

# Oklahoma Scenic Rivers Joint Phosphorus Study: Interim Report, 6 June 2016

## Principal Investigator:

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## Joint Study Committee Members:

Brian Haggard; Co-Chair (University of Arkansas)

Marty Matlock (University of Arkansas)

Ryan Benefield (Arkansas Natural Resources Commission)

Derek Smithee; Co-Chair (Oklahoma Water Resources Board)

Shellie Chard-McClary (Oklahoma Dept. of Environmental Quality)

Shanon Philips (Oklahoma Conservation Commission)

# Study Framework

*"to determine the total phosphorus threshold response level....at which any statistically significant shift occurs in*

1. algal species composition OR
2. algal biomass production

*...resulting in undesirable*

1. aesthetic OR
2. water quality

*...conditions in the Designated Scenic Rivers."*

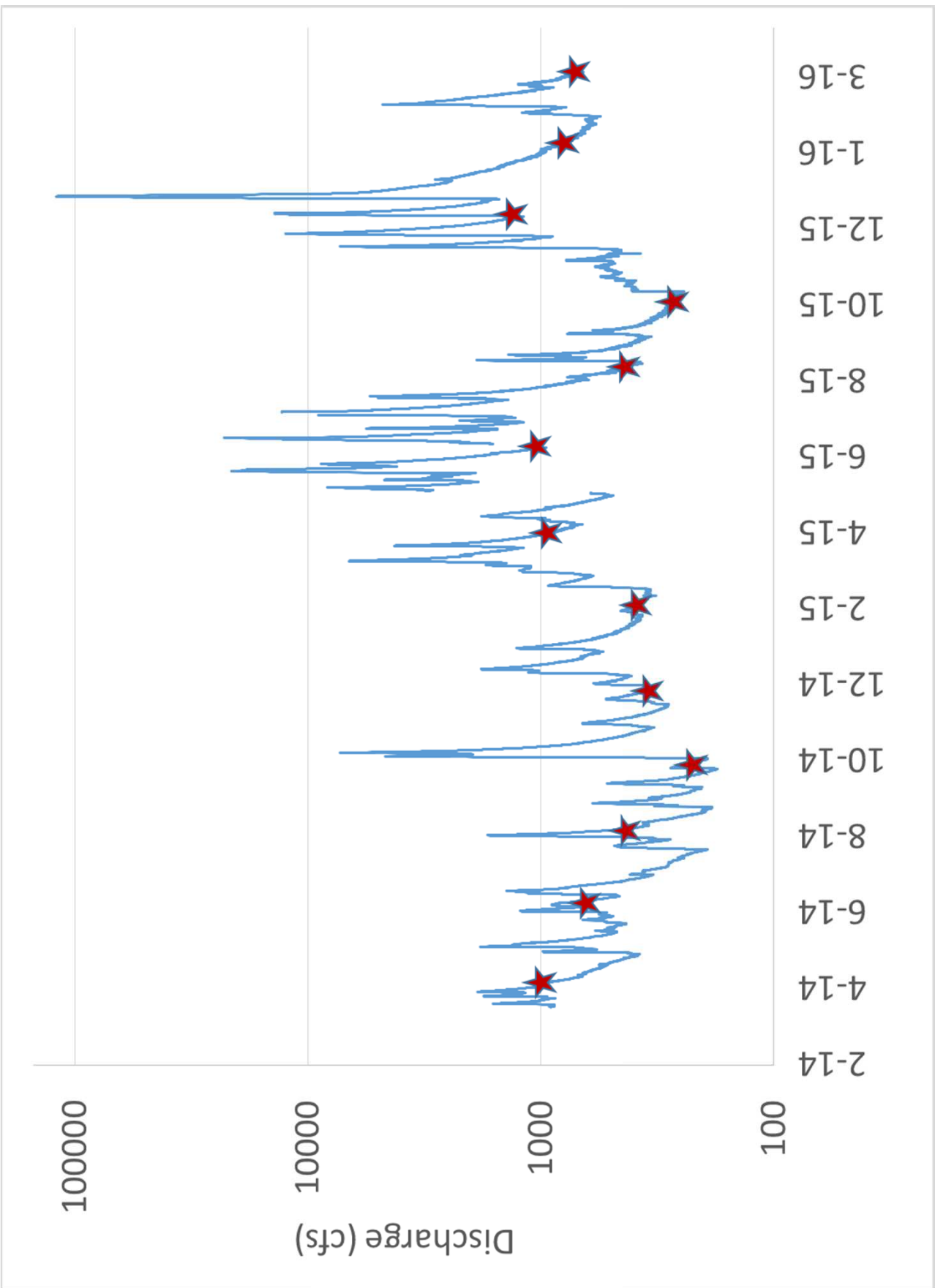
# Schedule

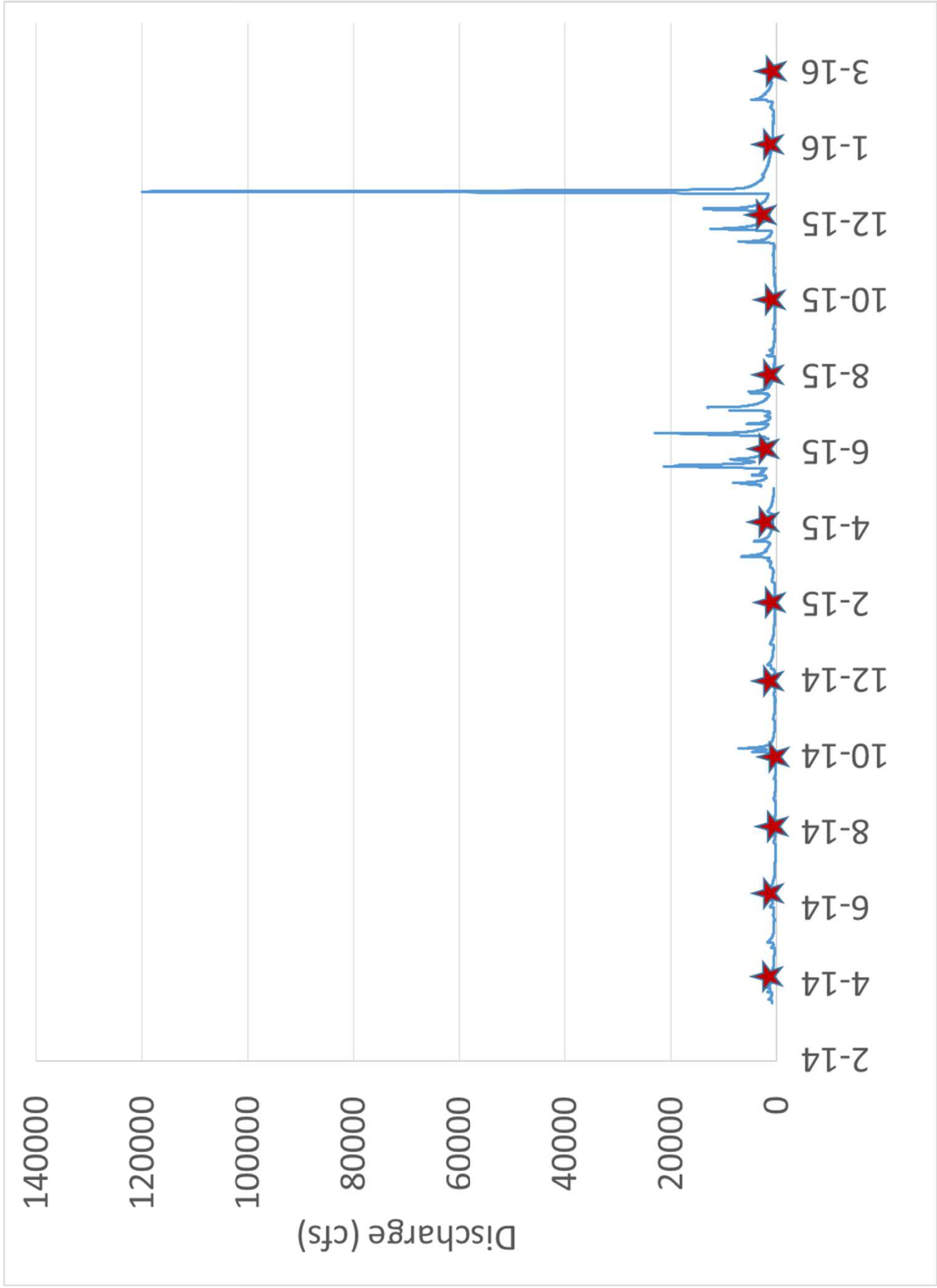
Sampling scheduled bimonthly. Proposed sampling was to result in 12 events in 2 years. All 12 sampling events have been completed.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2014				Site selection		X		X		X		X
2015		X		X		X		X		X		X
2016		X		X	Final analyses & report writing							

