

Spatial Ecology of Grass Carp in Lake Erie and its Implications to Response Efforts

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**Great Lakes Food Webs, Invasive Species and Fisheries:
An Interactive Conference**

THEME: INVASIVE SPECIES



Grass Carp

- First imported to the U.S. in 1960s for aquatic vegetation control
- First collection of free ranging fish in U.S. waters in 1970
- Stocking in public and private impoundments widespread through the 1970s and 1980s
- Concerns about unwanted spread and negative effects led to the production of mono-sex and sterile fish



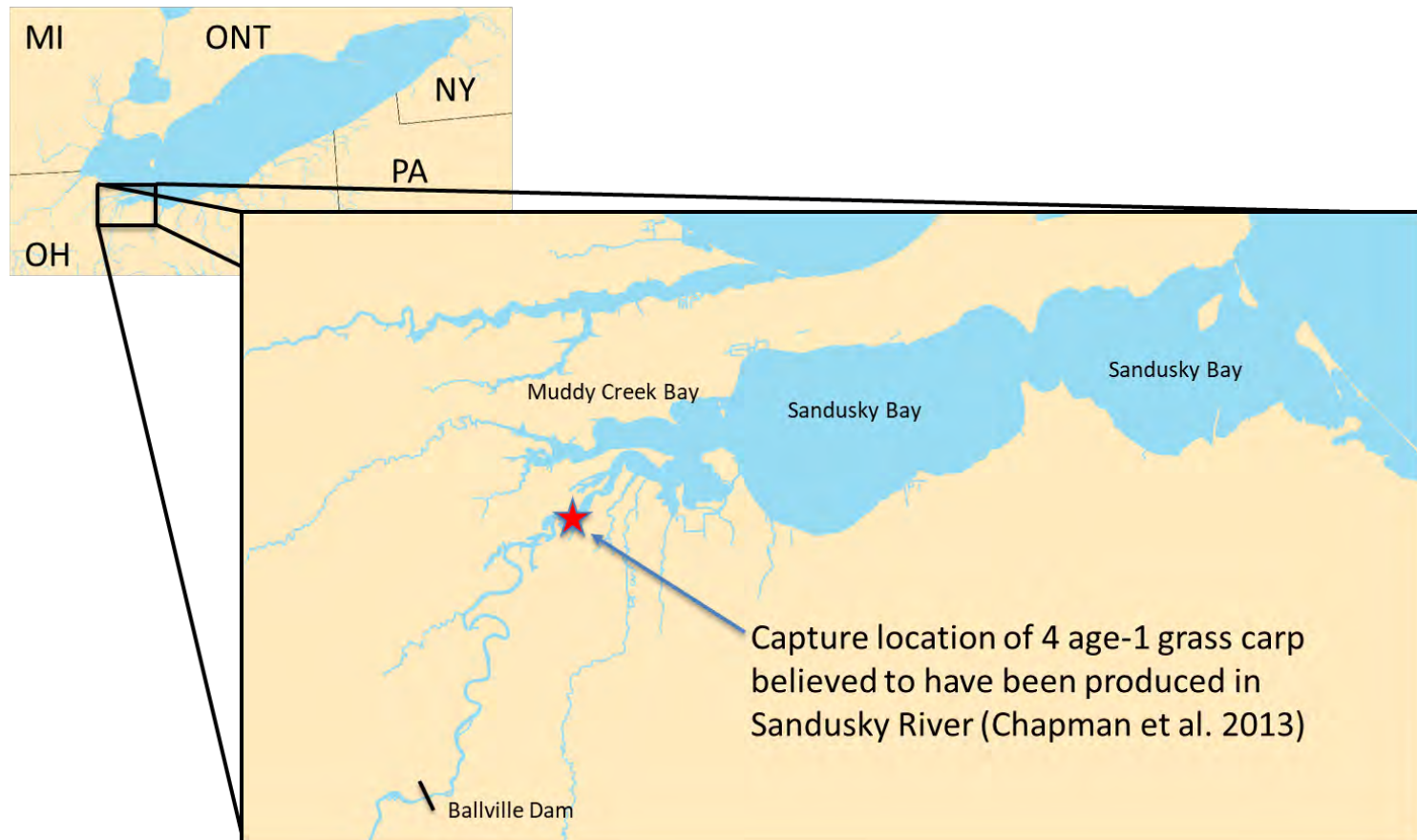
Grass Carp in the Great Lakes

- First captured in the Great Lakes in Lake Erie in 1985
- Have been captured in every Great Lake except Lake Superior
- Captures in Lake Erie were infrequent and/or unreported through the 1980s, 1990s, and 2000s
- Reported captures in Lake Erie's Western Basin increased in 2010s



Lake Erie Grass Carp

- In 2012, 4 age-1 grass carp were captured in the Sandusky River and determined to be diploid (fertile) and likely produced from the river (Chapman et al. 2013)



Lake Erie Grass Carp

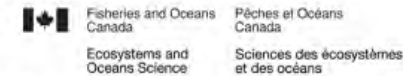
- Grass carp eggs collected from the Sandusky River in 2015, 2017, and 2018 (Embke et al. 2016; Kococsky et al. 2021)
- Grass carp eggs and larvae collected from the Maumee River in 2019 (unpublished data)
- 87% of grass carp collected from Lake Erie's WB were fertile (Wieringa et al. 2017)
- 64% of grass carp collected throughout Lake Erie were fertile (Whitledge et al. 2021)



Why Care About Grass Carp Movement and Space Use?

- Inform risk of spread to other parts of Lake Erie and to other Great Lakes

1. “There is a lack of knowledge regarding individual movements given there is some variability with individual fish.”
2. “Whether reproductive movements would enhance spread, or perhaps limit spread...”
3. “Understanding movement of fishes from Lake Erie to Lake Ontario through the Niagara River...”



