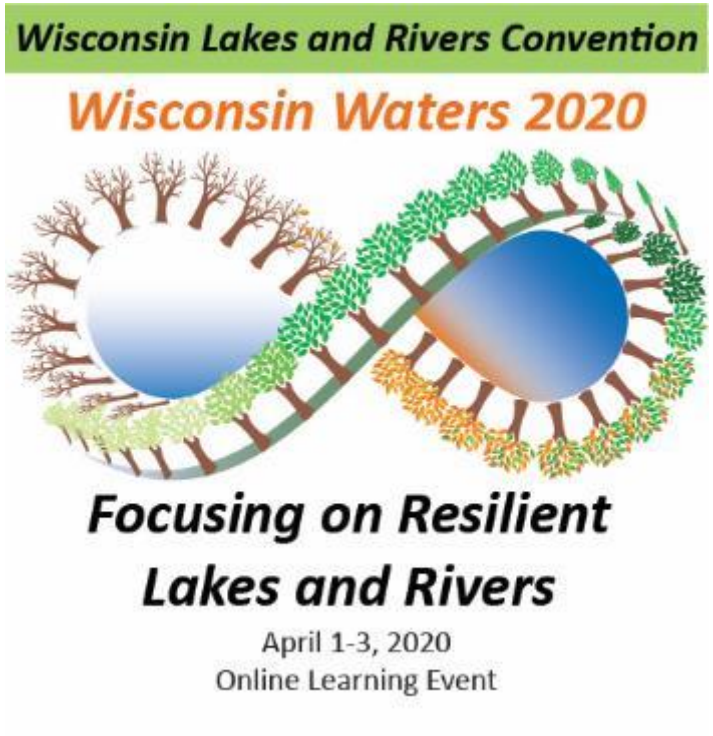
Welcome

Friday, April 3, 2020

Lake and River Science



1:30-2:30 pm

Lab- and Field-based Determination of 2,4-D Degradation Rates

Effects of Subchronic Exposure of 2,4-D on Developmental States of Freshwater Game Fish

Japanese Hops Control Efforts in the Driftless Area

This session will be recorded.

New insights into the degradation of 2,4-dichlorophenoxyacetic acid

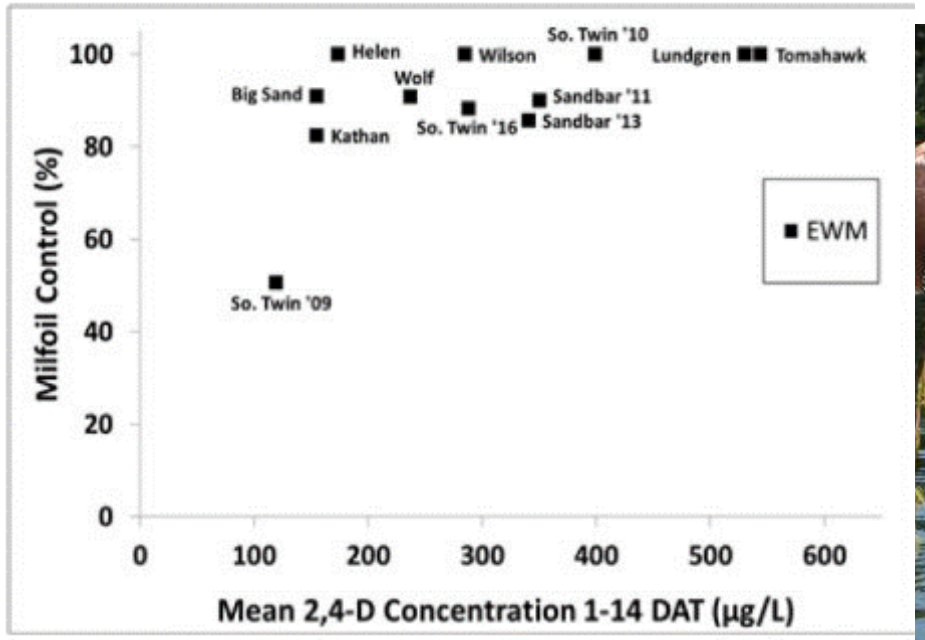
Amber White, Environmental Chemistry and Technology, University of Wisconsin- Madison

Christina Remucal, Civil and Environmental Engineering, Environmental Chemistry and Technology, University of Wisconsin- Madison

Trina McMahon, Bacteriology, Civil and Environmental Engineering, Environmental Chemistry and Technology, University of Wisconsin- Madison

EURASIAN WATERMILFOIL (EWM) AND 2,4-D IN WISCONSIN

- EWM has a negative impact on waterbody use
- Invasion causes 13% decrease in property value[1]
- State of WI spends ~$2 million a year on EWM abatement[2]



1: Horsch and Lewis 2009, Land Econ. 85:391–409; 2: Frater et al. 2017, Lake Reserv Manage. 33:1, 1-7; Graph: Nault et al. 2017, Lake Reserv Manage. 34:115—129.

Variations in 2,4-D half-life in Wisconsin Lakes

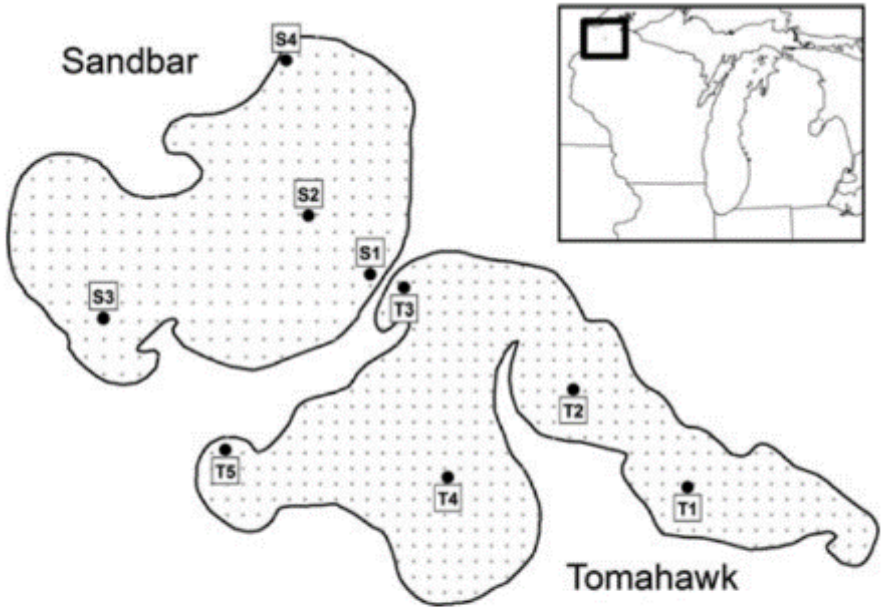


Figure 1.-Location of Tomahawk and Sandbar lakes, Bayfield County, WI. Aquatic plant sampling grid points are shown in gray with point spacing of 35 and 40 m, respectively. 2,4-D herbicide concentration sampling locations on both lakes are labeled.

