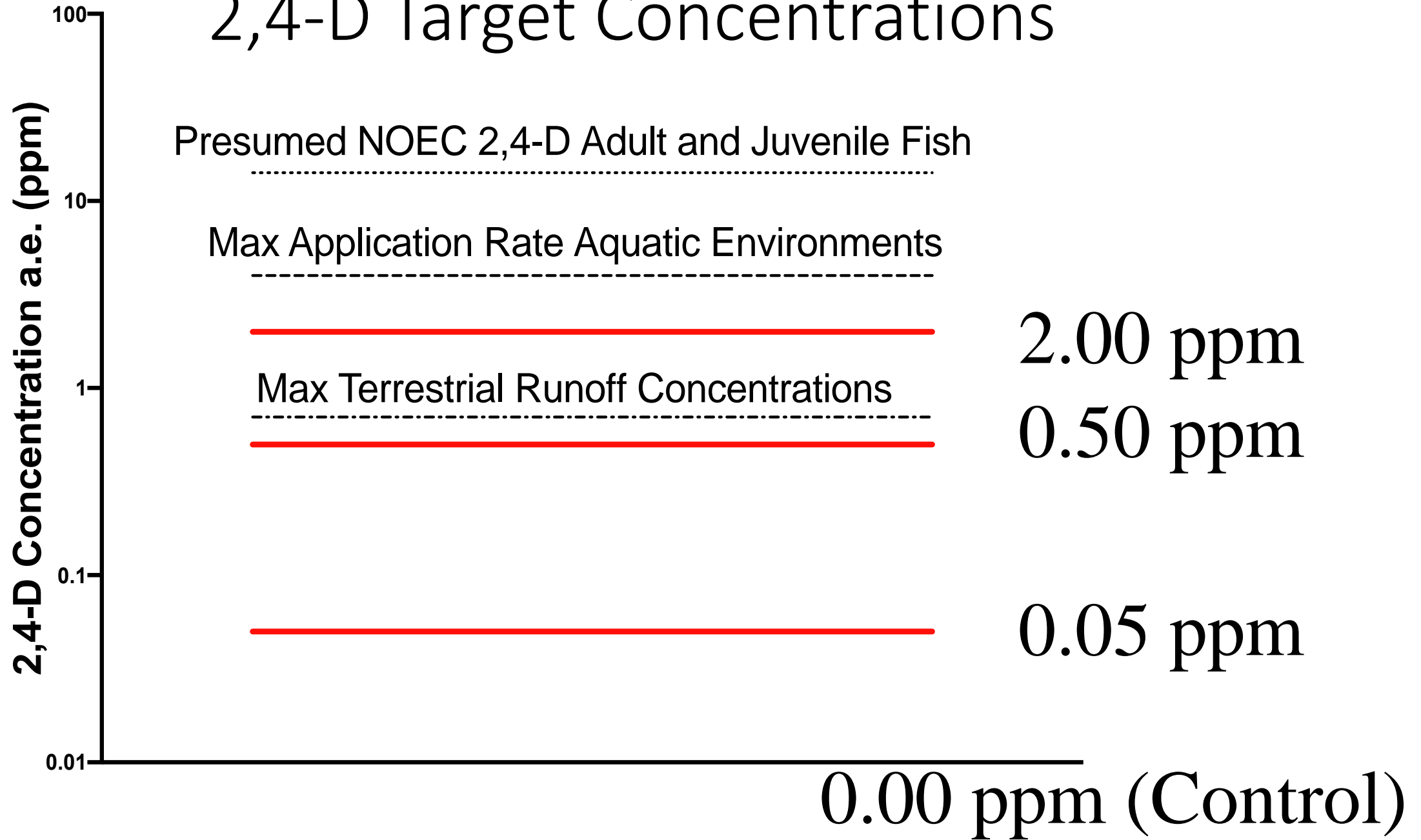
Phylogenetic Pseudoreplication

“Phylogenetic Pseudoreplication is caused by presence of phylogenetic signal in the data (i.e., the degree of similarity in trait values between species due to their common ancestry)”

Does 2,4-D exposure only impact early developing life stages of Cyprinidae?



2,4-D Target Concentrations



Embryo Assay

- Exposure from fertilization until hatch
- Assess survivorship and deformities
- Unaffected embryo = Alive with no deformities
- 0.00 ppm (control), 0.05 ppm, 0.50 ppm, and 2.00 ppm 2,4-D

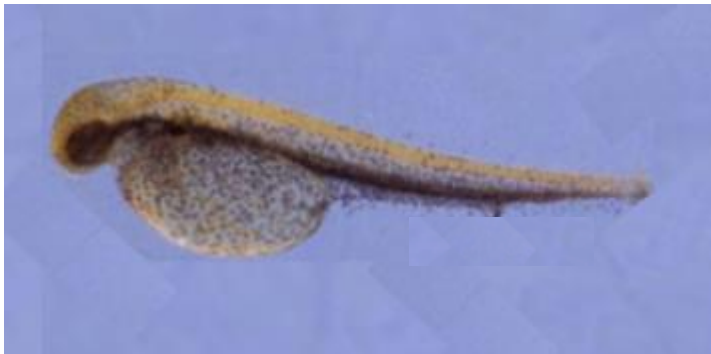
Unaffected



Common Deformities

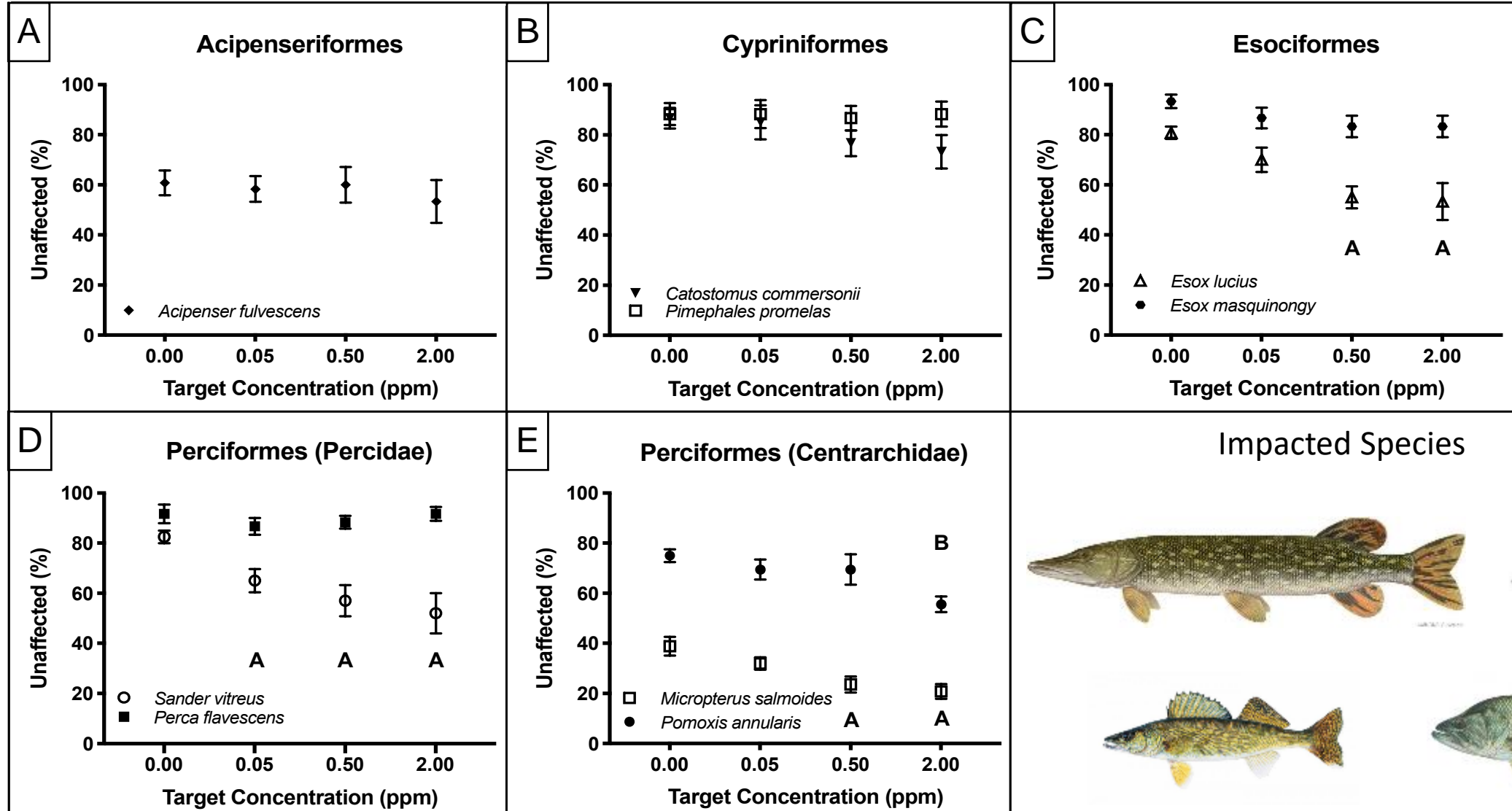


Curved Spin (Scoliosis)



