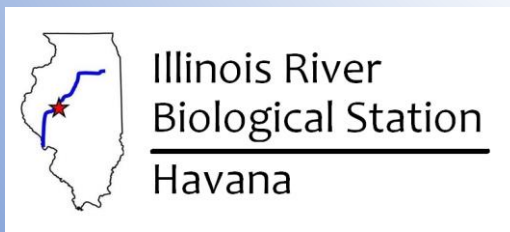
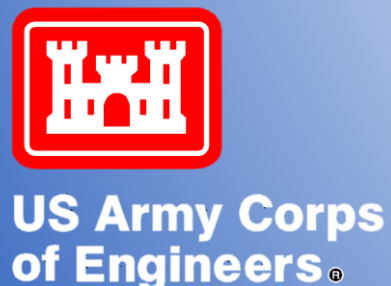


Illinois River Turbidity Response to Reduced Vessel Traffic

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2/15/2022

¹ Illinois Natural History Survey, Havana, Illinois ² USGS UMESC, La Crosse, Wisconsin



Outline

Background

Research Question and Methods

Results

- Longitudinal Patterns

- Lateral Patterns

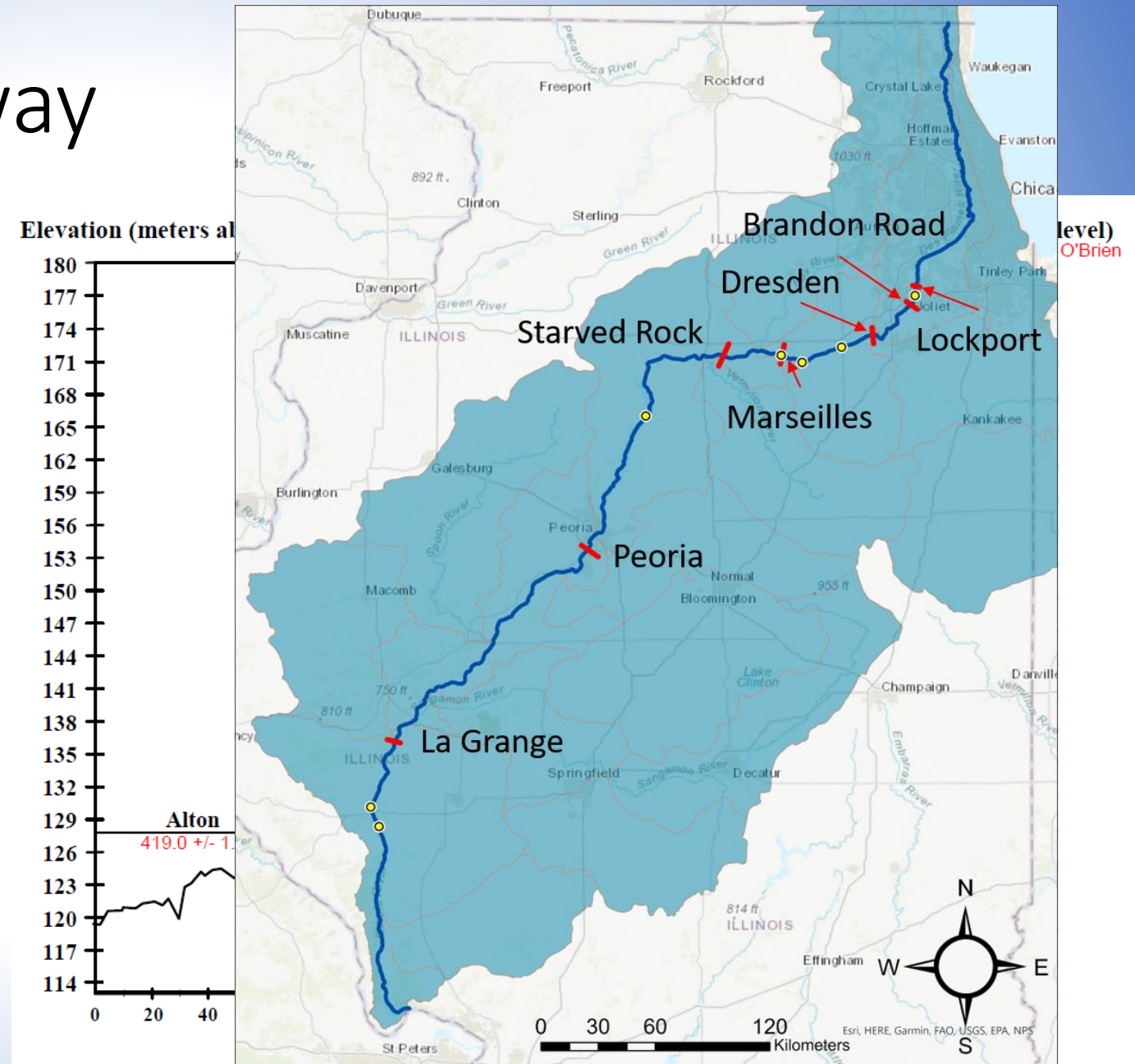
- Temporal Patterns

Discussion and Conclusions

Illinois River Waterway

Connects Lake Michigan to Mississippi River

Lock and dams constructed in the 1930s to allow navigation

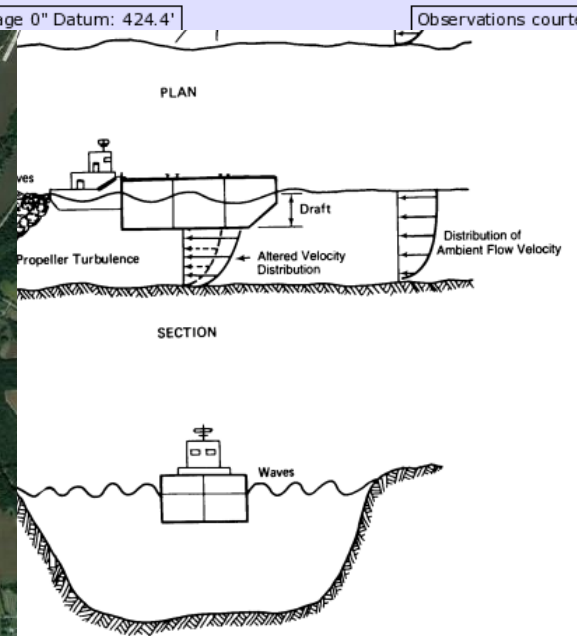
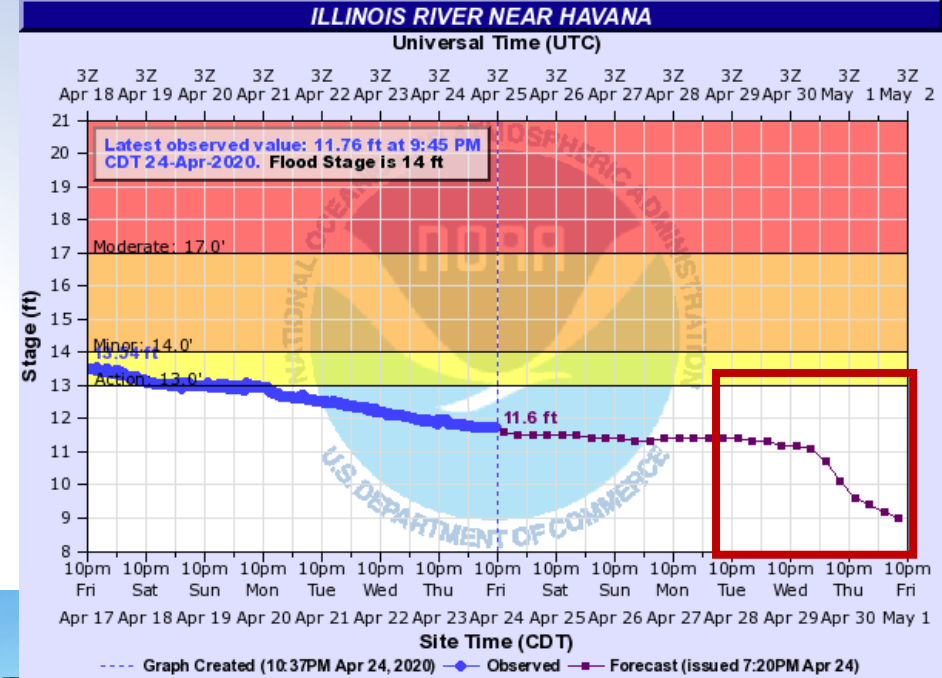


Issues

Dams can create lake-like conditions (lacustrine)

Alter flow regime

BOWZER



(Bhowmik 1998)

Implications

Higher turbidity = Lower water clarity →

Lower productivity &
Suppressed aquatic vegetation

Increased bed load & sediment transport

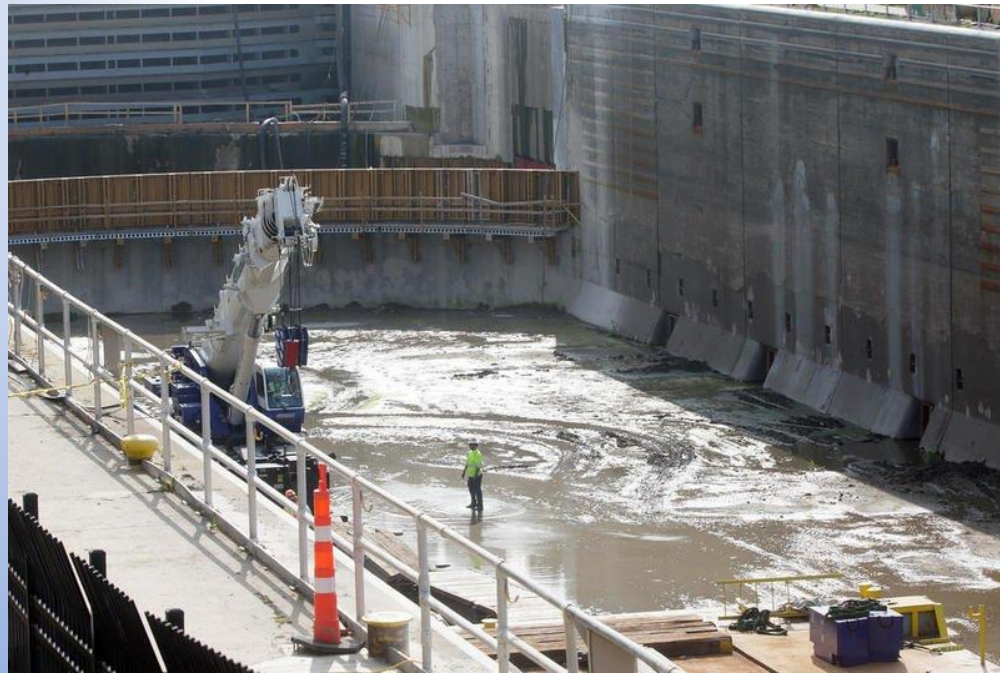


Lock Closure

Locks Closed July-October 2020 for repairs

(Dresden, Marseilles, Starved Rock, Peoria, La Grange)

Collect pre- and post-data to see effects commercial traffic has on river



Research Question

Does vessel traffic have an overall impact on turbidity?

