

Oklahoma Scenic Rivers Joint Phosphorus Study: Interim Report, 8 April 2016

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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

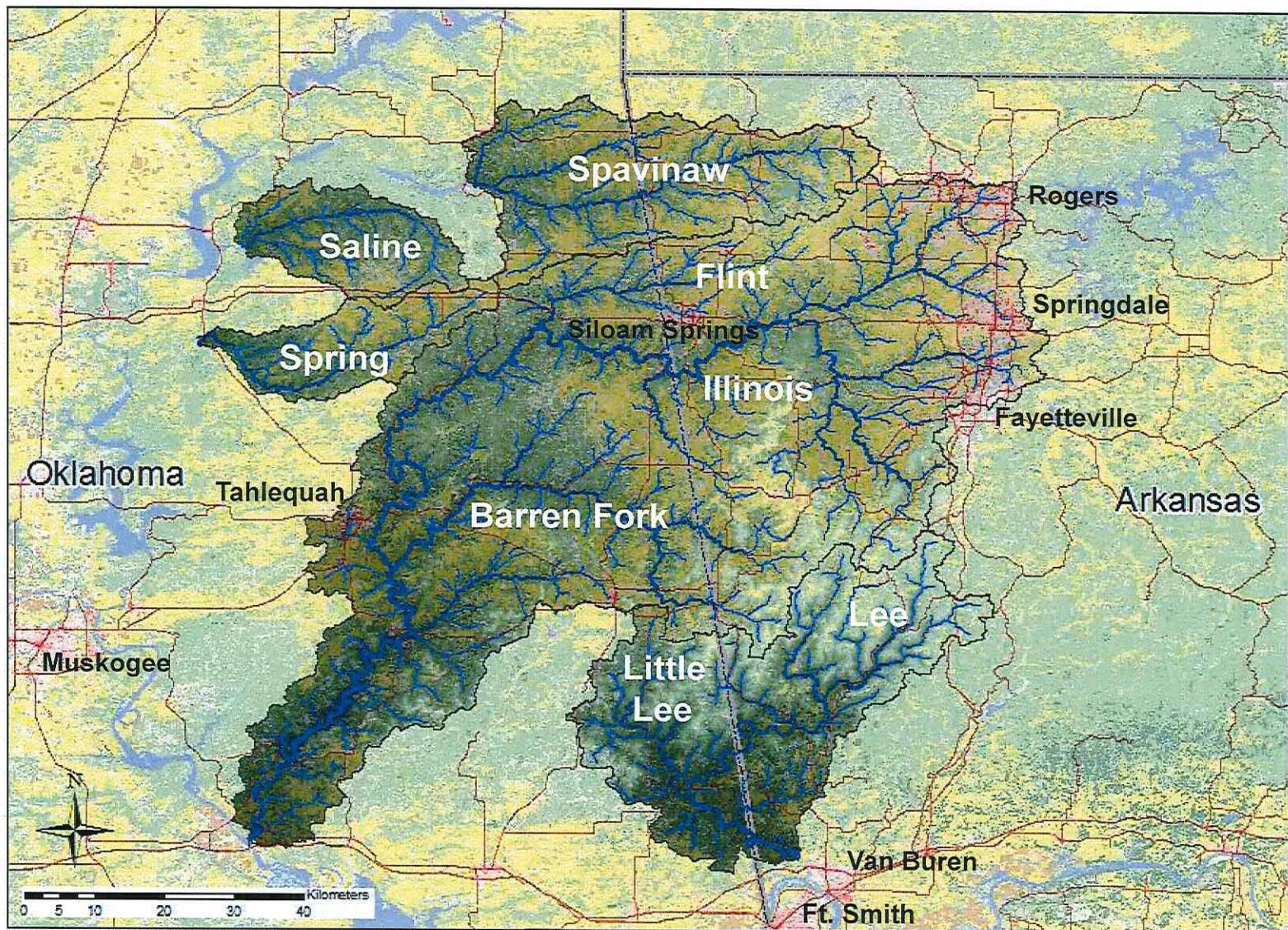
"to determine the total phosphorus threshold response level....at which any statistically significant shift occurs in

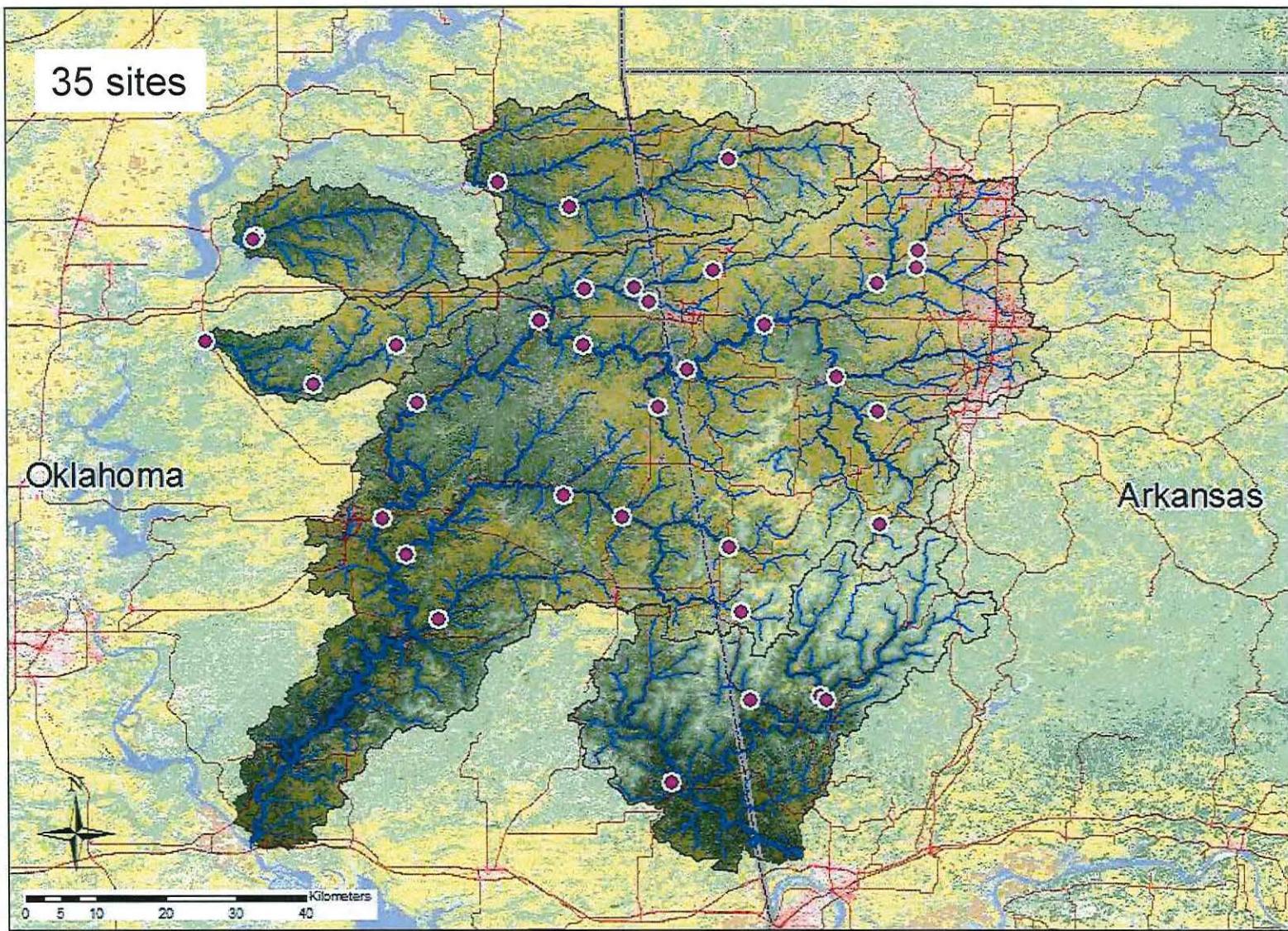
1. algal species composition OR
2. algal biomass production

...resulting in undesirable

1. aesthetic OR
2. water quality

...conditions in the Designated Scenic Rivers."