Nault et al. 2014, Lake and Reservoir Management, 30:1, 1-10

Variations in 2,4-D half-life in Wisconsin Lakes

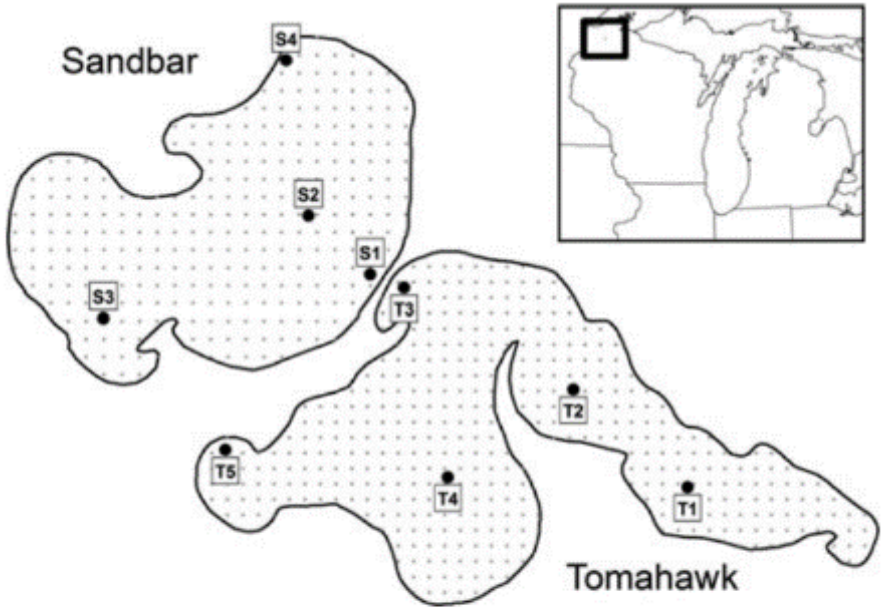
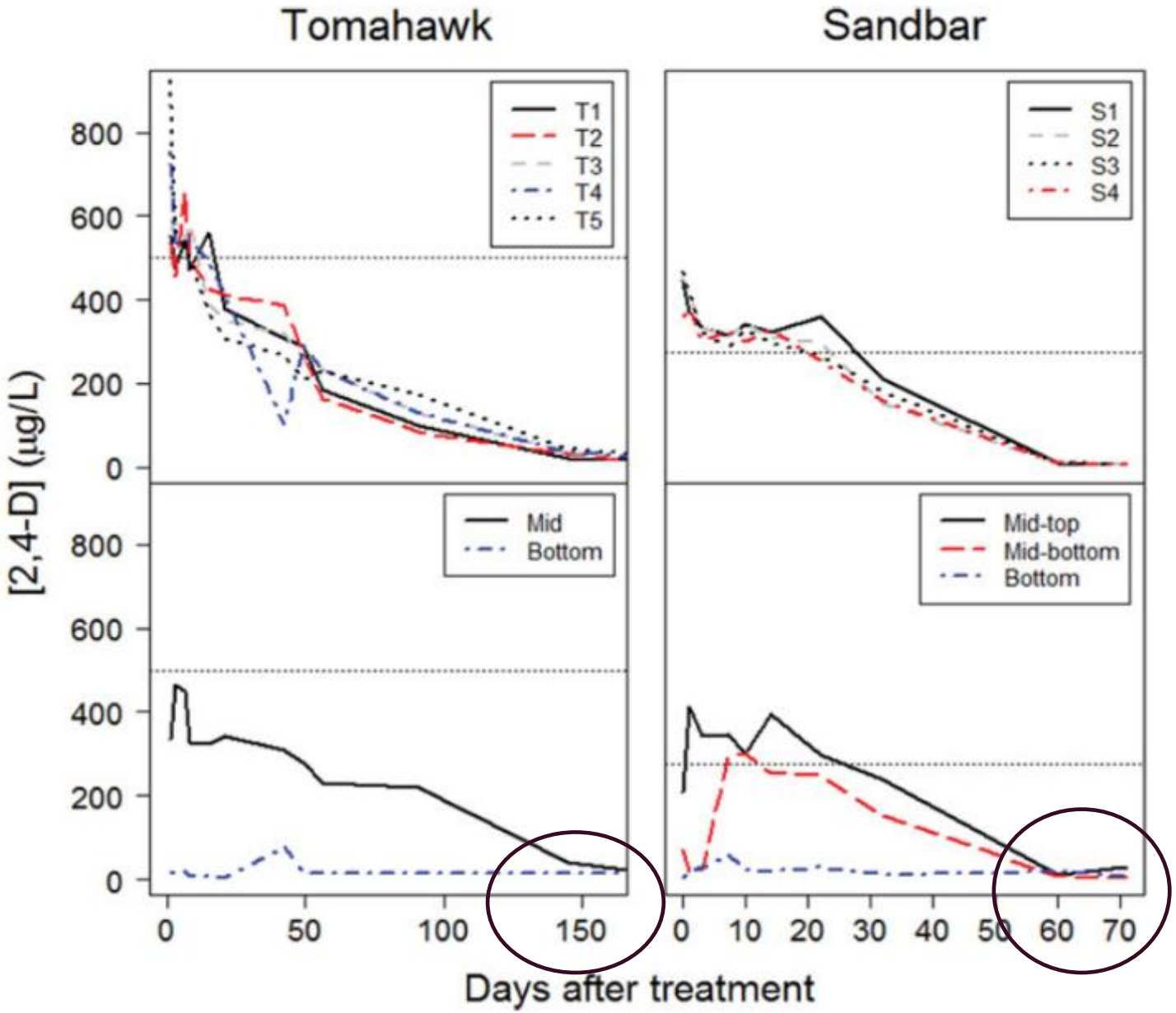
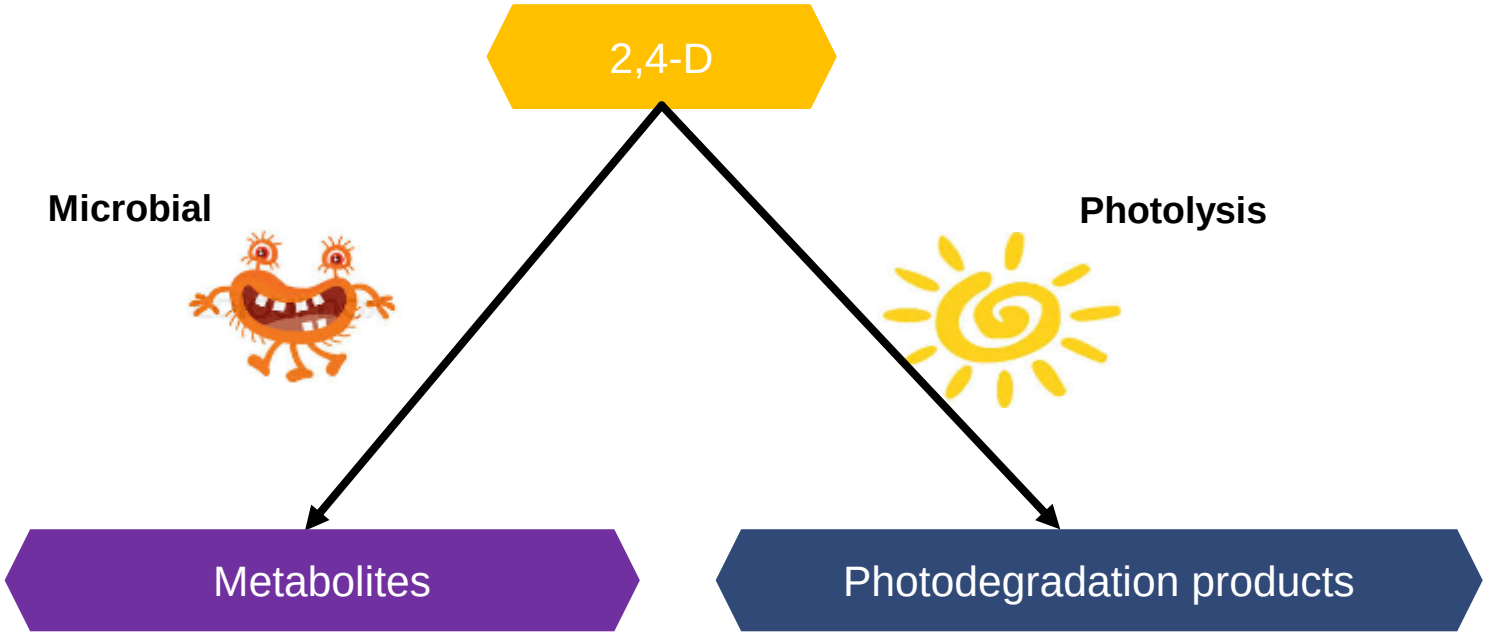


Figure 1.-Location of Tomahawk and Sandbar lakes, Bayfield County, WI. Aquatic plant sampling grid points are shown in gray with point spacing of 35 and 40 m, respectively. 2,4-D herbicide concentration sampling locations on both lakes are labeled.