Longitudinal patterns in response

Lateral patterns in response



Methods

Turbidity

Collect at all fish sampling sites

SRS, 2019, (840)

2020, (1359)

2021, (1167)*

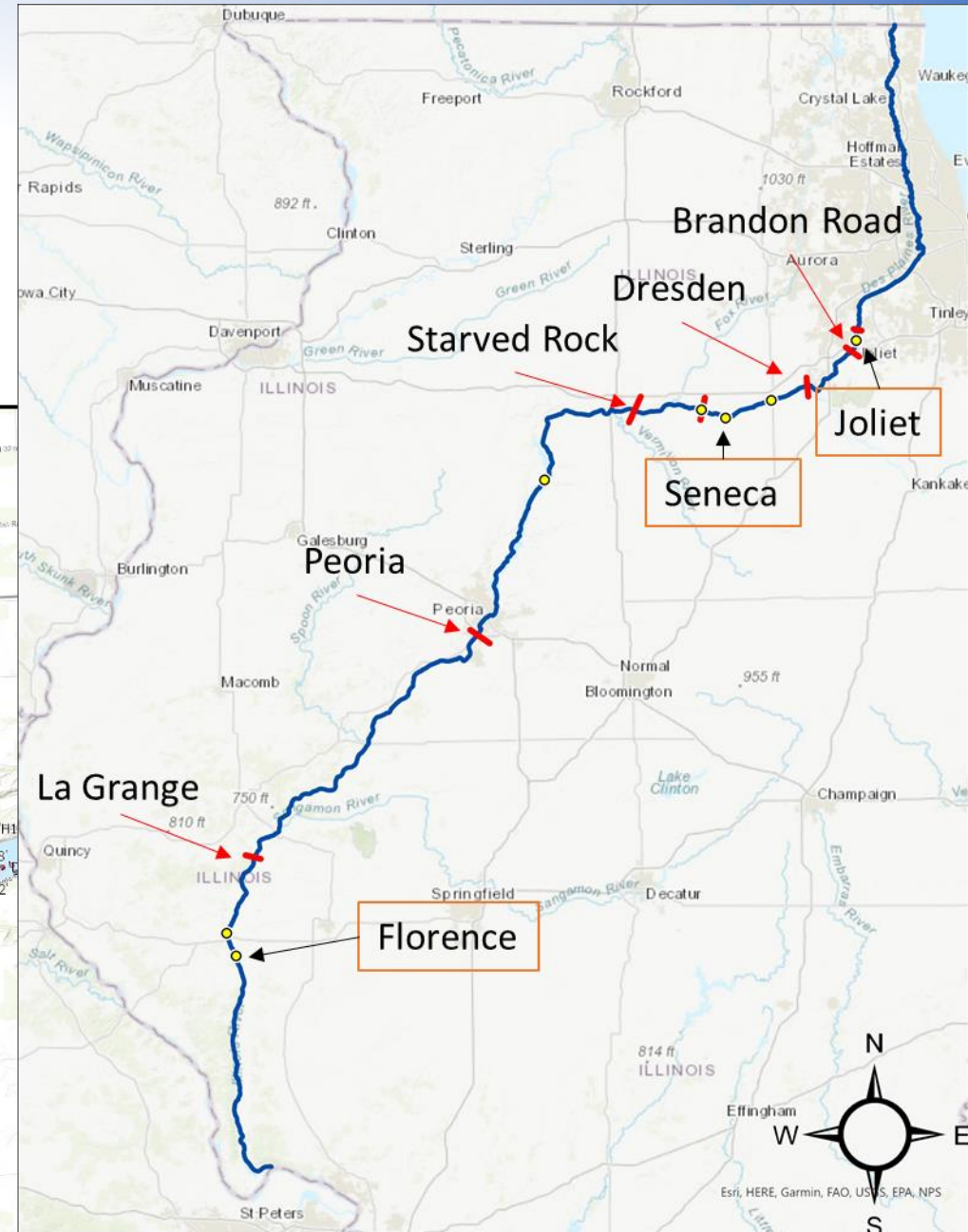
USGS fixed sondes

Turbidity, discharge

15-min timeseries data

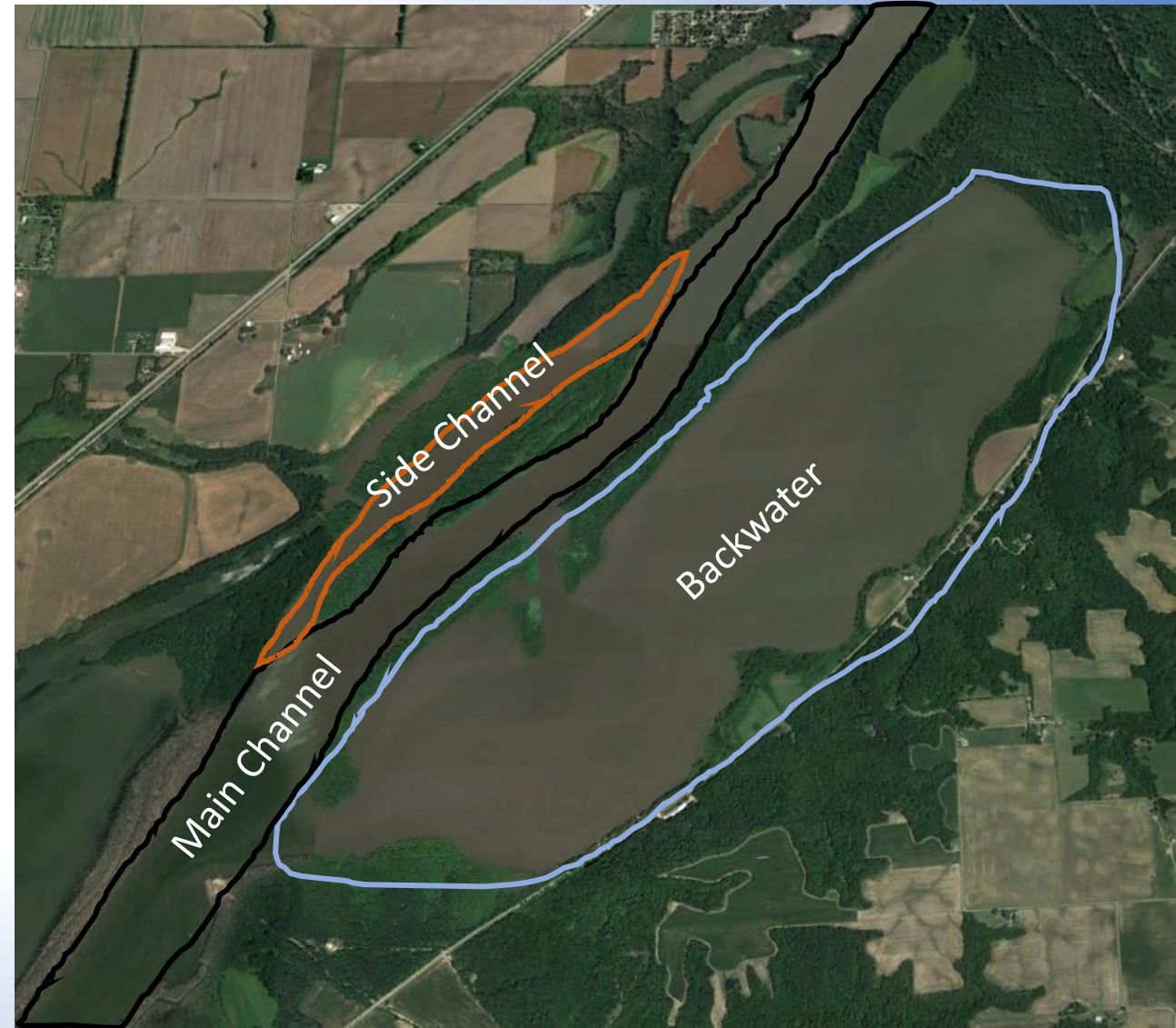
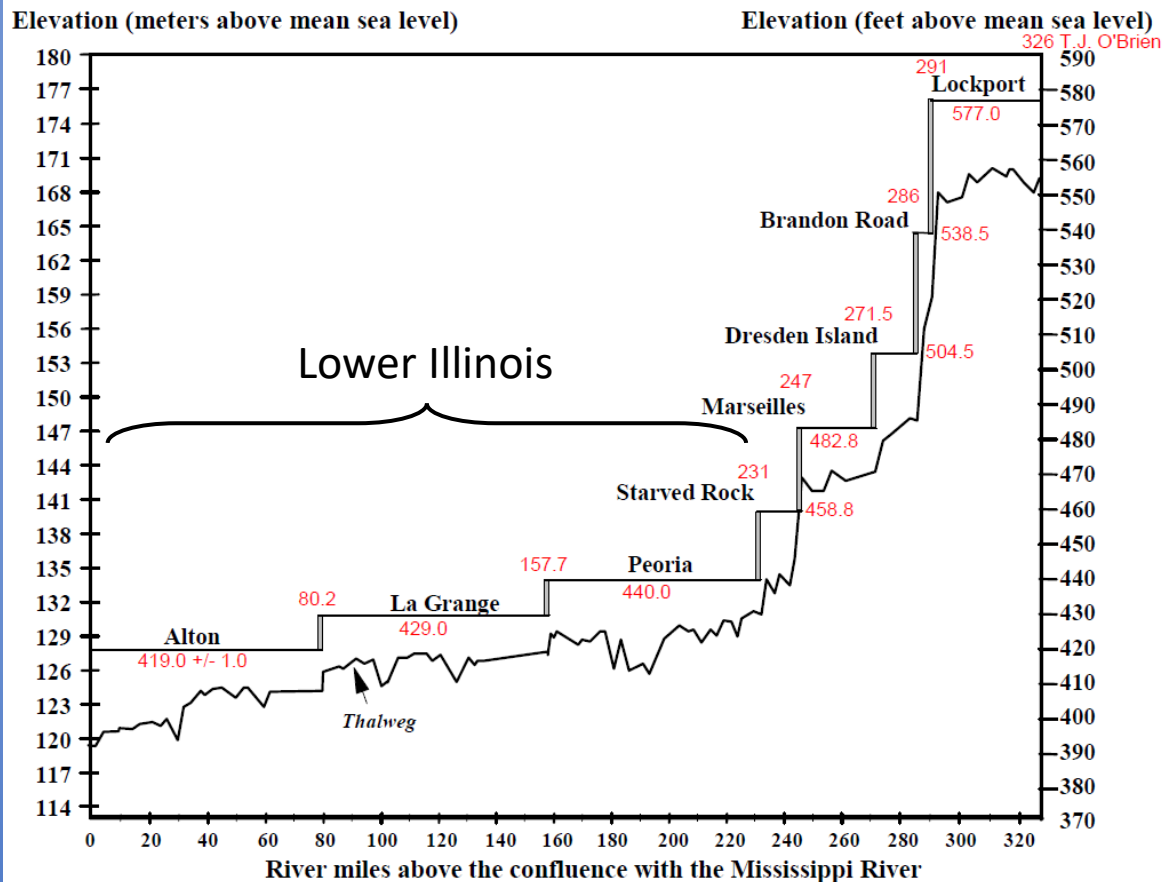
2019-2021 (14,000/year)