# Data status report

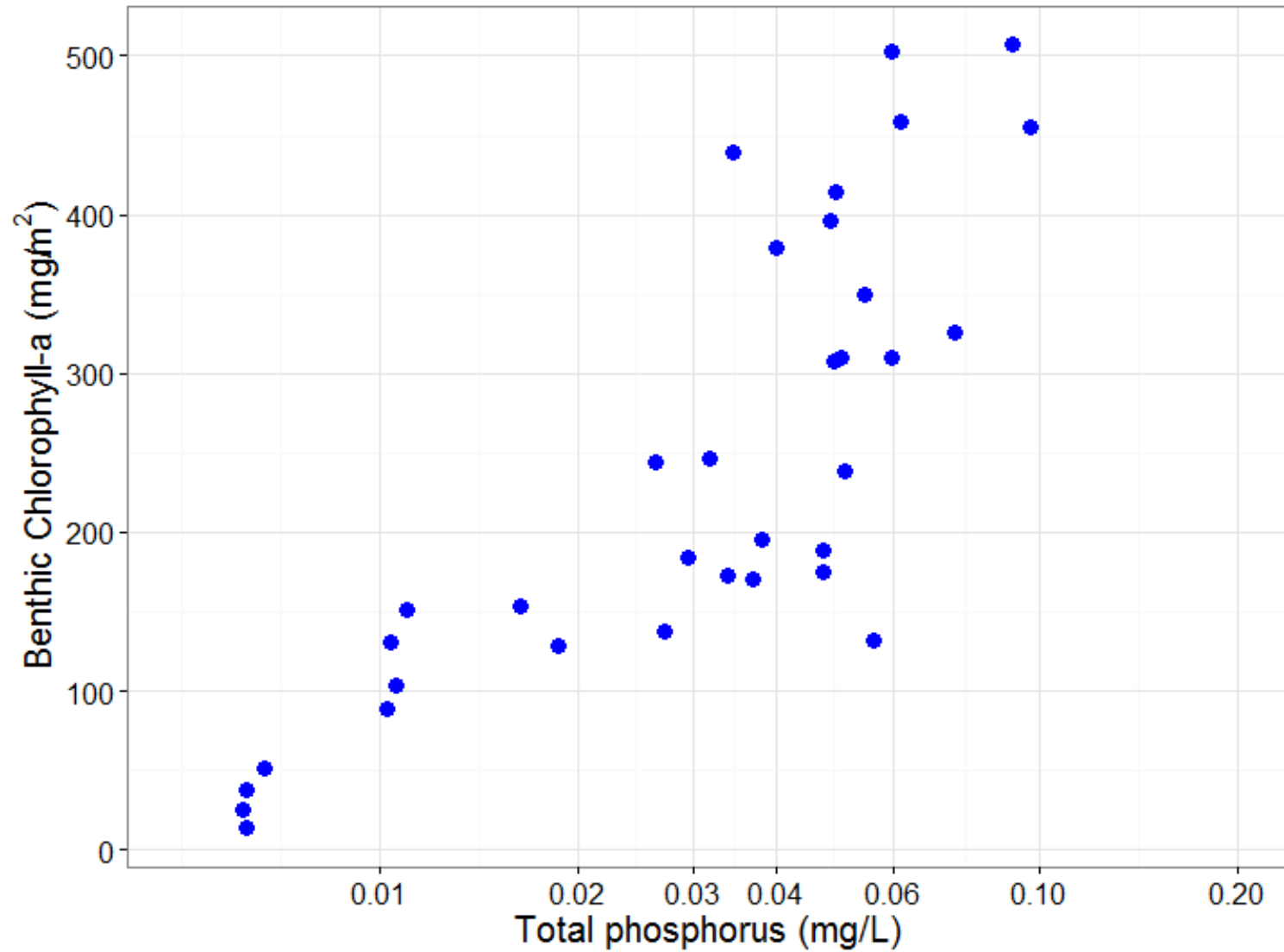
Event	TP	TN, DOC, DNP	Benthic CHLA/ AFDM	Sestonic CHLA/ TSS	Ben- thic CNP	Soft spp.	Dia- tom spp.	Hess	Diel DO
Jun-14	X	X	X	X	X	X	X	X	N/A
Aug-14	X	X	X	X	X	N/A	N/A	X	X
Oct-14	X	X	X	X	X	X	X	X	N/A
Dec-14	X	X	X	X	X	N/A	N/A	X	N/A
Feb-15	X	X	X	X	X	X	N/A	X	N/A
Apr-15	X	X	X	X	X	X	X	X	N/A
Jun-15	X	X	X	X	X	N/A	N/A	X	N/A
Aug-15	X	X	X	X	X	N/A	N/A	X	X
Oct-15	X	X	X	X	X	In prog	N/A	X	N/A
Dec-15	X	X	X	X	X	N/A	N/A	X	N/A
Feb-16	X	X	X	X	X	N/A	N/A	X	N/A
Apr-16	X	X	X	X	X	In prog	In prog	X	N/A





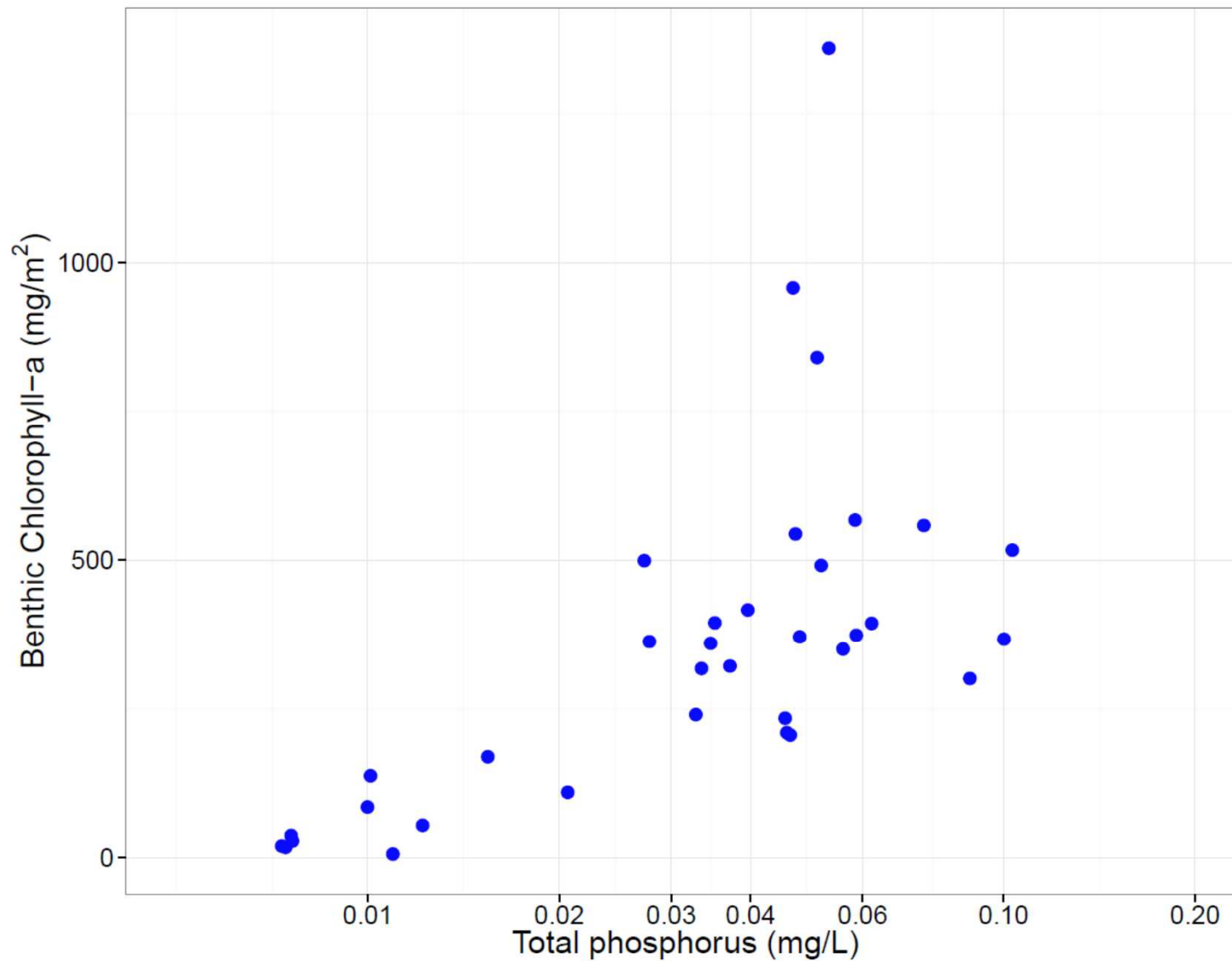
# Benthic (Periphyton) Chlorophyll-*a* (mg/m<sup>2</sup>) vs TP

February 2016



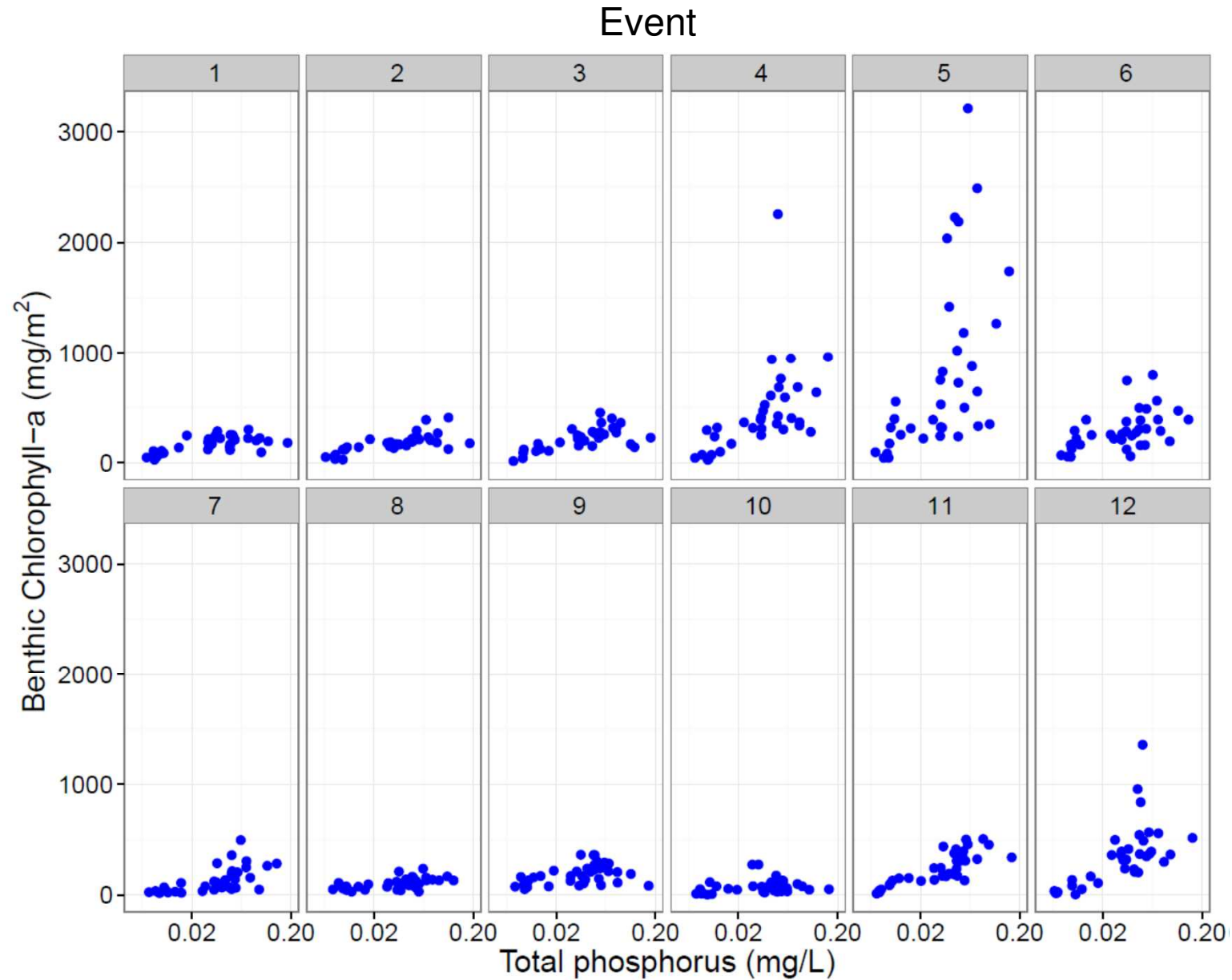
# Benthic (Periphyton) Chlorophyll-*a* (mg/m<sup>2</sup>) vs TP