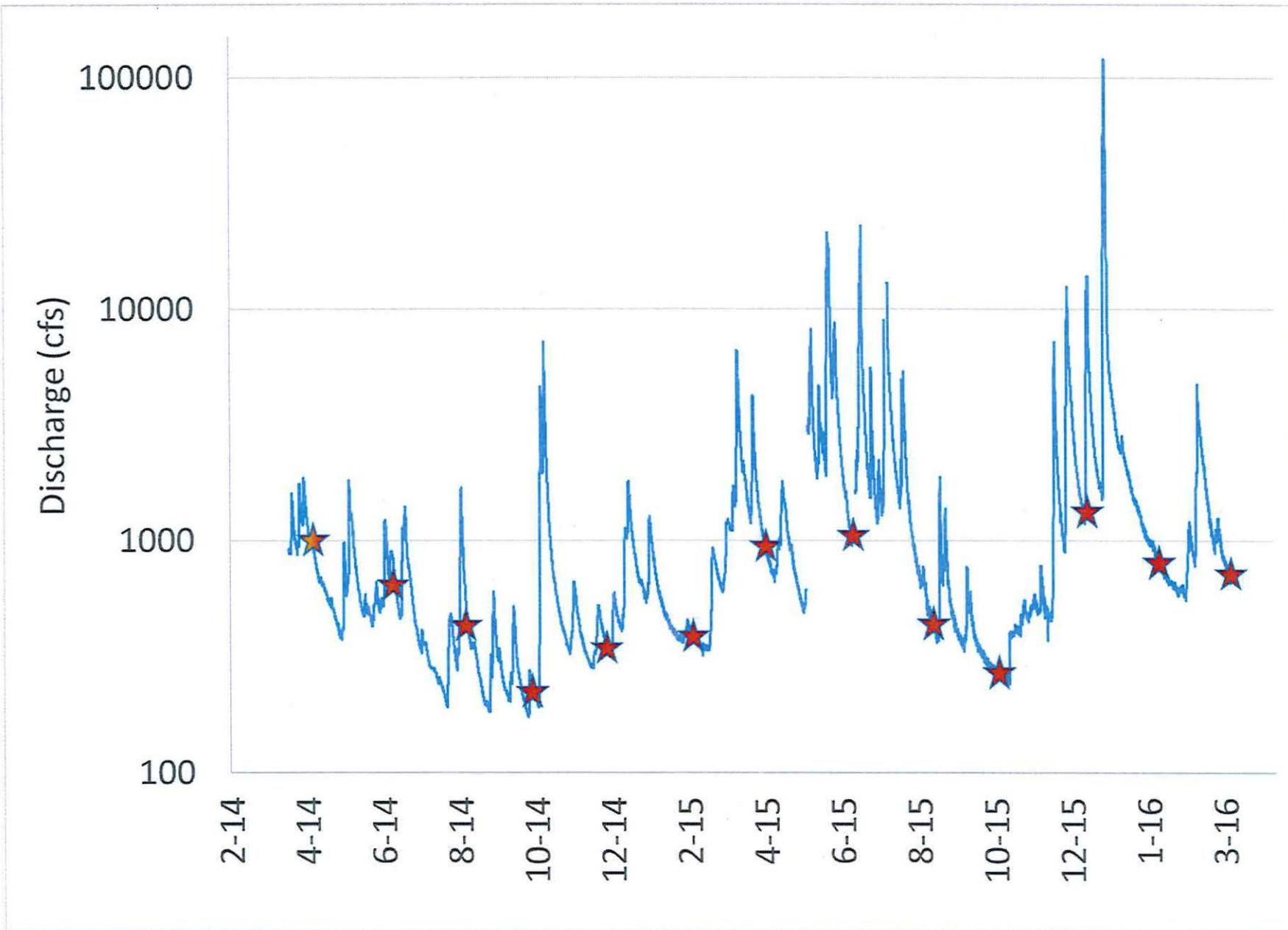


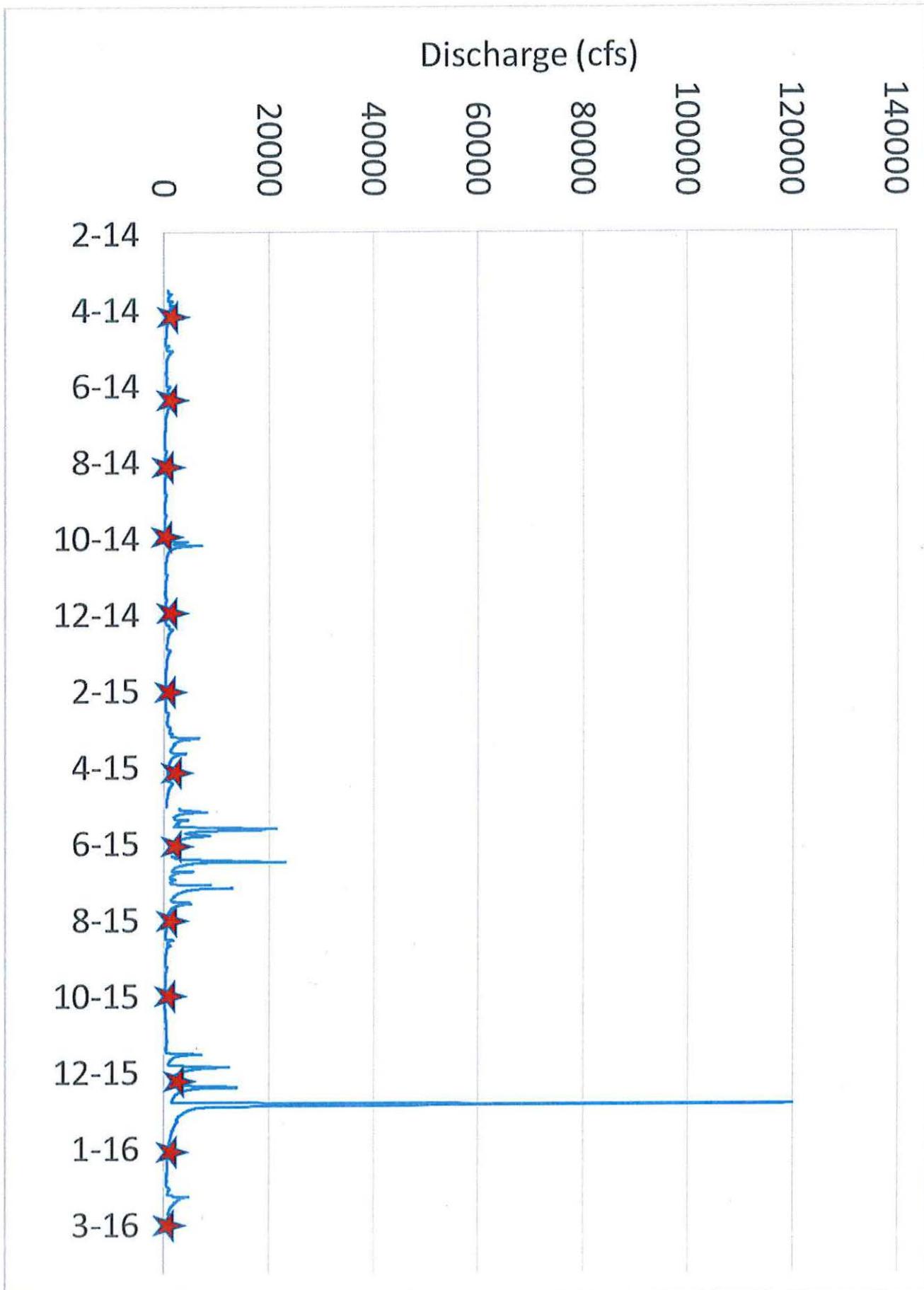
Sampling Frequency

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

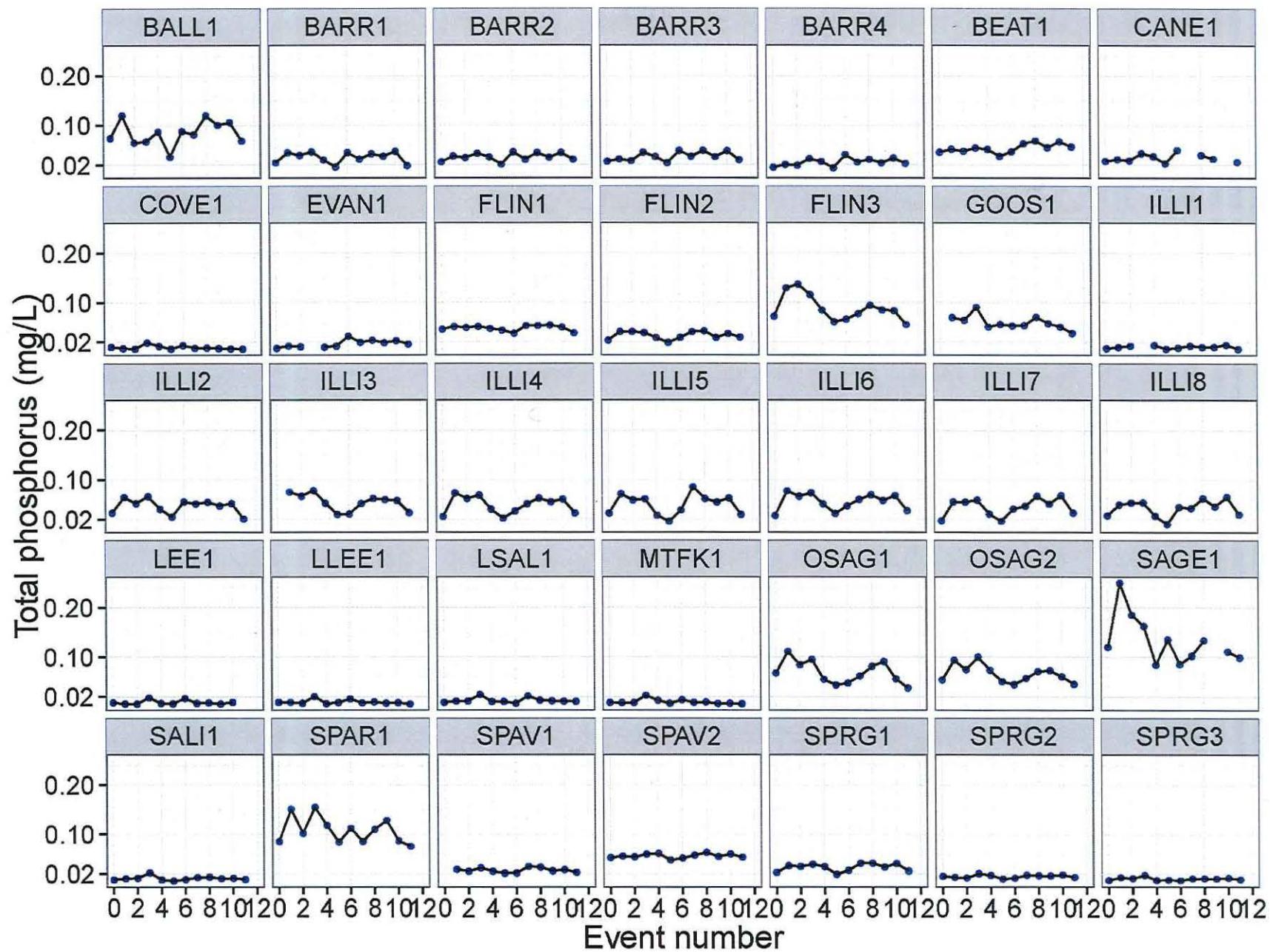
Data status report

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	✗	N/A	X	N/A
Apr-15	X	X	X	X	X	X	X	X	N/A
Jun-15	X	X	X	X	X	?	?	X	N/A
Aug-15	X	X	X	X	X	?	?	X	X
Oct-15	X	X	X	X	X	?	?	X	N/A
Dec-15	X	X	X	X	X	?	?	X	N/A
Feb-16	X	X	X	X	X	?	?	80%	N/A
Apr-16						?	?		