*Still being processed



Longitudinal vs Lateral

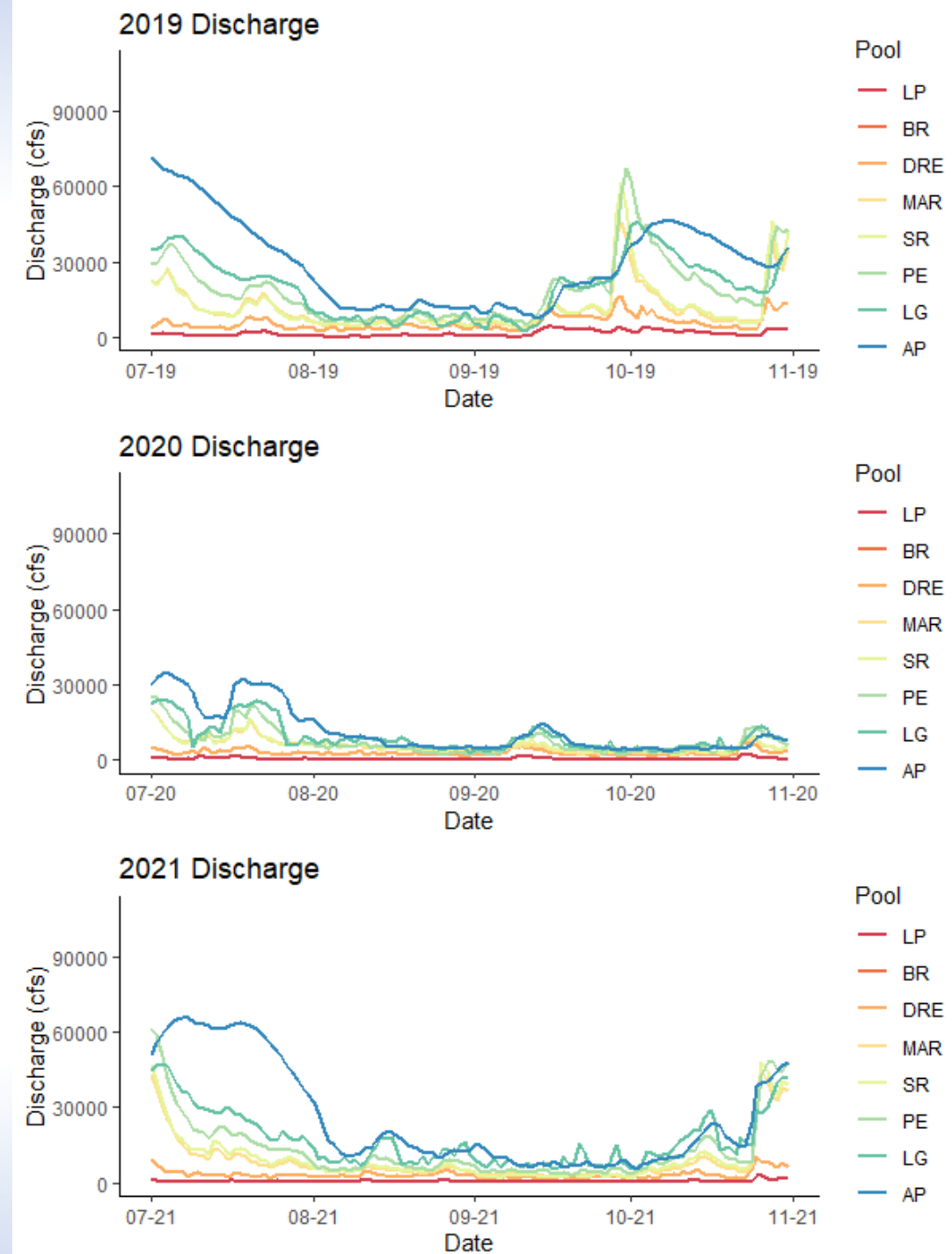
Downstream



Methods: Analysis

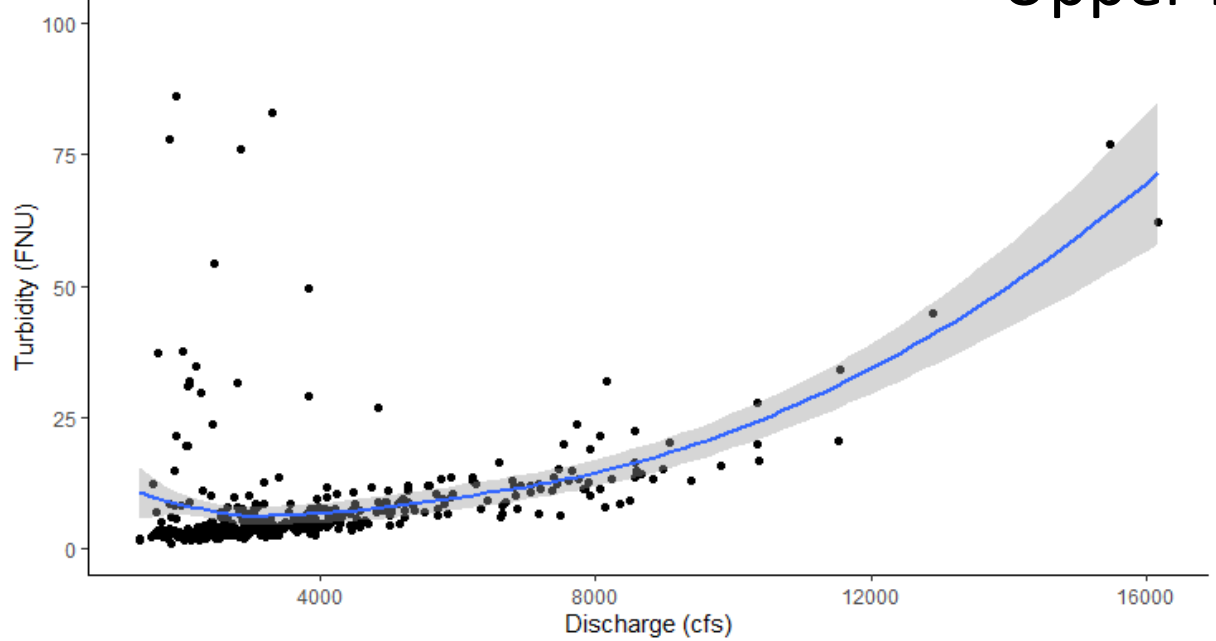
Use generalized additive mixed models to apply random effect and account for non-normal data