Nault et al. 2014, Lake and Reservoir Management, 30:1, 1-10

EURASIAN WATERMILFOIL AND 2,4-D DEGRADATION IN LAKES



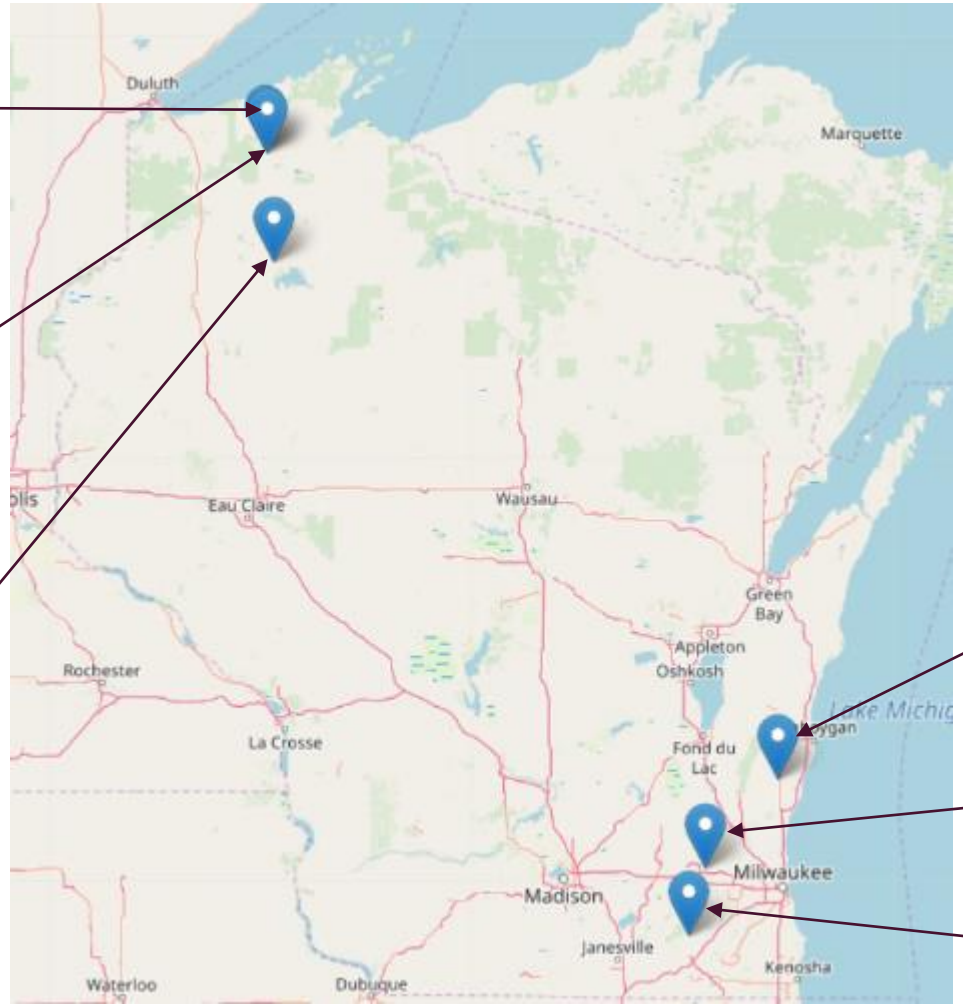
Combination of lab and field techniques to look at this