Cardiac Edema

Embryo Assays: 4 out of 9 species impacted



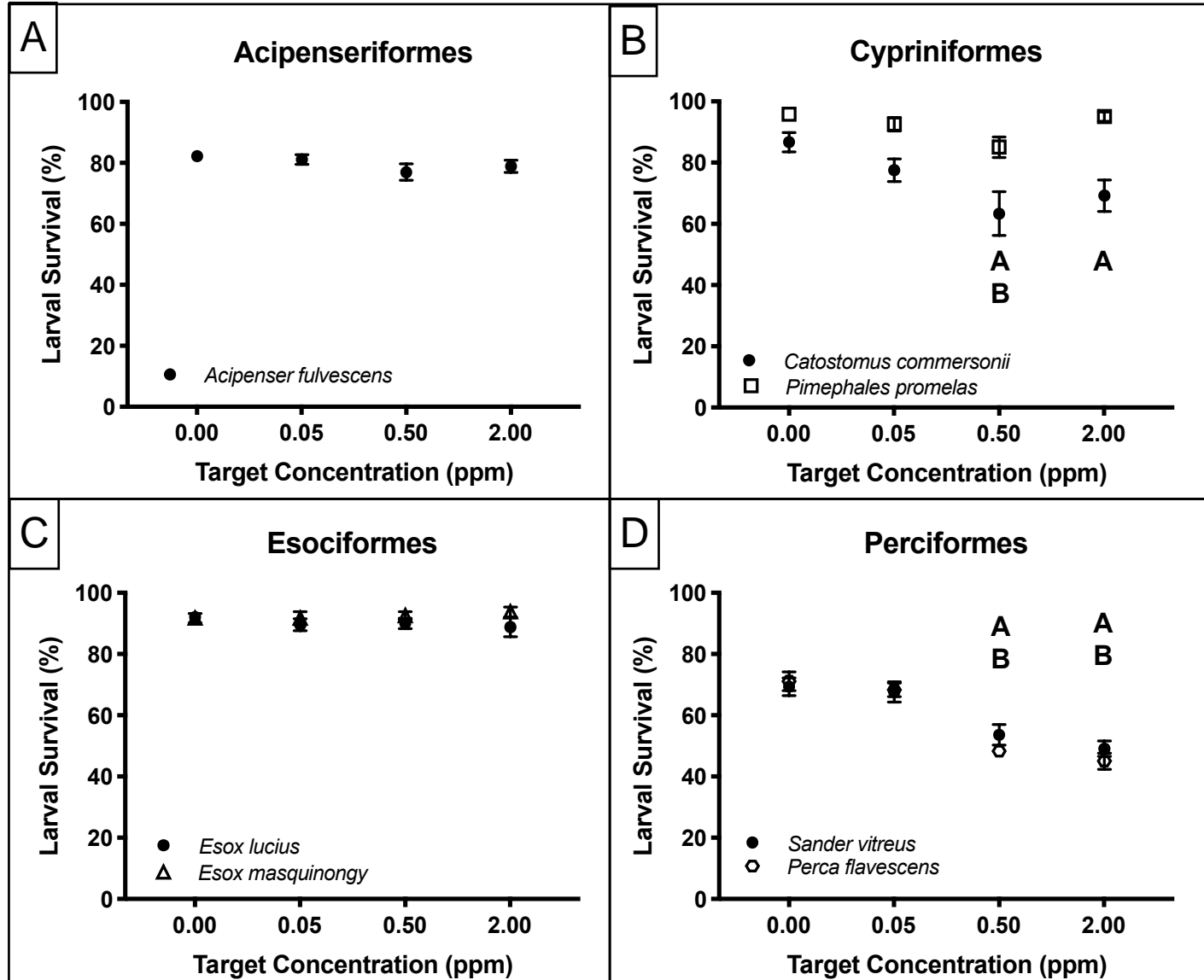
Impacted Species



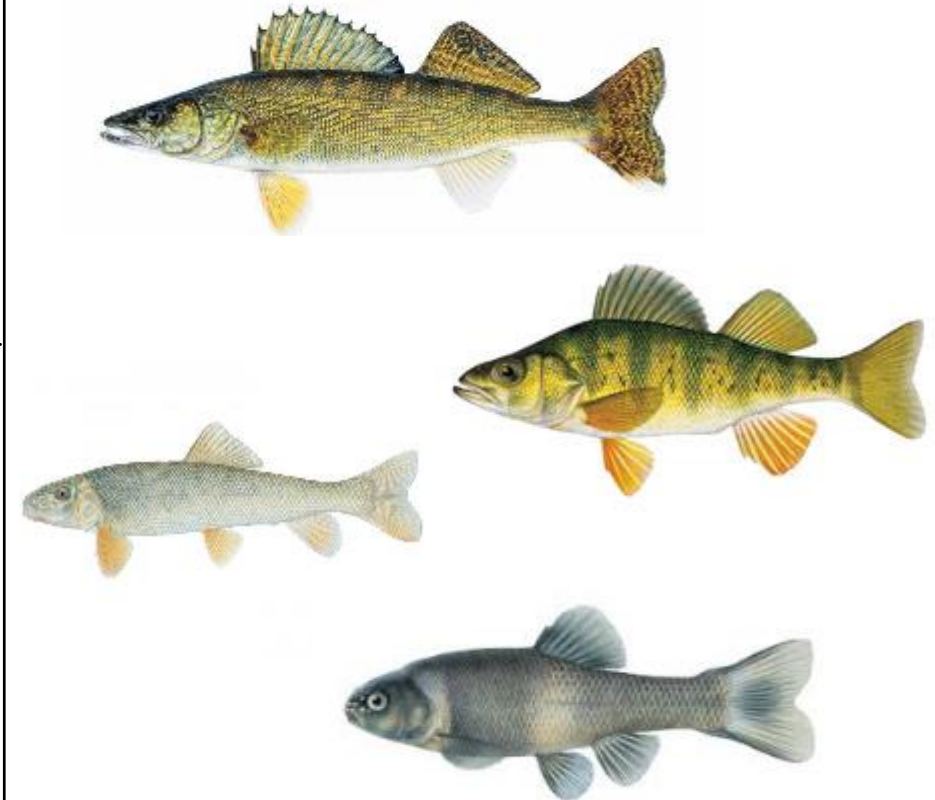
Larval Assays

- Exposure from hatch until 30 days post hatch
- Assess survivorship and growth
- 0.00 ppm (control), 0.05 ppm, 0.50 ppm, and 2.00 ppm 2,4-D

Larval Assays: 4 out of 7 species impacted



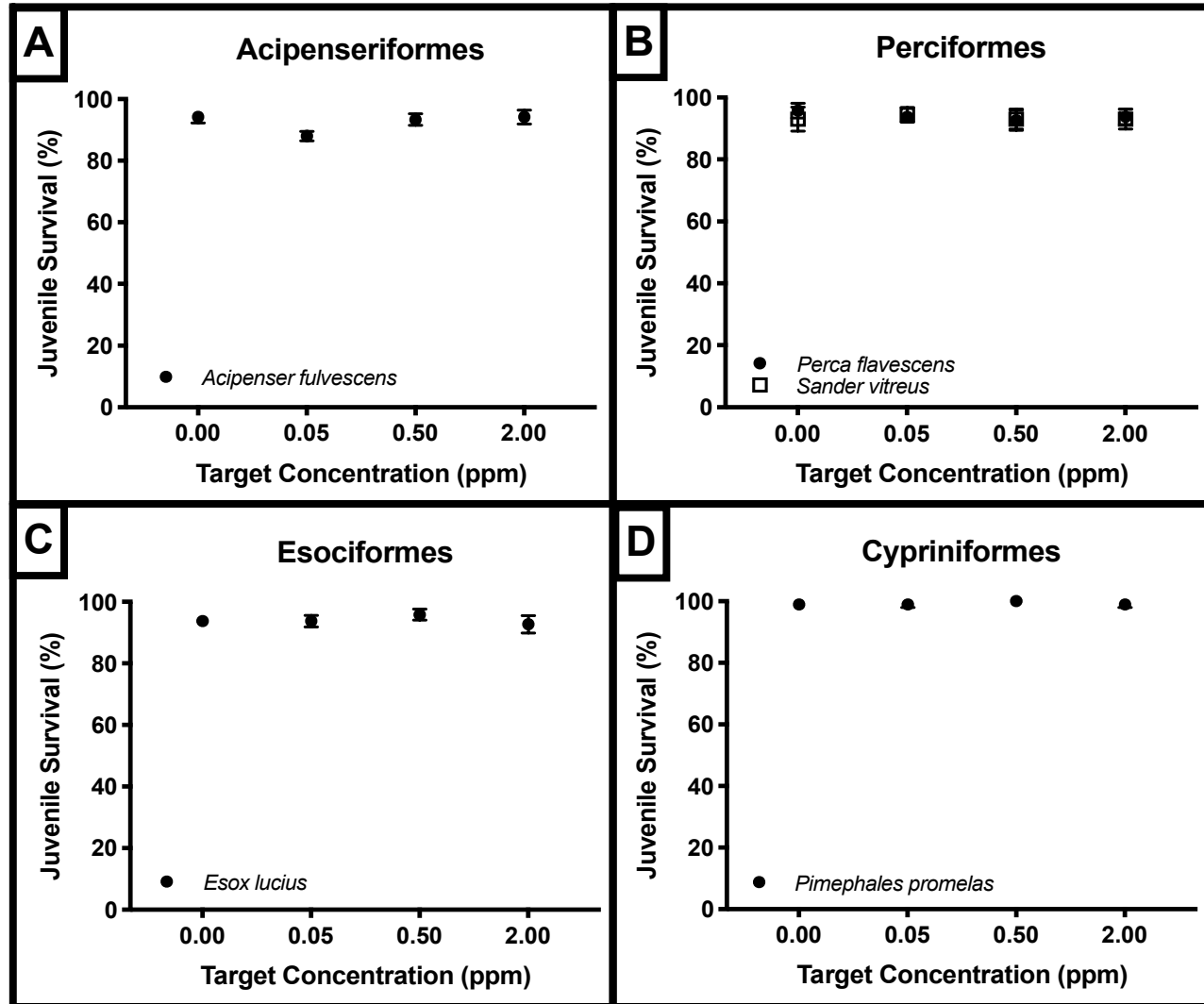
Impacted Species



Juvenile Assays

- Exposure from 60 days post until 150 days post hatch
- Assess survivorship and growth
- 0.00 ppm (control), 0.05 ppm, 0.50 ppm, and 2.00 ppm 2,4-D