April 2016



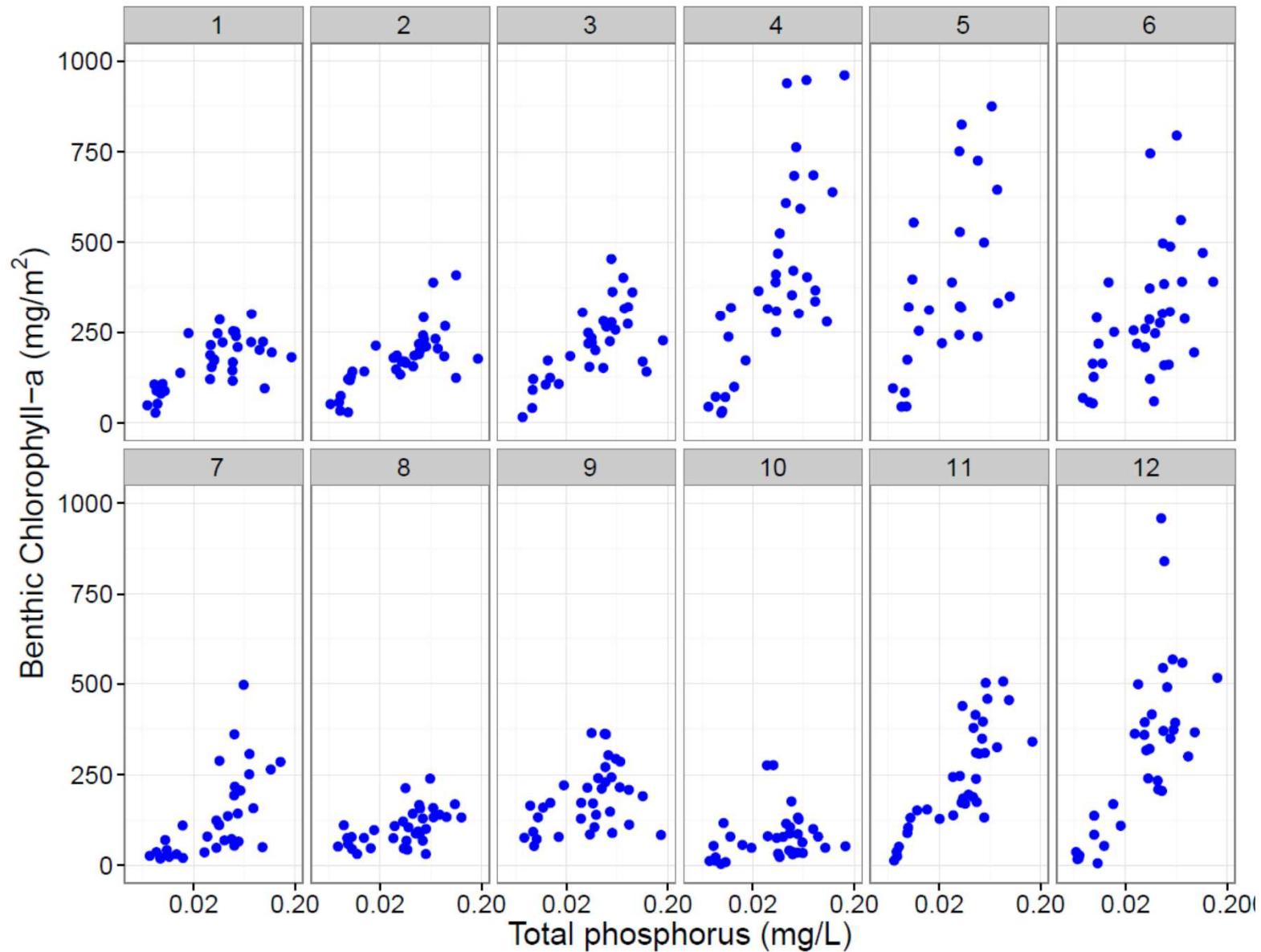


# Benthic (Periphyton) Chlorophyll-*a* (mg/m<sup>2</sup>) vs TP

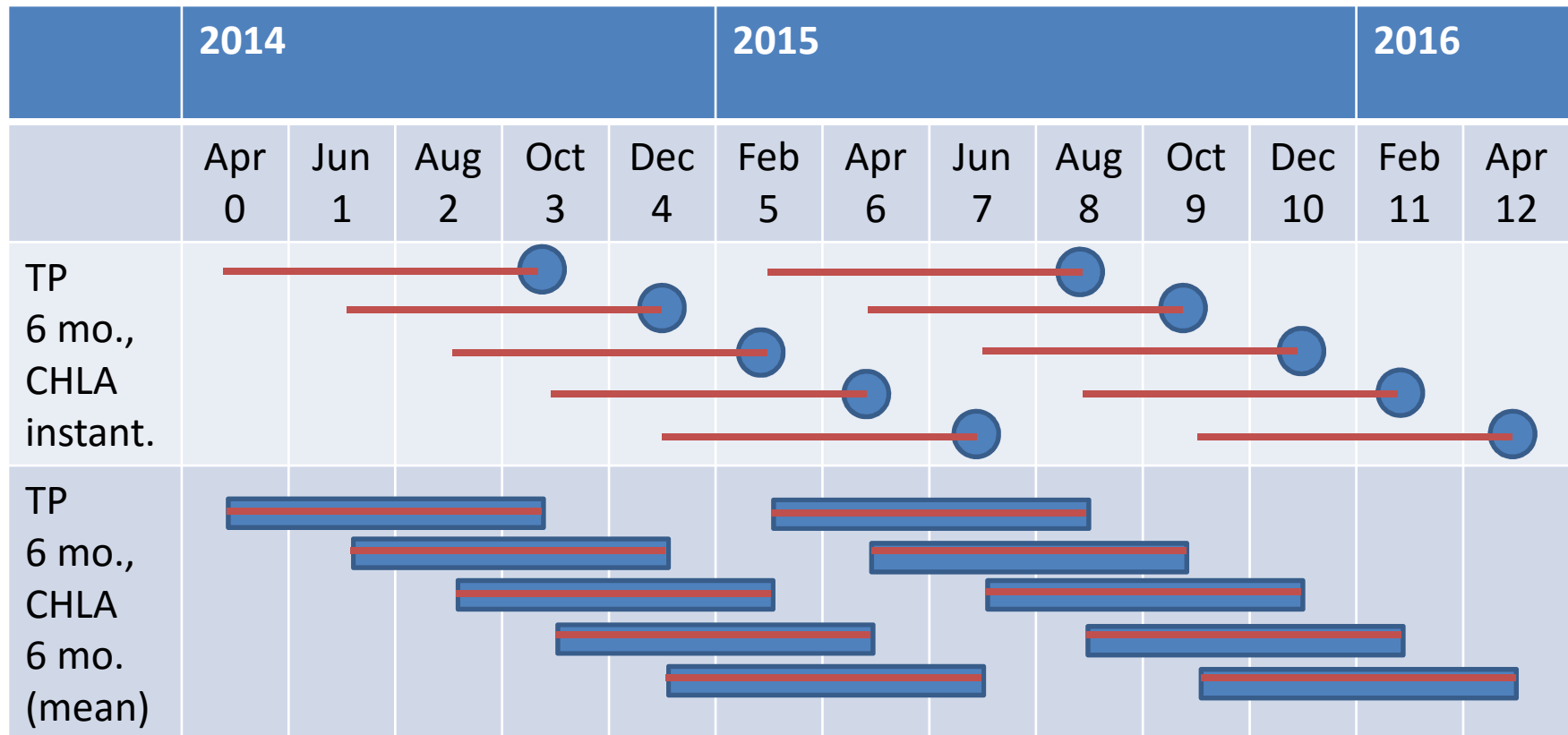


# Benthic (Periphyton) Chlorophyll-*a* vs TP (y-axis truncated at 1000 mg/m<sup>2</sup>)

Event