2019 FIELD SITES

McCarry Lake

Eagle Lake

Round Lake

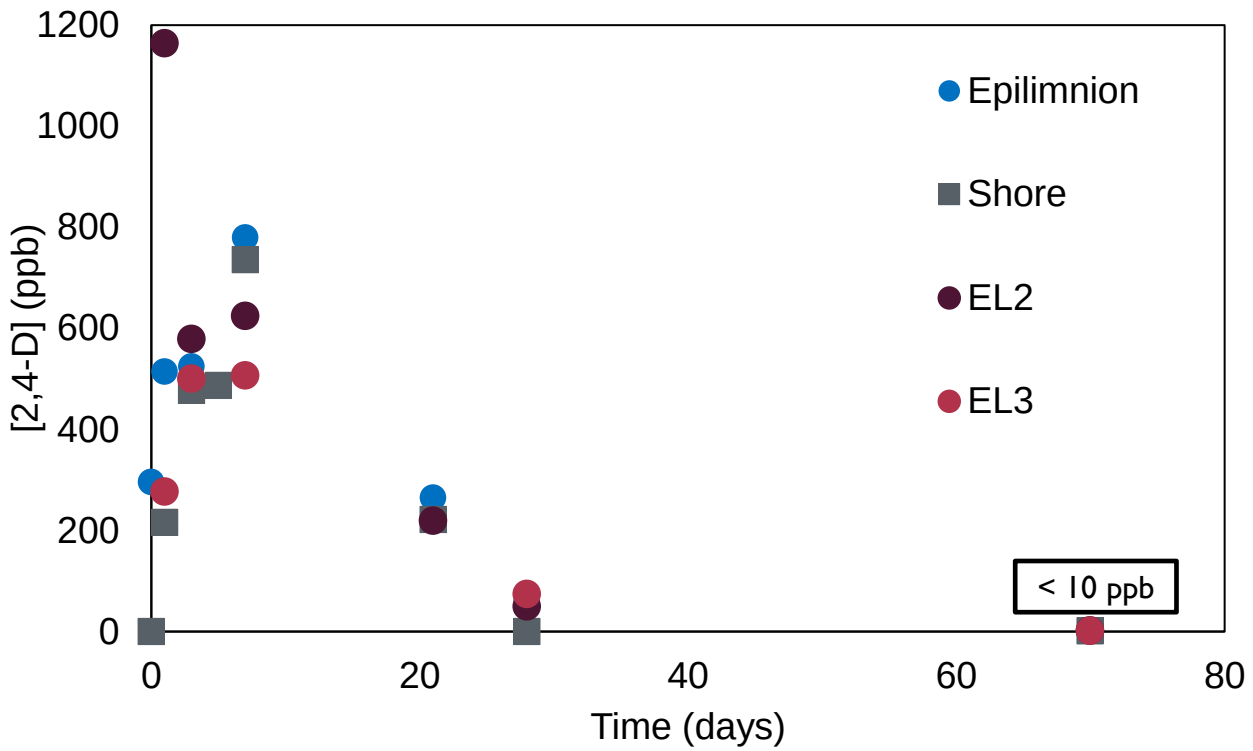


Random Lake

Okauchee Lake

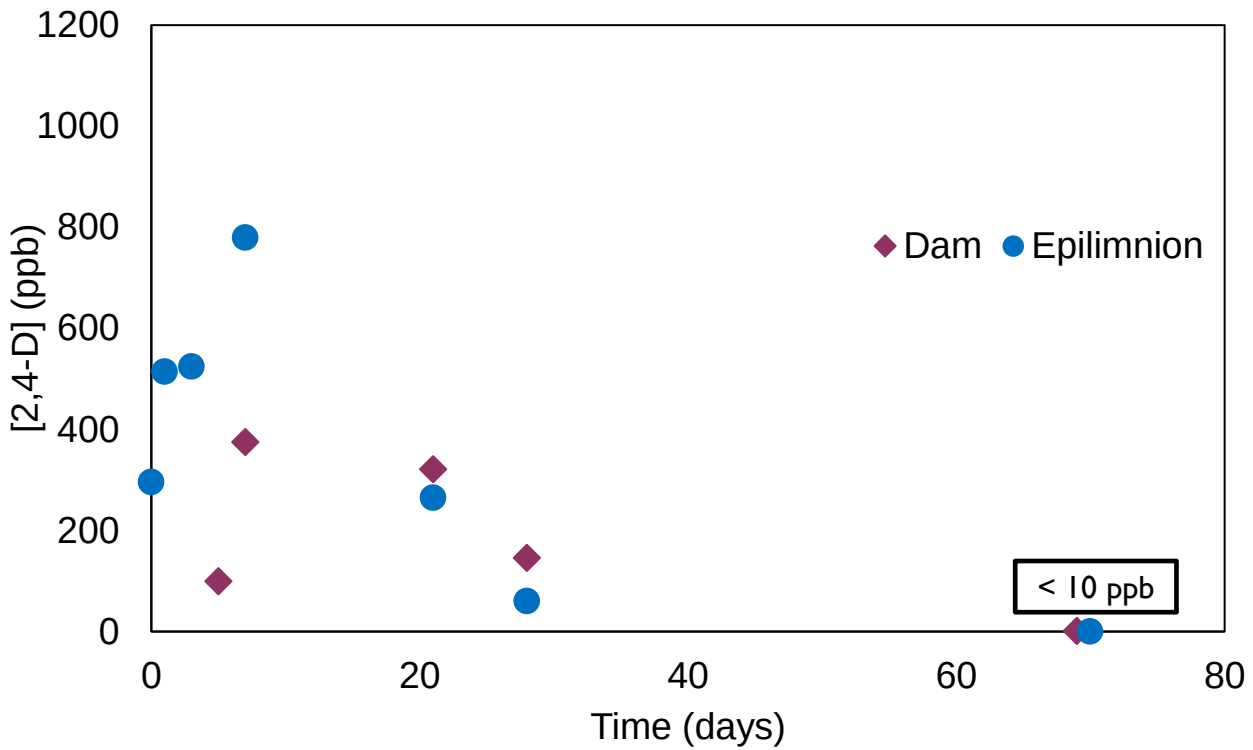
Pleasant Lake

Eagle Lake



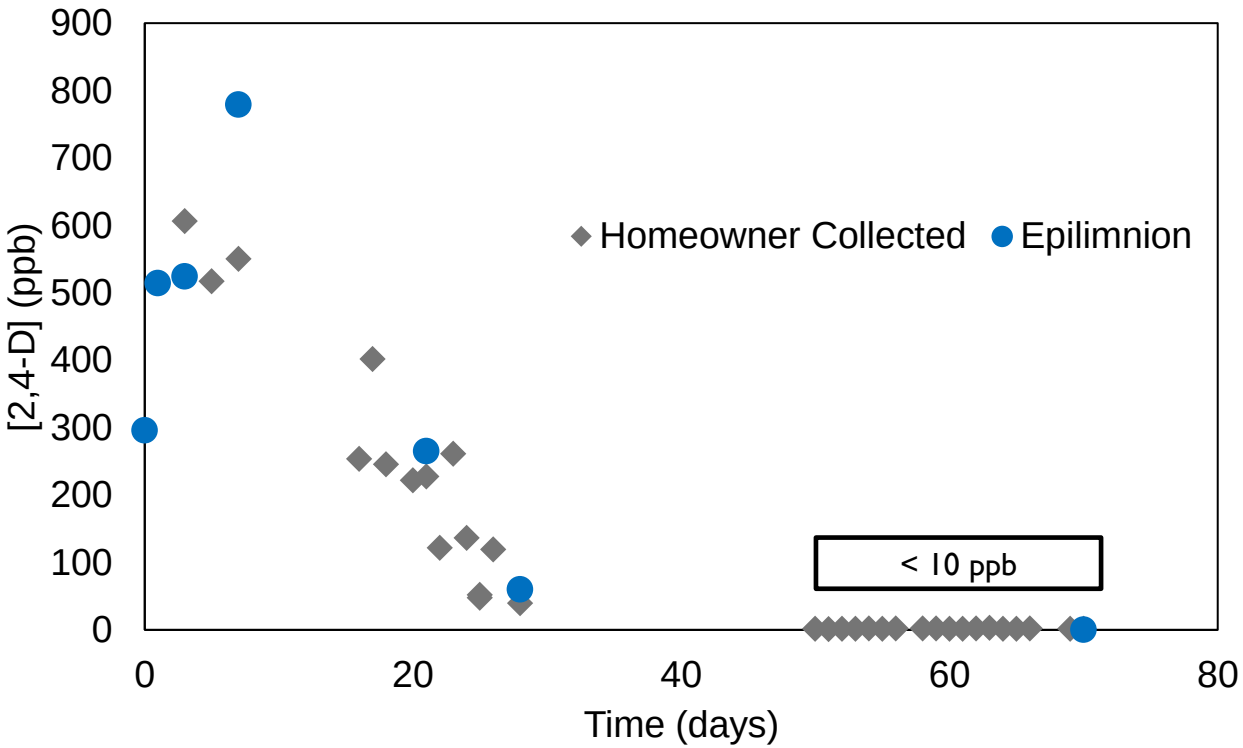
Surface water is well-mixed → even distribution of 2,4-D

Eagle Lake



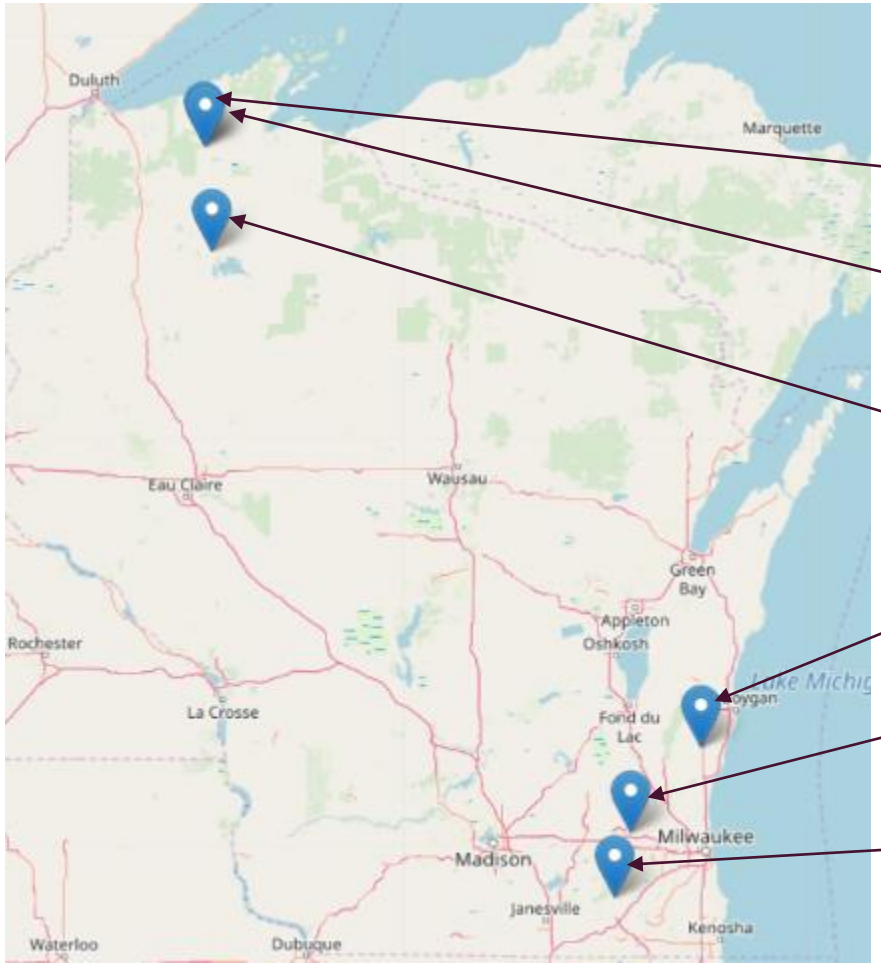
2,4-D can be measured flowing out the dam