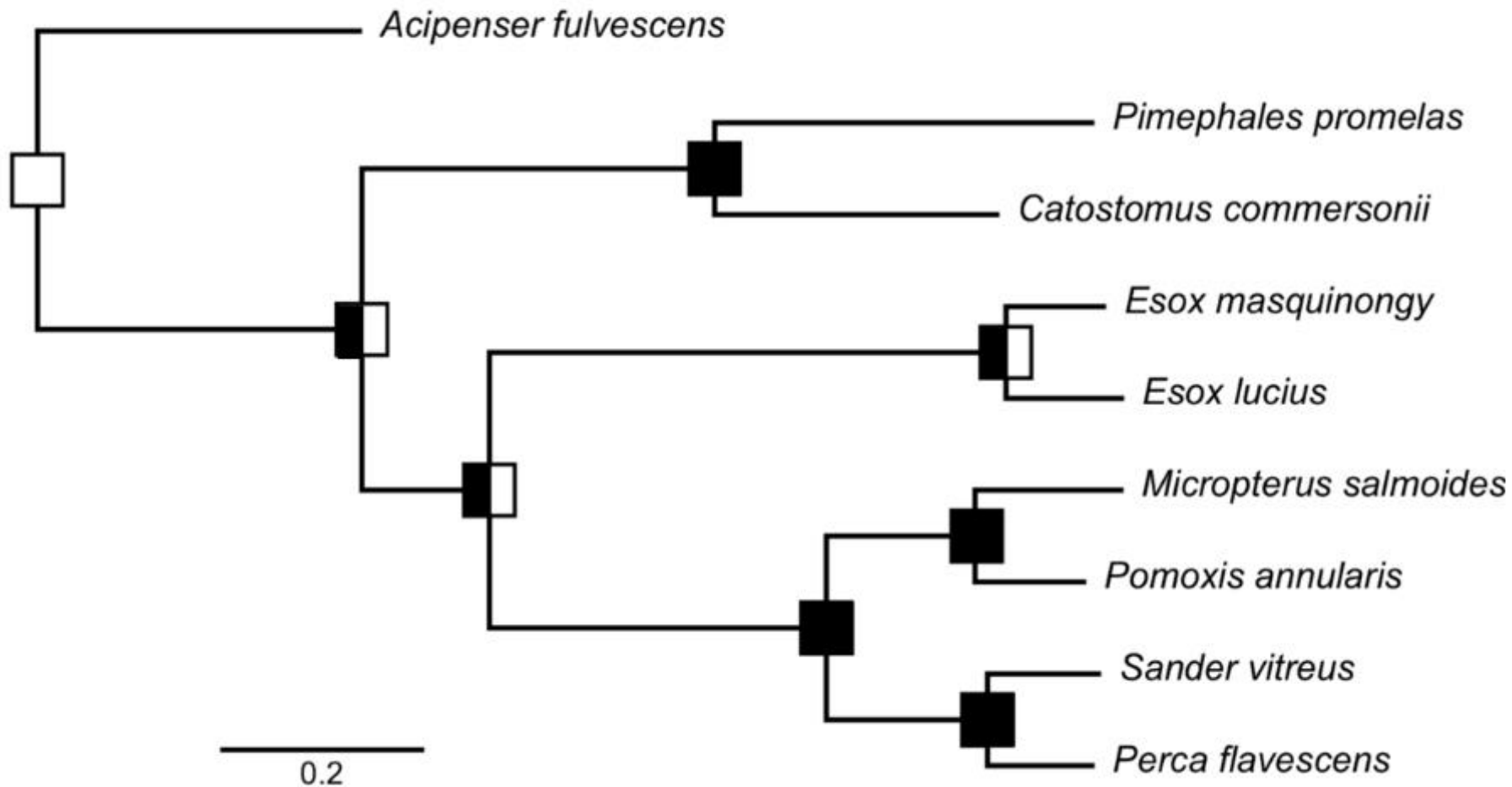
No observed impacts of 2,4-D exposure on juvenile fish



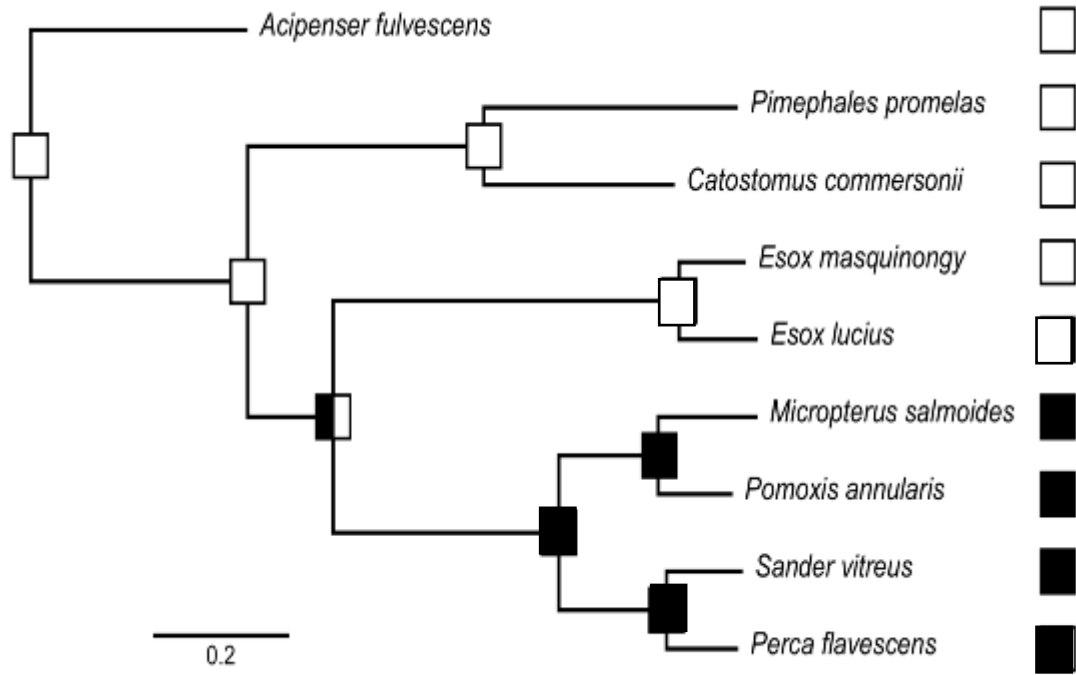
No Impacted Species

Is there a correlation with sensitivity to 2,4-D exposure and phylogenetic distances