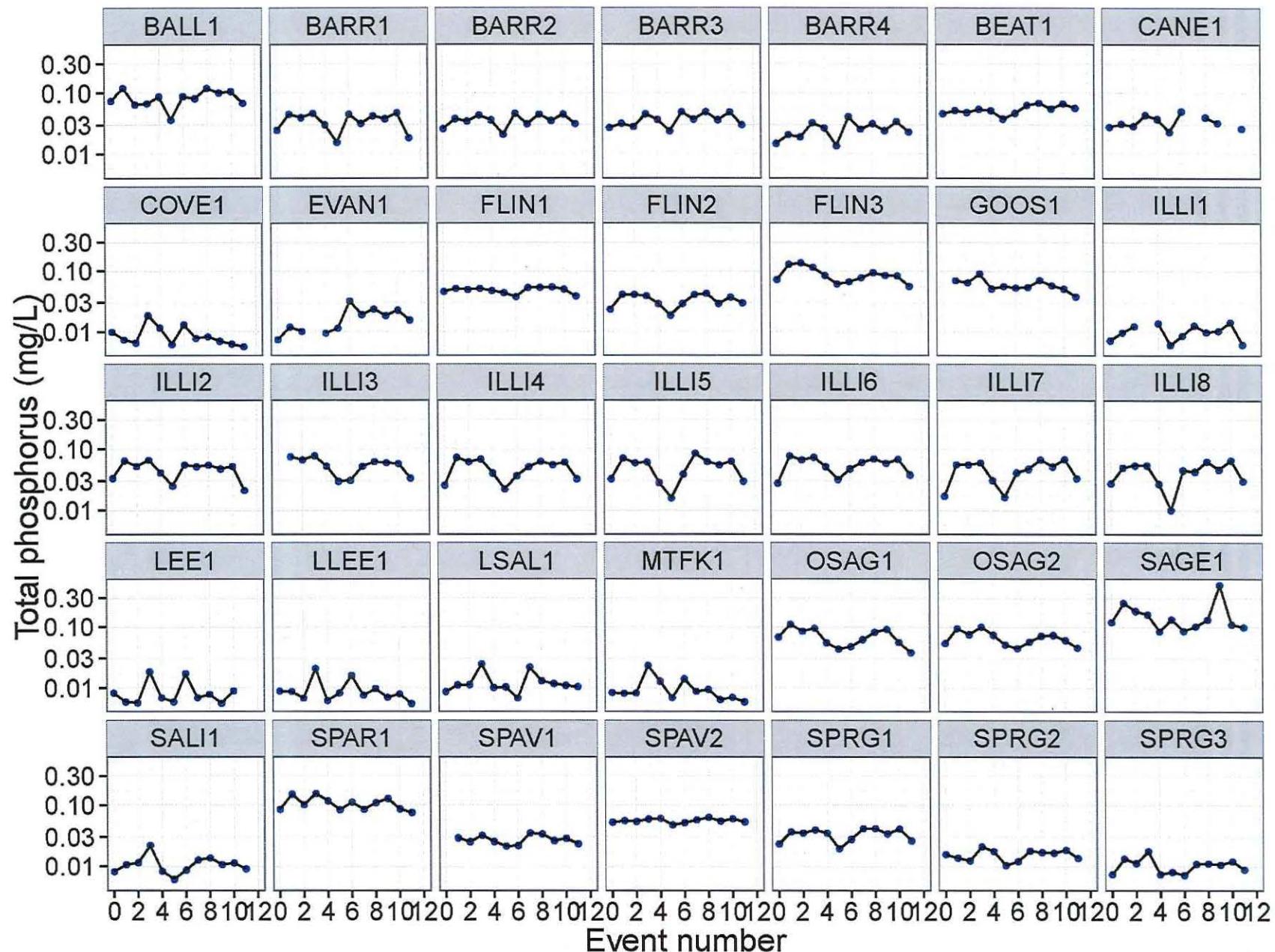


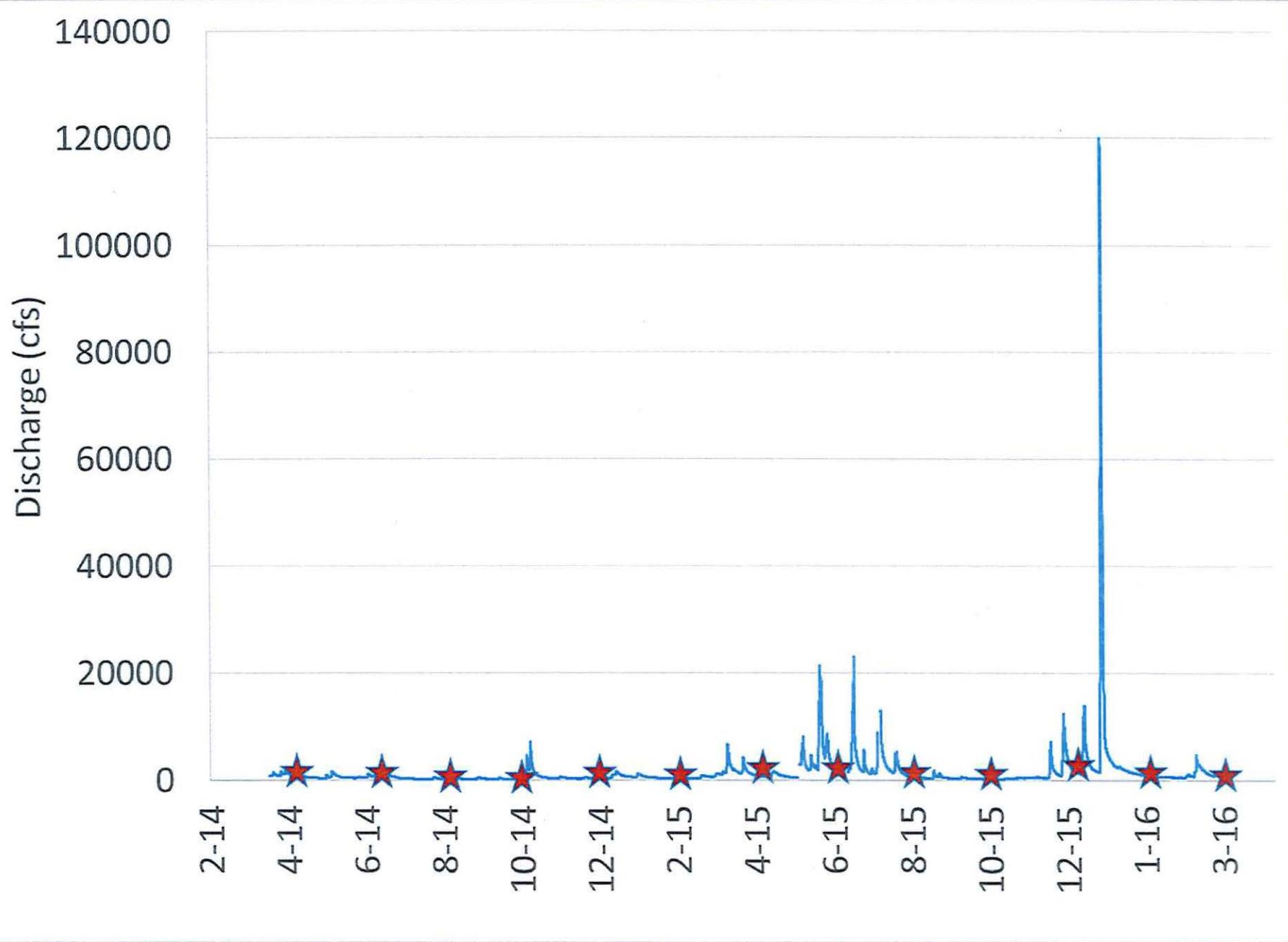


TP vs time by location



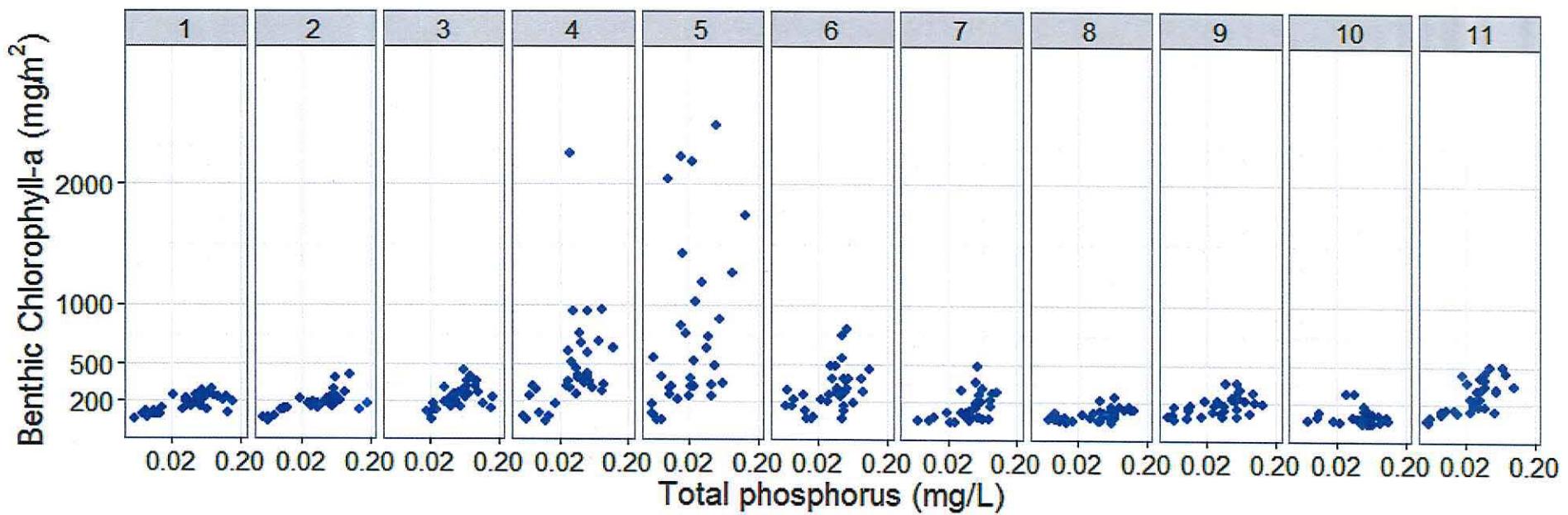
TP (log scale) vs time by location





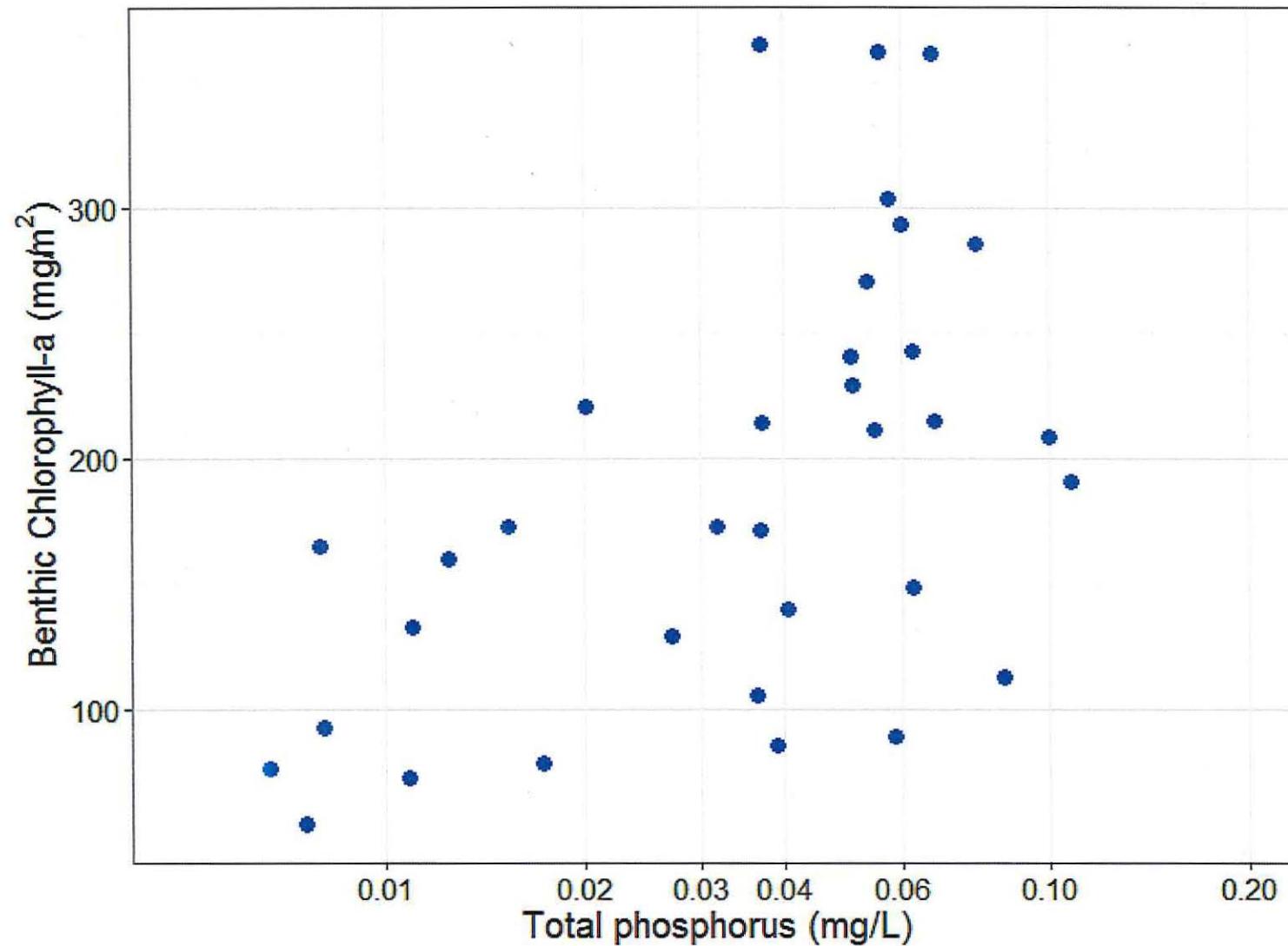
Benthic (Periphyton) Chlorophyll-a (mg/m²) vs TP