Eagle Lake



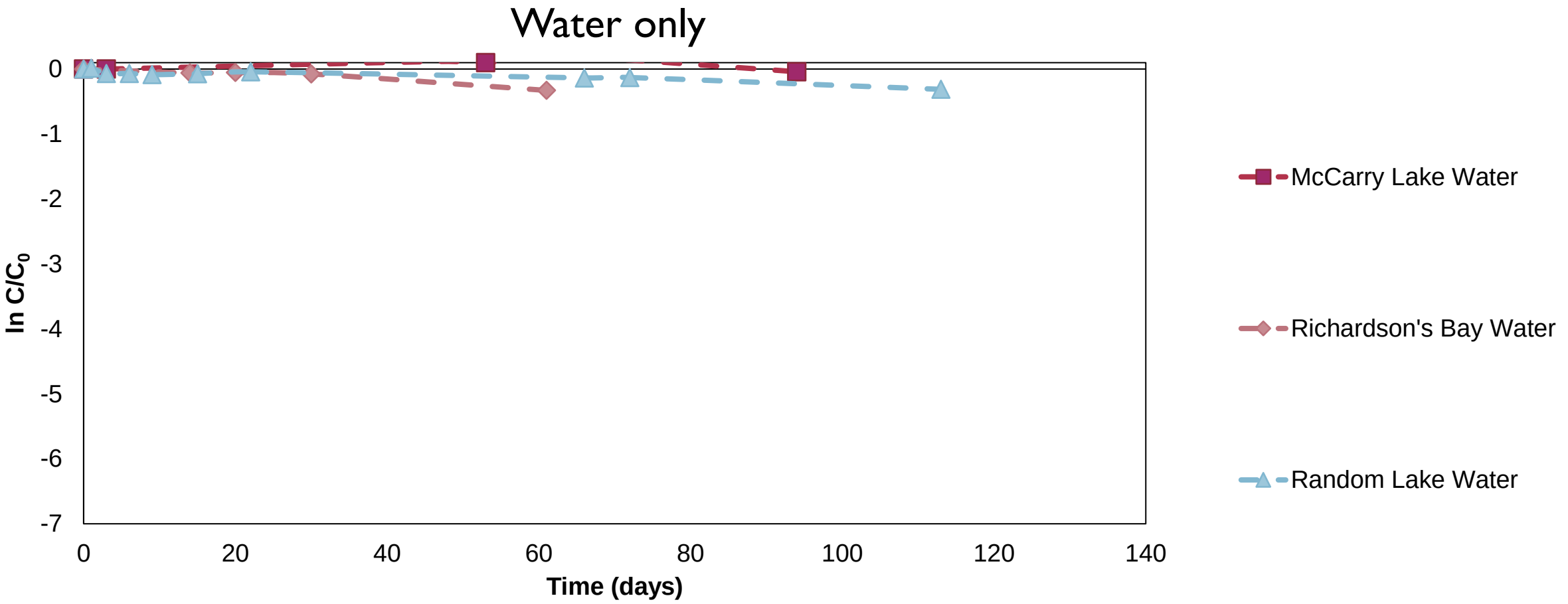
Homeowner sampling provided more data for understanding 2,4-D movement in lake

FIELD DATA SUMMARY

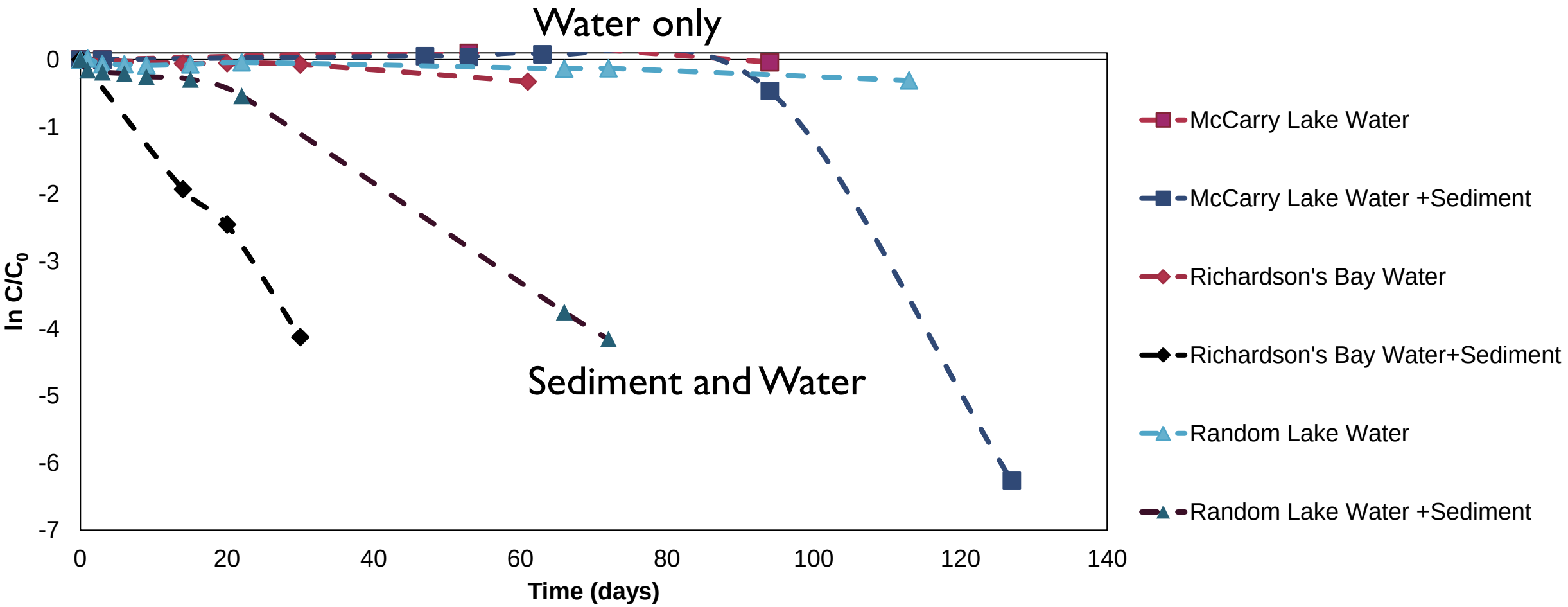


Lake	Half-life field	Days to 50 ppb
McCarry	15 days	45 days
Eagle	16 days	28 days
Round	15 days	27 days
Random	24 days	24 days
Okauchee	6 days	6 days
Pleasant	6 days	19 days

MICROCOSM INCUBATIONS



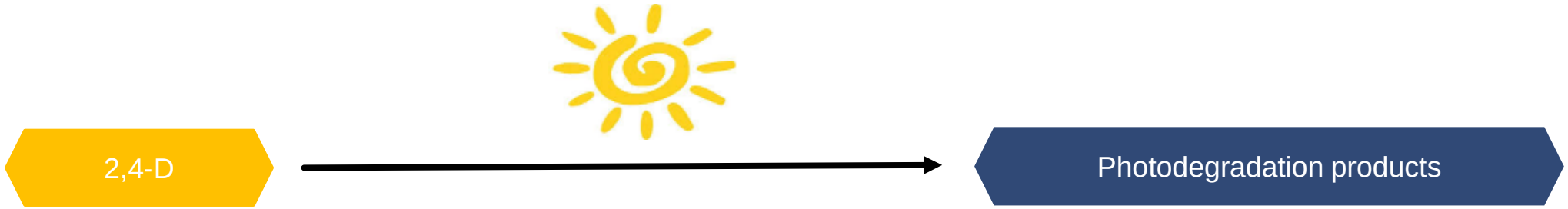
MICROCOSM INCUBATIONS



2,4-D HALF-LIFE IN MICROCOSM

Lake	Half-life field	Half-life Microcosm
Pleasant	6 days	7 days
Round	15 days	6 days
McCarry	15 days	100 days
Random	24 days	25 days

PHOTODEGRADATION OF 2,4-D



Conducted irradiation experiments with 2,4-D in lake water and ultra-pure water to measure direct and indirect photodegradation

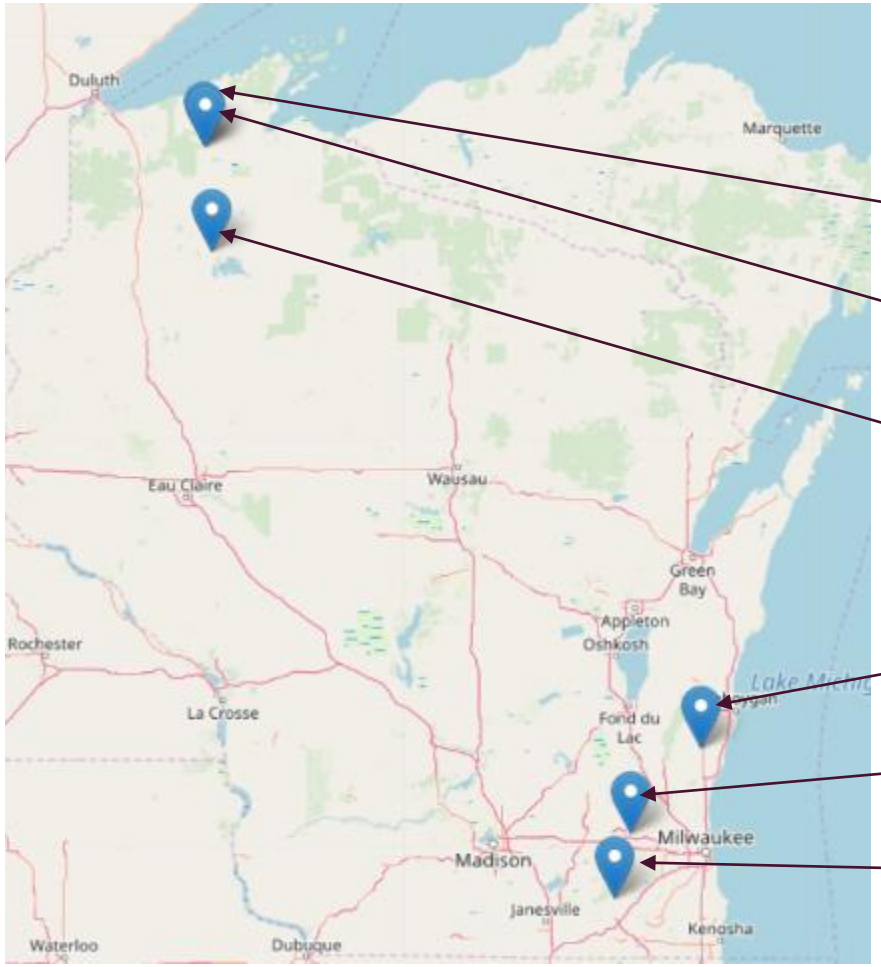
2,4-D Quantum Yield: 9×10^{-6} (unitless)