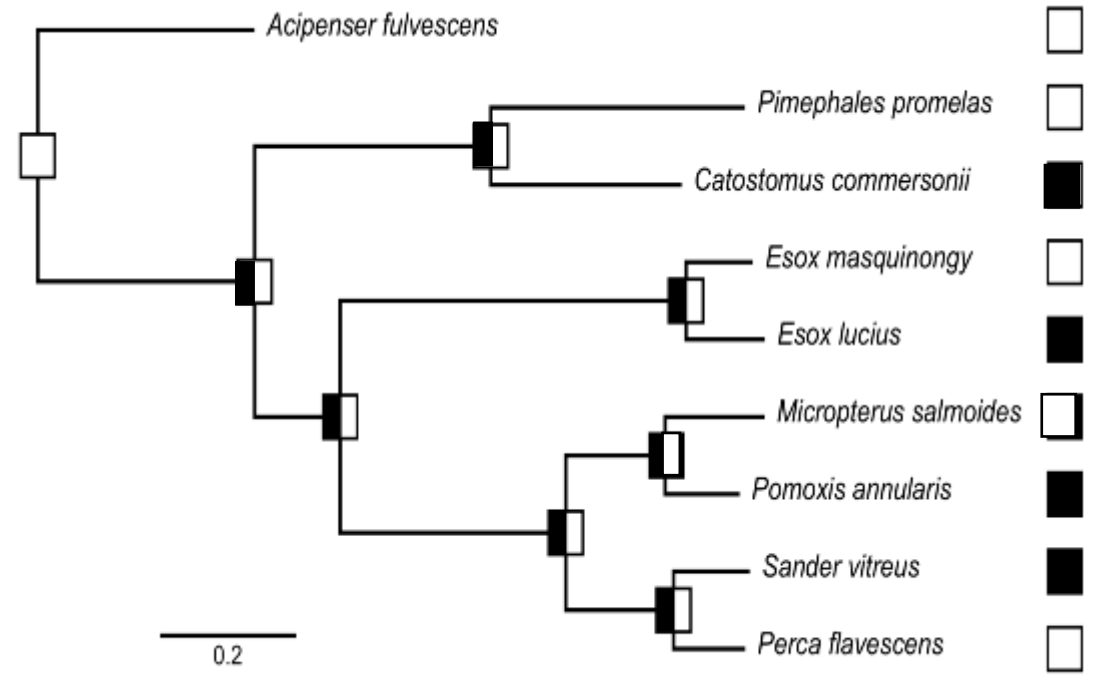
Bayesian Inference Tree



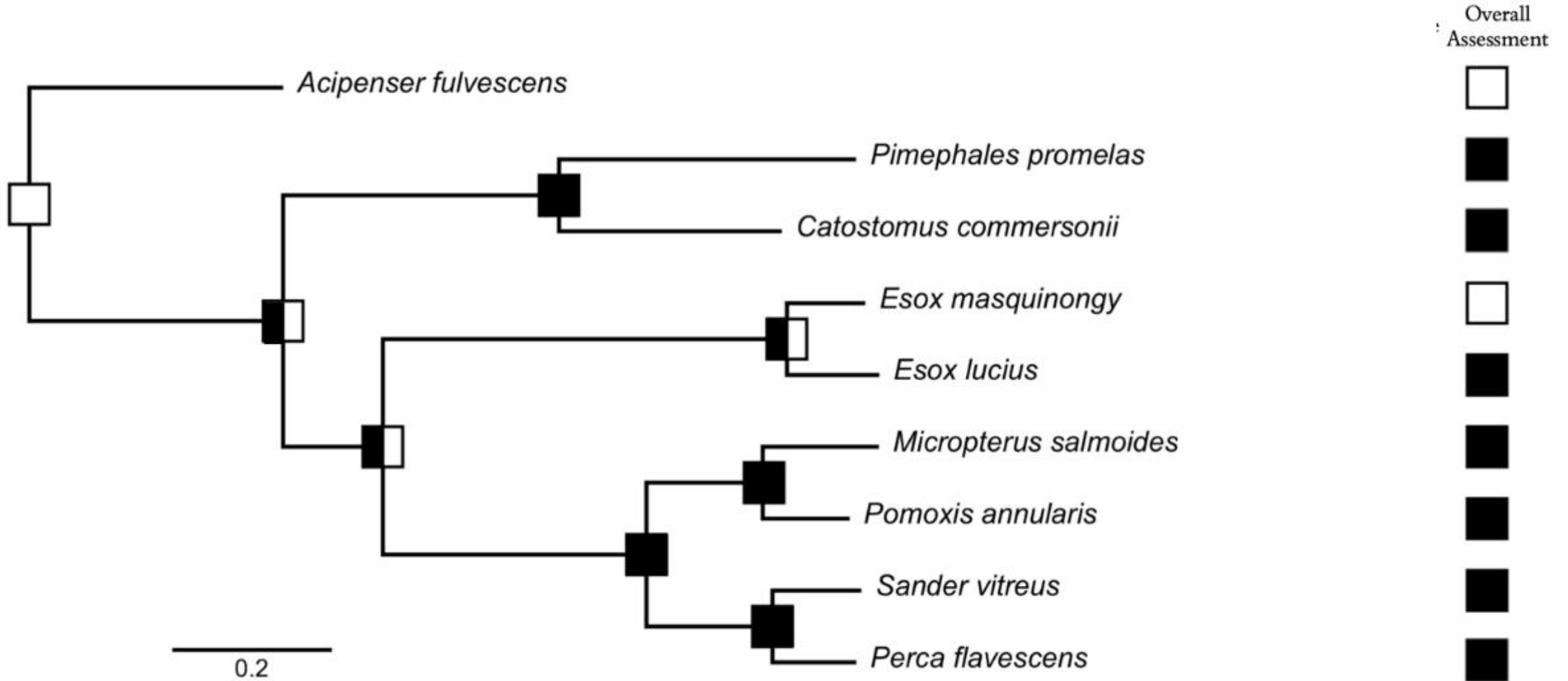
Strong Phylogenetic Prediction



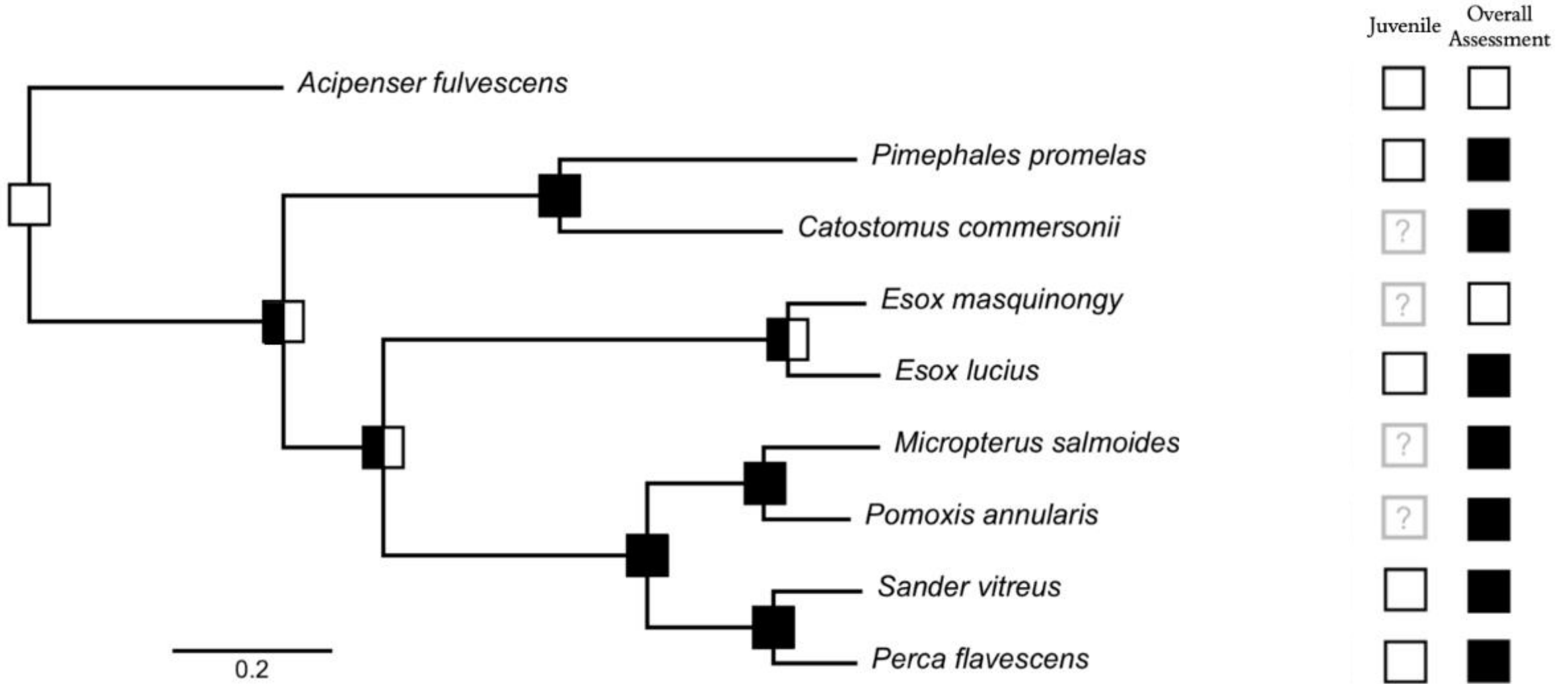
No/Weak Phylogenetic Prediction



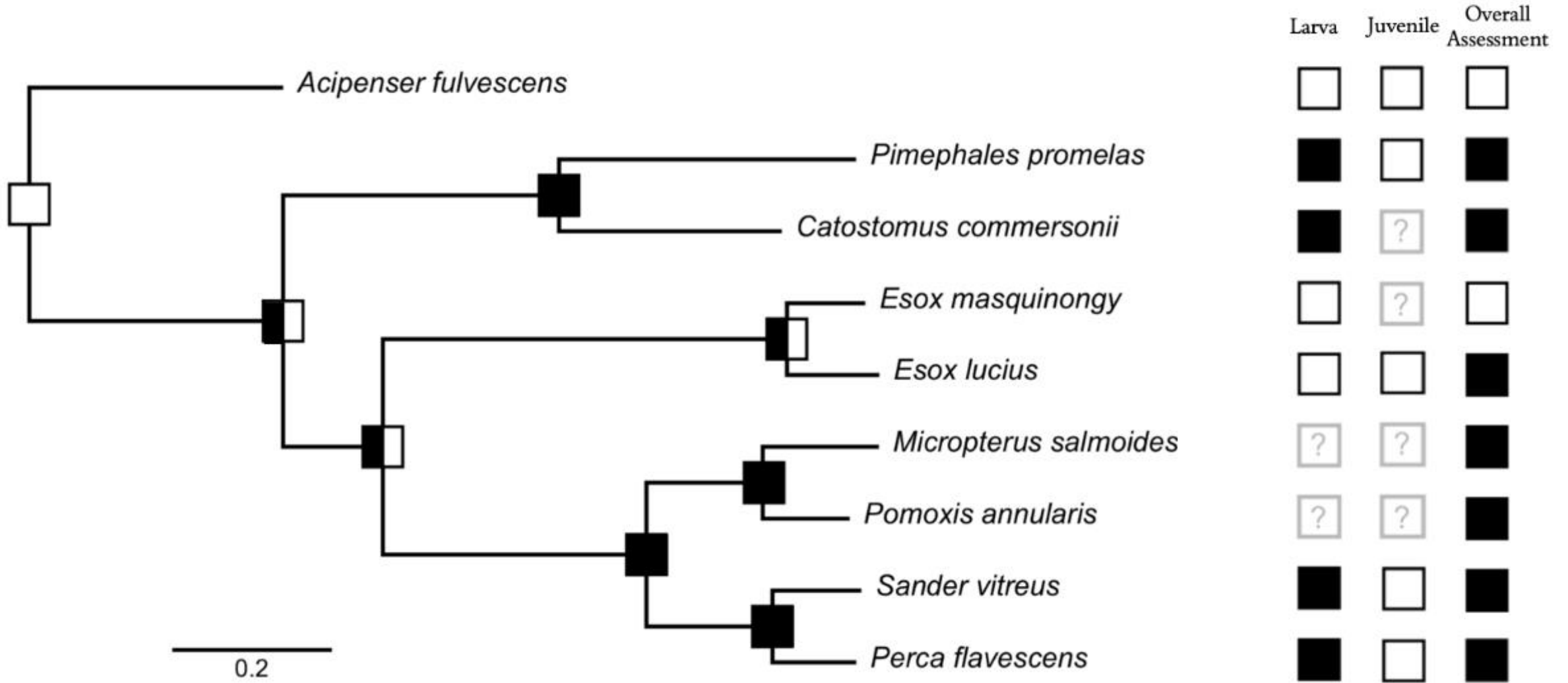
No correlation between sensitivity to 2,4-D exposure and phylogenetic proximity