Use discharge as fixed effect variable

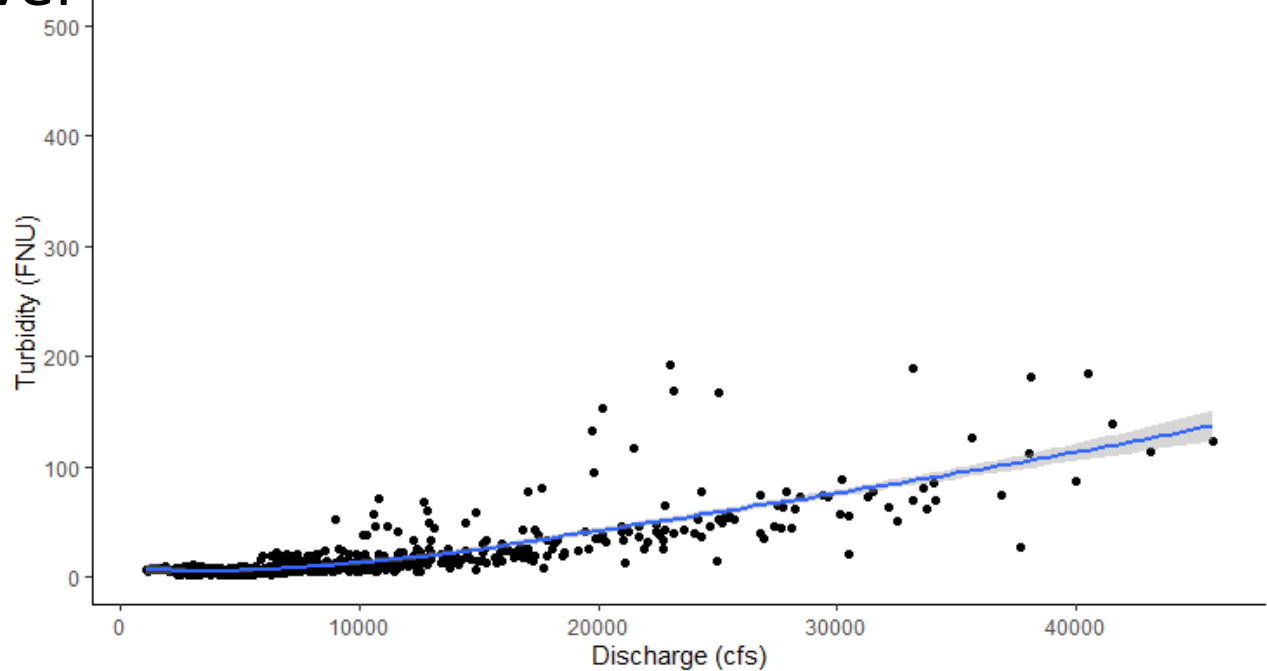


Upper River

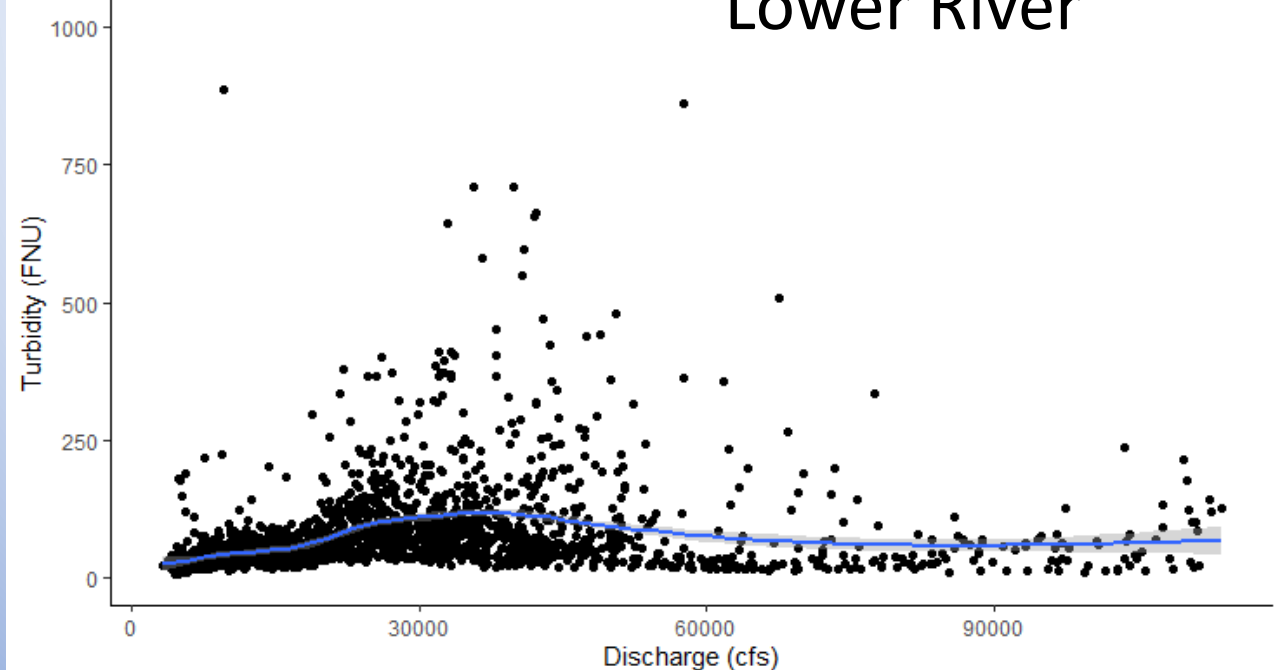
Joliet Flow vs Turbidity 2017-2021



Seneca Flow vs Turbidity 2016-2021

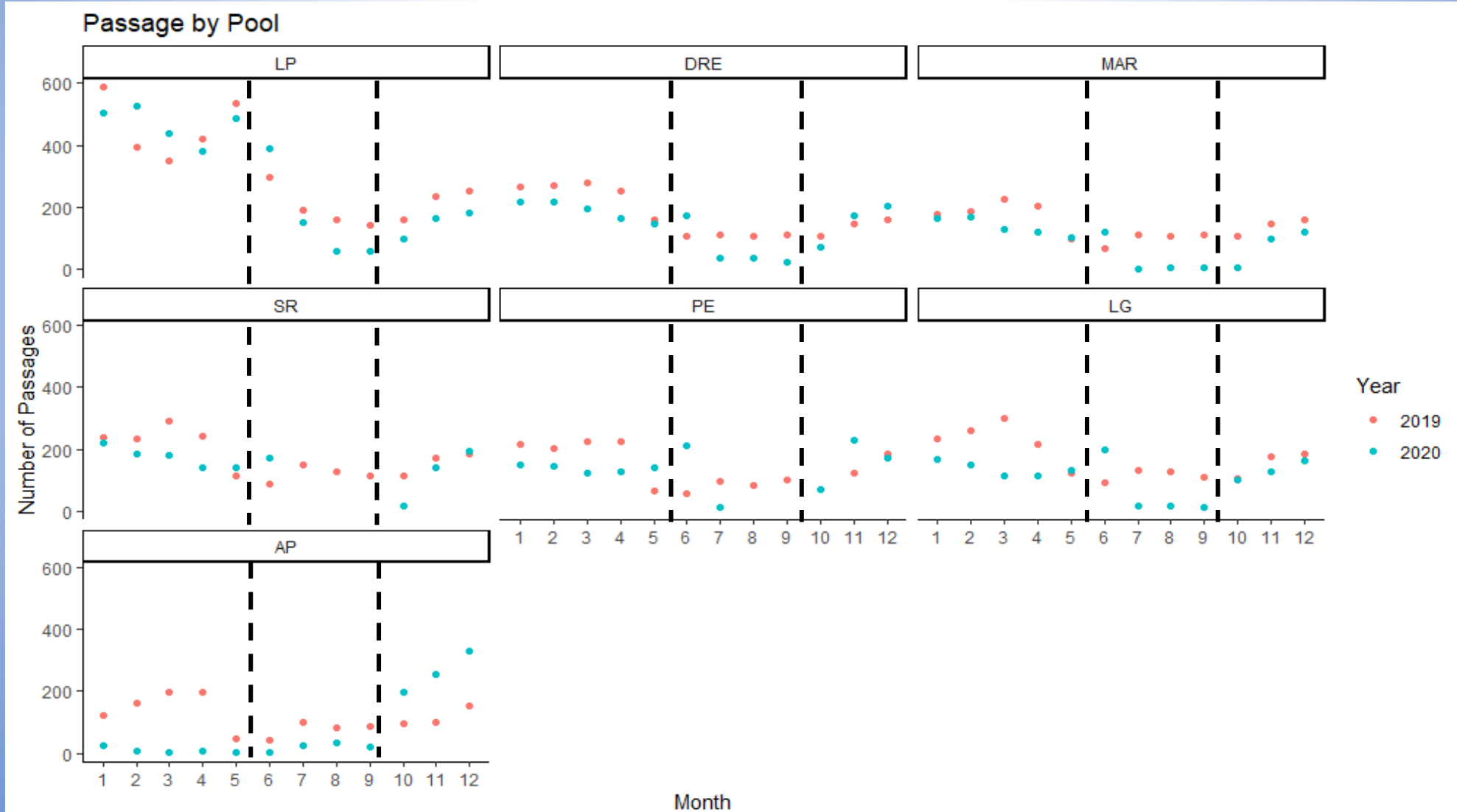


Florence Flow vs Turbidity 2012-2021

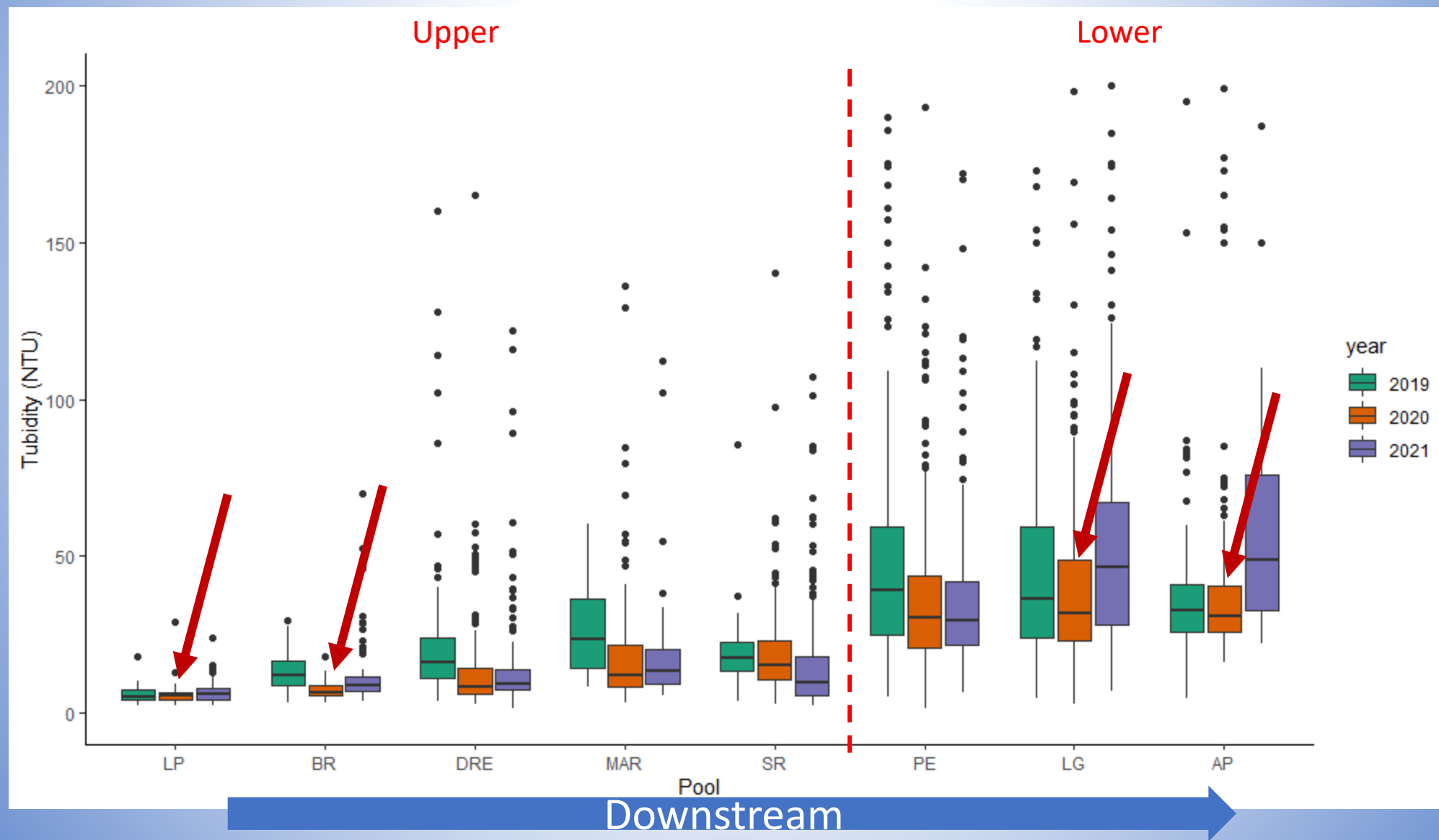


Lower River

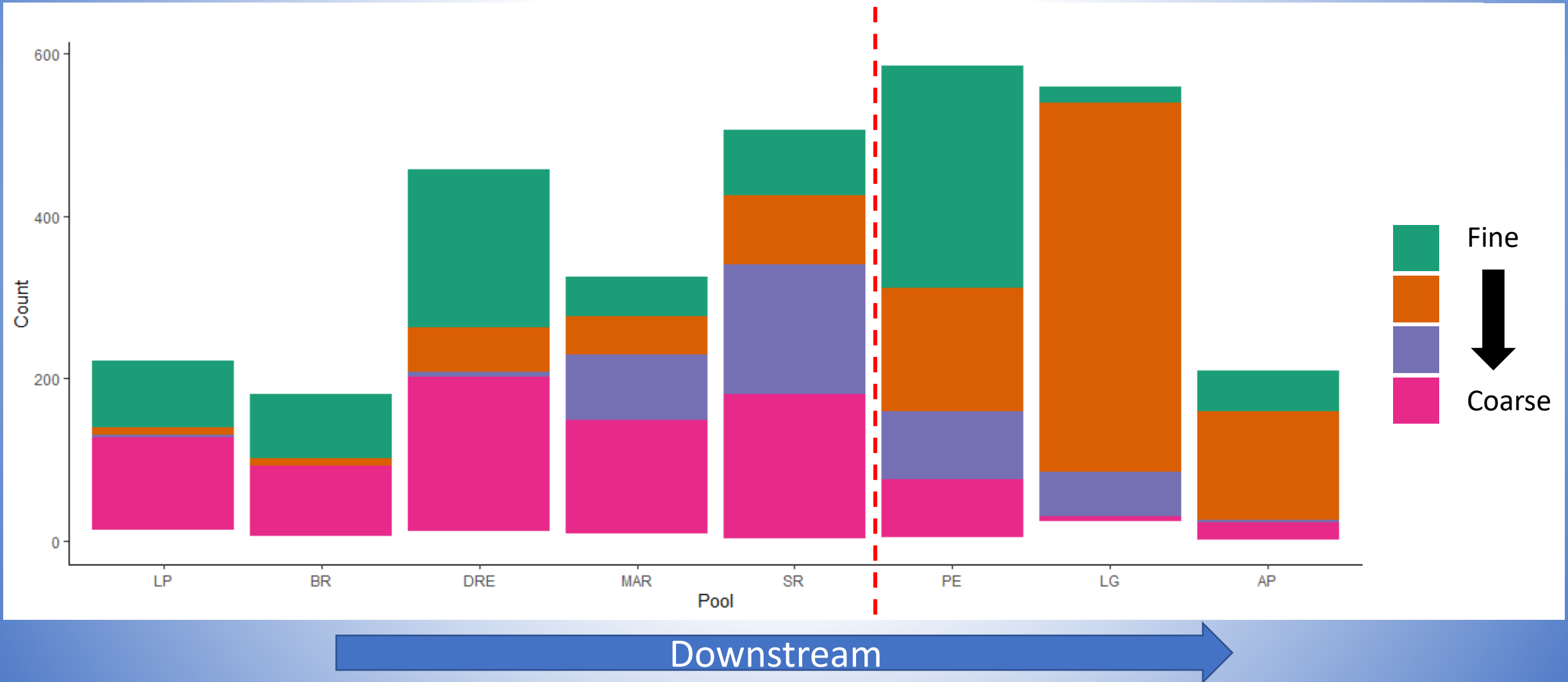
Was Vessel Traffic Reduced?



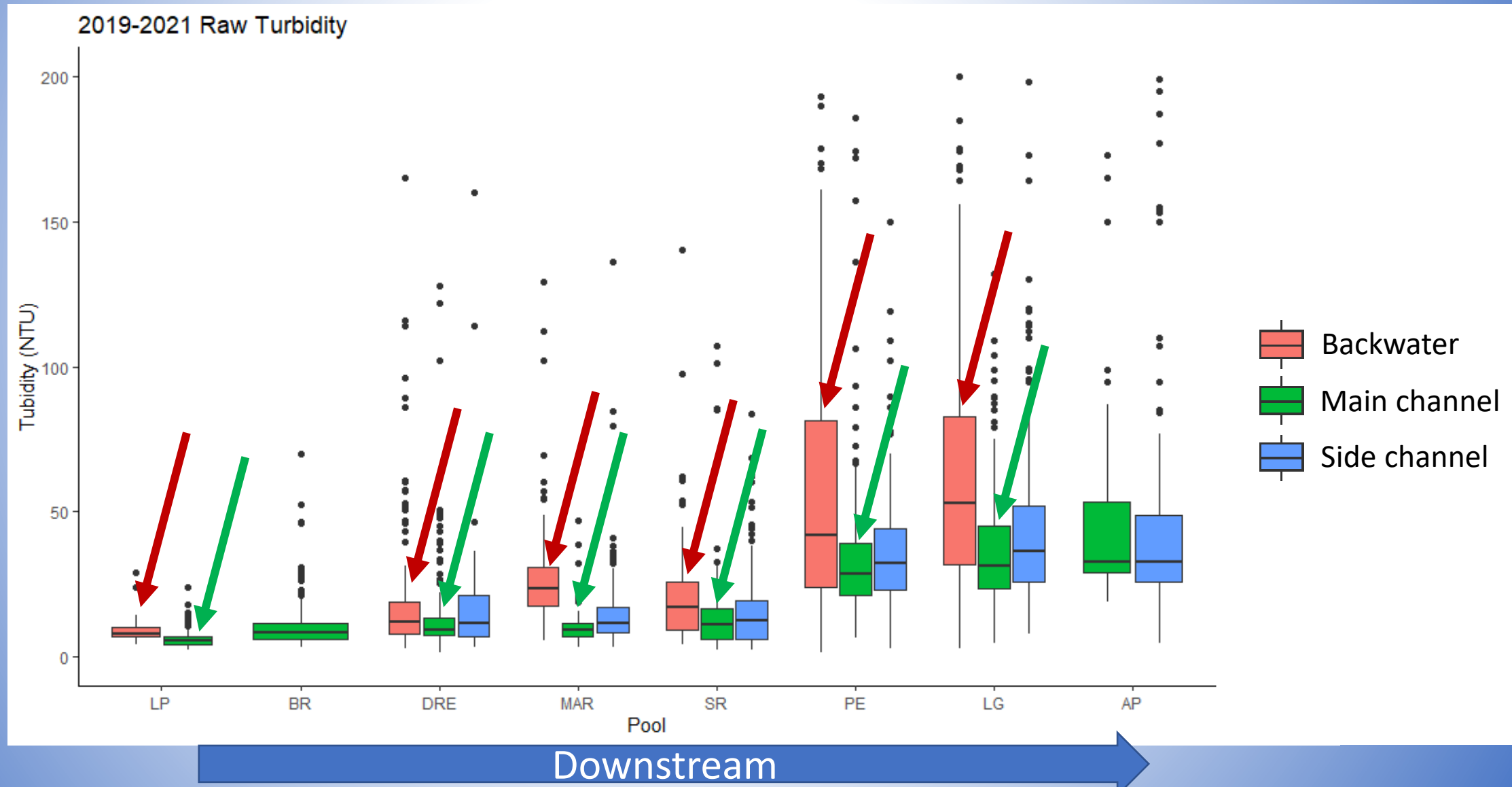
Trends: longitudinal turbidity (raw)