Niclosamide Quantum Yield: 3.21×10^{-6} (unitless)

Half-life Niclosamide in 55cm of lake water: **126 days**

McConville et al. 2016

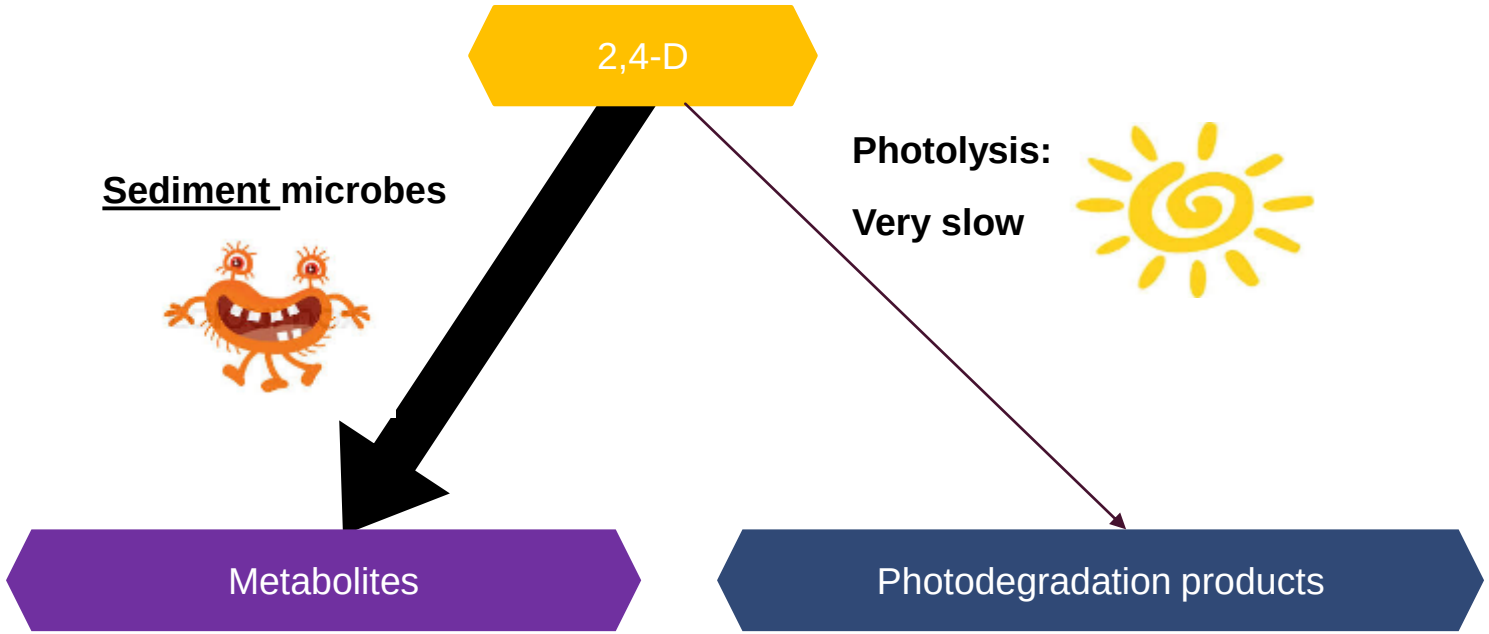
HALF-LIFE SUMMARY



Lake	Half-life field	Half-life Microcosm	Half-life Photodegradation	Days to 50 ppb
McCarry	15 days	100 days	126 days	45 days
Eagle	16 days	-		28 days
Richardson	15 days	6 days		27 days
Random	24 days	25 days		24 days
Okauchee	6 days	-		6 days
Pleasant	6 days	7 days		19 days

CONCLUSIONS

- 2,4-D is susceptible to direct photodegradation but is likely too slow to be a major degradation pathway in the environment
- Sediment microbes are likely driving most 2,4-D degradation in lakes
- More investigation is needed into the microbial mechanisms and physical processes driving 2,4-D transport within lakes