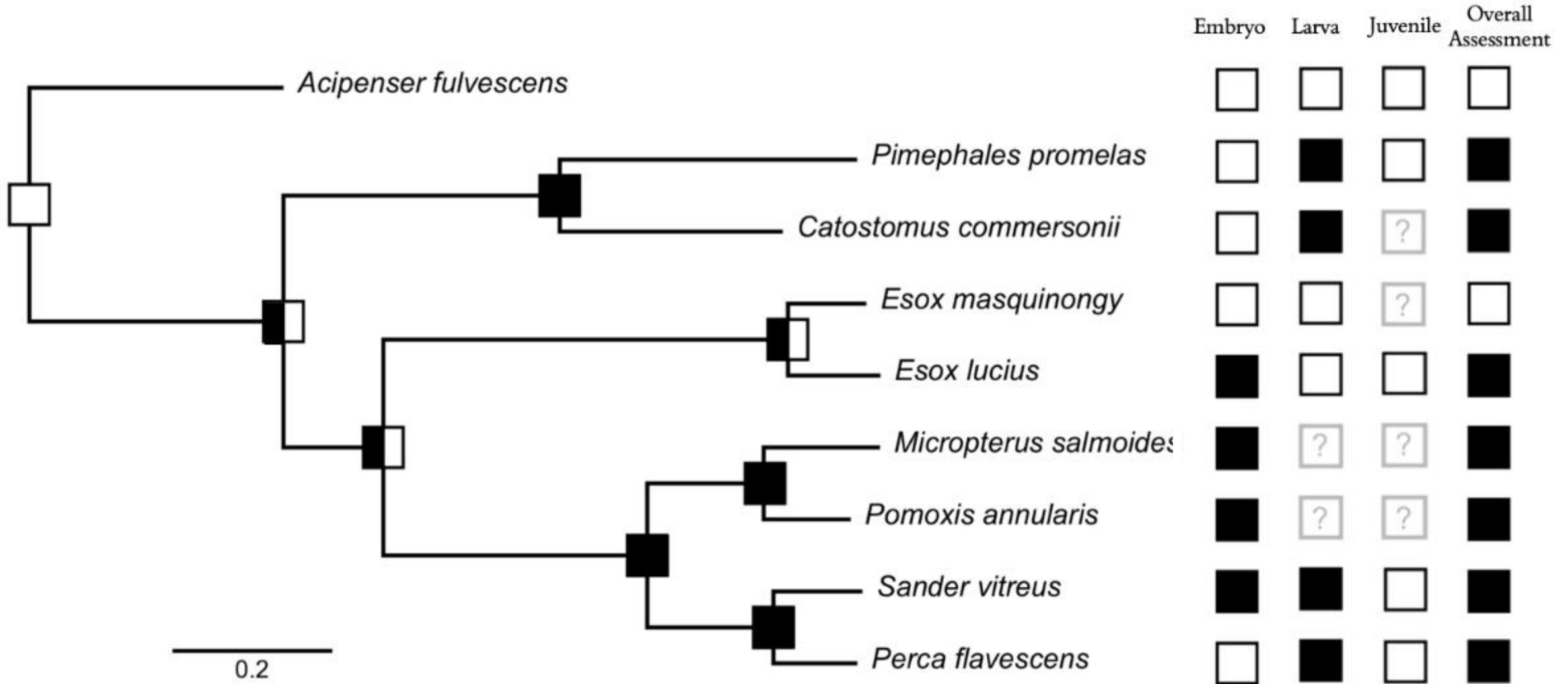
No correlation between sensitivity to 2,4-D exposure and phylogenetic proximity



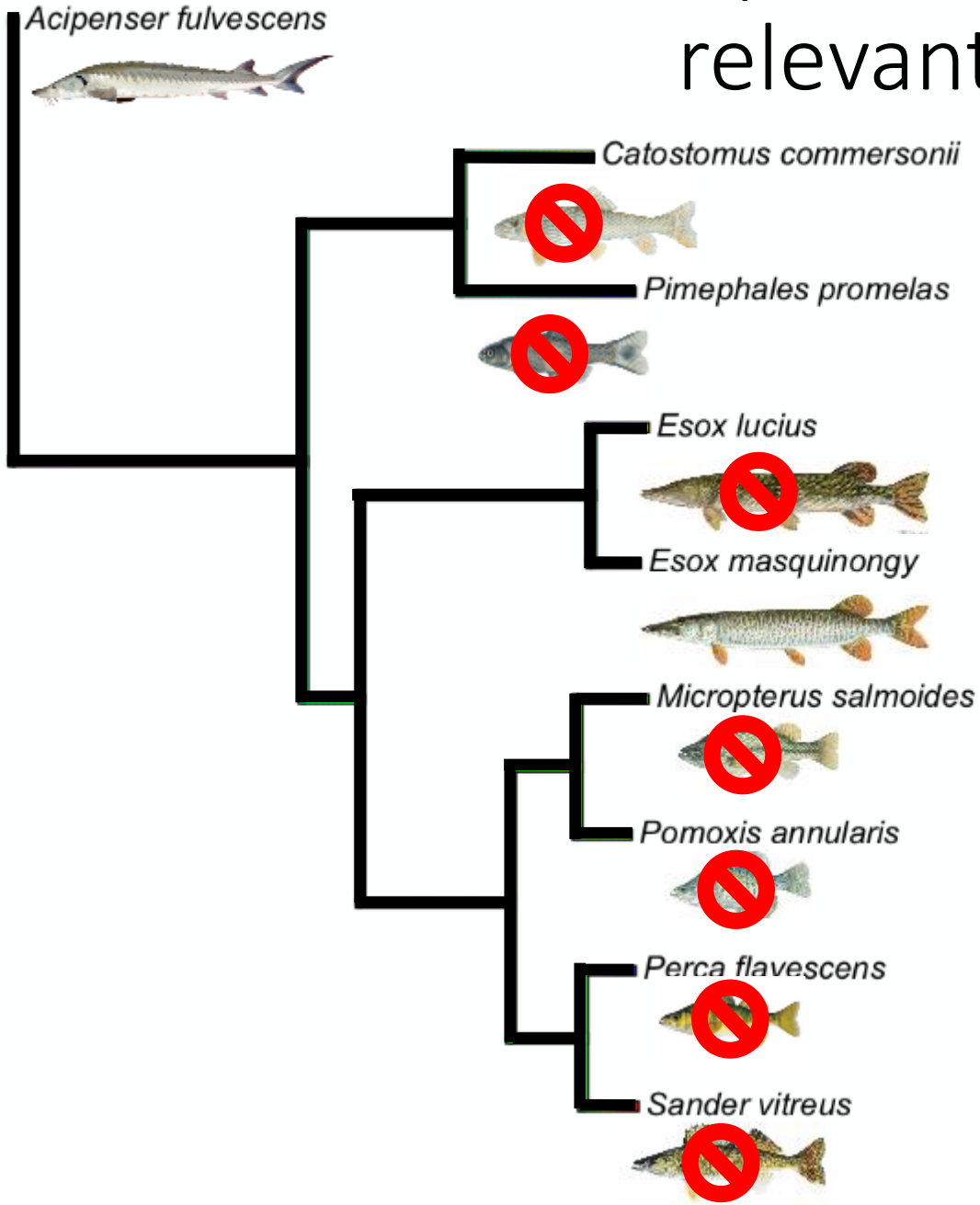
No correlation between sensitivity to 2,4-D exposure and phylogenetic proximity



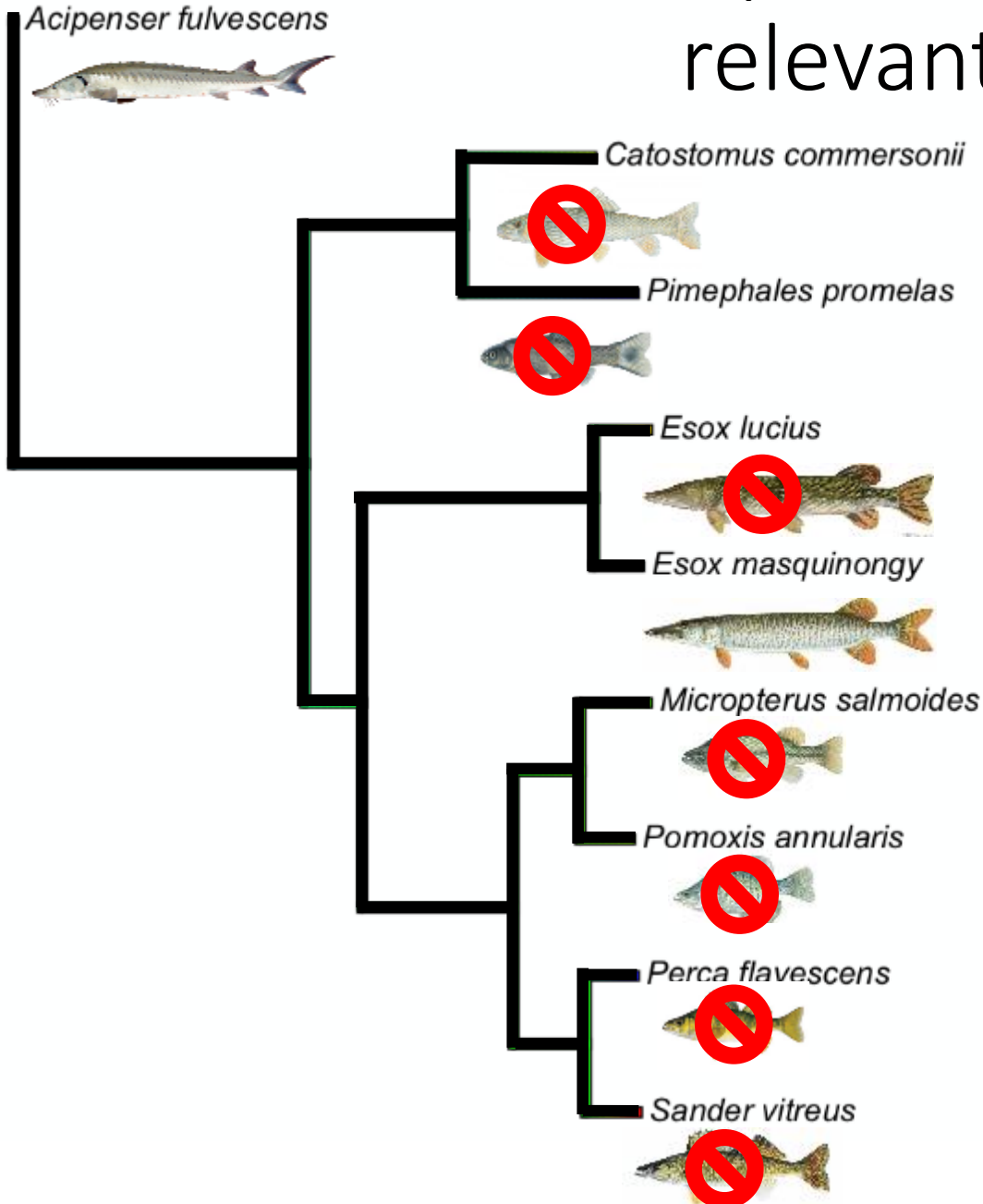
No correlation between sensitivity to 2,4-D exposure and phylogenetic proximity