Canadian Science Advisory Secretariat (CSAS)

Research Document 2016/118

Central and Arctic Region

Ecological Risk Assessment of Grass Carp (*Ctenopharyngodon idella*) for the Great Lakes Basin

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Why Care About Grass Carp Movement and Space Use?

- Improve response efforts to eradicate grass carp from Lake Erie



2014 Lake Erie Invasive Carp Response Exercise



Collaborating partners

ILLINOIS

Effort

219 Electrofishing Runs = 96 hours of electrofishing time

53 Gillnet Lifts = 58.8 hours of soak time

3 Seine Hauls

Results

2 Grass Carp Collected

Funding Source

Great Lakes
RESTORATION



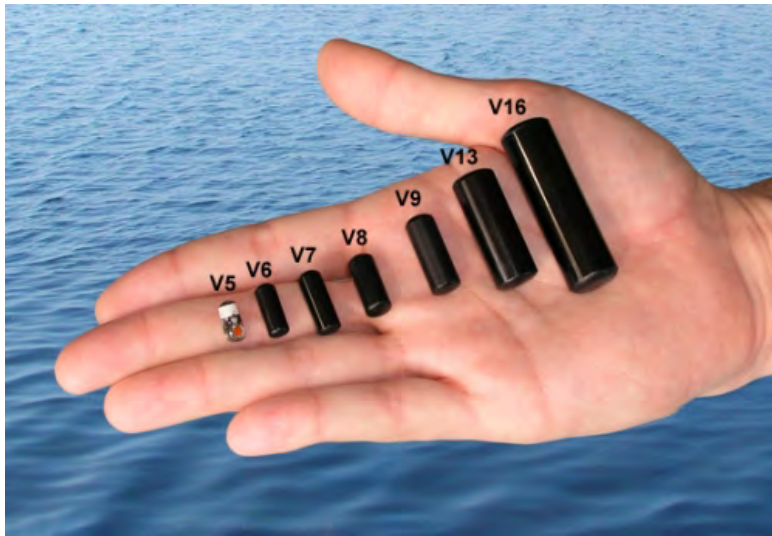
Why Care About Grass Carp Movement and Space Use?

- Improve response efforts to eradicate grass carp from Lake Erie
- Judas technique
 - Use tagged animals to identify aggregations of conspecifics for targeted removals



Acoustic Telemetry

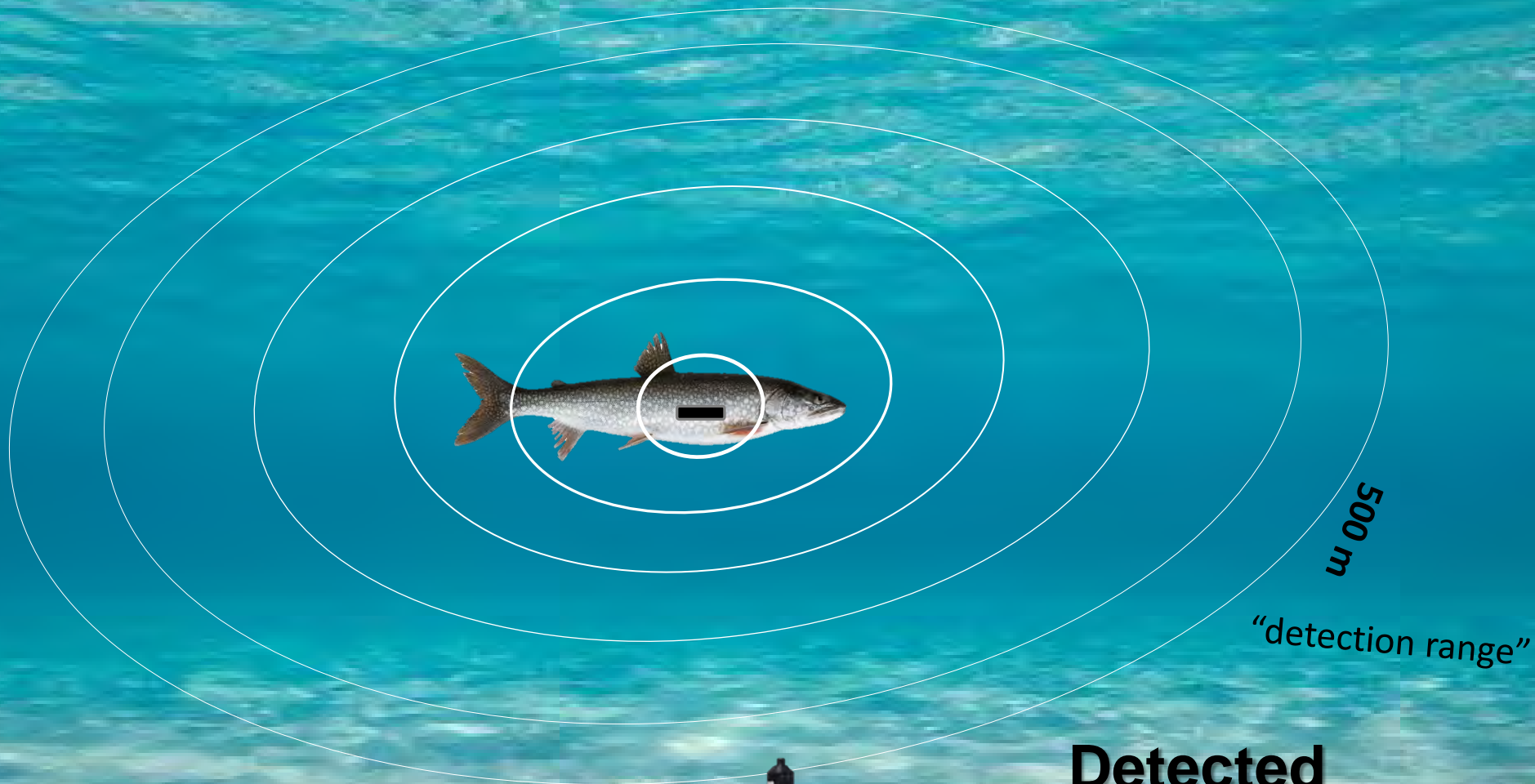
Transmitters



Receivers



Acoustic Telemetry



CBG-025
41.3697 -82.9658



Detected

A69-901-320687, 2019-10-30 12:04:00; 4.5 M

Great Lakes Acoustic Telemetry Observation System (GLATOS)