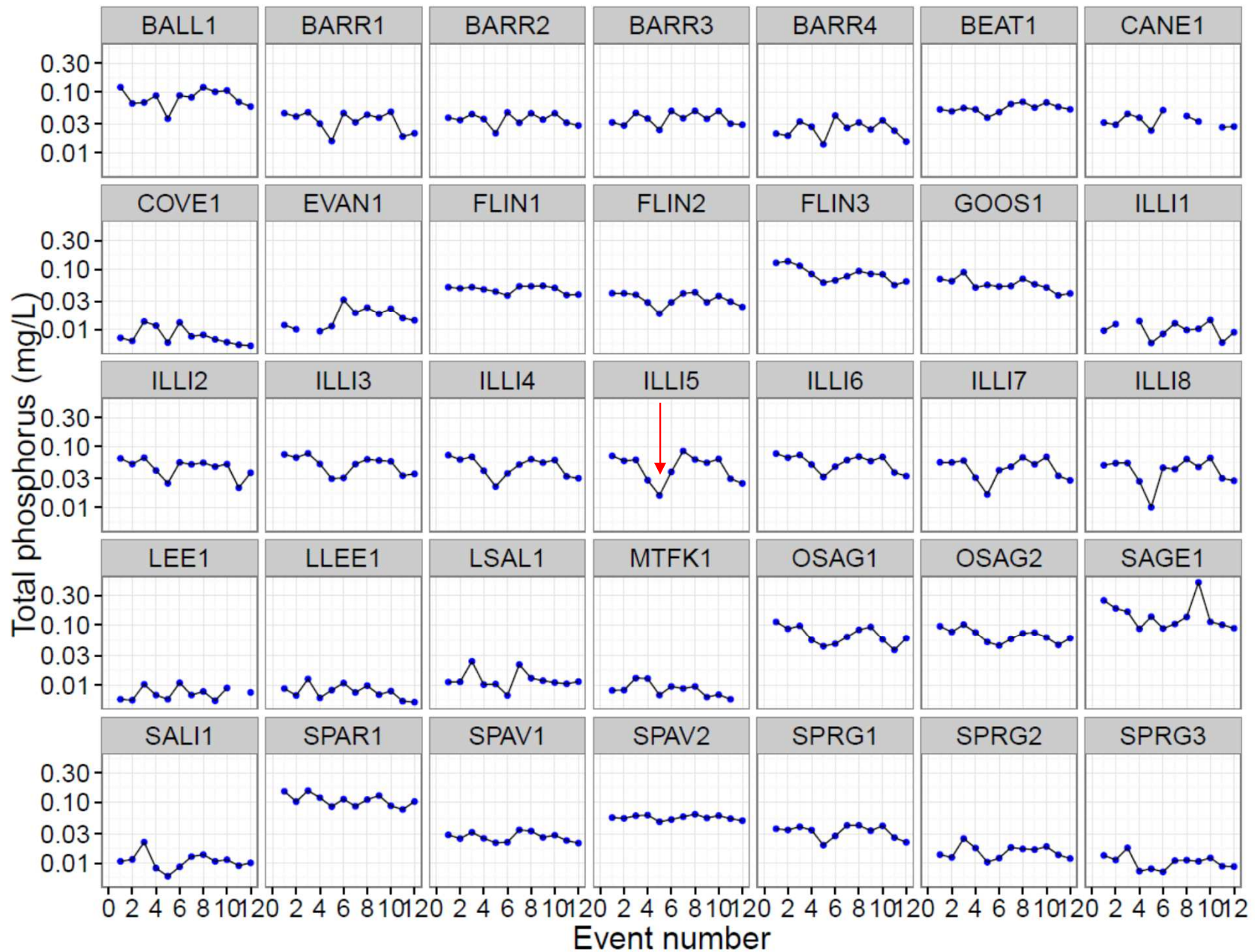


# Duration of exposure (TP) vs. instantaneous/cumulative response (CHLA)



# TP vs time by location

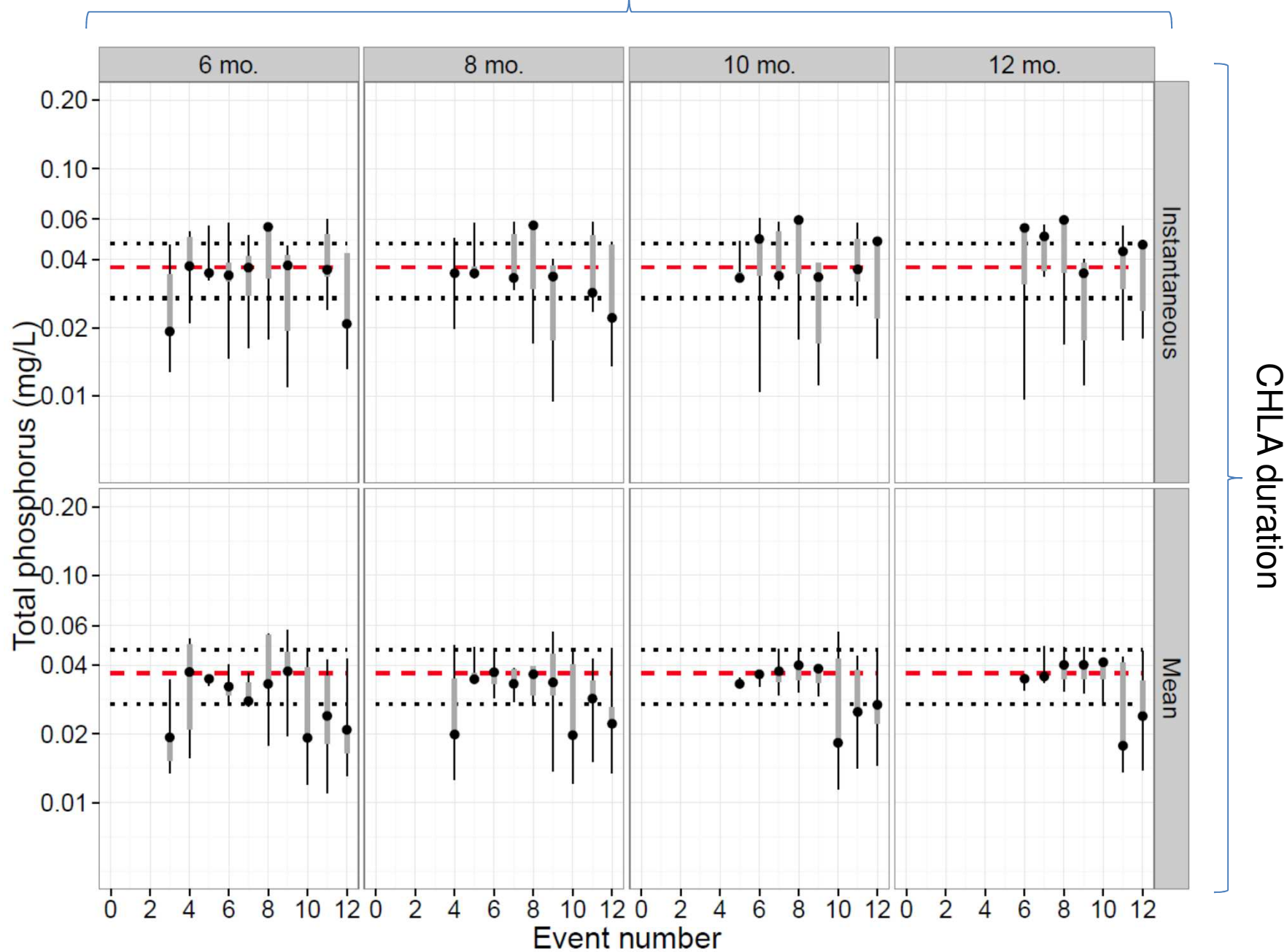
(red arrow corresponds to large reduction in TP during Feb 2015 (peak of *Cladophora* bloom))