Most species impacted by environmentally relevant concentrations of 2,4-D



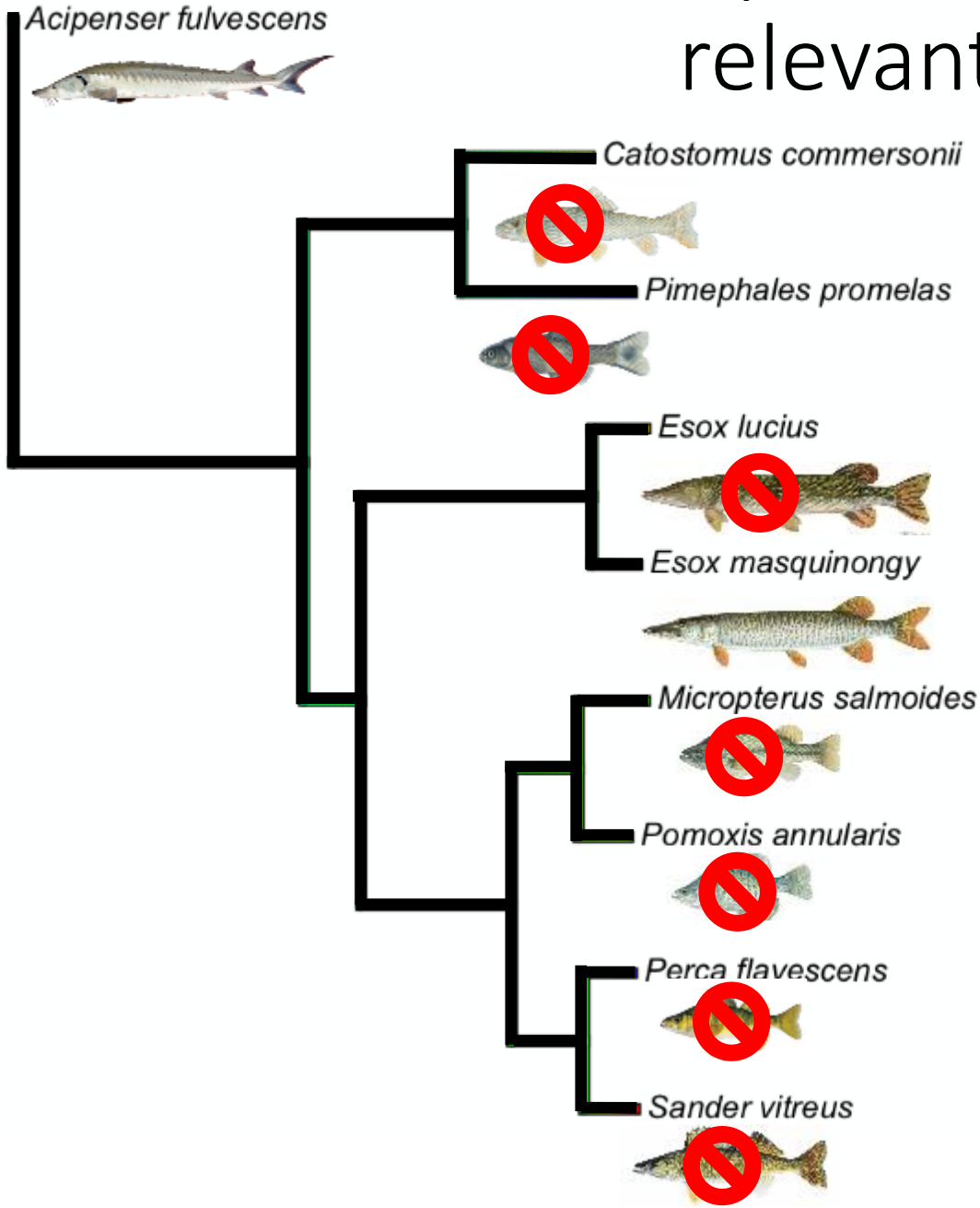
Most species impacted by environmentally relevant concentrations of 2,4-D



Impacted Species

- 7 out of 9 species

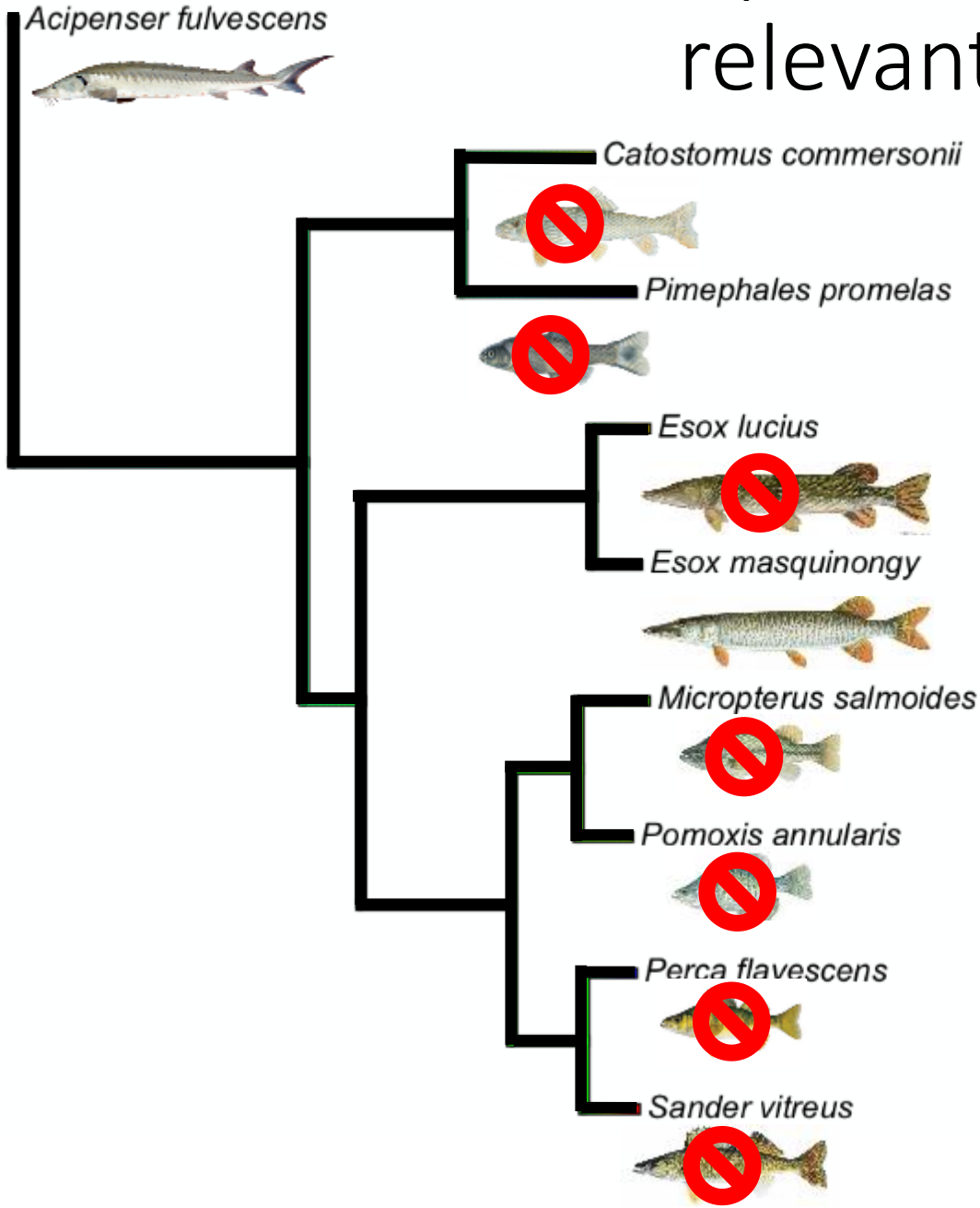
Most species impacted by environmentally relevant concentrations of 2,4-D