Trends: longitudinal substrate

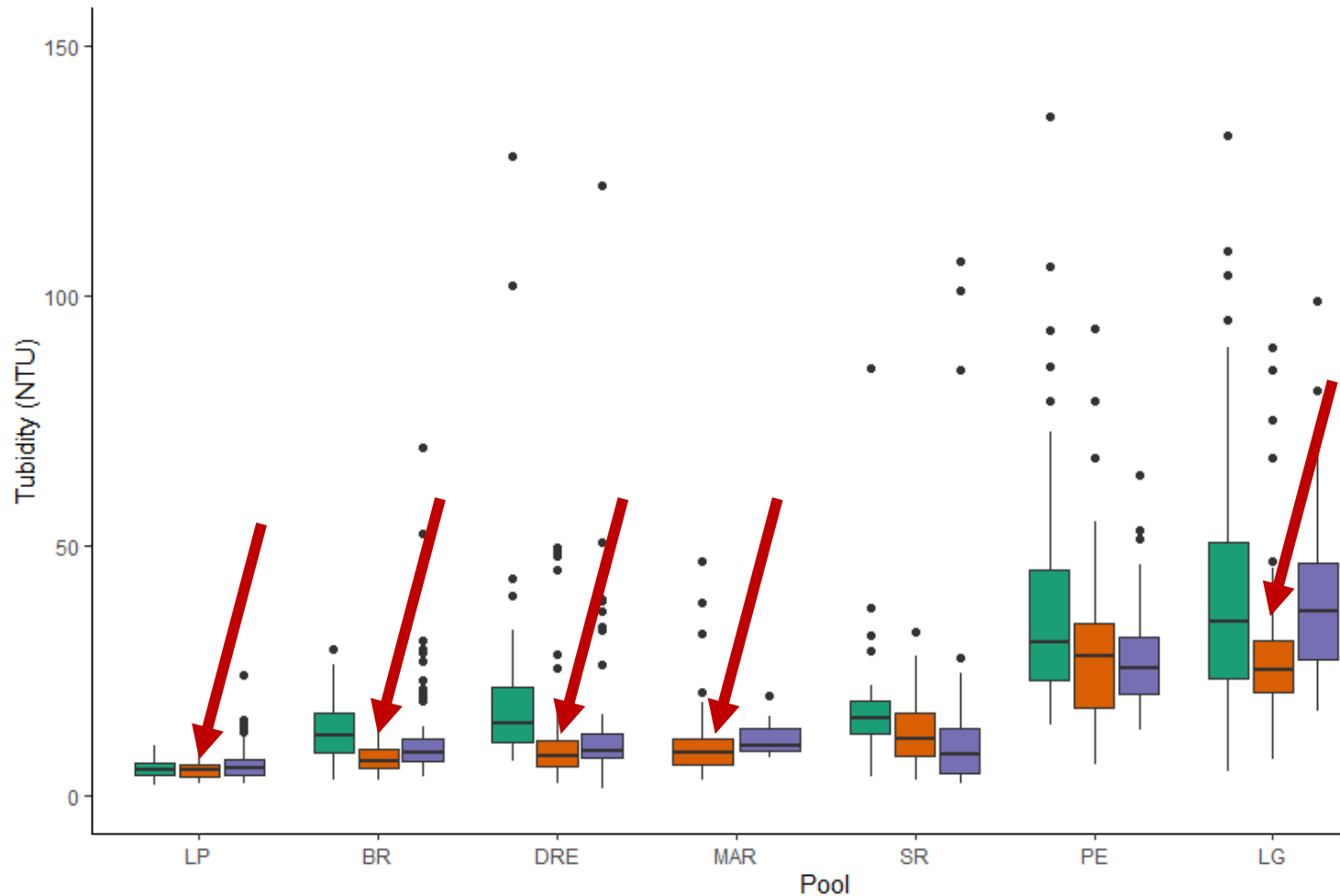


Trends: Lateral turbidity



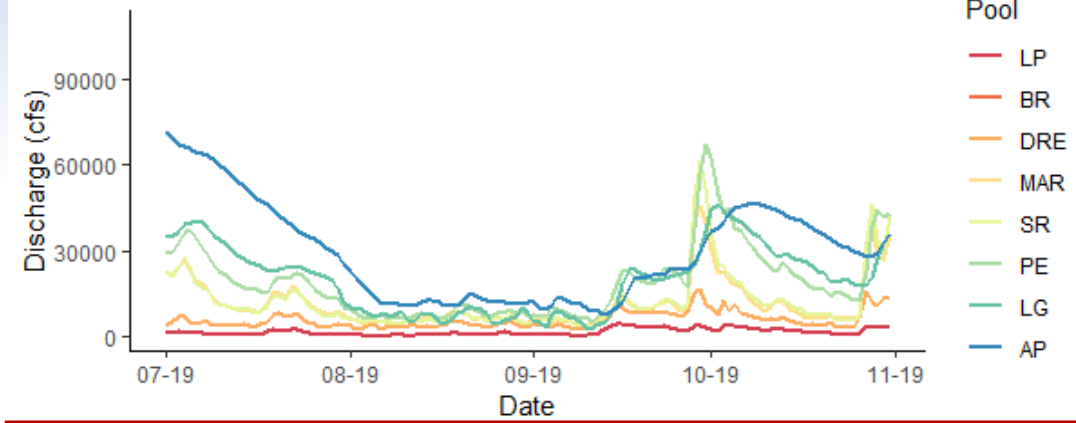
Main Channel Turbidity

2019-2021 Raw Main channel Turbidity

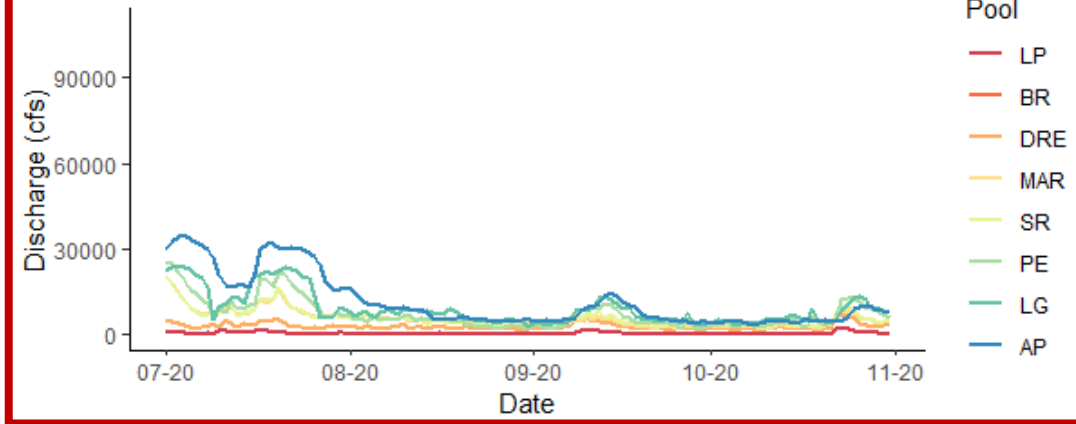


Downstream

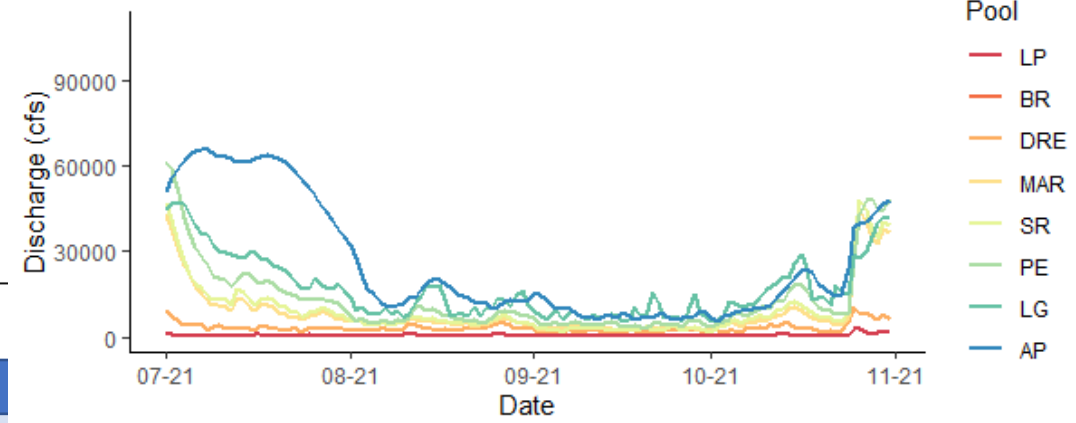
2019 Discharge



2020 Discharge



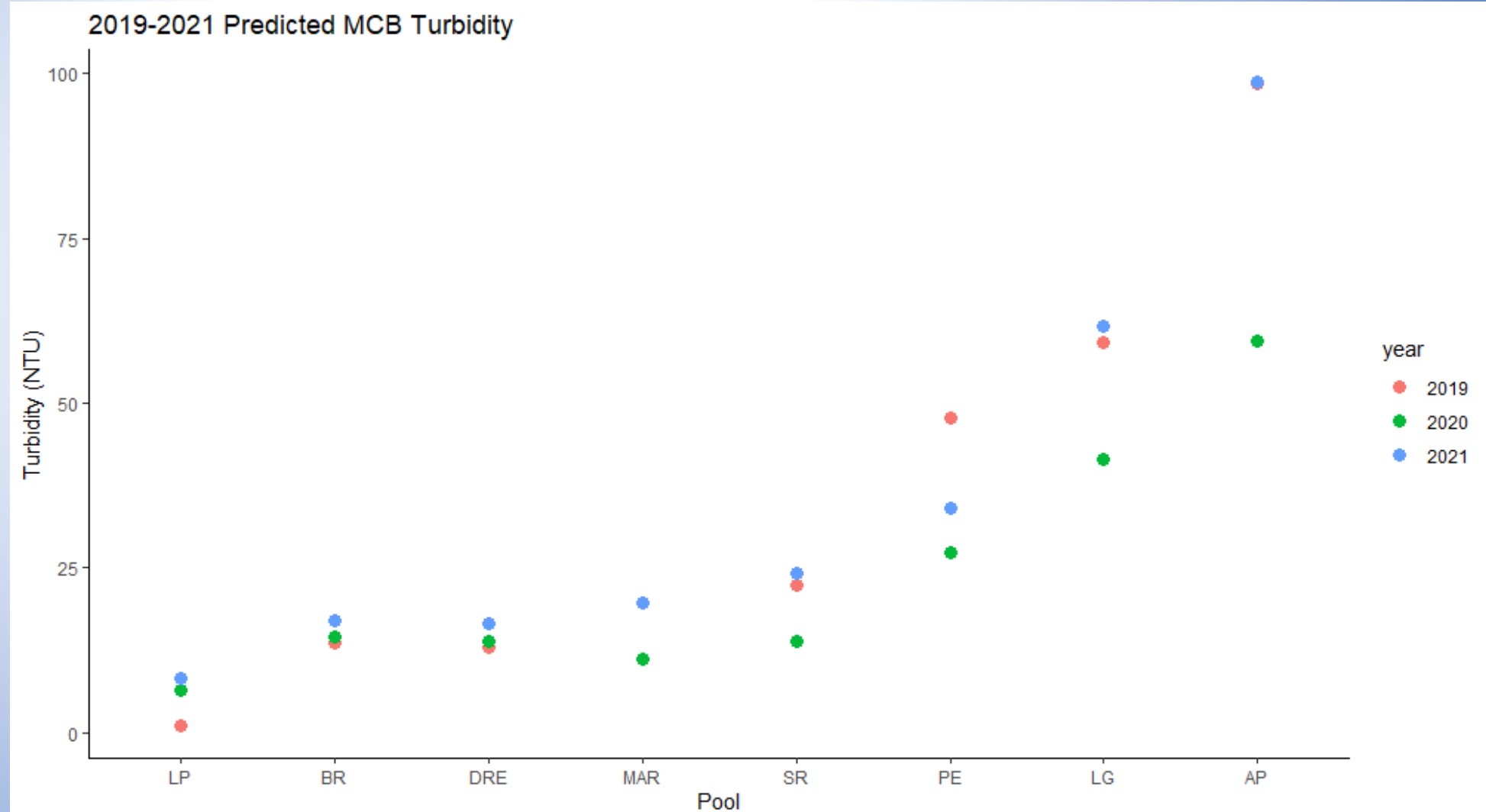
2021 Discharge



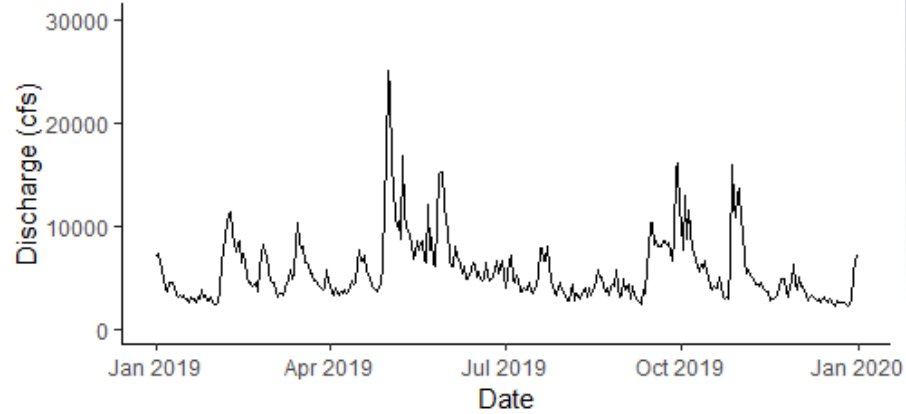
Predicted Main Channel Turbidity

Pool	Year	Discharge
LP	2019	1452.75
LP	2020	511.91
LP	2021	450.23
BR	2019	5672.63
BR	2020	2836.00
BR	2021	3104.68
DRE	2019	5672.63
DRE	2020	2836.00
DRE	2021	3104.68
MAR	2019	11338.77
MAR	2020	5524.29
MAR	2021	8128.41
SR	2019	11870.96
SR	2020	5705.87
SR	2021	8976.83
PE	2019	18703.27
PE	2020	7169.47
PE	2021	12454.44
LG	2019	19661.54
LG	2020	9086.17
LG	2021	16485.84
AP	2019	28922.07
AP	2020	11538.90
AP	2021	25171.94

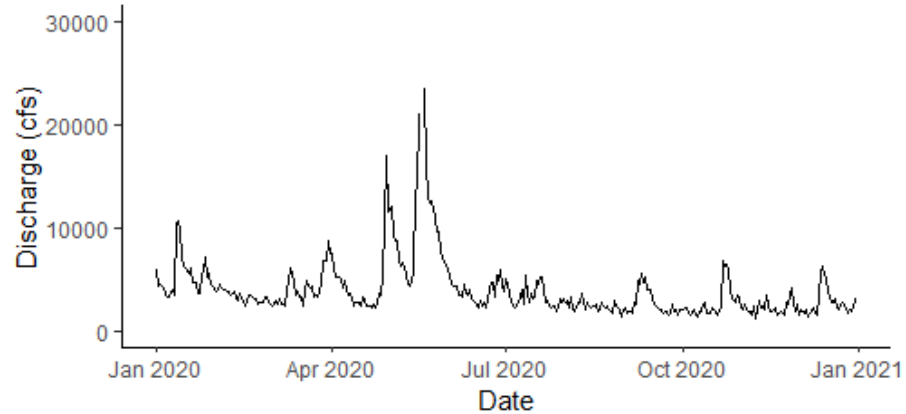
gamm4(turbidity~s(flow)+year,data=All_sturb19.21MC,random=~(1|pool))