TP change points: normal distribution

TP duration

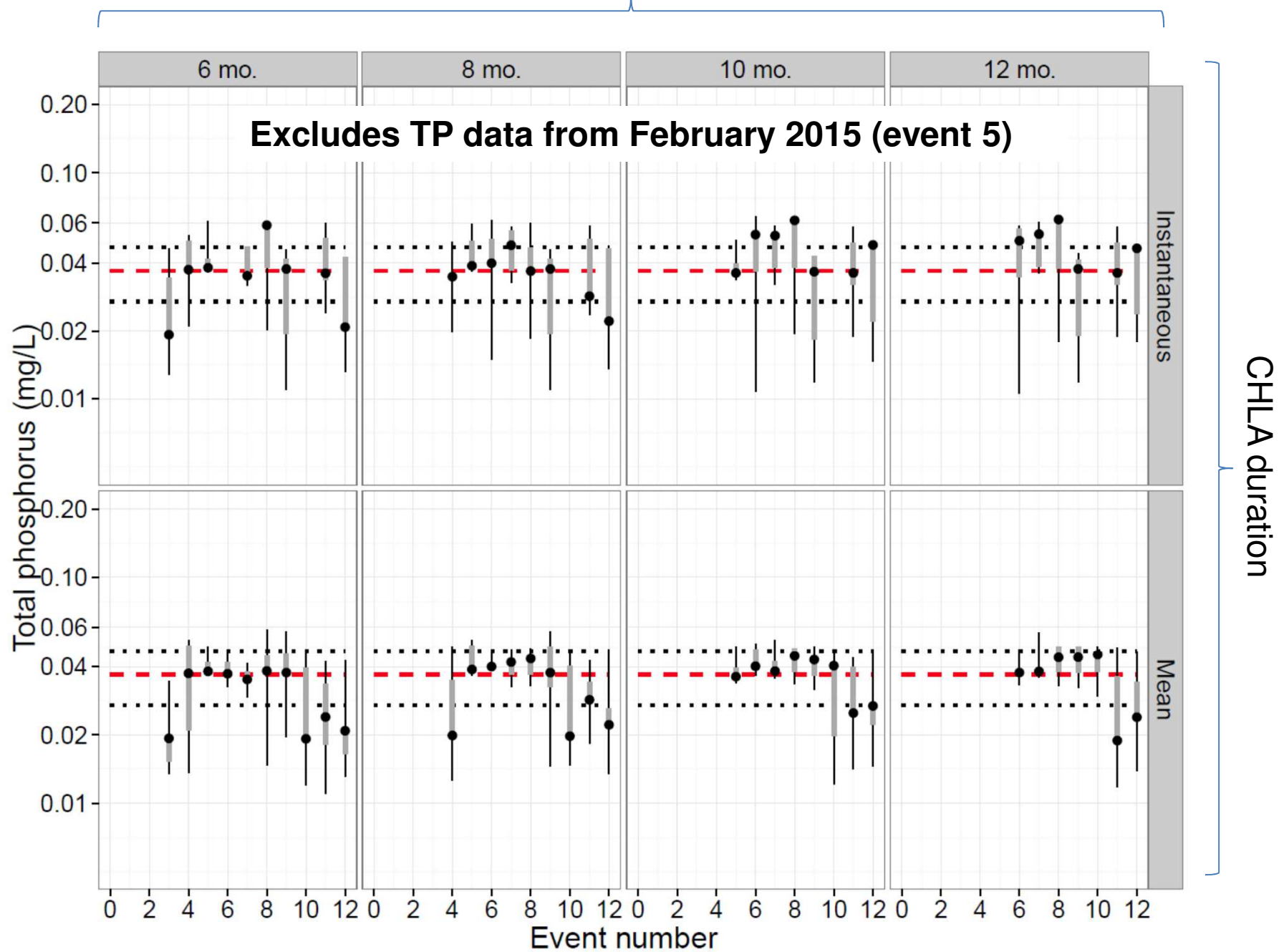
Benthic chlorophyll-a



*TP change points: normal distribution*

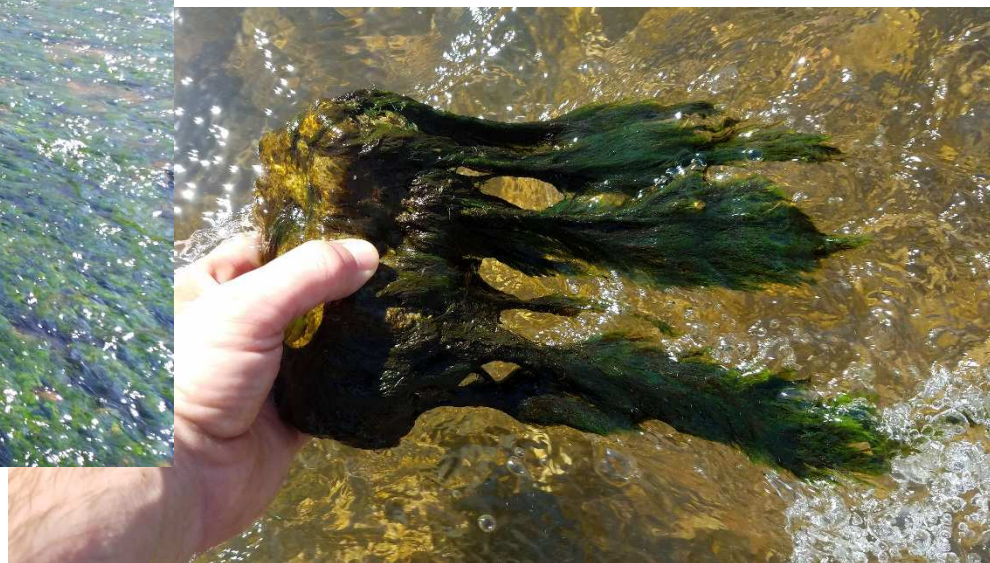
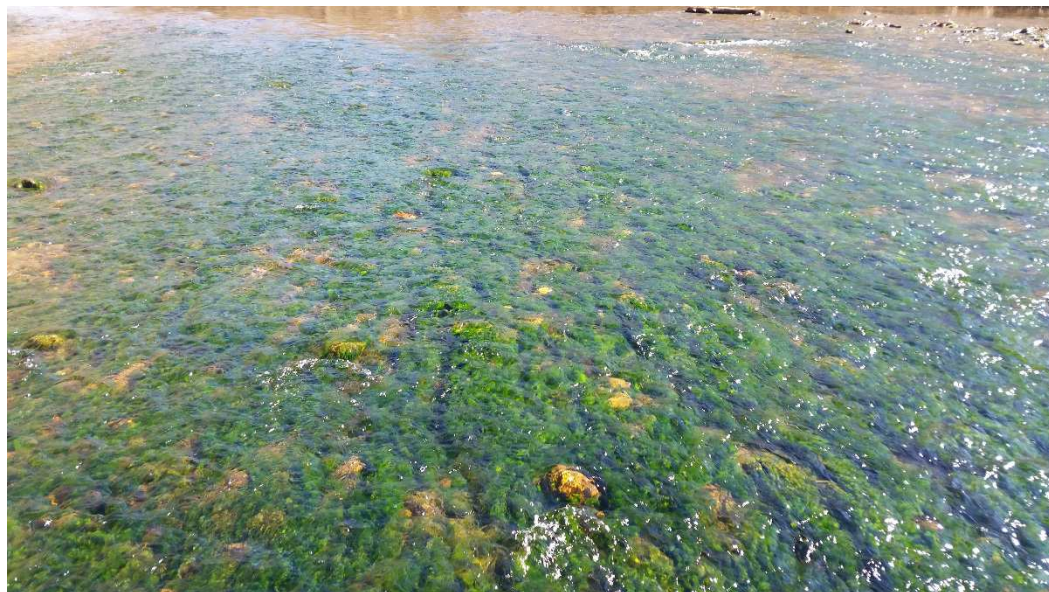
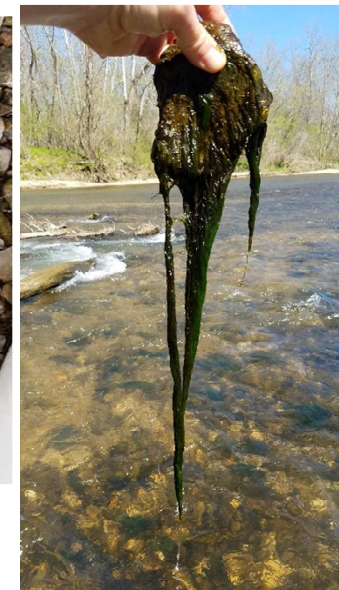
## TP duration

*Benthic chlorophyll-a*



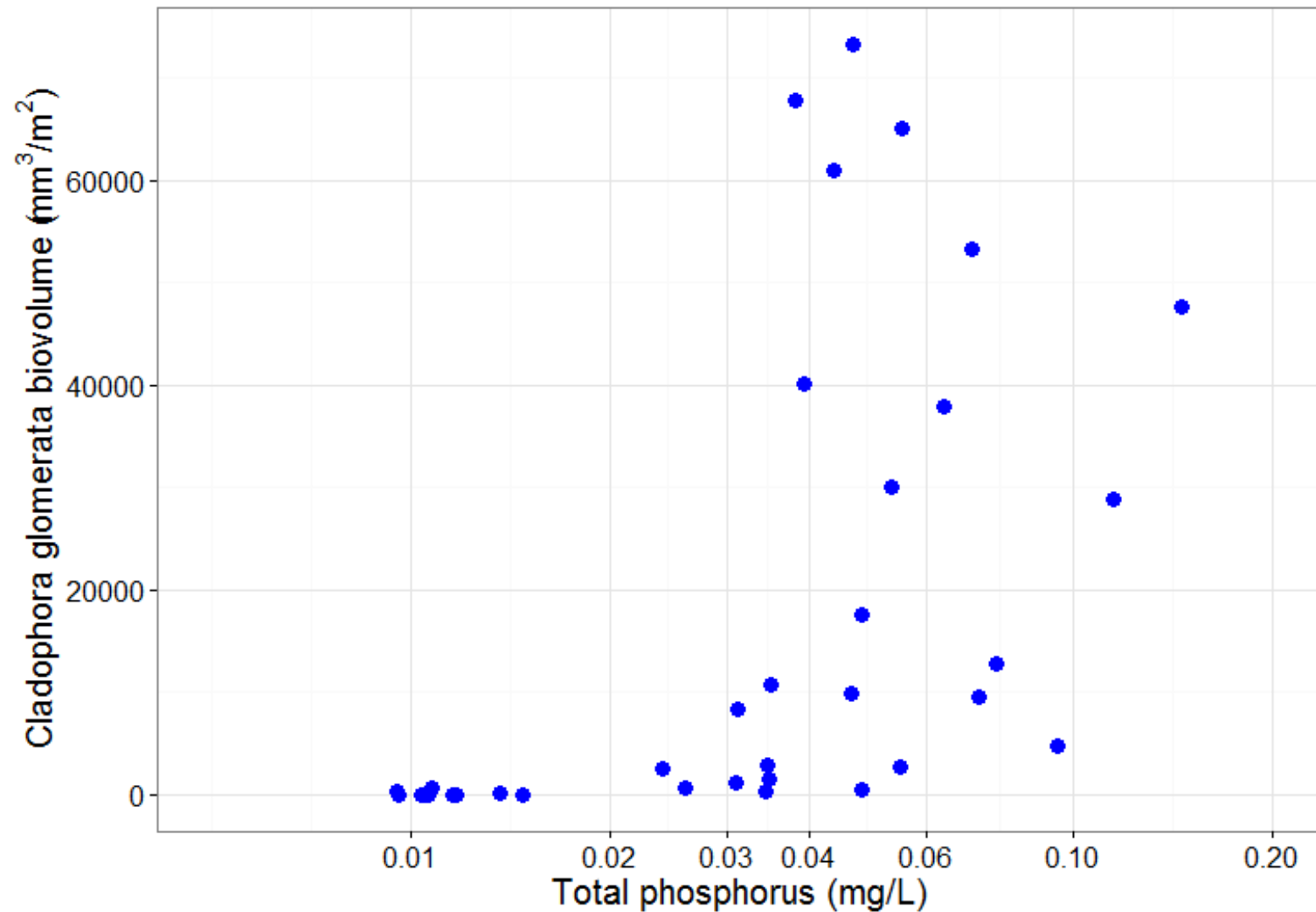


# ***Cladophora glomerata* biovolume ( $\mu\text{m}^3/\text{m}^2$ ) vs TP**



# ***Cladophora glomerata* biovolume vs TP**

12 month TP, Mean *Cladophora* biovolume (June 14 – April 15)