ACKNOWLEDGMENTS

- Wisconsin DNR
  - Michelle Nault
  - Arthur and Amanda
  - Heidi Bunker
  - Pam Toshner
  - Scott Van Egren
- Remucal lab group
- McMahon lab group
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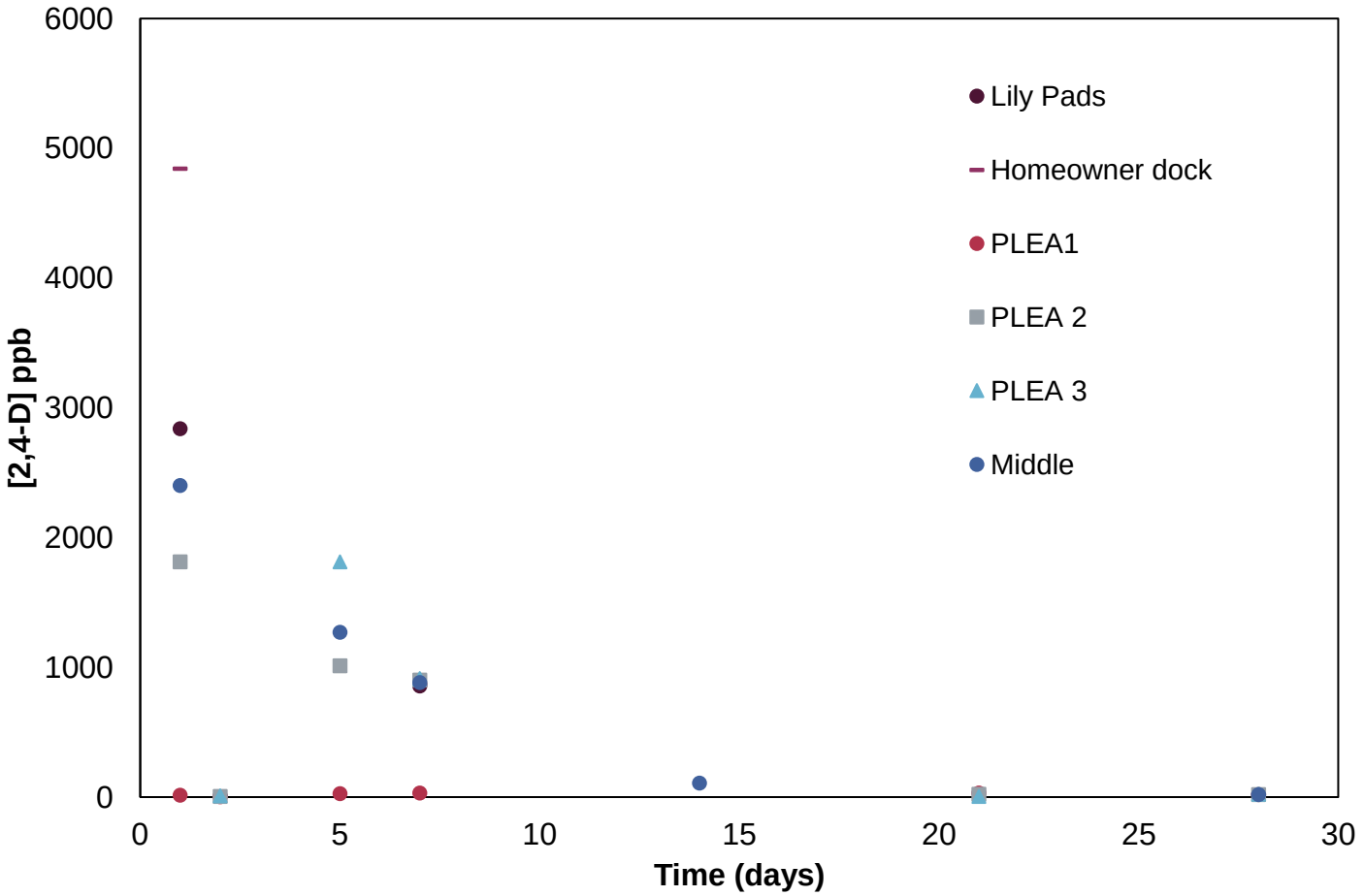
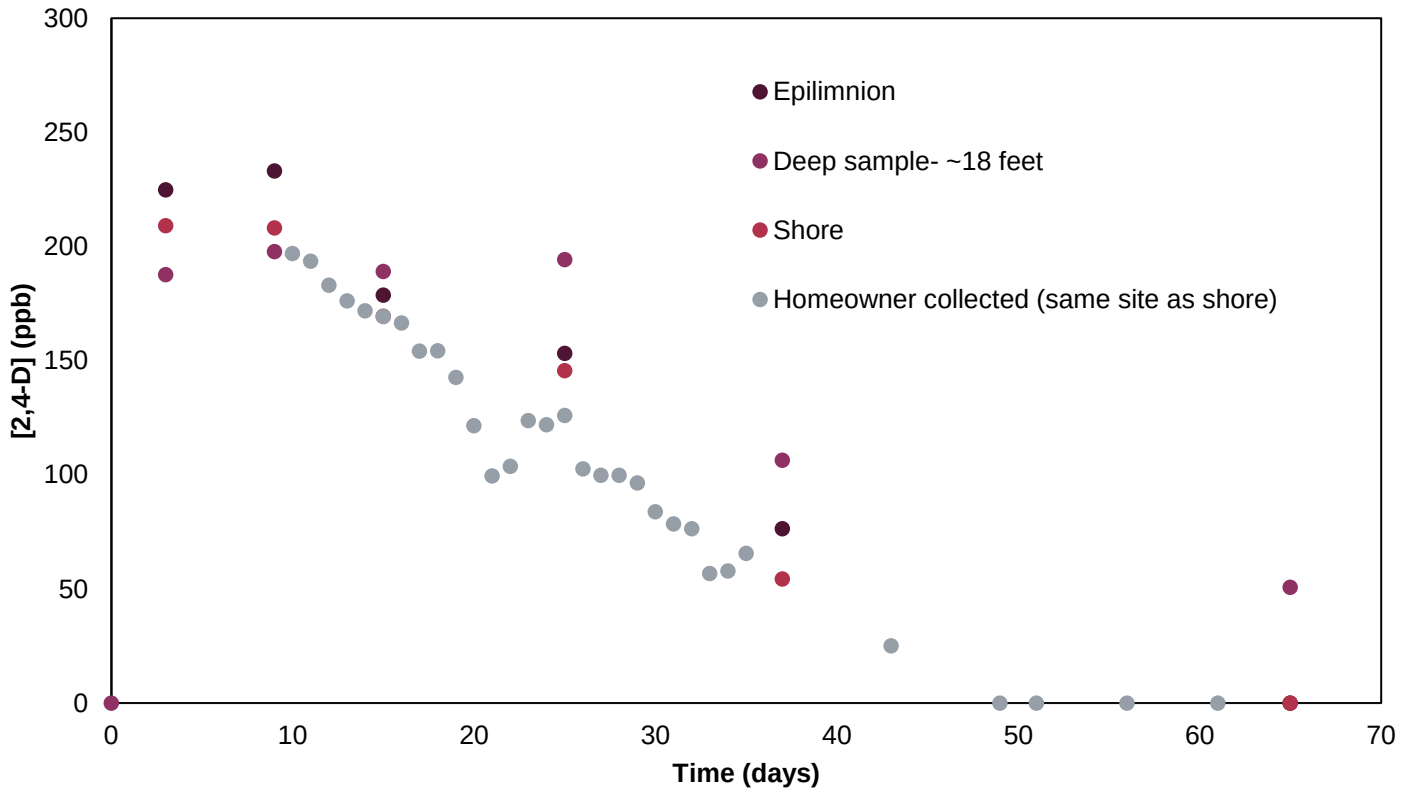
- UW-Center for Limnology
- UW-Civil and Environmental Engineering
- Ellie Kimlinger
- Sydney Van Frost
- Marissa Kneer
- Pleasant Lake Lake Association
  - Tracy M.
  - Mike Y
- Pike Lake Chain of Lakes
  - Gary H.
  - Donna S.
  - Terry and Doddi W.
  - Al B.
  - Eddie W.
  - Jay J.
- Random Lake:
  - Mike S.
  - Village of Random Lake
- Round Lake:
  - Ron S.
  - Props Bar and Grill
  - Round Lake Marina
  - Molly