Jun14 Aug14 Oct14 Dec14 Feb15 Apr15 Jun15 Aug15 Oct15 Dec15 Feb16



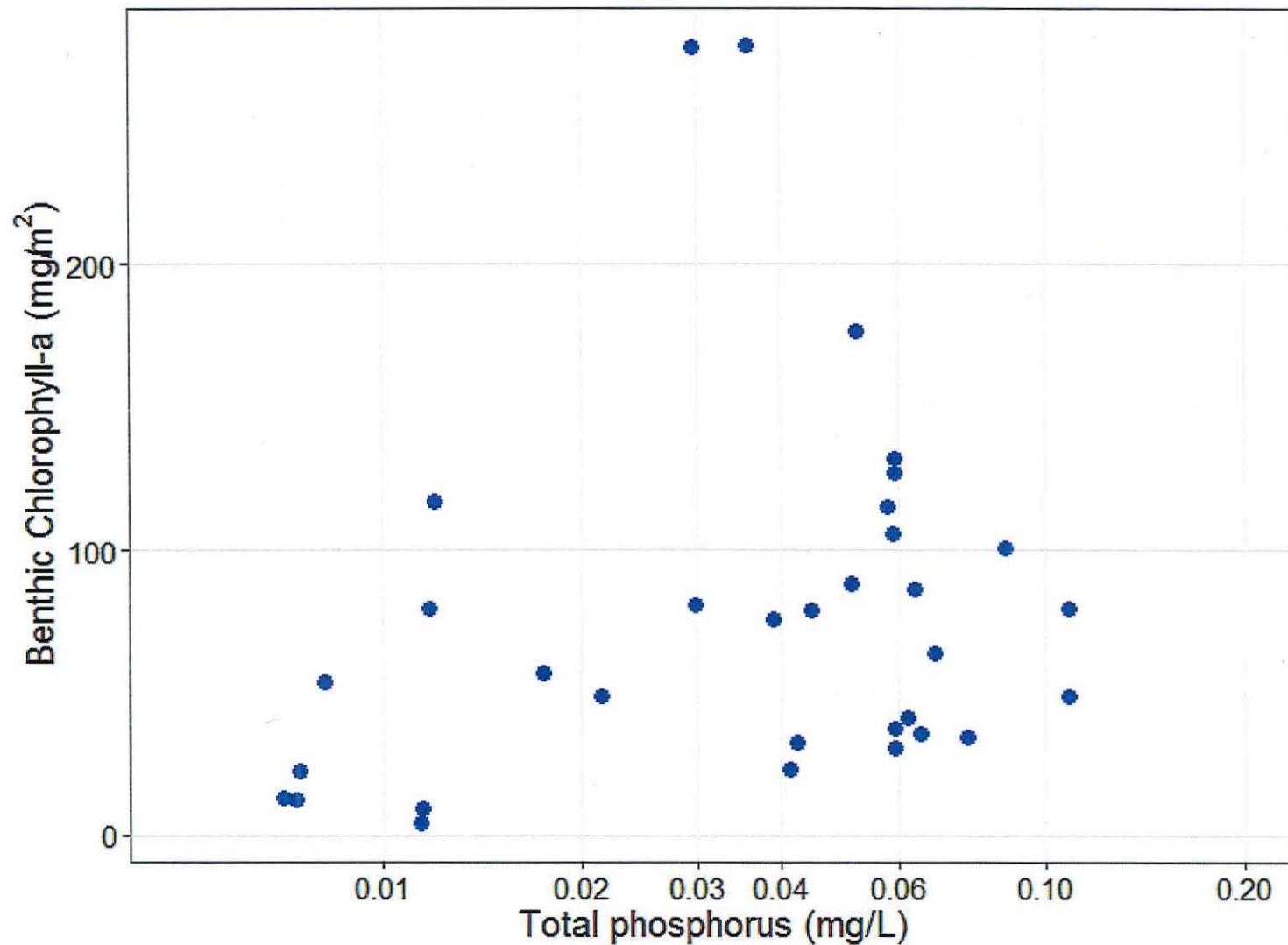
Benthic (Periphyton) Chlorophyll-a (mg/m²) vs TP

October 2015



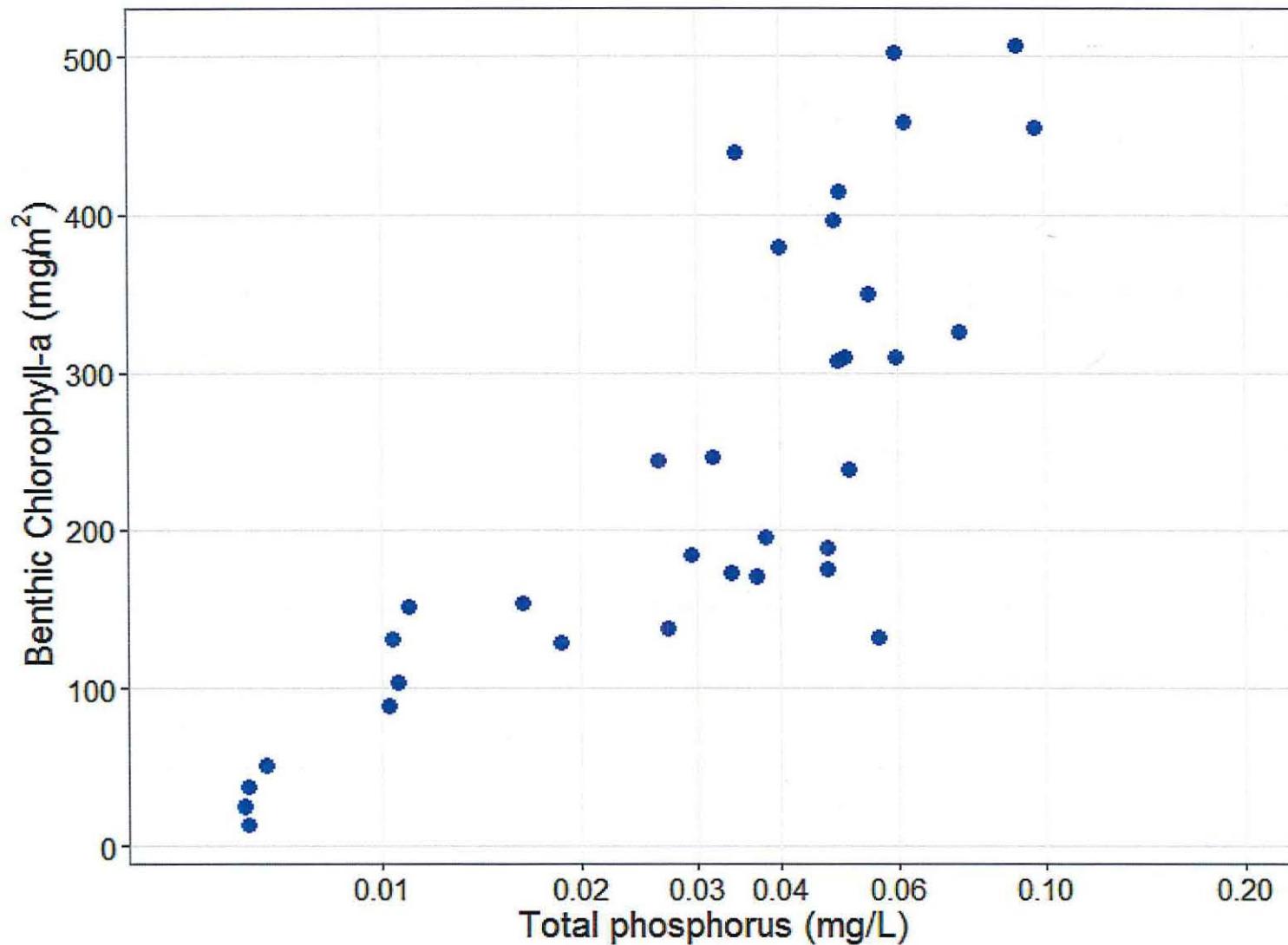
Benthic (Periphyton) Chlorophyll-a (mg/m^2) vs TP