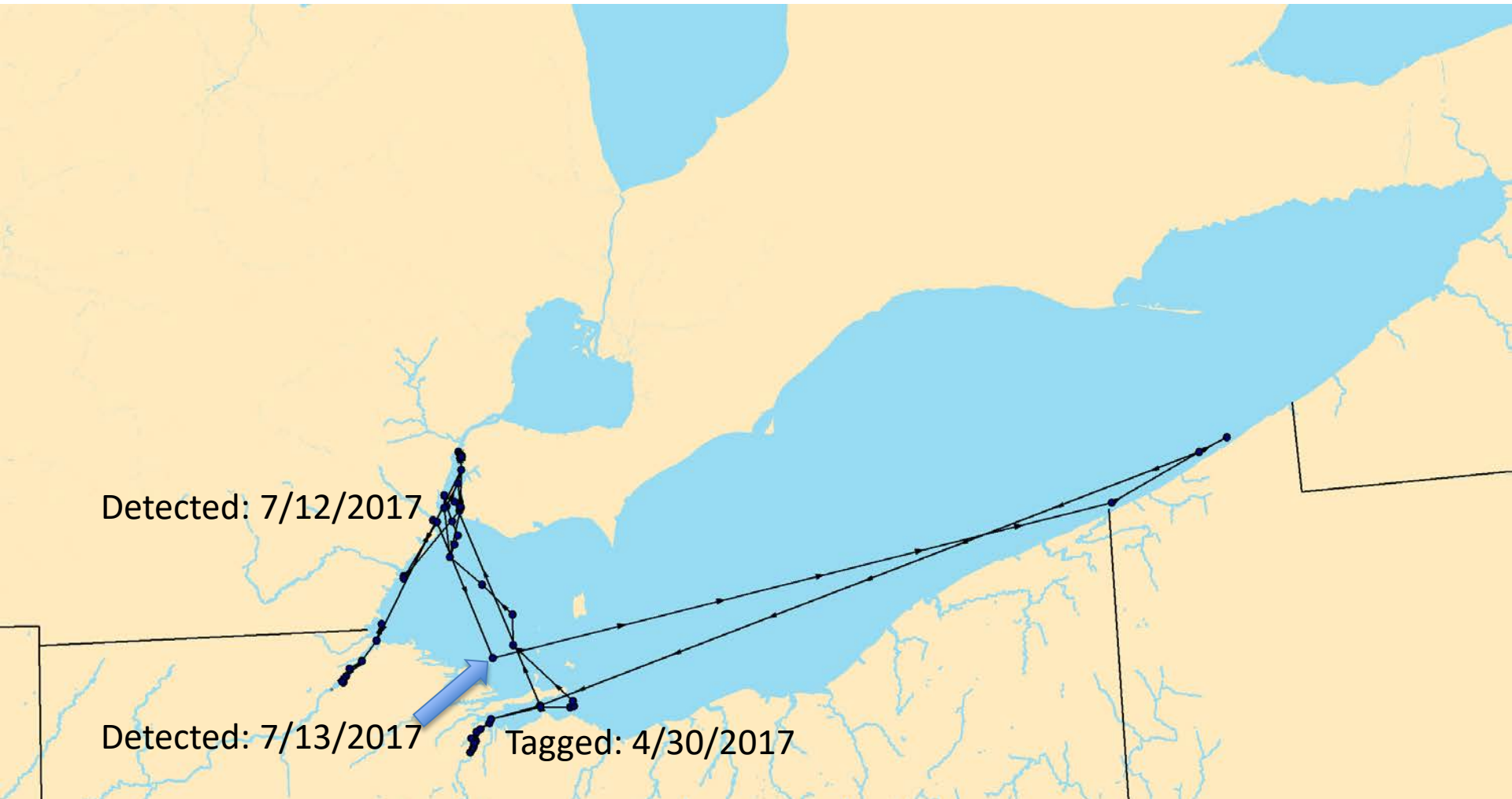


Lake Erie Grass Carp Acoustic Telemetry

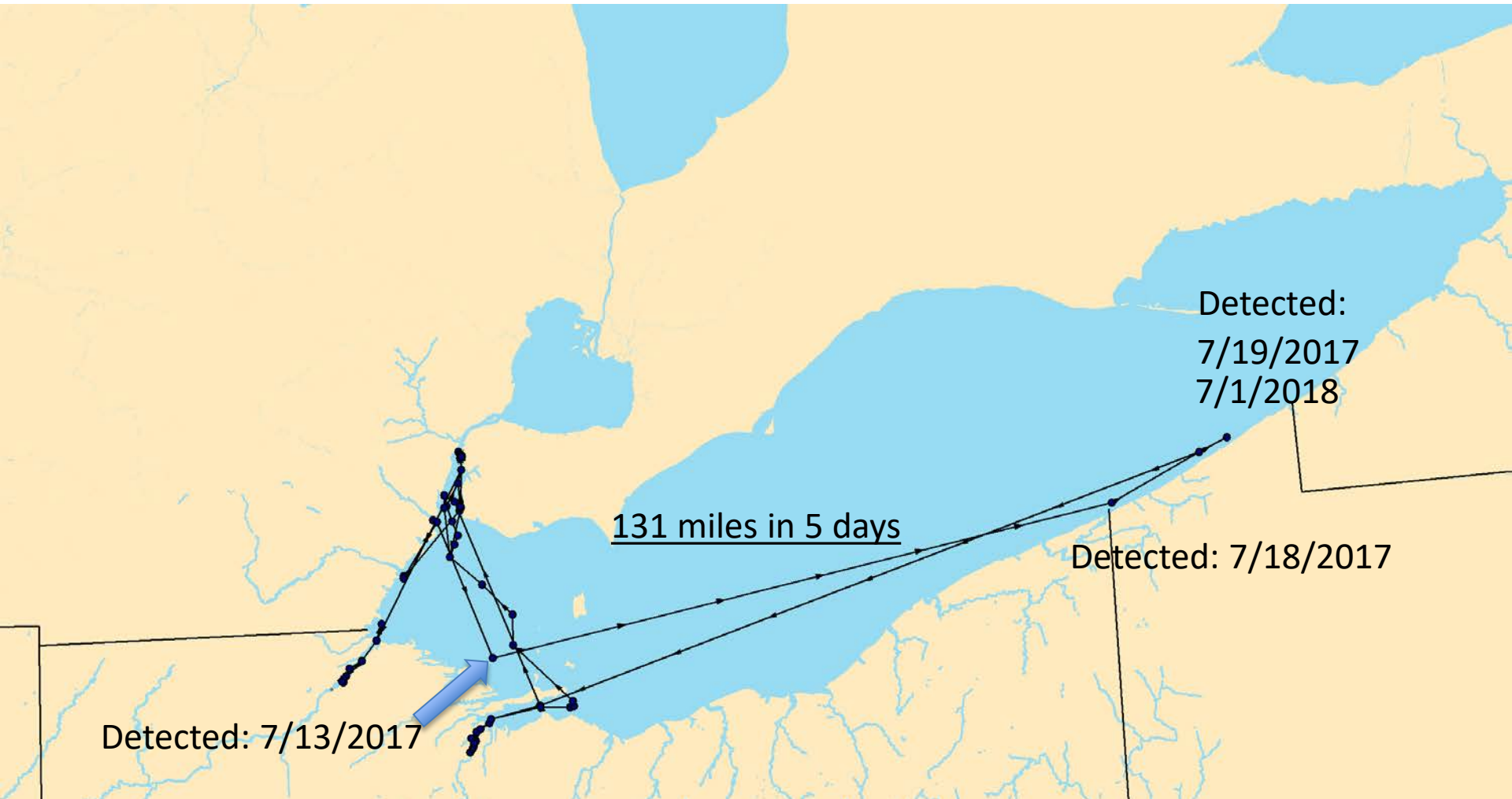
- To date, 70 grass carp have been implanted with transmitters (Length range of fish: 26 to 50 inches, Weight: <60 lbs)
- Estimated that only 40 grass carp have survived the tagging process
- Of those 40 fish
 - 7 fish have been harvested
 - 4 fish were last detected in 2017
 - 1 fish was last detected in 2018
 - 3 fish were last detected in 2019
 - 25 fish were last detected or tagged in 2020