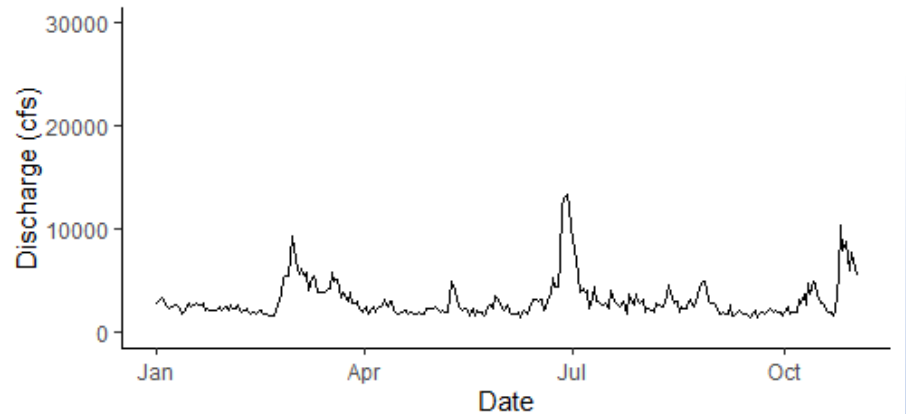
Joliet Discharge 2019



Joliet Discharge 2020

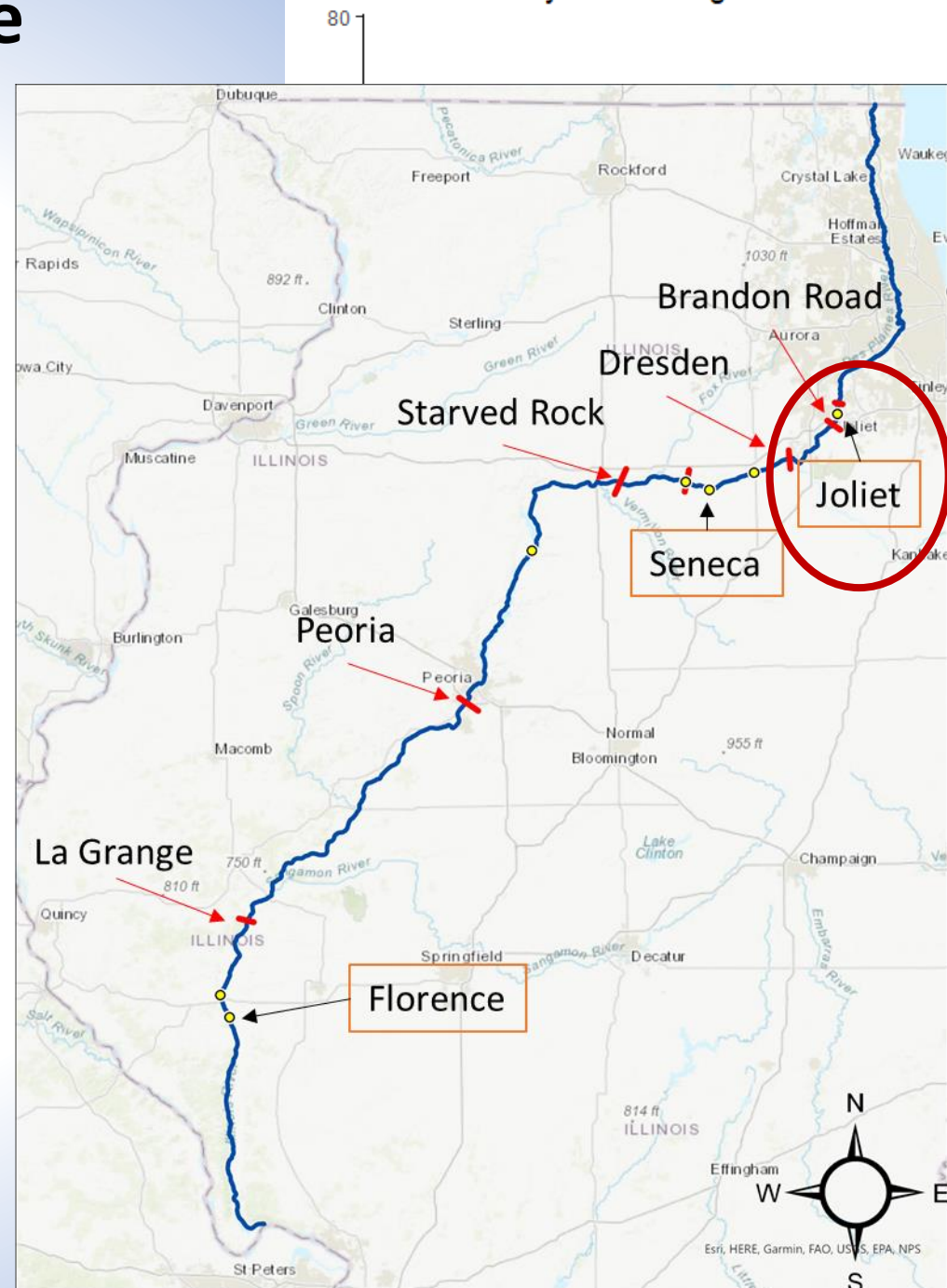


Joliet Discharge 2021

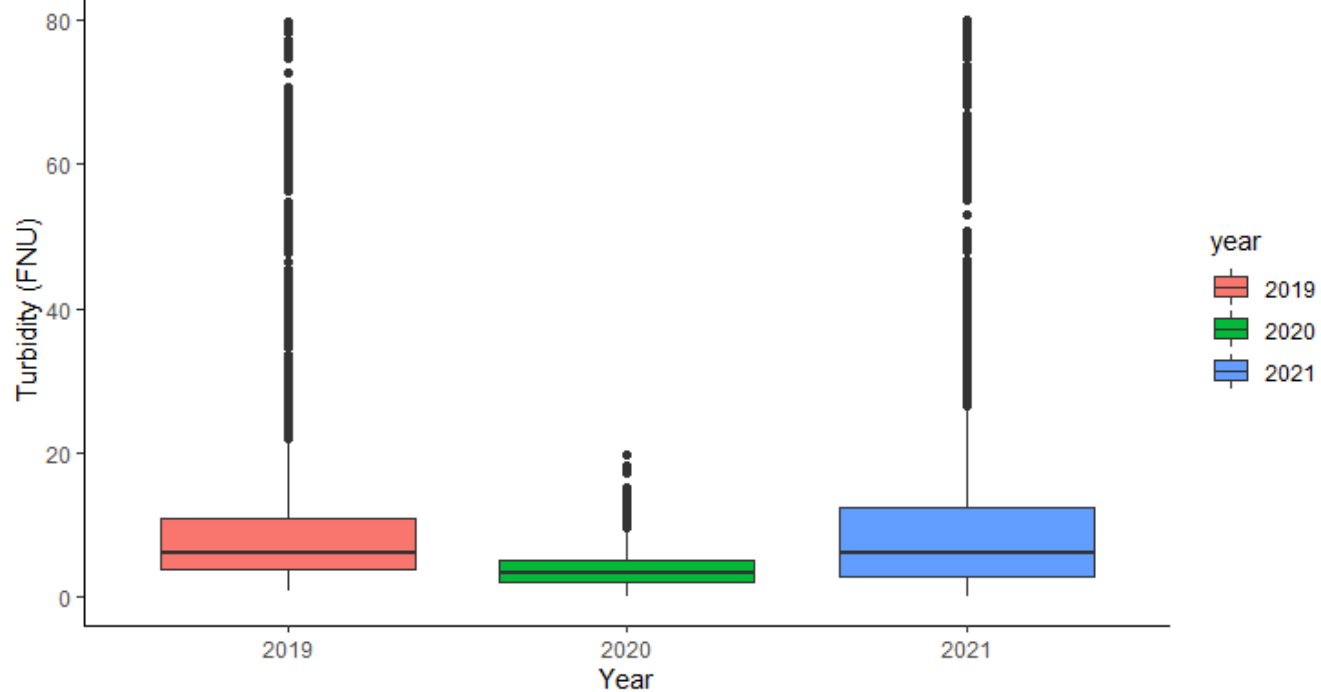


Joliet USGS sonde

Joliet Turbidity vs Discharge 2019



Joliet Raw Turbidity

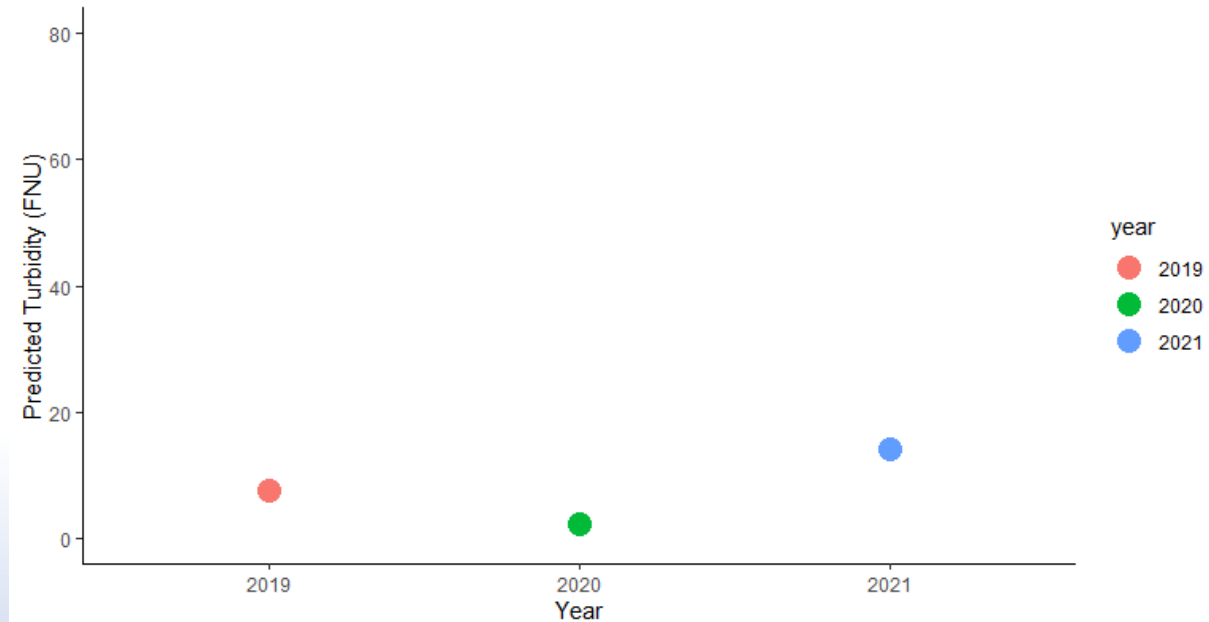


Turbidity is lower during 2020 Lock Closure event

`gamm4(ysi.21~s(flow)+year,data=JTF1921)`

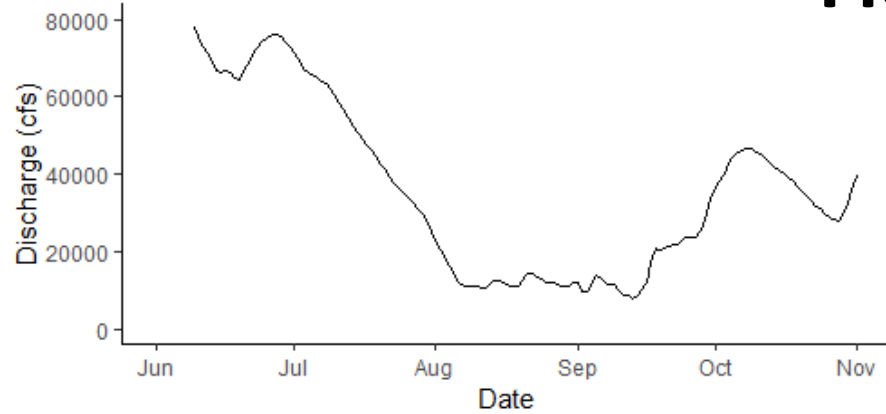
Using mean annual discharge to predict values