December 2015

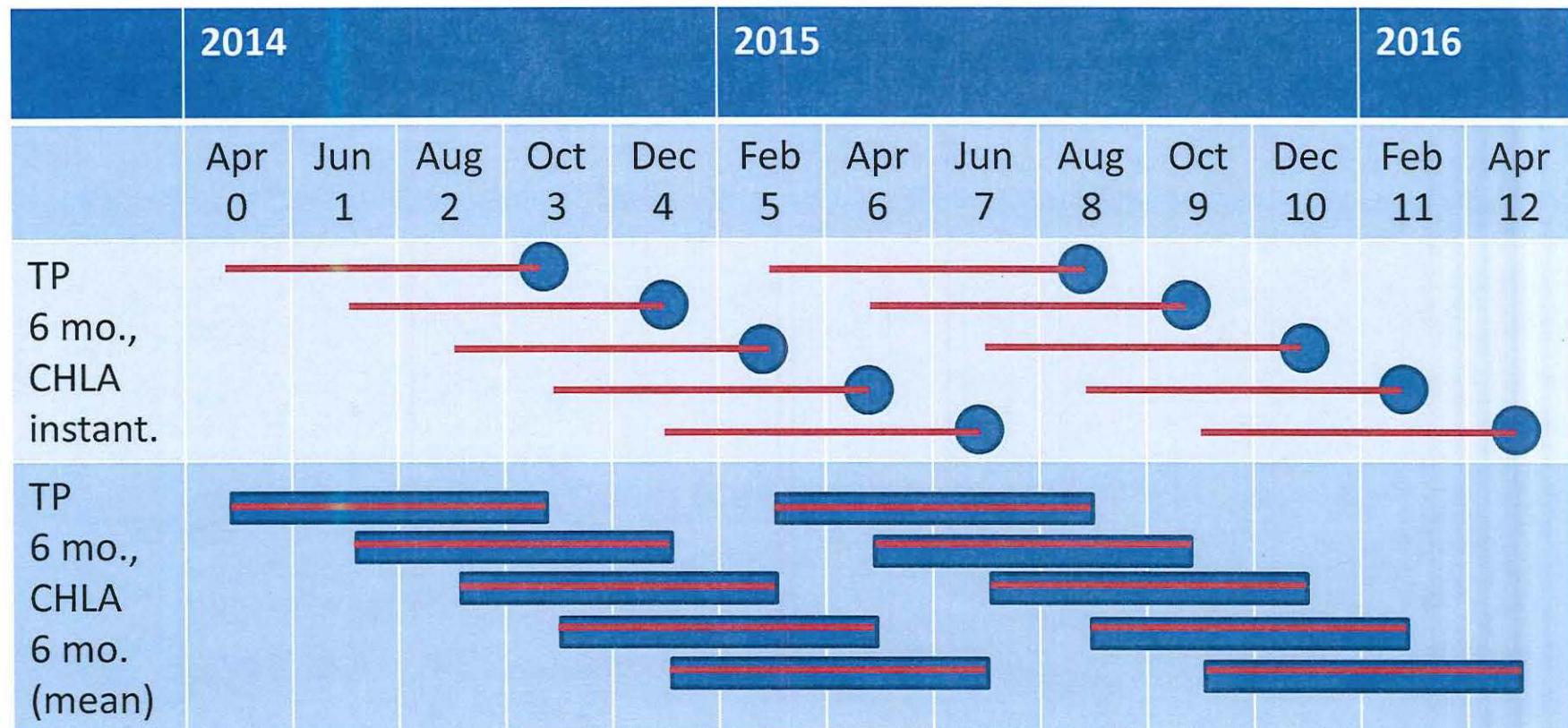


Benthic (Periphyton) Chlorophyll-a (mg/m²) vs TP

February 2016



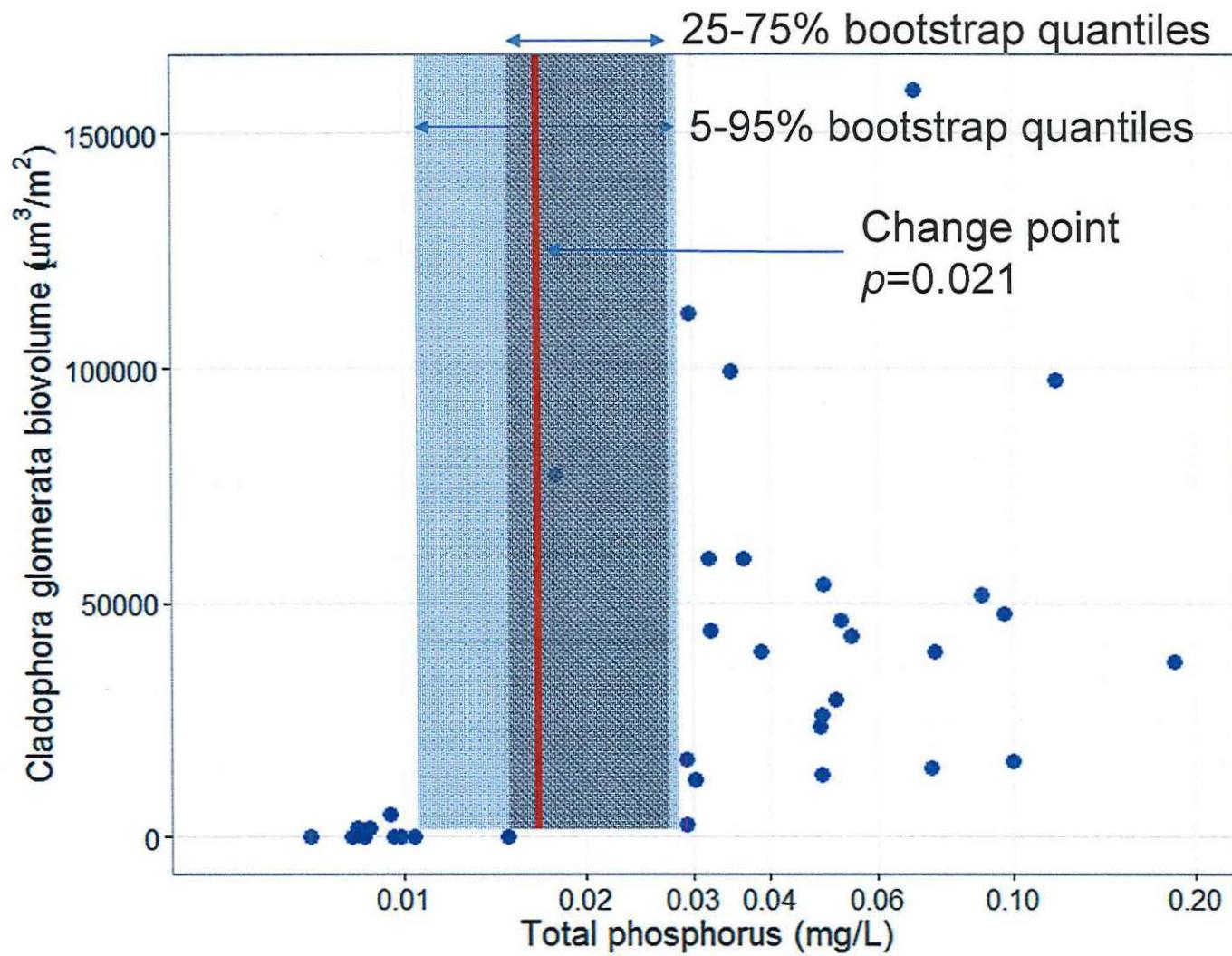
Duration of exposure (TP) vs. instantaneous/cumulative response (CHLA)



Change point analysis

- “What value of TP splits the data into two groups with the largest difference in mean chlorophyll-a?”
- More technically, “what value of the predictor (x axis variable) results in the greatest reduction in variance (deviance) by splitting the response data into two groups.”