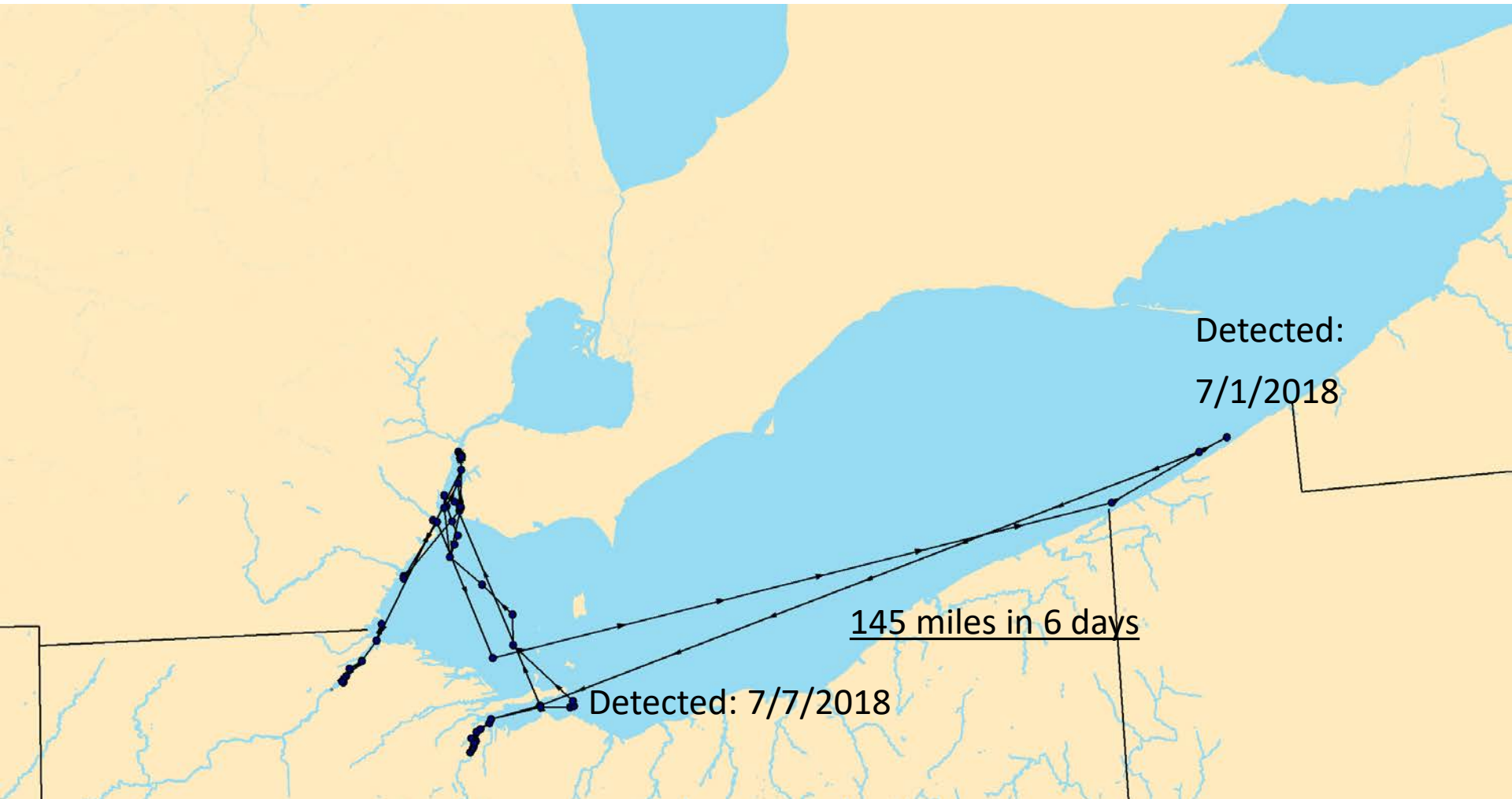
Grass Carp Risk of Spread



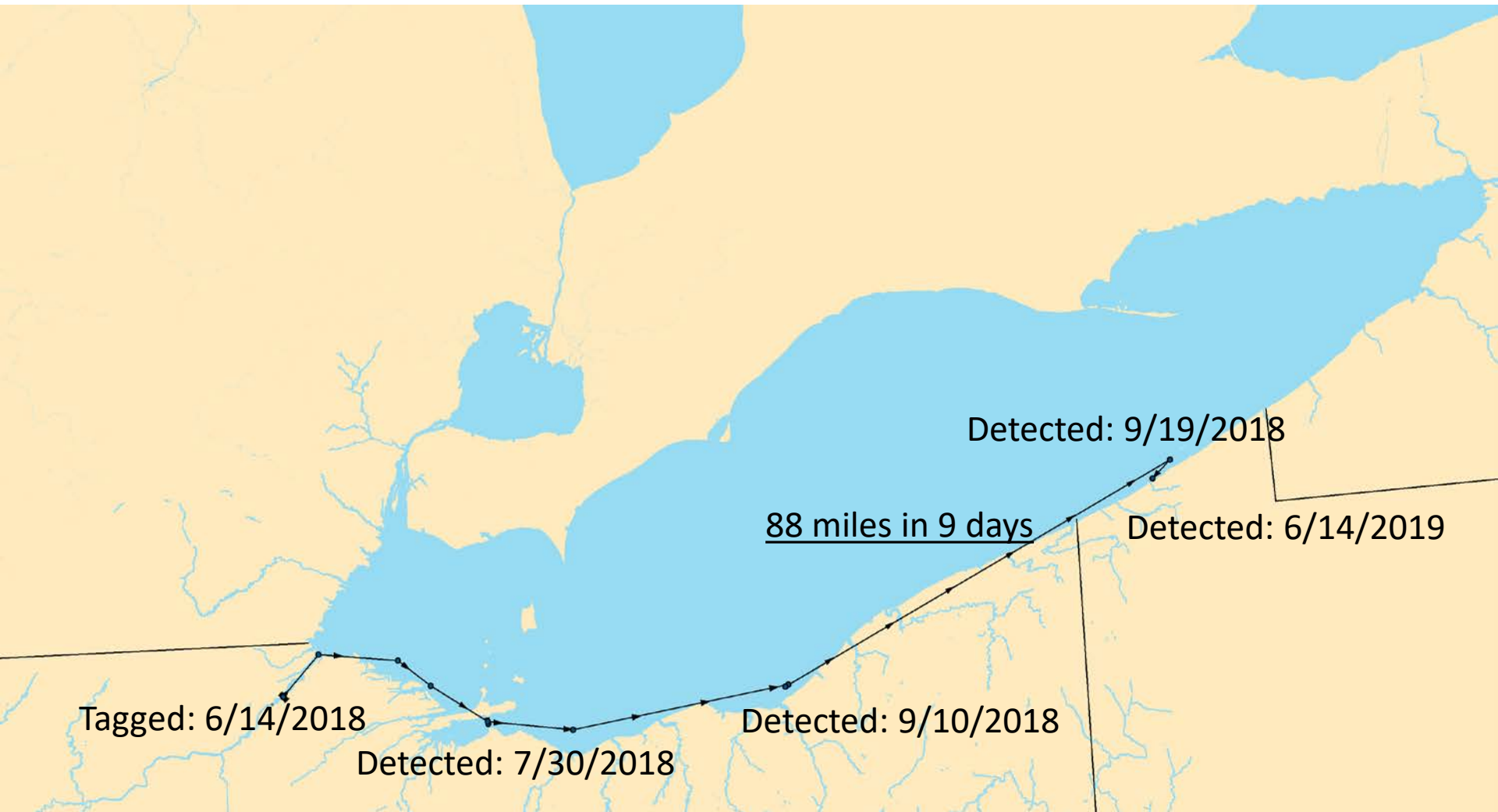
Grass Carp Risk of Spread



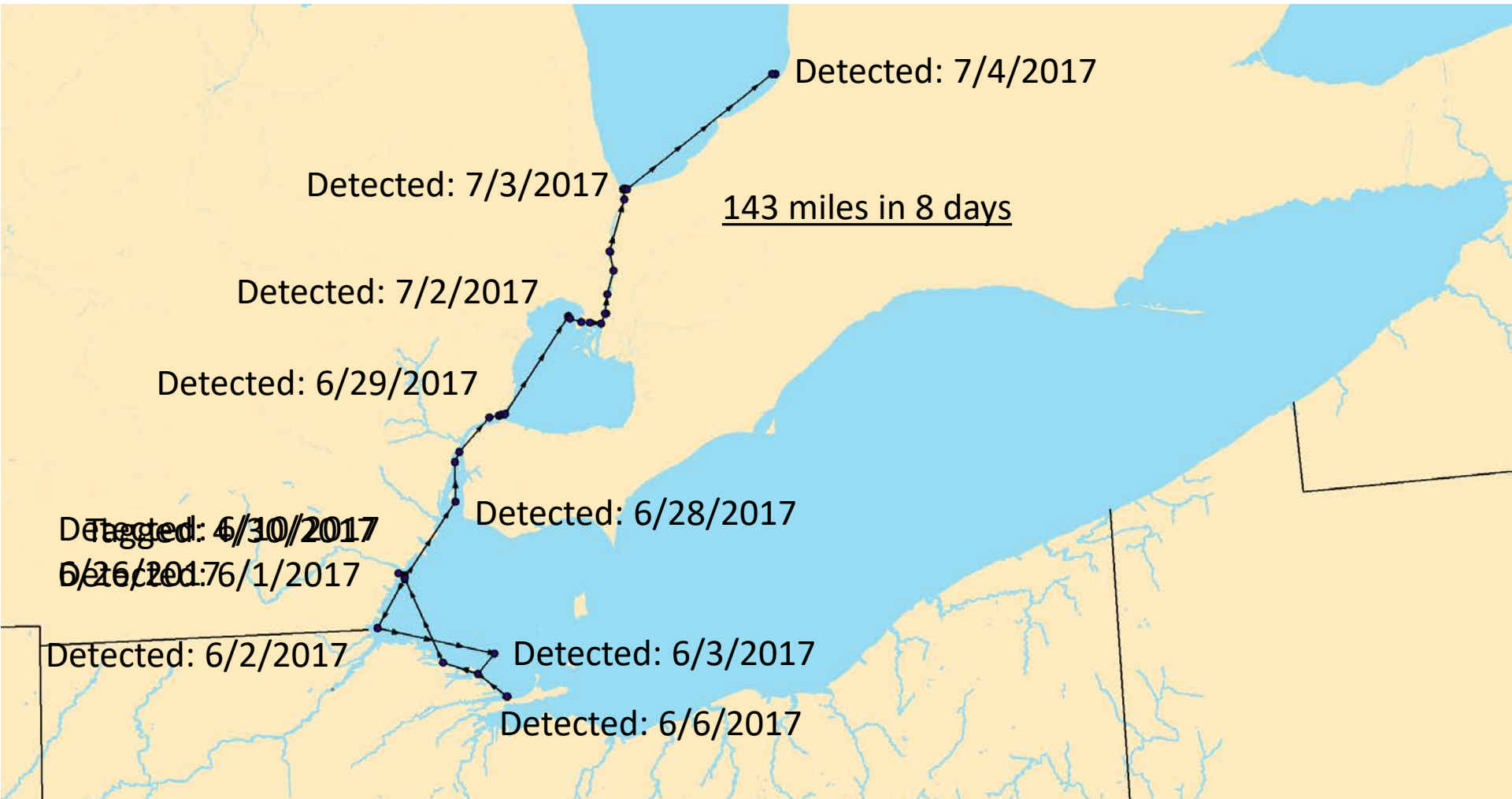
Grass Carp Risk of Spread



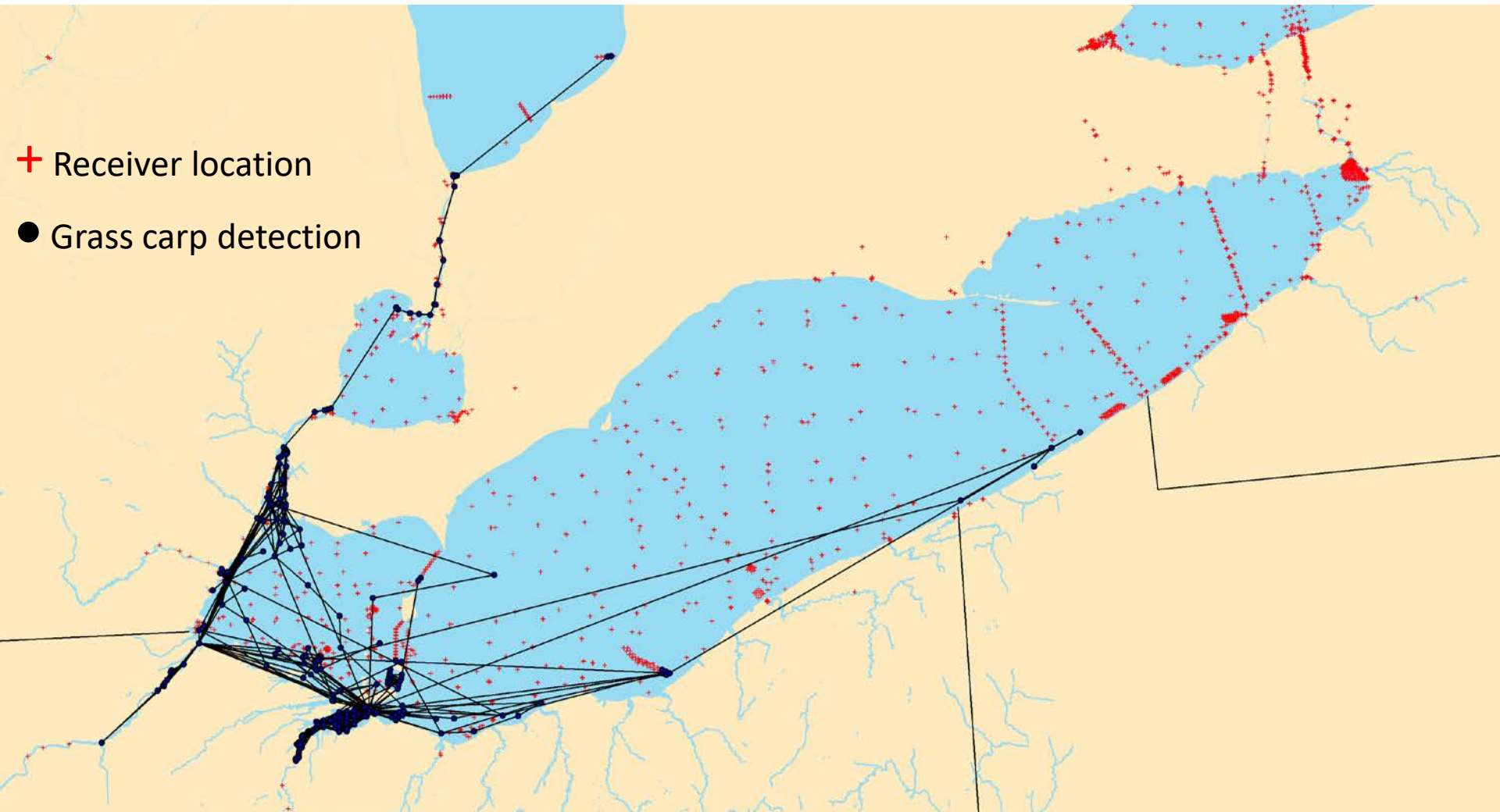
Grass Carp Risk of Spread



Grass Carp Risk of Spread