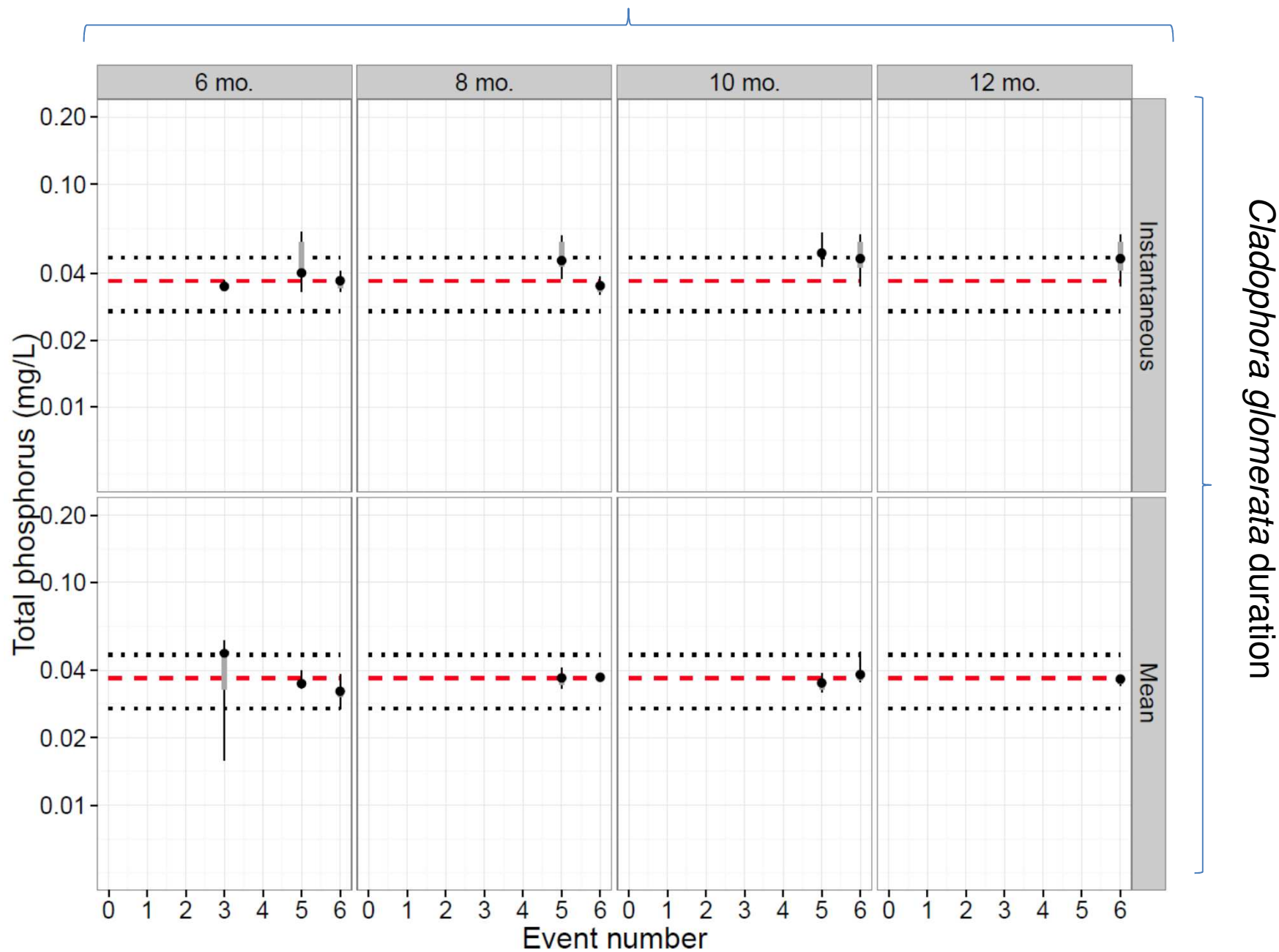




TP change points: Poisson distribution

Cladophora biovolume

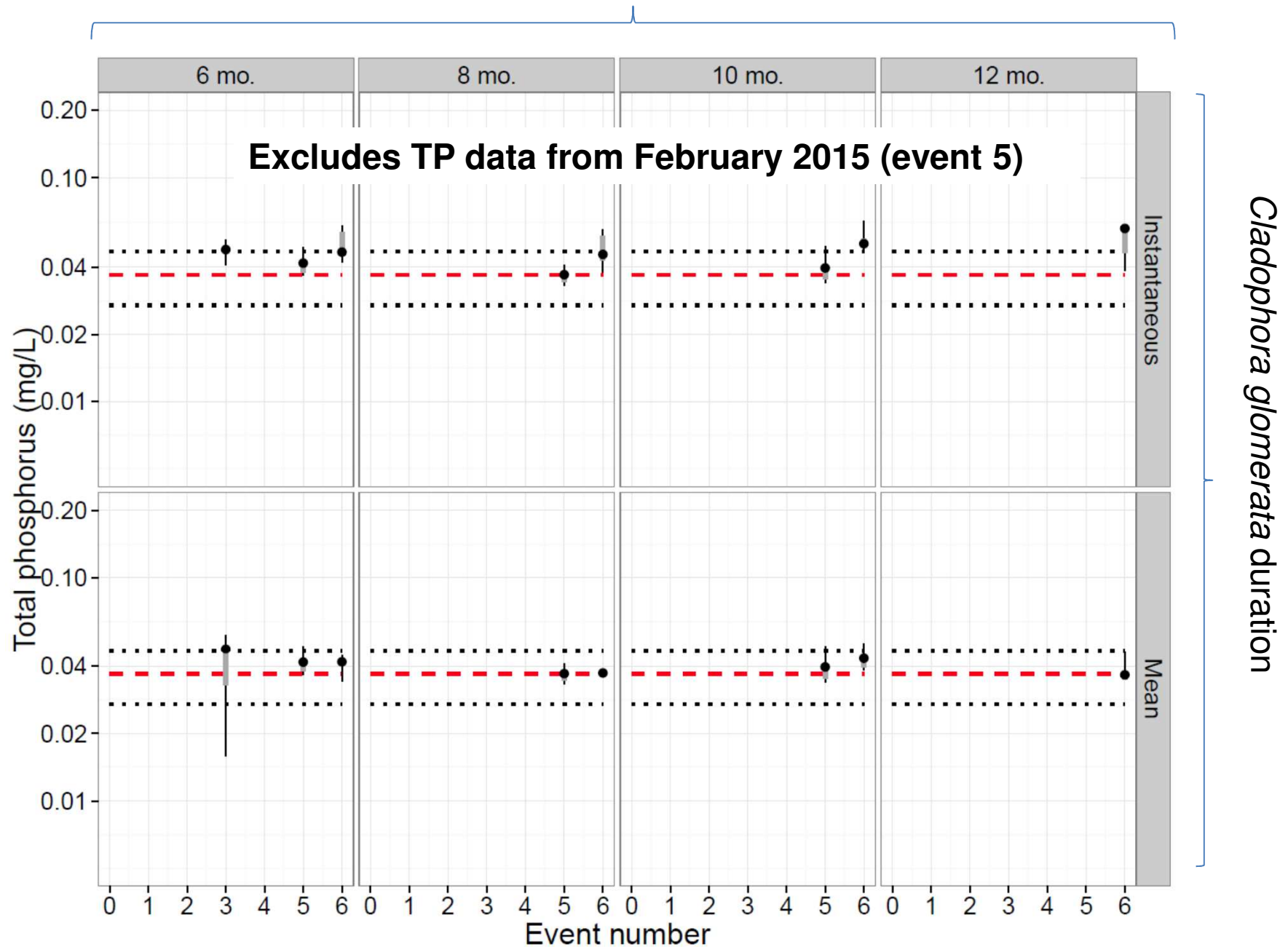
TP duration



TP change points: Poisson distribution

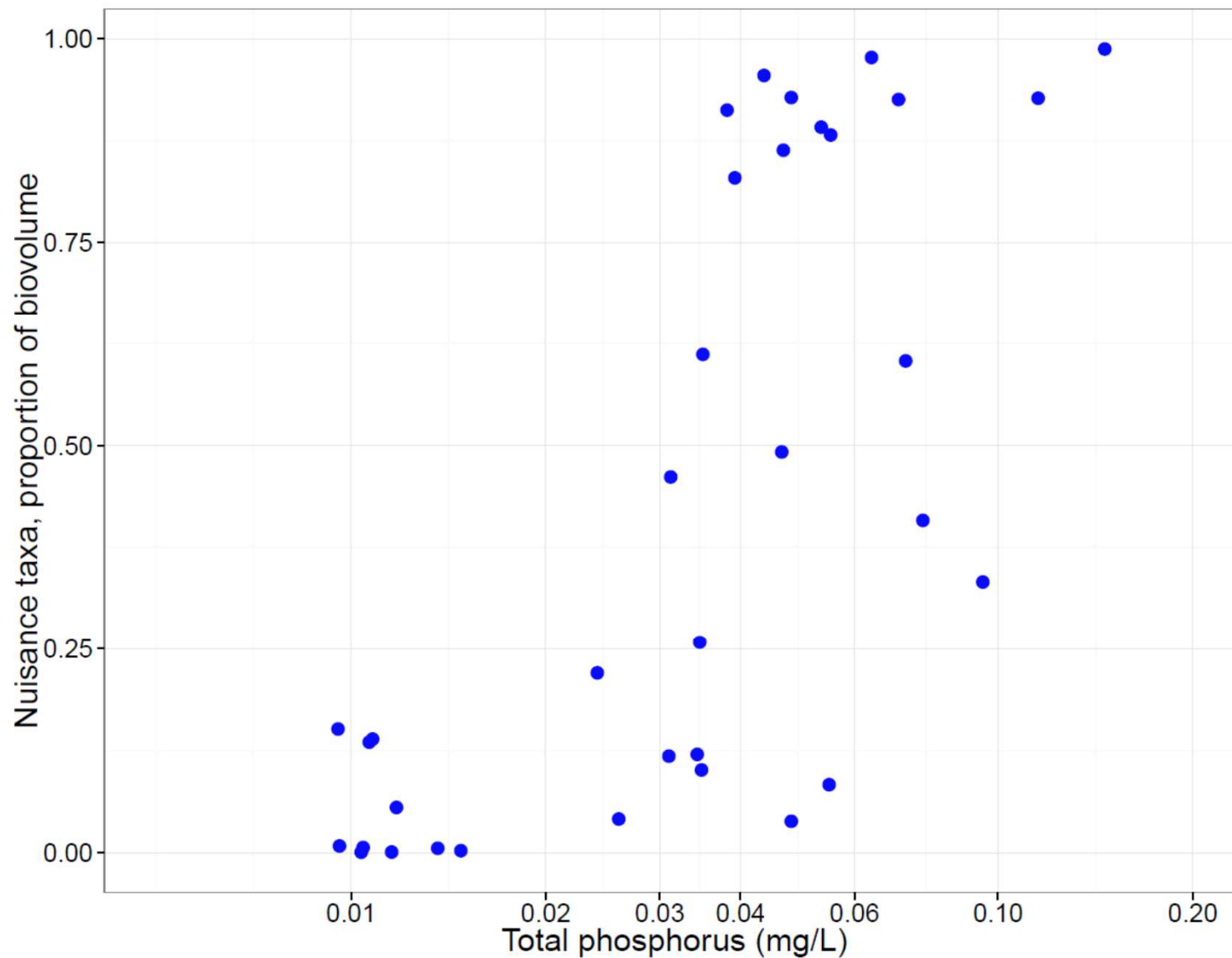
Cladophora biovolume

TP duration



# Nuisance taxa proportion vs TP

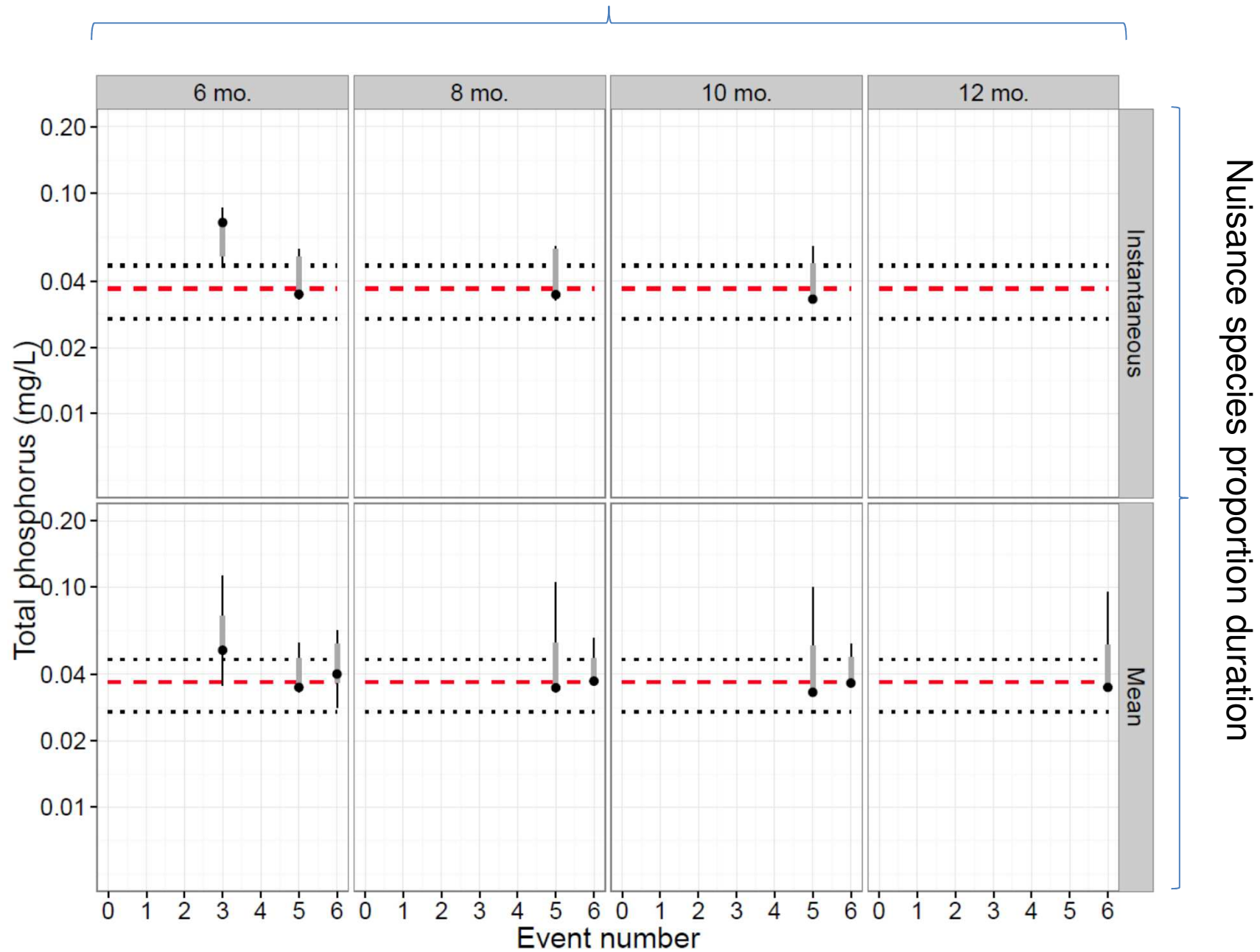
12 month TP, Mean nuisance taxa biovolume (June 14 – April 15)