Change point analysis



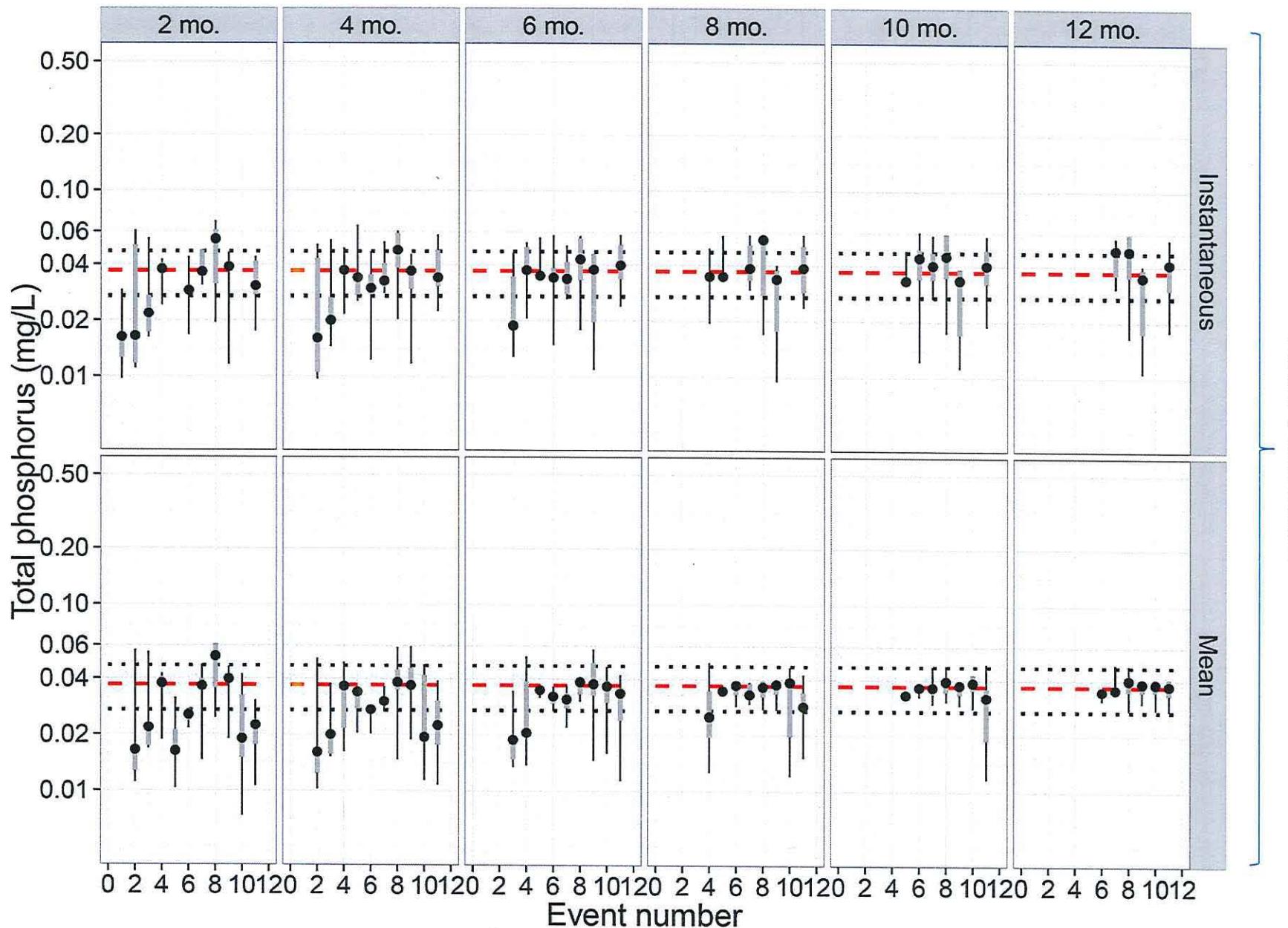
Change point analysis

- Deviance is calculated differently based on the appropriate probability distribution for each variable
 - Normal and lognormal distributions were used for benthic chlorophyll-a analyses
 - Poisson distribution was used for *Cladophora* biovolume (biovolume is converted from counts, hence Poisson or neg. binomial is appropriate)
 - Binomial distribution was used for proportion of biovolume as nuisance taxa