Grass Carp Risk of Spread





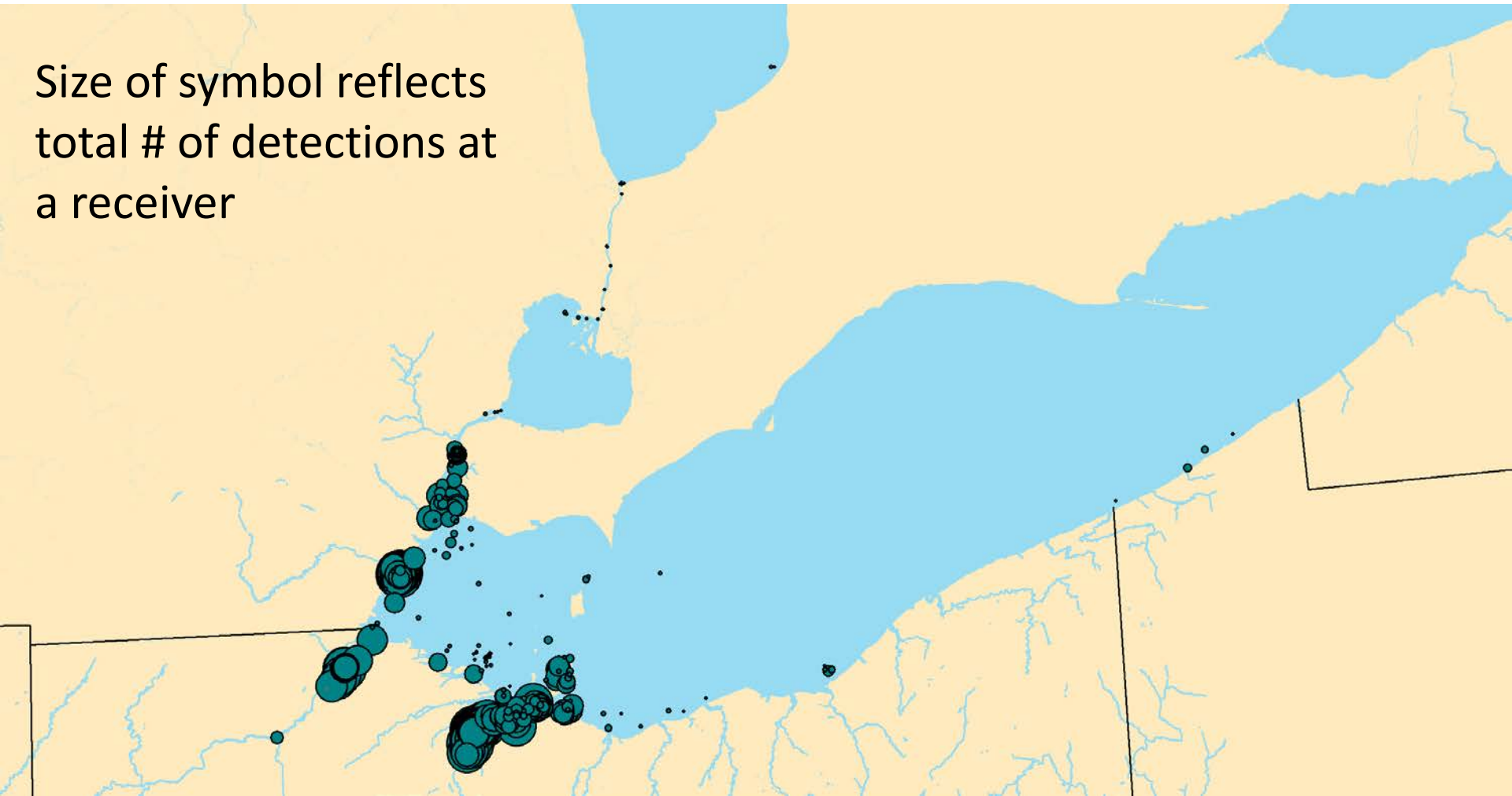
Grass Carp Risk of Spread

Main Take Home

- Likely underestimating risk of spread to other areas of Lake Erie and other Great Lakes
- >25% of tagged fish had dispersal distances of more than 60 miles
- Average daily movement rate as high as 1 mile/day
- Multiple fish exhibited single day movements in excess of 22 miles

Grass Carp Aggregations

Size of symbol reflects total # of detections at a receiver



Grass Carp Aggregations

Size of symbol reflects the # of unique grass carp detected on that receiver



Grass Carp Aggregations

Size of symbol reflects the # of unique grass carp detected on that receiver

Main Take Home

- Sandusky River, Maumee River, Raisin River (Hot Ponds area) and Detroit River should be areas where response efforts are targeted
- Sandusky River in particular is an area extensively use by grass carp with fish residing in the river year round