Impacted Species

- 7 out of 9 species
- 5 out of 6 families

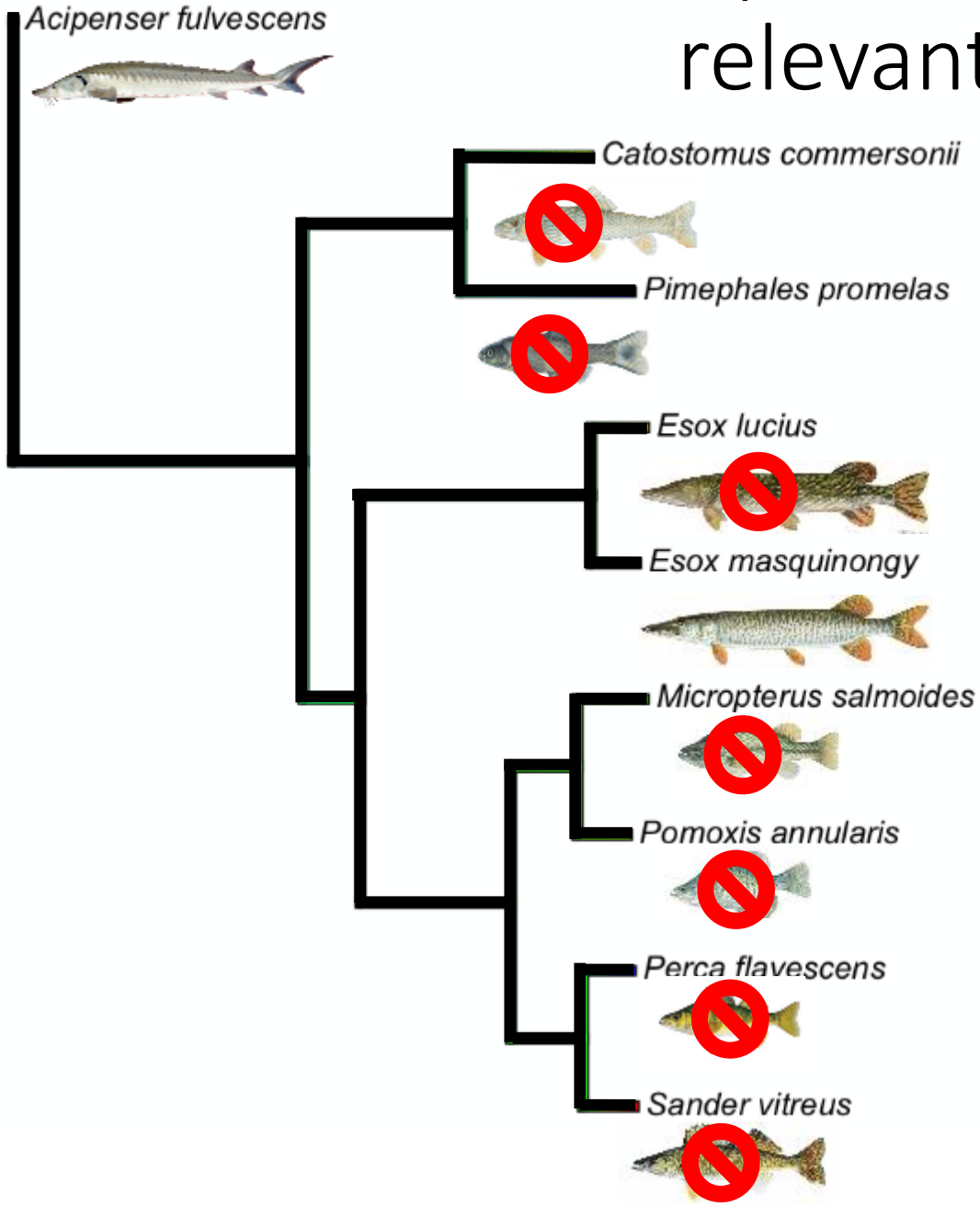
Most species impacted by environmentally relevant concentrations of 2,4-D



Impacted Species

- 7 out of 9 species
- 5 out of 6 families
- 3 out of 4 orders

Most species impacted by environmentally relevant concentrations of 2,4-D



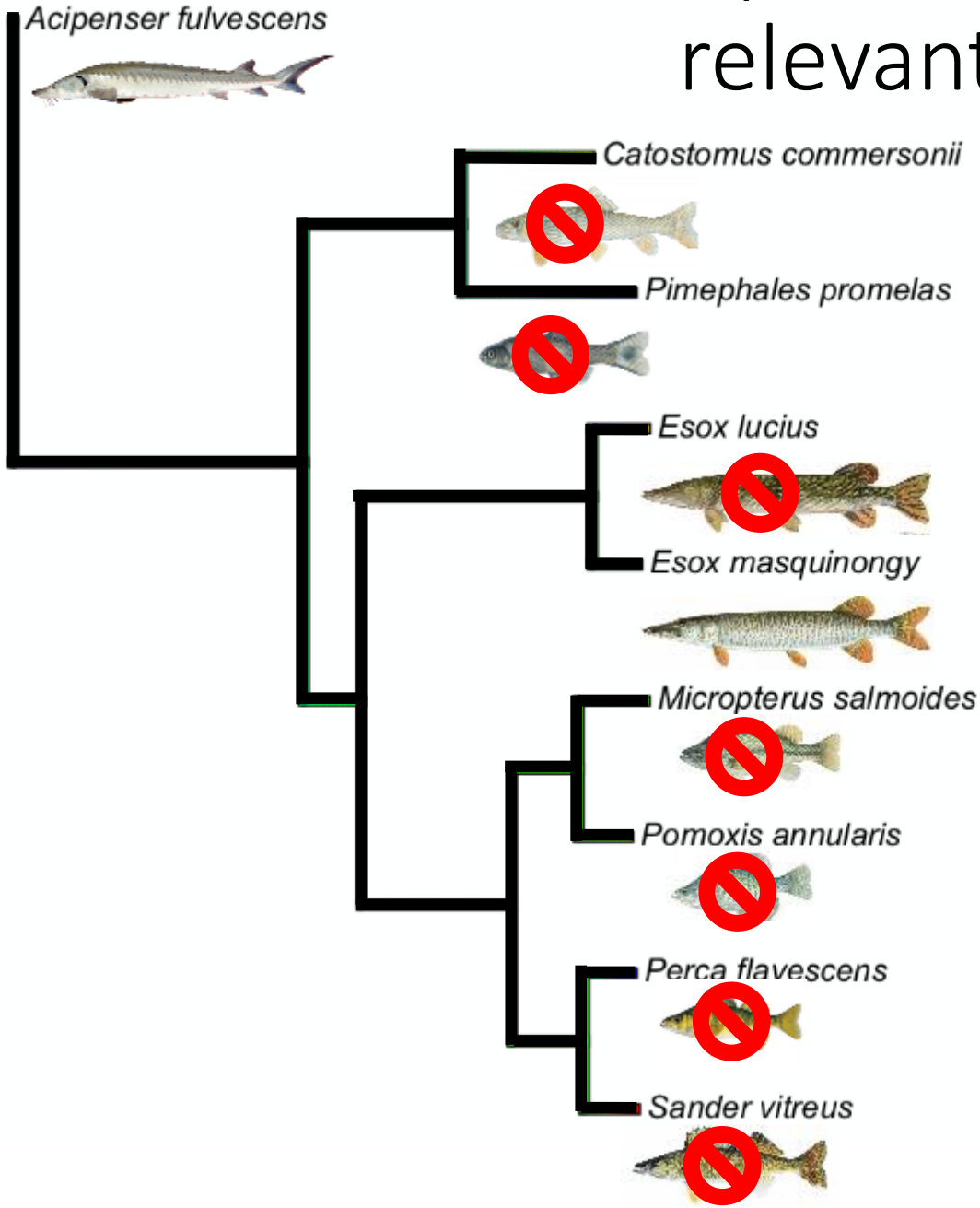
Impacted Species

- 7 out of 9 species
- 5 out of 6 families
- 3 out of 4 orders

Developmental Stage

- Early life stages most sensitive
- Juvenile not sensitive

Most species impacted by environmentally relevant concentrations of 2,4-D



Impacted Species

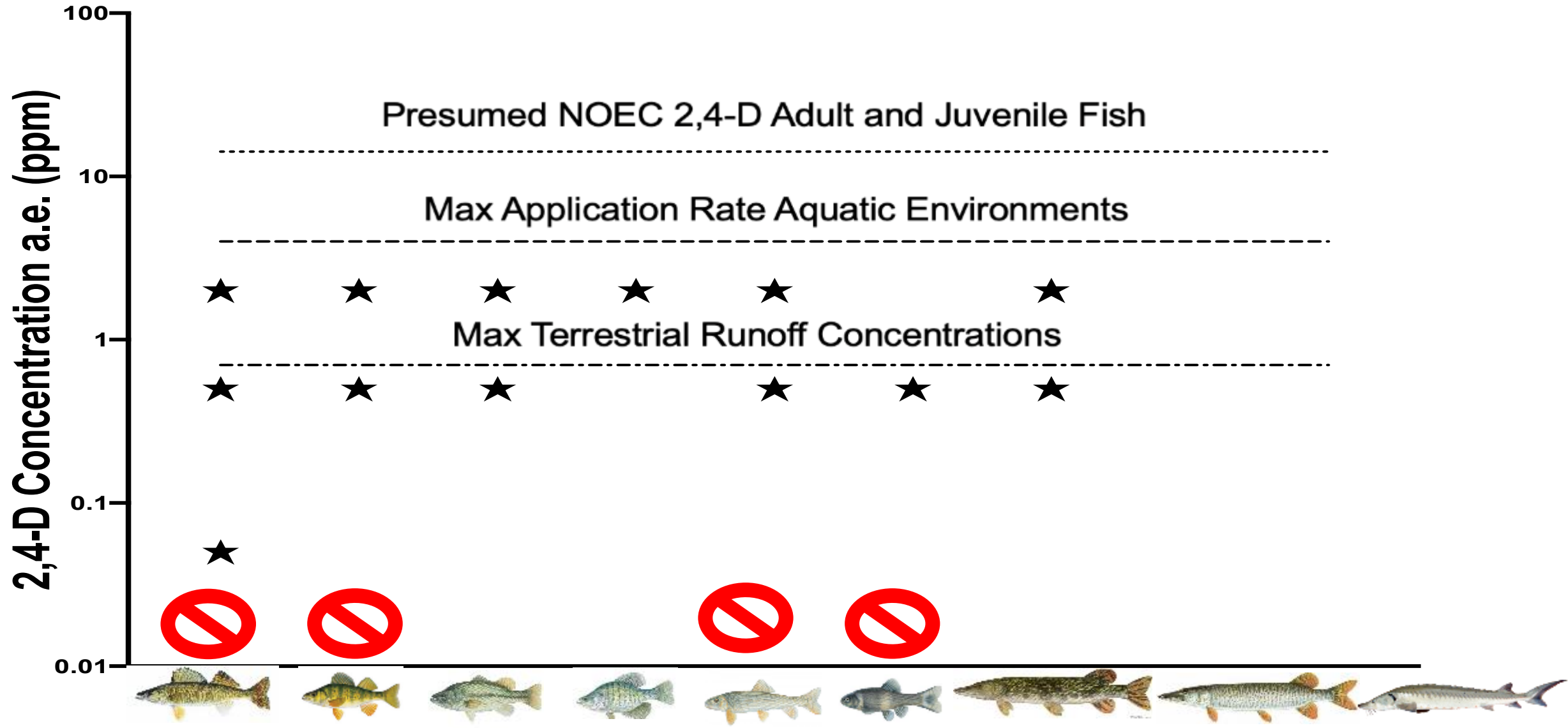
- 7 out of 9 species (8 out of 10)
- 5 out of 6 families
- 3 out of 4 orders