WISCONSIN
DEPT. OF NATURAL RESOURCES

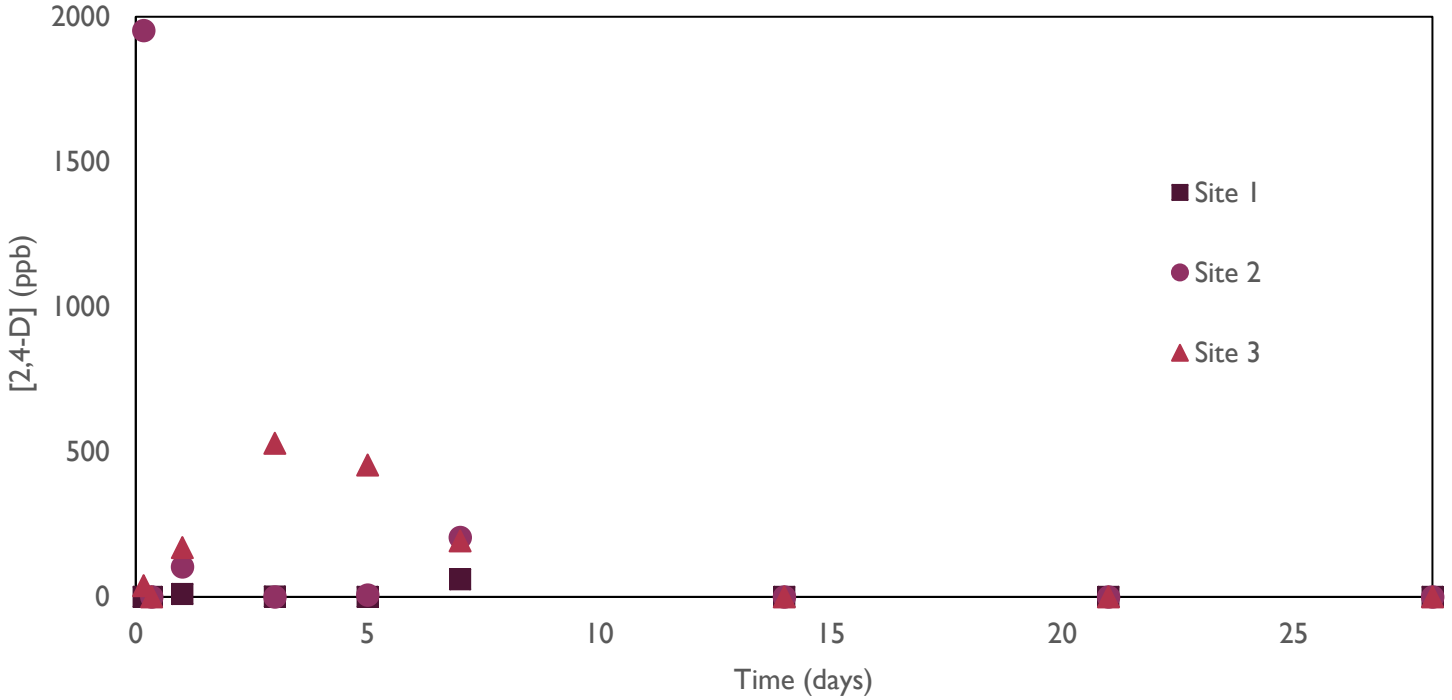
PLEASANT LAKE



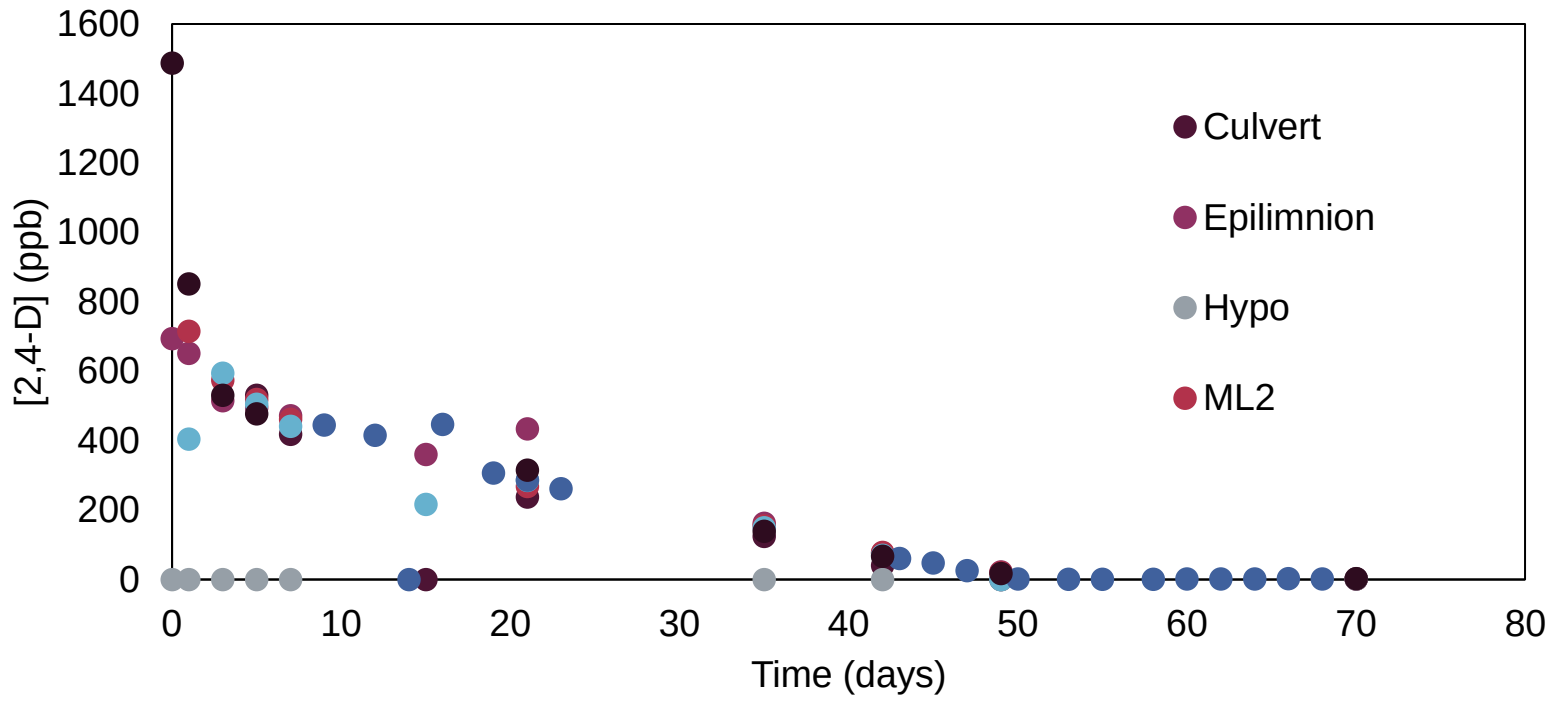
RANDOM LAKE


300
250
200
150
100
50
0
[2,4-D] (ppb)
0
10
20
30
40
50
60
70
Time (days)
Epilimnion
Deep sample- ~18 feet
Shore
Homeowner collected (same site as shore)

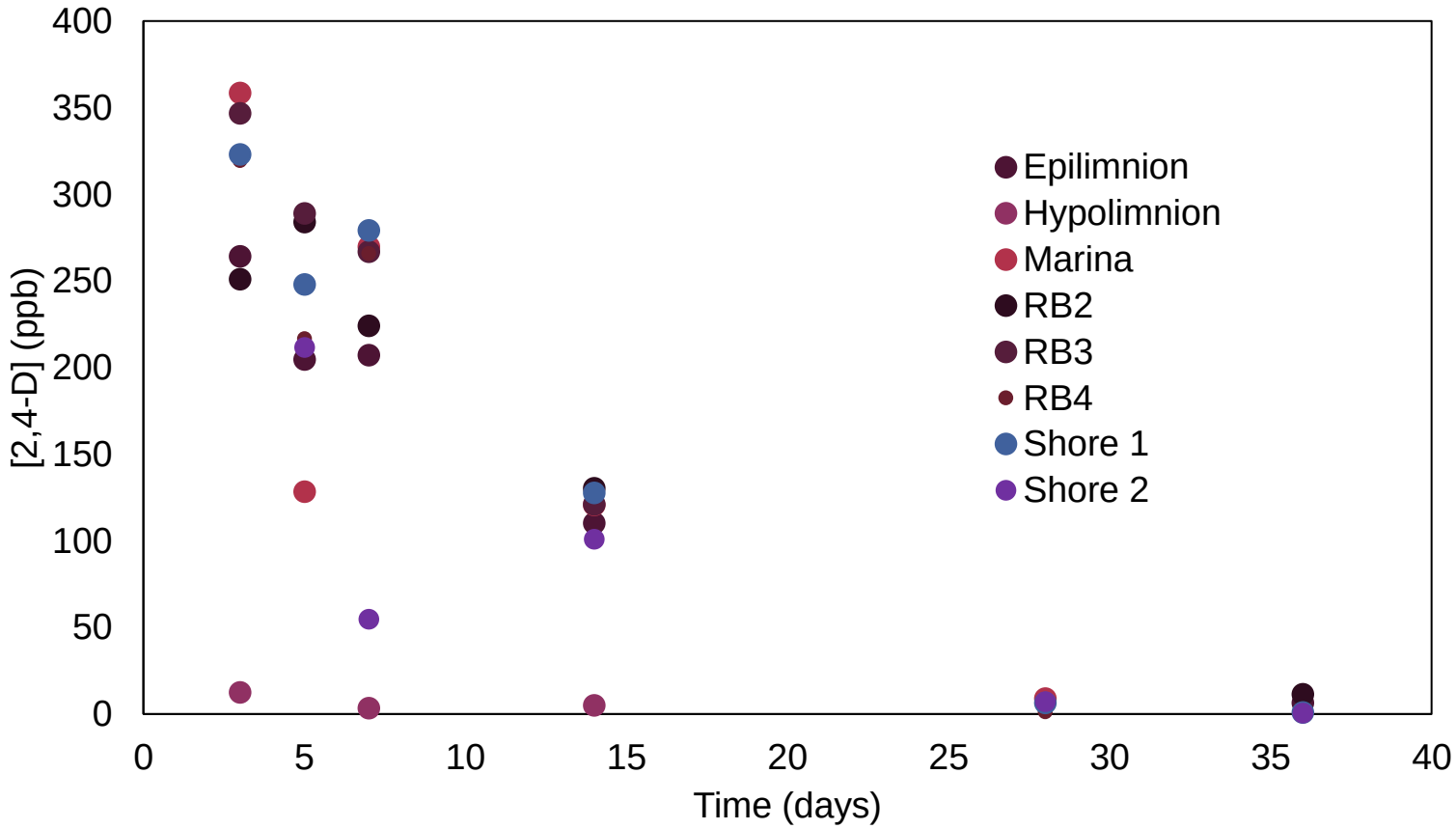
OKAUCHEE LAKE



MCCARRY LAKE



ROUND LAKE


400
350
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250
200
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100
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0
[2,4-D] (ppb)
0
5
10
15
20
25
30
35
40
Time (days)
Epilimnion
Hypolimnion
Marina
RB2
RB3
RB4
Shore 1
Shore 2