TP change points: binomial distribution

Prop. Nuisance taxa

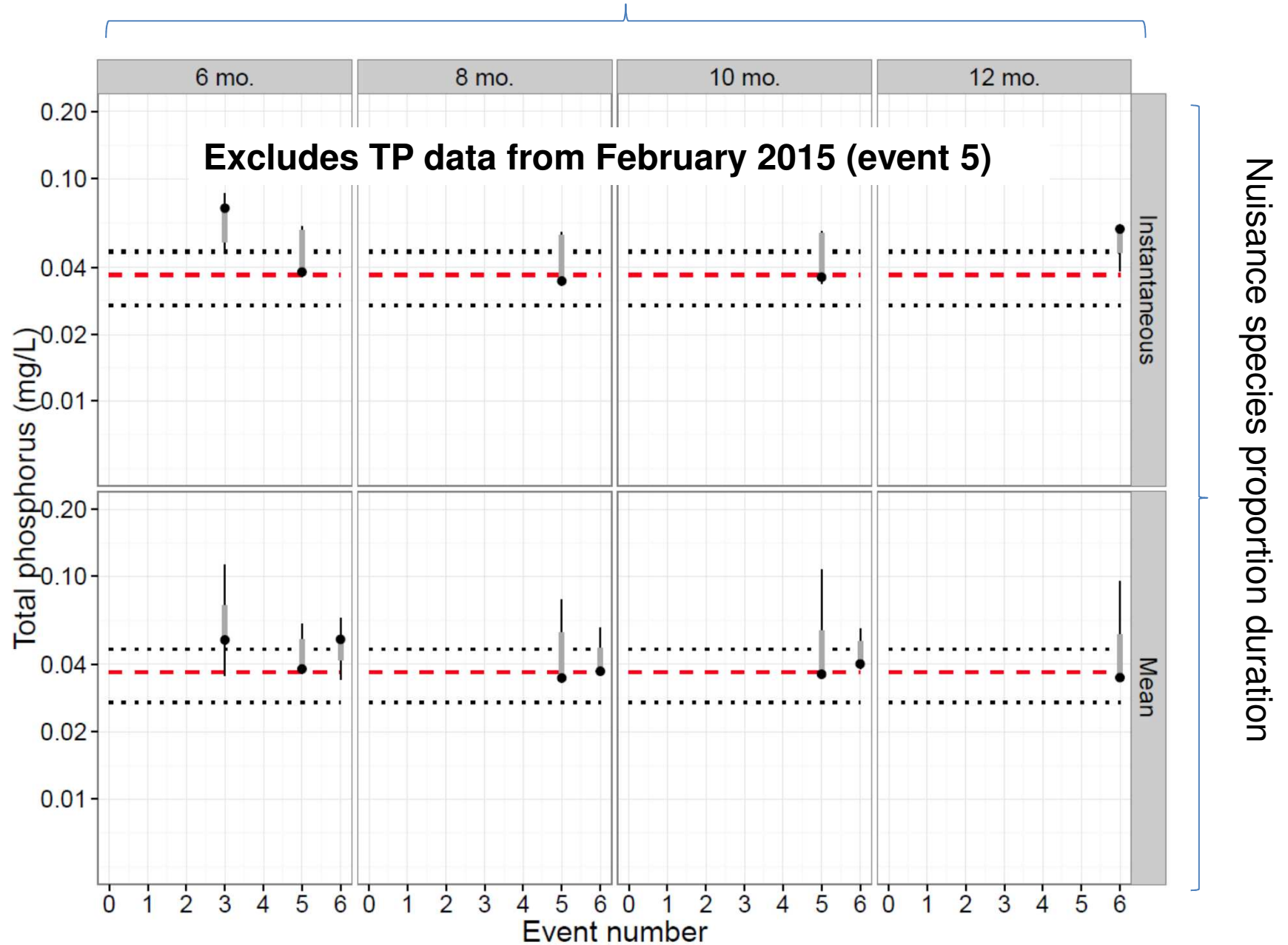
TP duration



TP change points: binomial distribution

Prop. Nuisance taxa

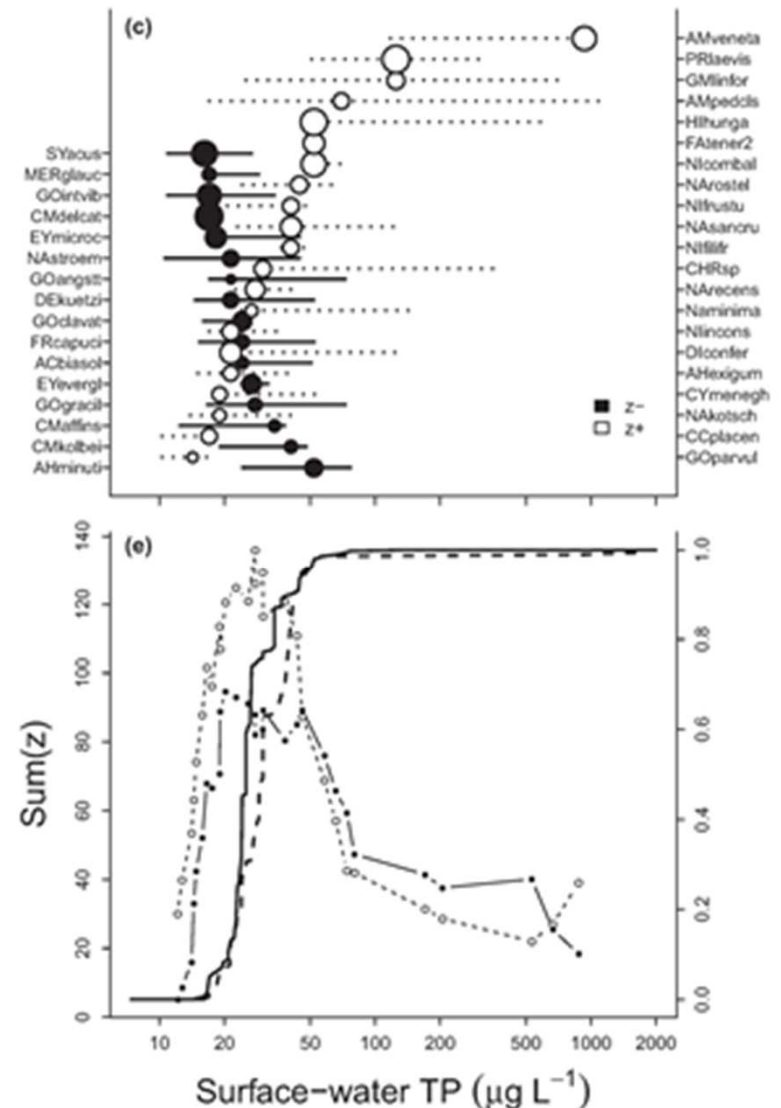
TP duration



# Threshold Indicator Taxa Analysis (TITAN)

TITAN identifies change points in species that decline (-) or increase (+) and distinguishes these two groups.

In this Texas example, significant turnover sharply peaked at 0.021 (0.016-0.052) mg/L TP for declining taxa and 0.028 (0.018-0.048) for increasing (z+) taxa, both indicative of a significant shift in species composition between ~0.02-0.05 mg/L TP.