TP change points: normal distribution

TP duration

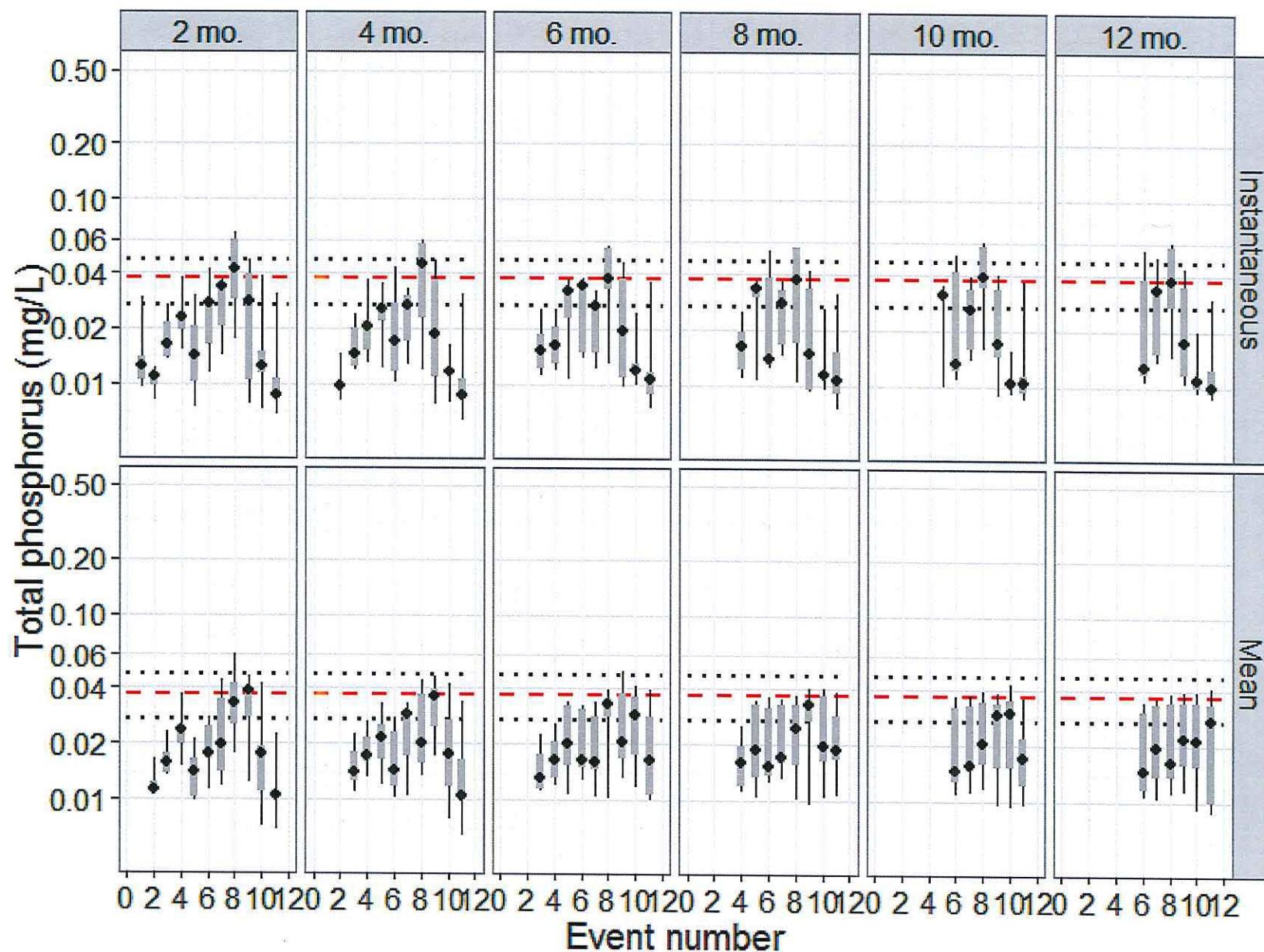
Benthic chlorophyll-a



TP change points: lognormal distribution

TP duration

Benthic chlorophyll-a

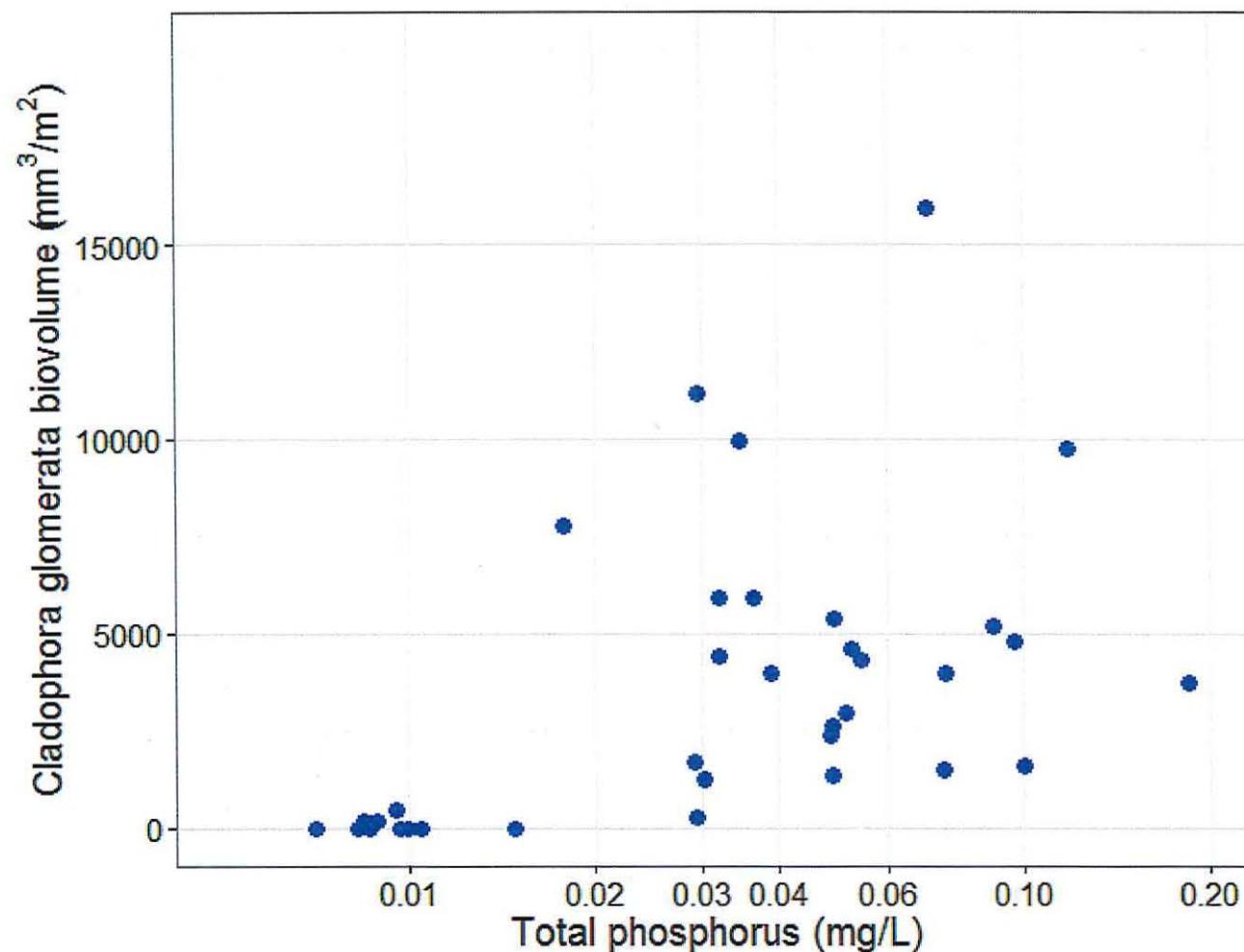


Cladophora glomerata biovolume ($\mu\text{m}^3/\text{m}^2$) vs TP



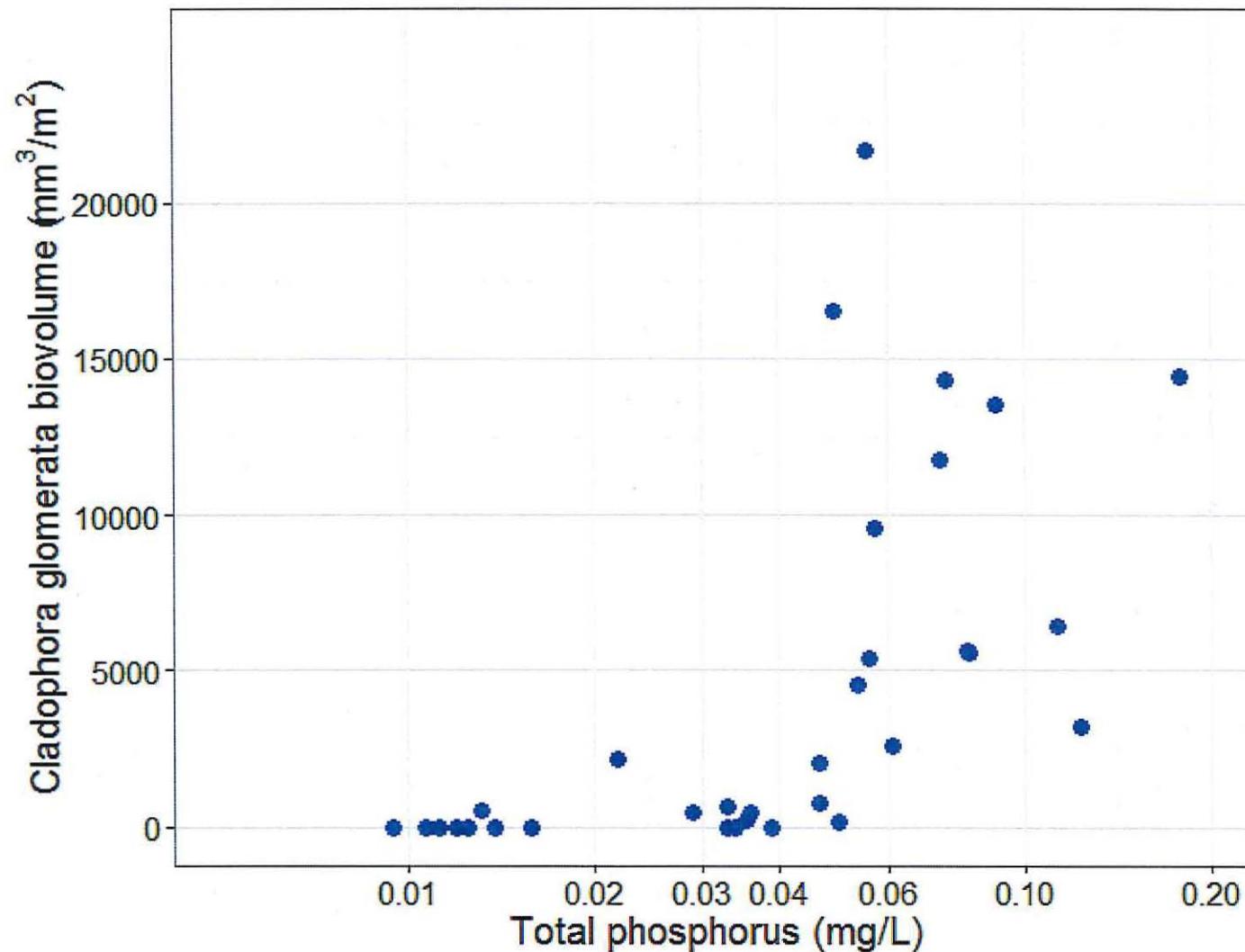
Cladophora glomerata biovolume (mm^3/m^2) vs TP

June 2014



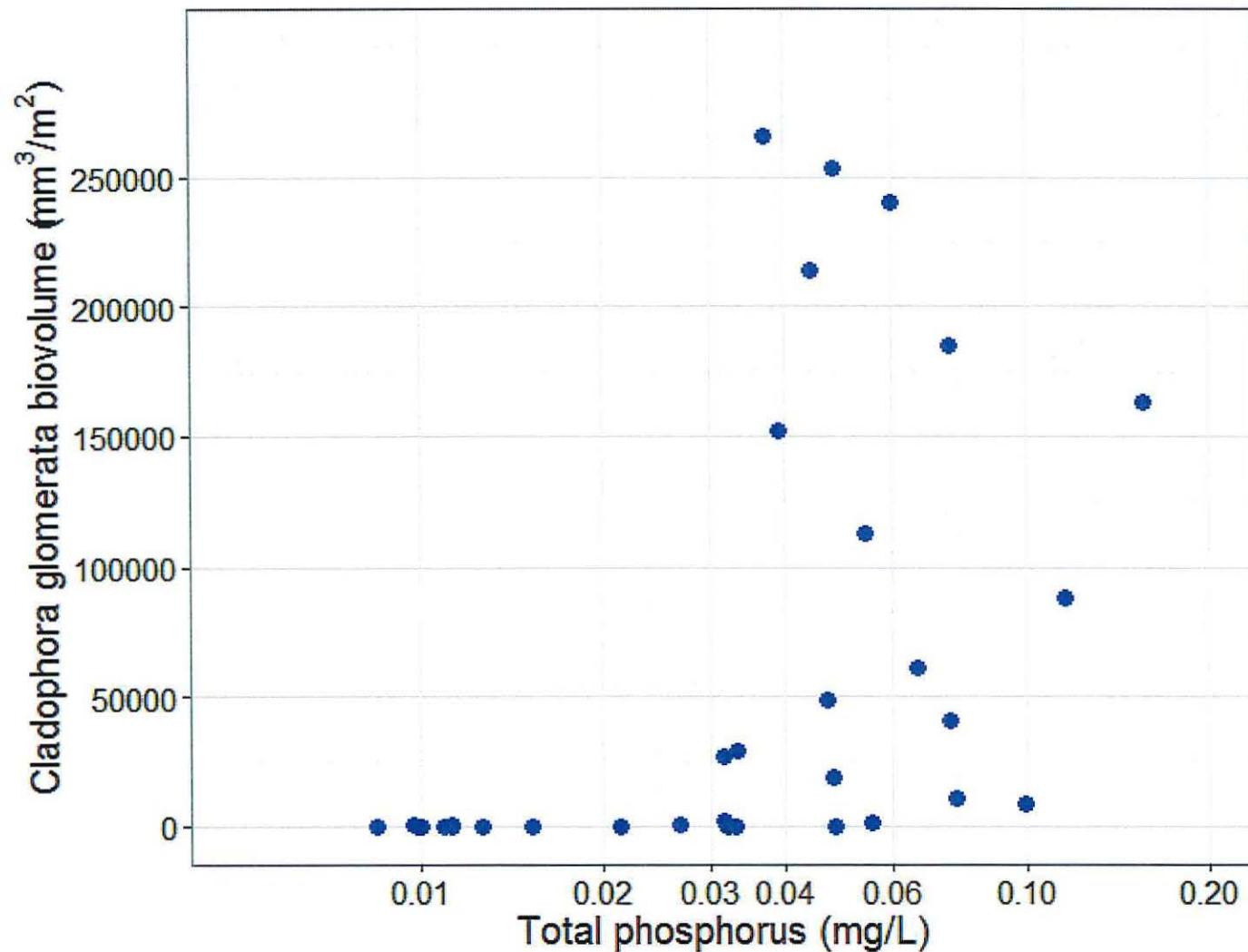
***Cladophora glomerata* biovolume (mm^3/m^2) vs TP**

October 2014 (Event 3)



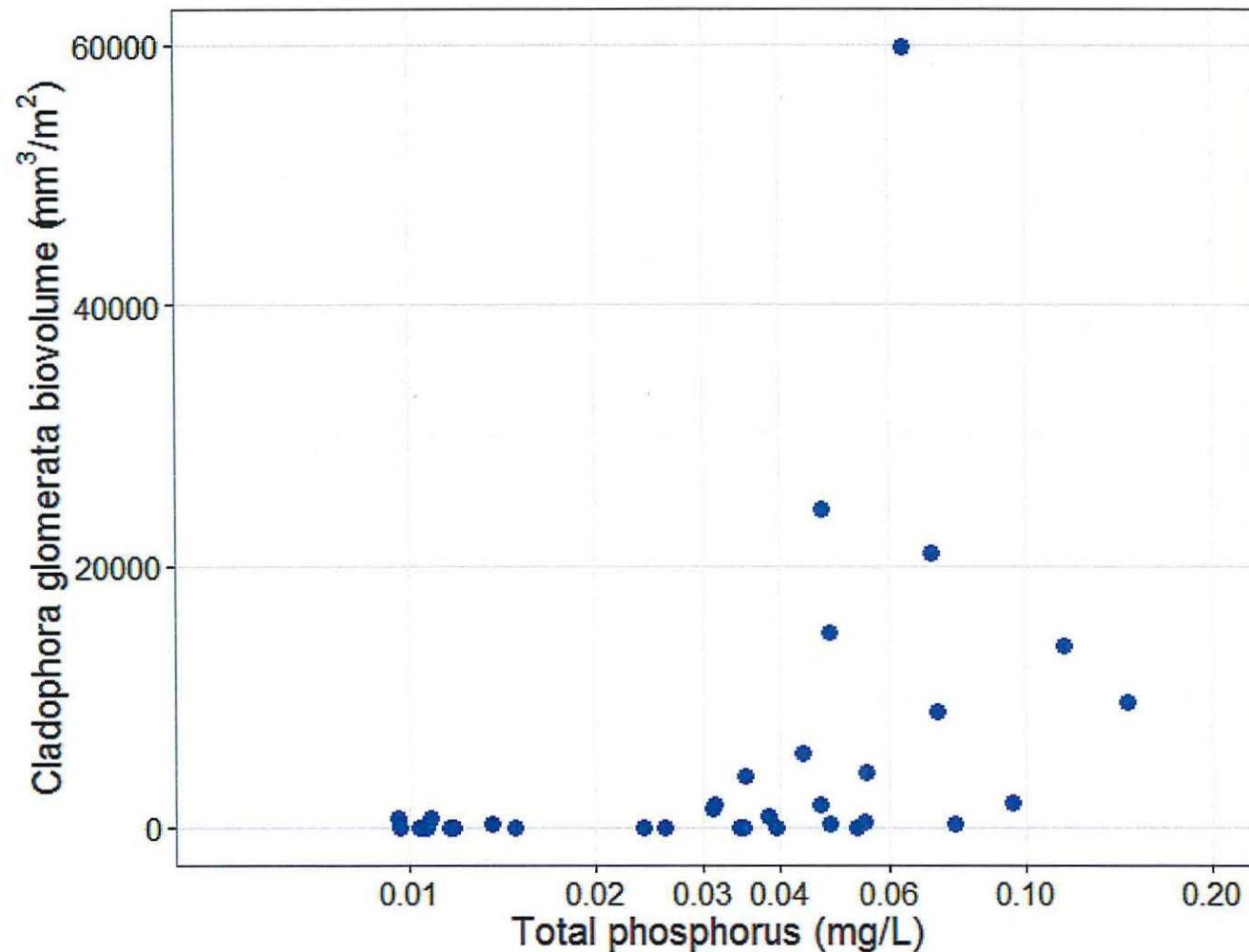
***Cladophora glomerata* biovolume (mm^3/m^2) vs TP**