Joliet Predicted Turbidity

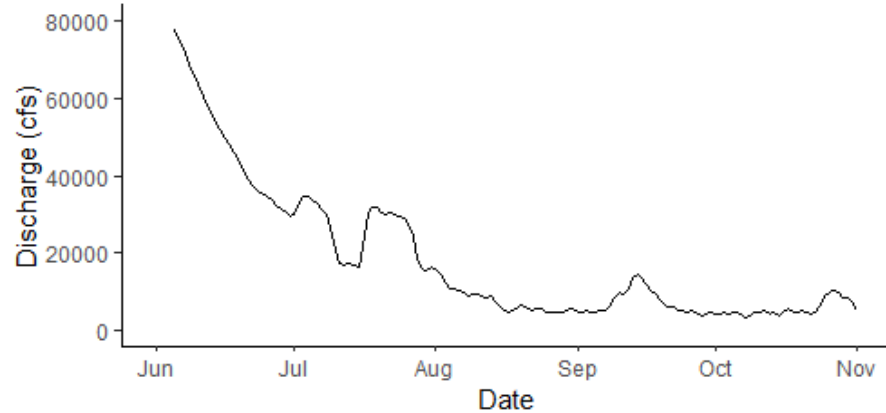


Florence USGS sonde

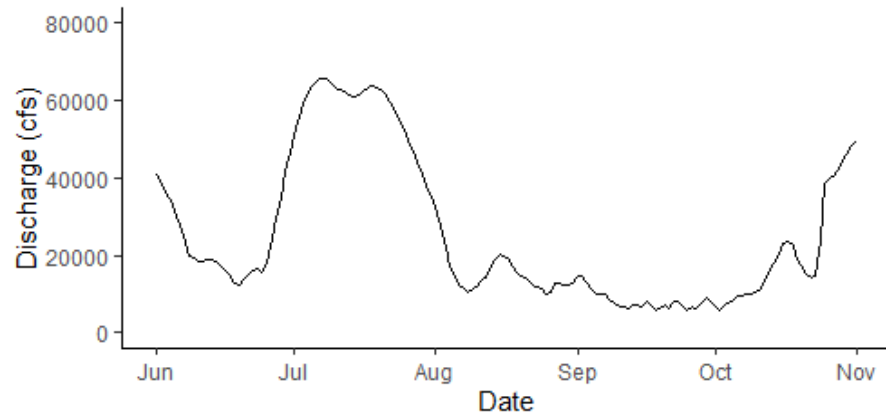
Florence Discharge 2019



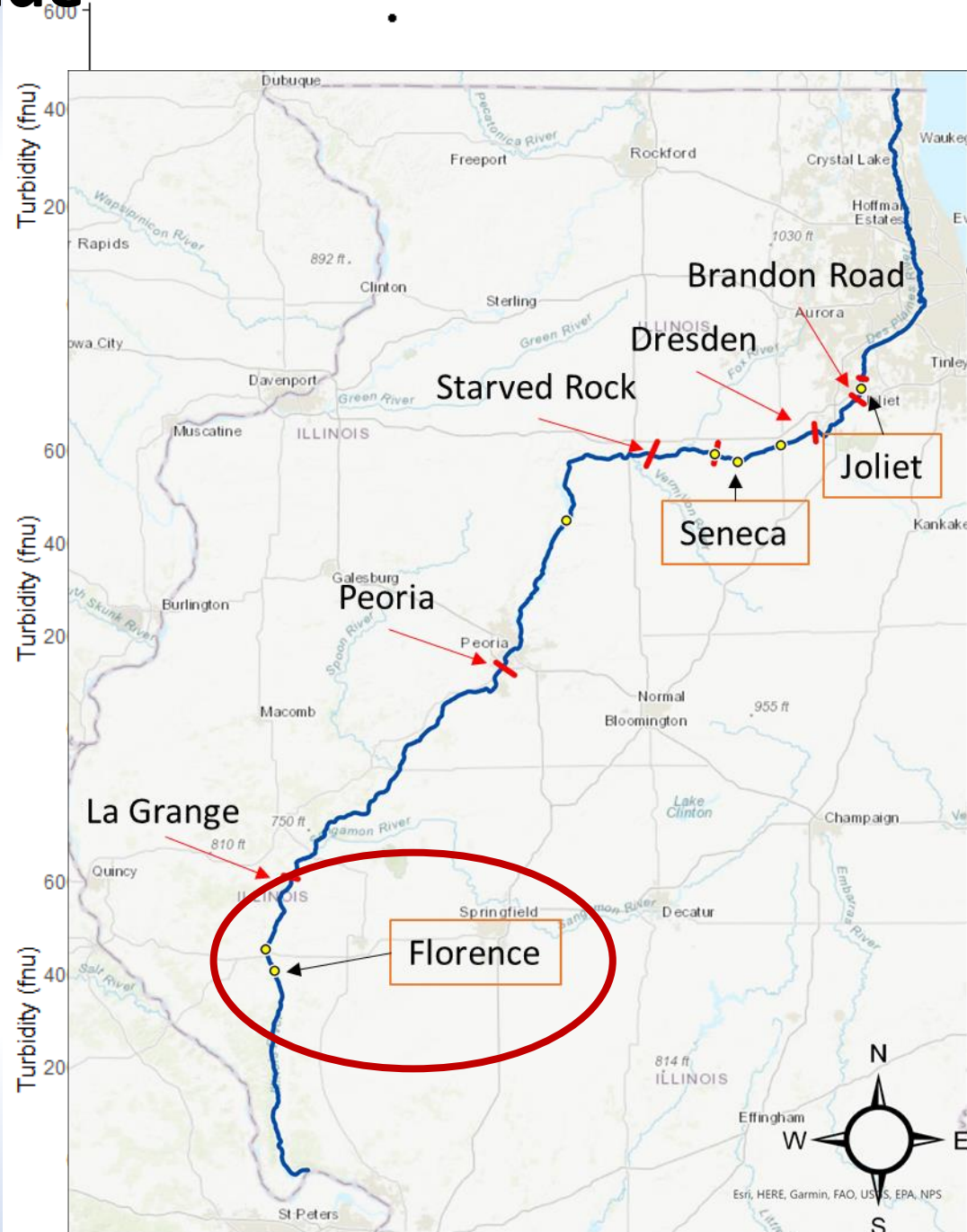
Florence Discharge 2020



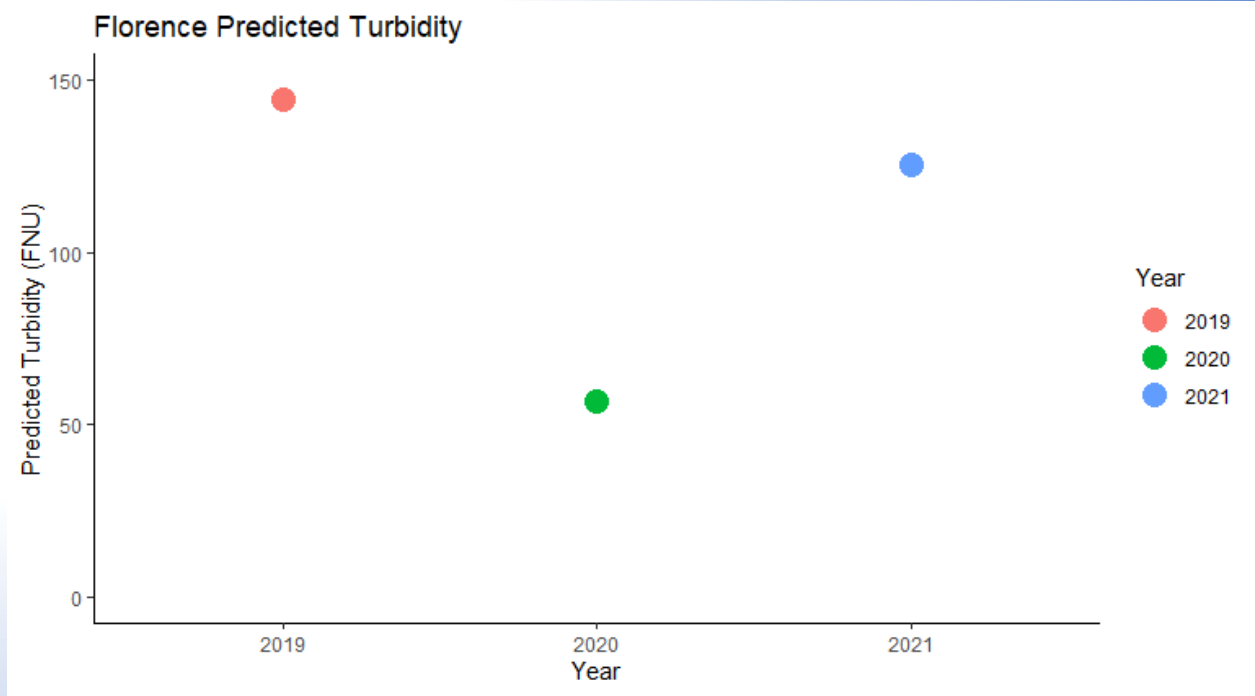
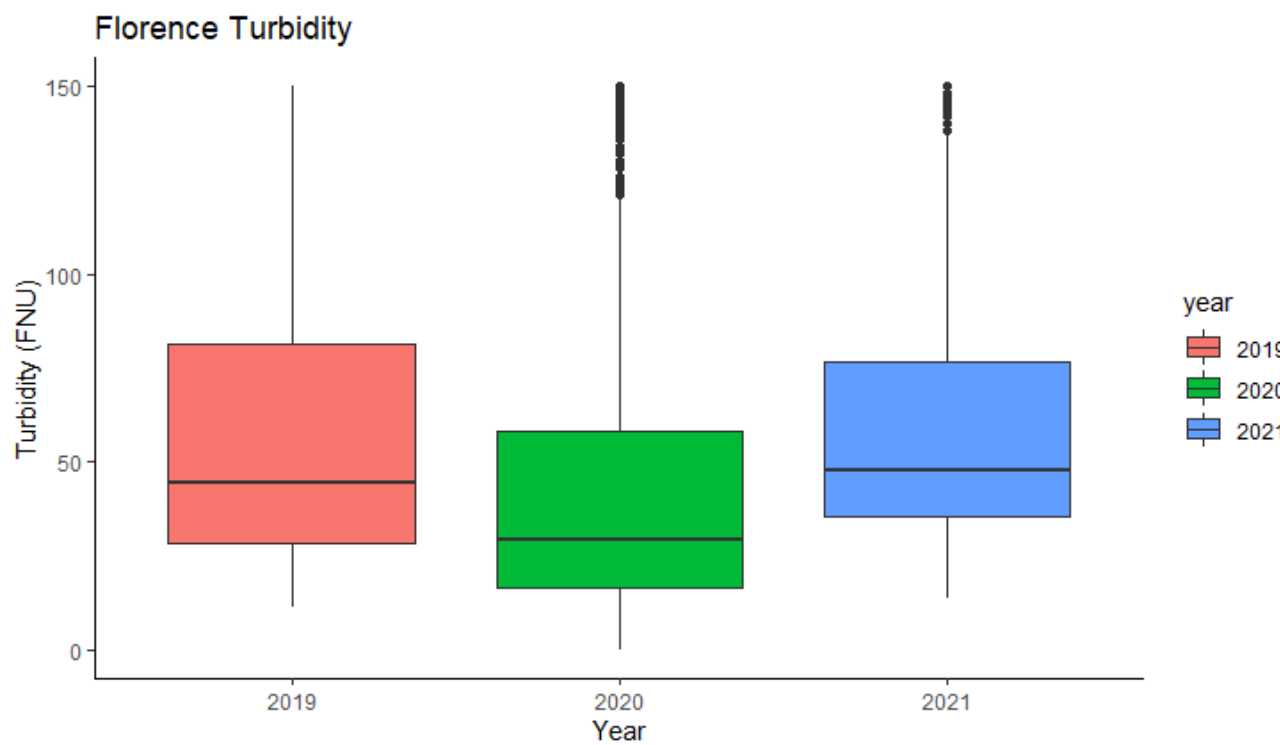
Florence Discharge 2021



Florence Turbidity vs Flow 2019



Turbidity is lower during 2020 Lock Closure event



```
gamm4(ysi~s(flow)+year,data=FTF1921)
```

Conclusions and Future

There appears to be a reduction in turbidity with reduced vessel traffic

Pool dependent based on geomorphological differences