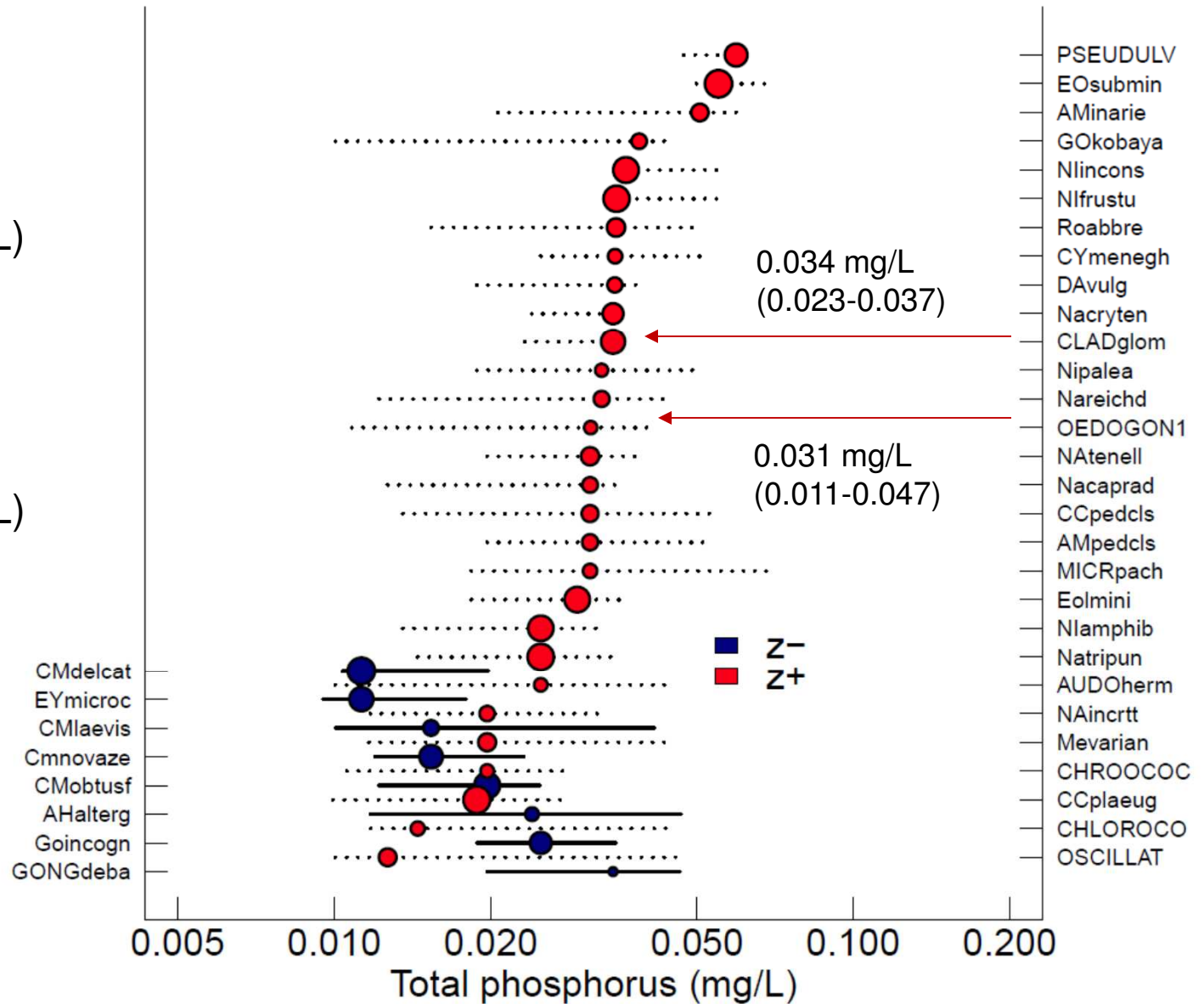


# TITAN

12 month TP, Mean taxa biovolume (June 14 – April 15)

z- change point:  
**0.0197 mg/L**  
(0.0119-0.0232 mg/L)

z+ change point:  
**0.0249 mg/L**  
(0.0189-0.0349 mg/L)





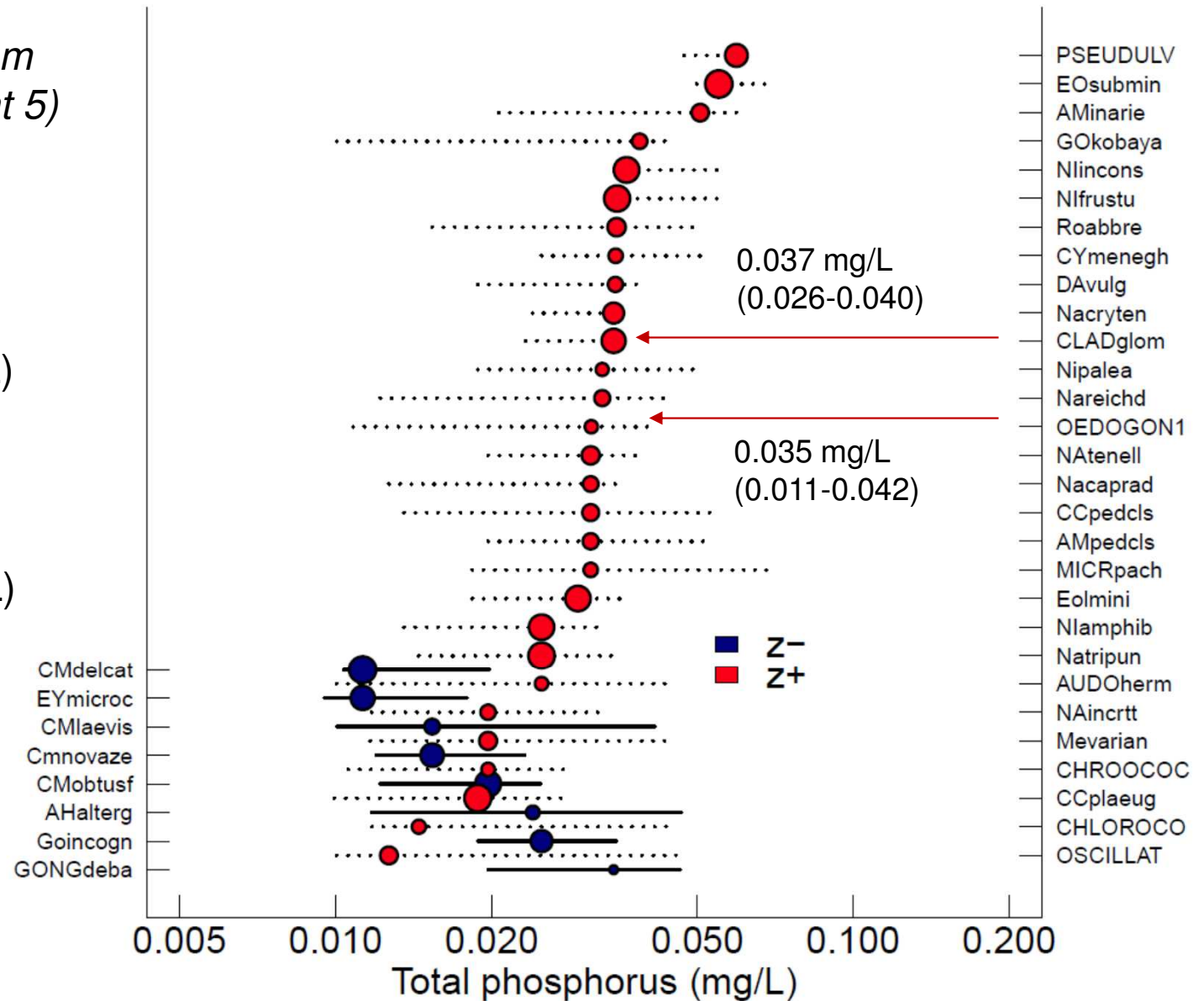
# TITAN

12 month TP, Mean taxa biovolume (June 14 – April 15)

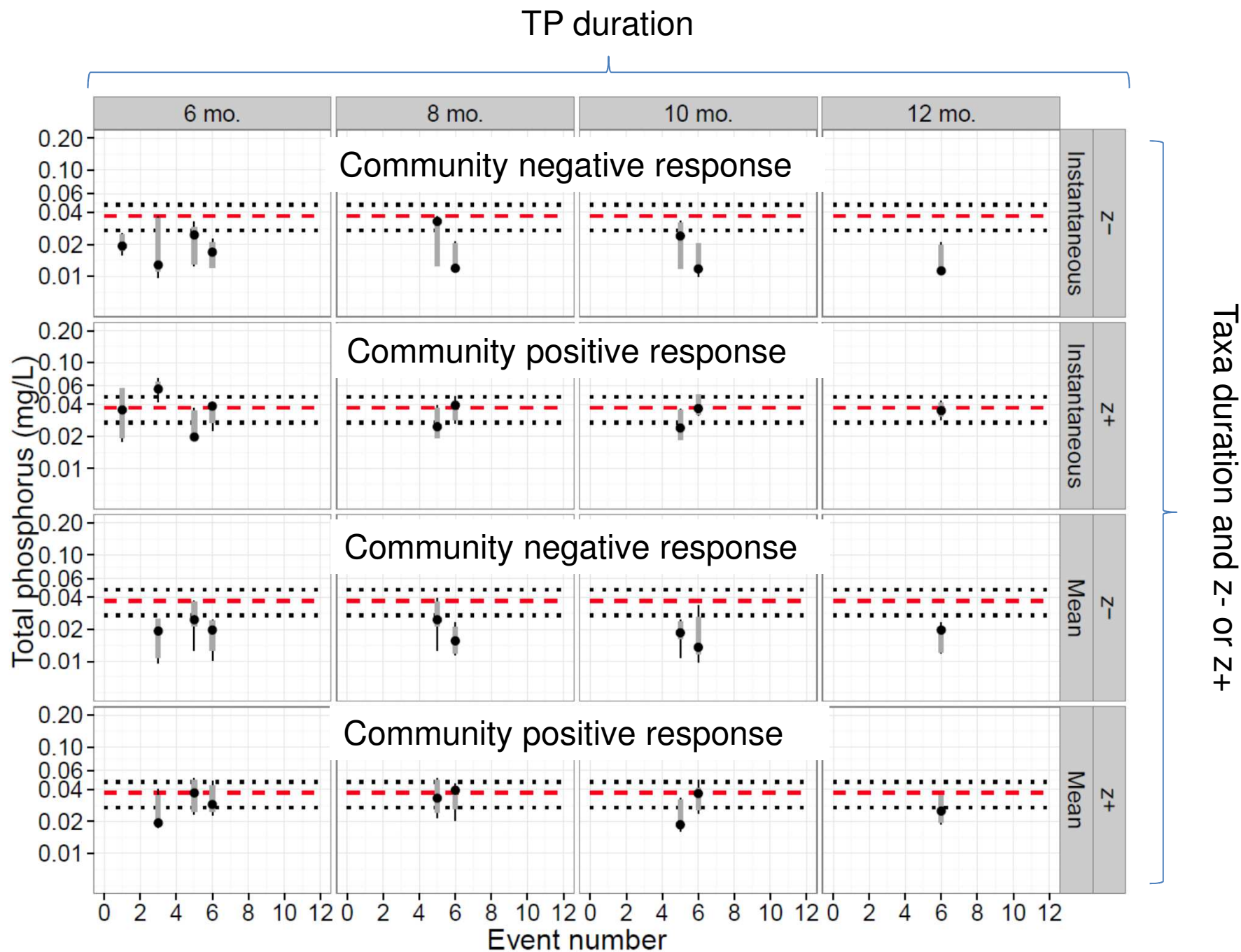
*Excludes TP data from  
February 2015 (event 5)*

z- change point:  
**0.0209 mg/L**  
(0.0124-0.0263 mg/L)

z+ change point:  
**0.0263 mg/L**  
(0.0198-0.0400 mg/L)







# Next steps

- Model fitting to response variables: quantile regression and/or GAM
  - Need y-axis (e.g., CHLA) targets
  - Mean of 200 mg/m<sup>2</sup> is supported in literature as a nuisance level, but others can be evaluated
- Macroinvertebrate analysis
- Components of the final report
- Future meetings

# Acknowledgments

- Baylor SRJS core team:
  - Dr. Jeffrey Back, instrument specialist and research associate
  - Morgan Bettcher, research technician (UNC '14)
  - Stephen Elser, research technician (ND '14)
  - Katherine Hooker, research technician (BU '14)
  - Stephen Cook, Ph.D. student, BU (2013- .)
  - Lauren Housley, M.S. student, BU (2014- .)
  - Caleb Robbins, Ph.D. student, BU (2012- .)
- Taxonomists
  - Dr. Stephen Porter (soft algae)
  - Dr. Barbara Winsborough (diatoms)