February 2015 (Event 5)



***Cladophora glomerata* biovolume (mm^3/m^2) vs TP**

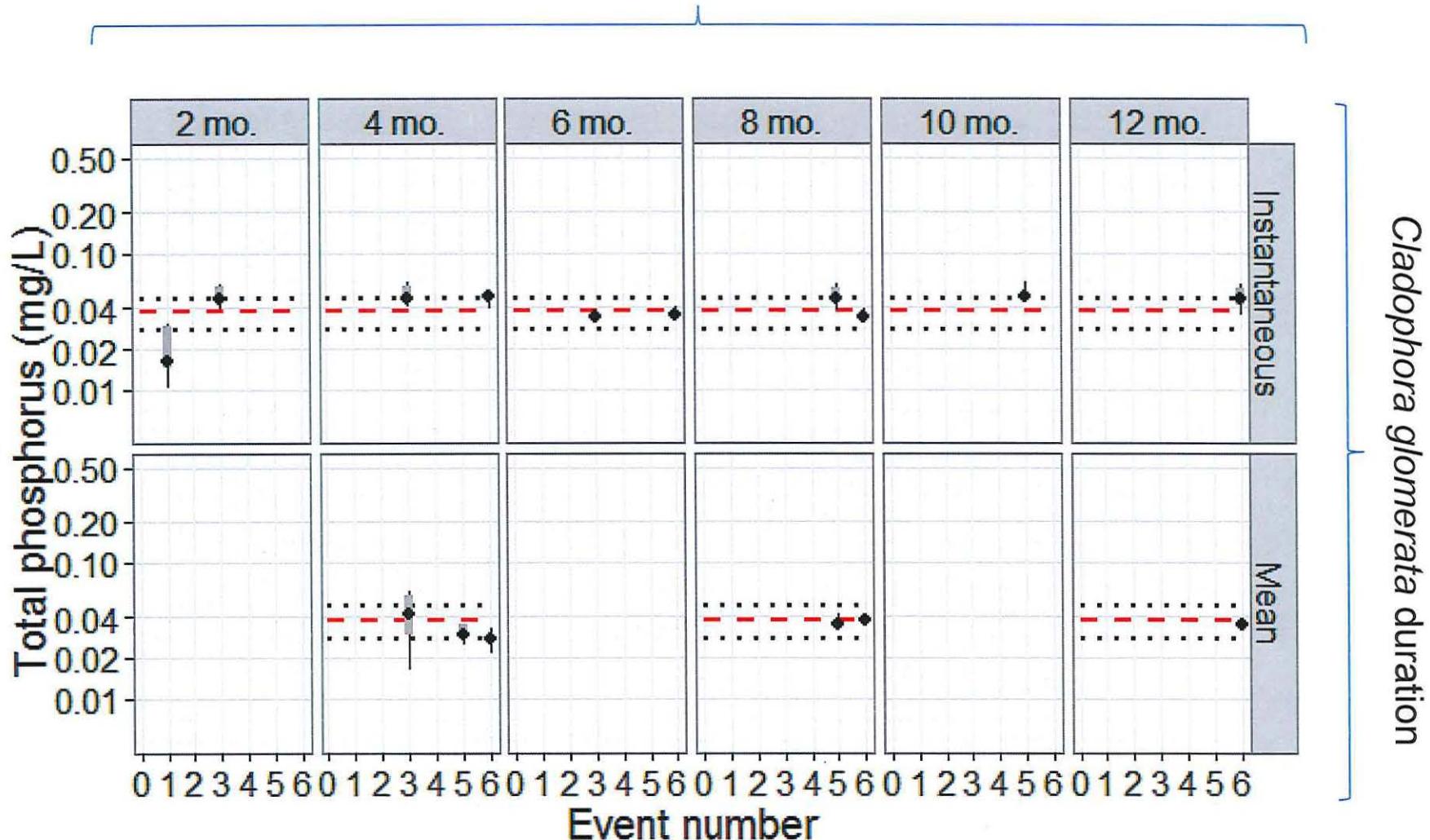
April 2015 (Event 6)



TP change points

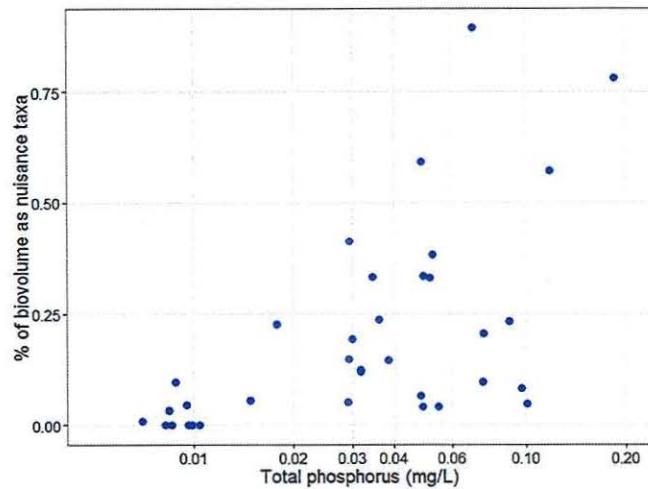
TP duration

Cladophora biovolume

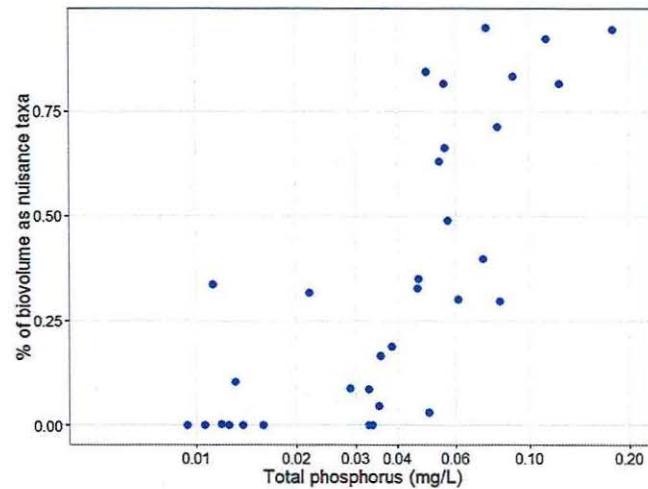


Proportion of biovolume as nuisance taxa vs TP

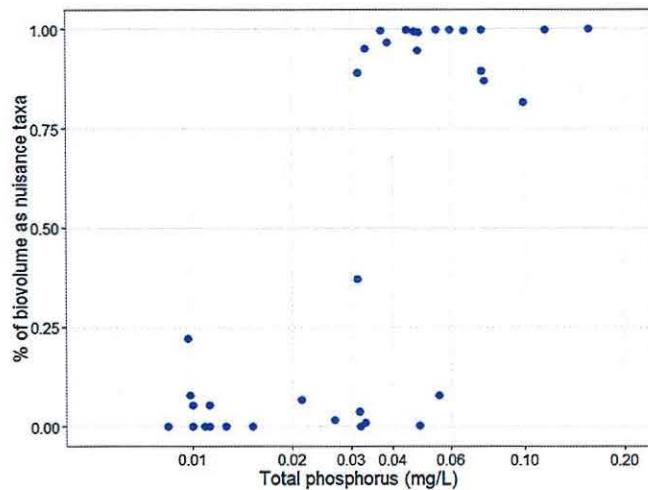
June 2014 (Event 1)



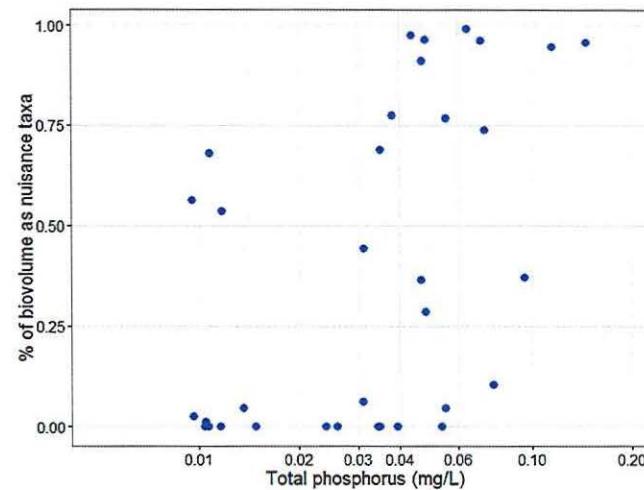
Oct 2014 (Event 3)



Feb 2015 (Event 5)



April 2015 (Event 6)



Data analysis status

- Proportion of nuisance taxa (binomial change point analysis) almost complete
- TITAN analysis in progress
 - Need clarification about TP and spp duration based on today's presentation
 - Results will change for cumulative spp analyses (aggregating multiple events) depending upon which 2 events are selected for final taxonomic analysis

Next steps

- Selection of events for soft algae (n=2) and diatom (n=1) taxonomic identification
- Duration(s) of TP and response variables for additional analyses
- 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)