Developmental Stage

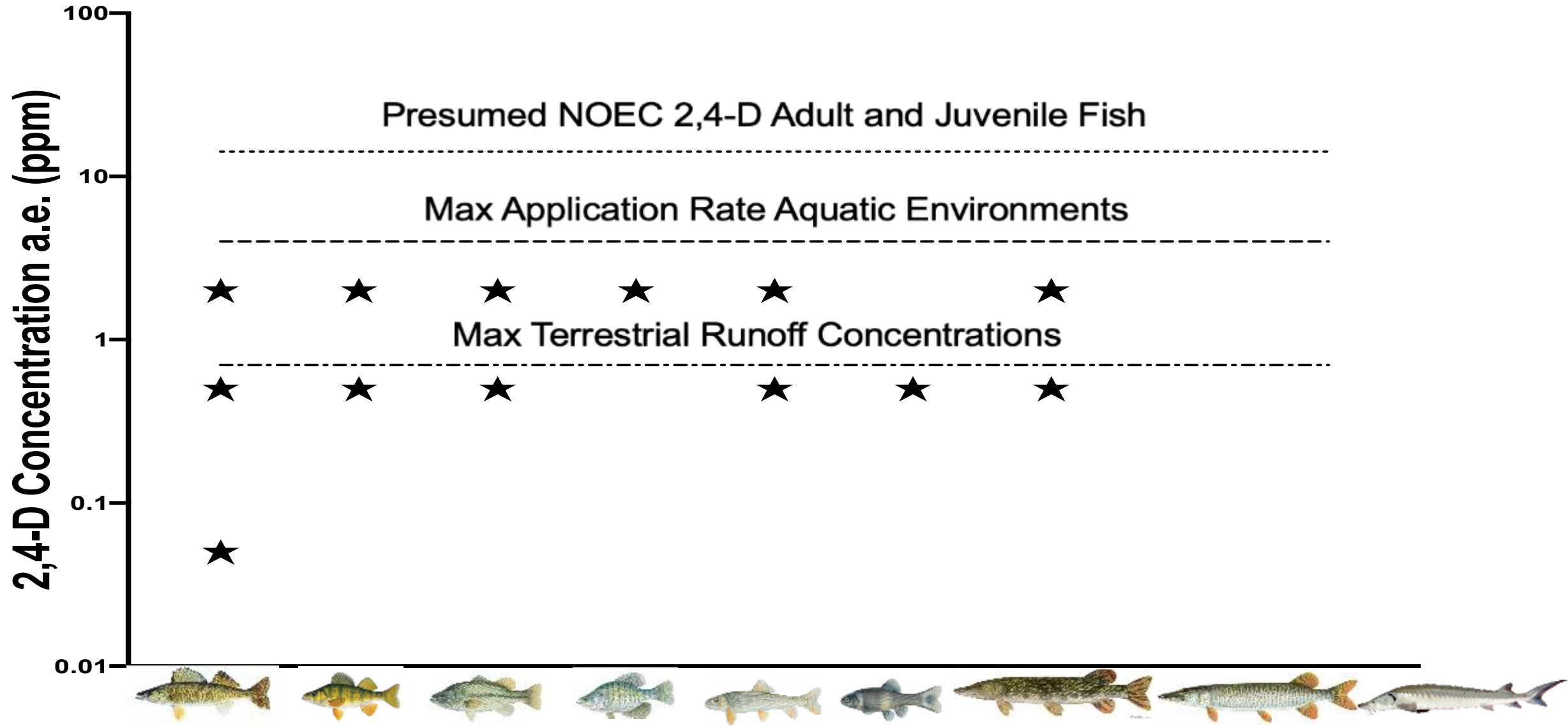
- Early life stages most sensitive
- Juveniles (adults) not sensitive

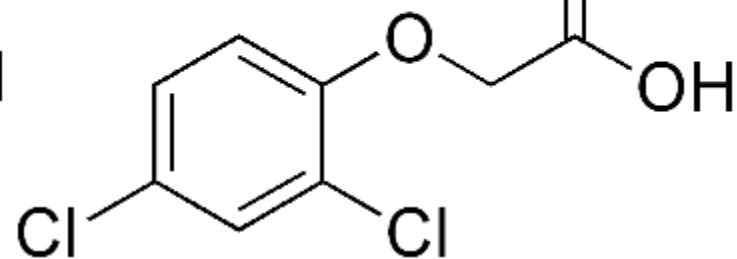
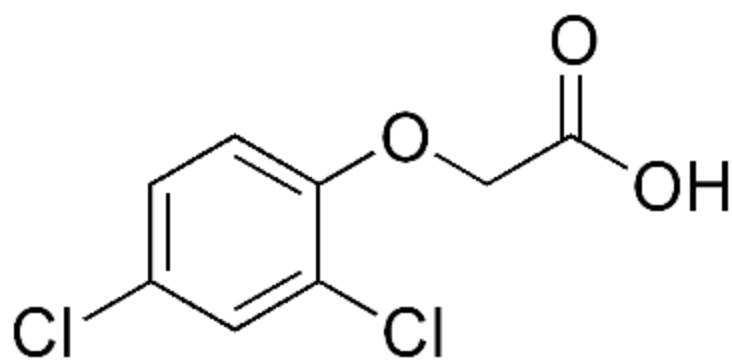
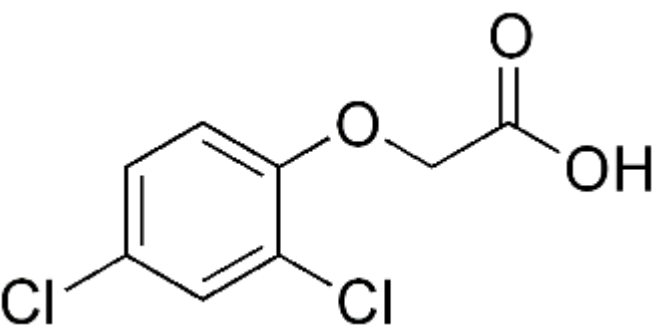
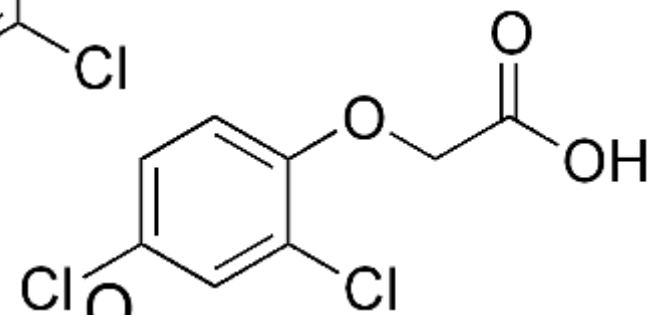
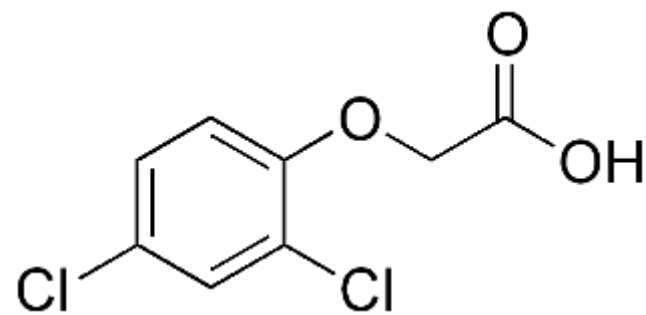
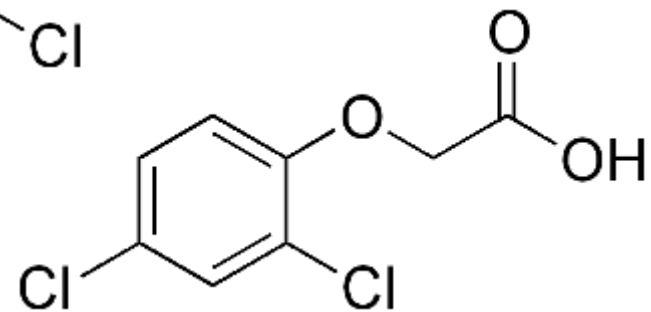
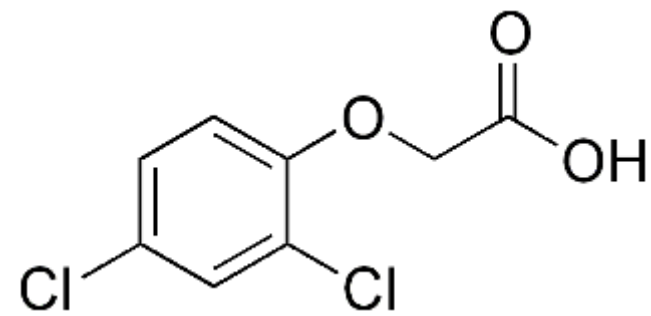
No Phylogenetic Relationship

Most species impacted by environmentally relevant concentrations of 2,4-D



Most species impacted by environmentally relevant concentrations of 2,4-D





Acknowledgements

UW- Aquaculture Lab:

Dr. Terence Barry and Paul Hoppe

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Questions? Dehnert2@wisc.edu