Strata dependent based on connectivity and disturbance

Future

Model selection to determine model of best fit

Information can be used to inform mitigation or restoration

Feel free to contact me with questions or comments at:

taylorbookout20@gmail.com

or

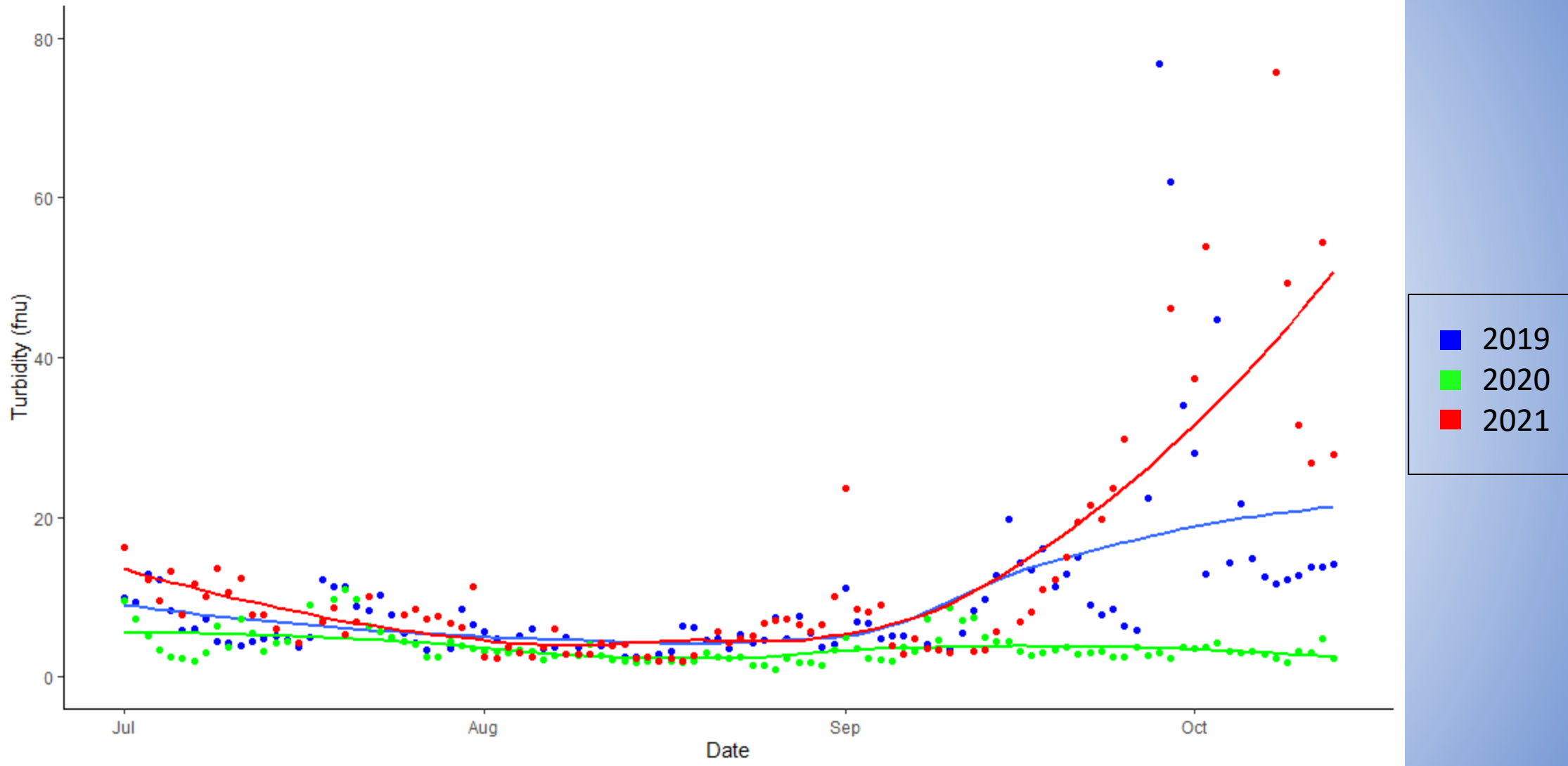
tbookout@illinois.edu



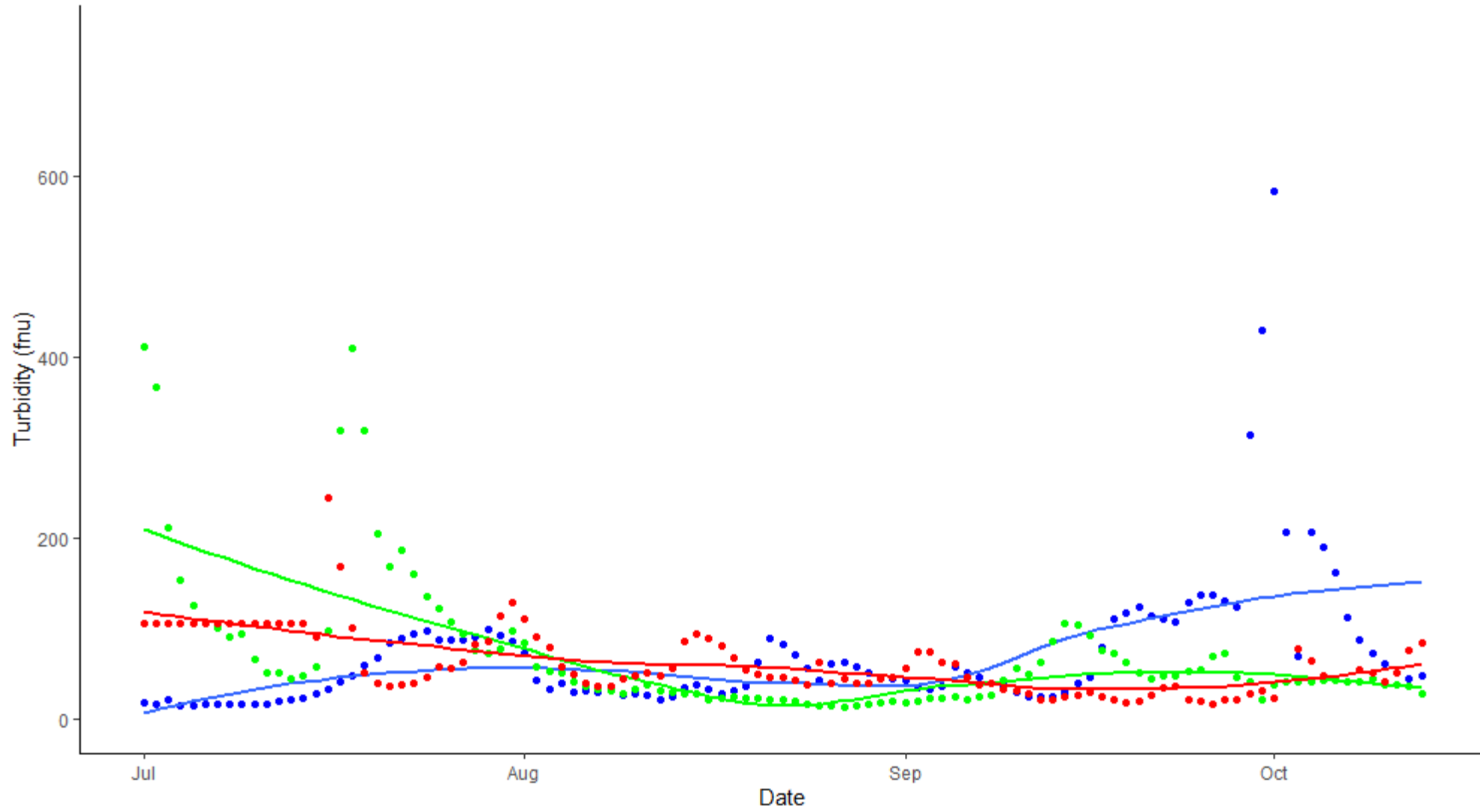
Closure Dates

Pool	Dam Location (river km)	Closure Period (2020)
Dresden	436.9	July 1- Oct 29
Marseilles	397.5	July 1- Oct 29
Starved Rock	371.8	July 1- Oct 29
Peoria	253.8	July 1- Sept 30
La Grange	129.1	July 1- Oct 13
Alton	X	X

Joliet Turbidity



Florence Turbidity



Turbidity vs Discharge