River

Sandusky River

Sandusky River Emphasis

2016 receiver coverage

+ receiver location



2017 receiver coverage

+ receiver location



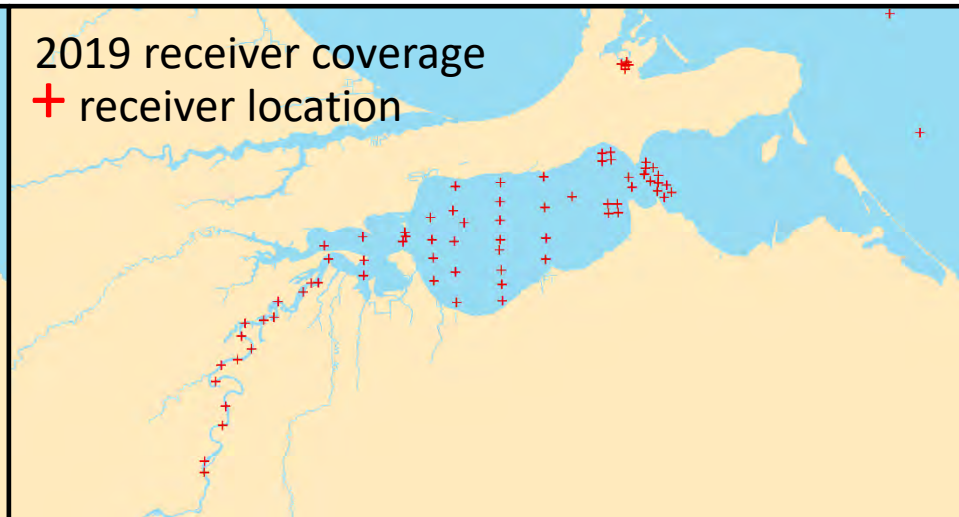
2018 receiver coverage

+ receiver location



2019 receiver coverage

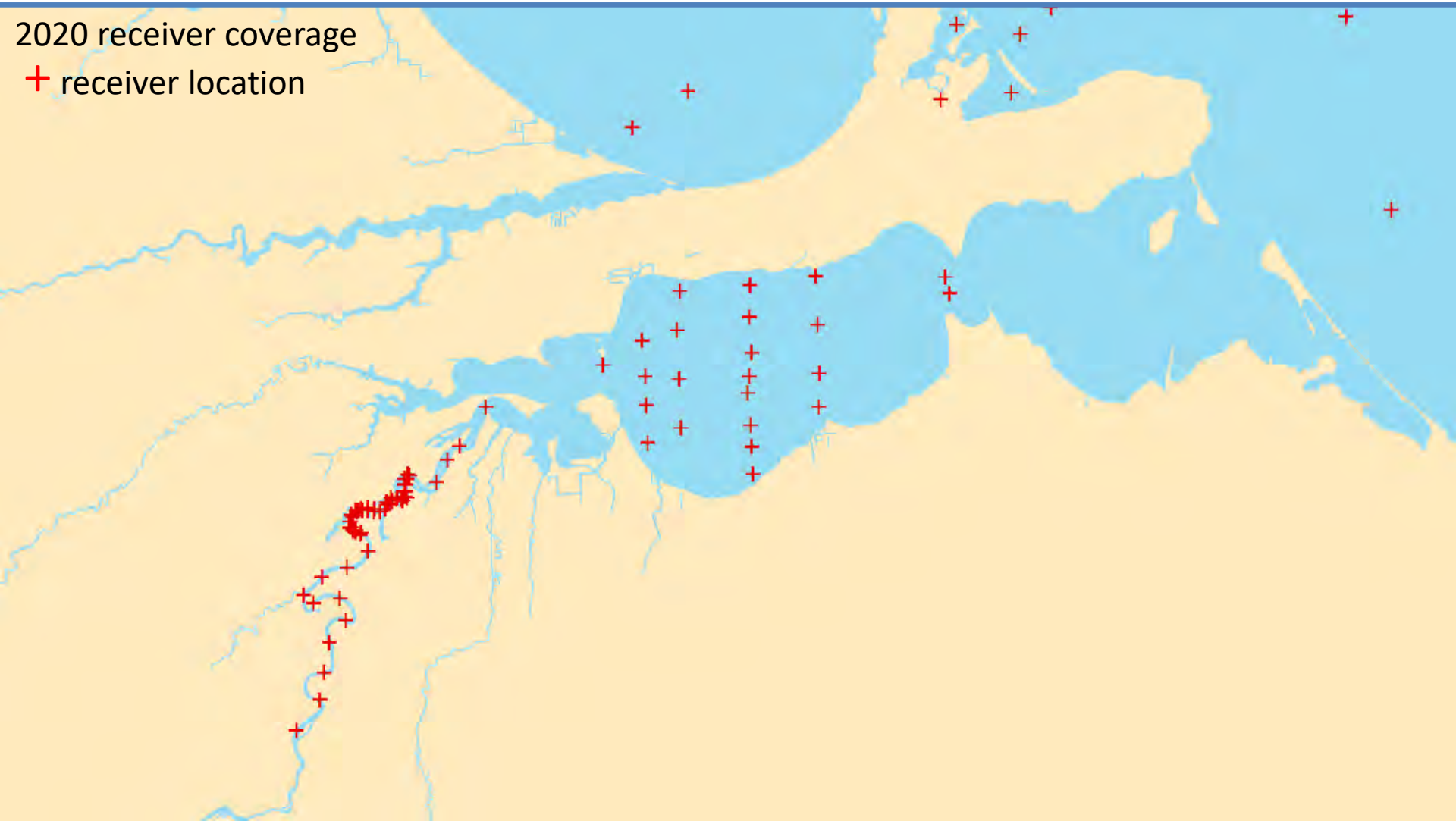
+ receiver location



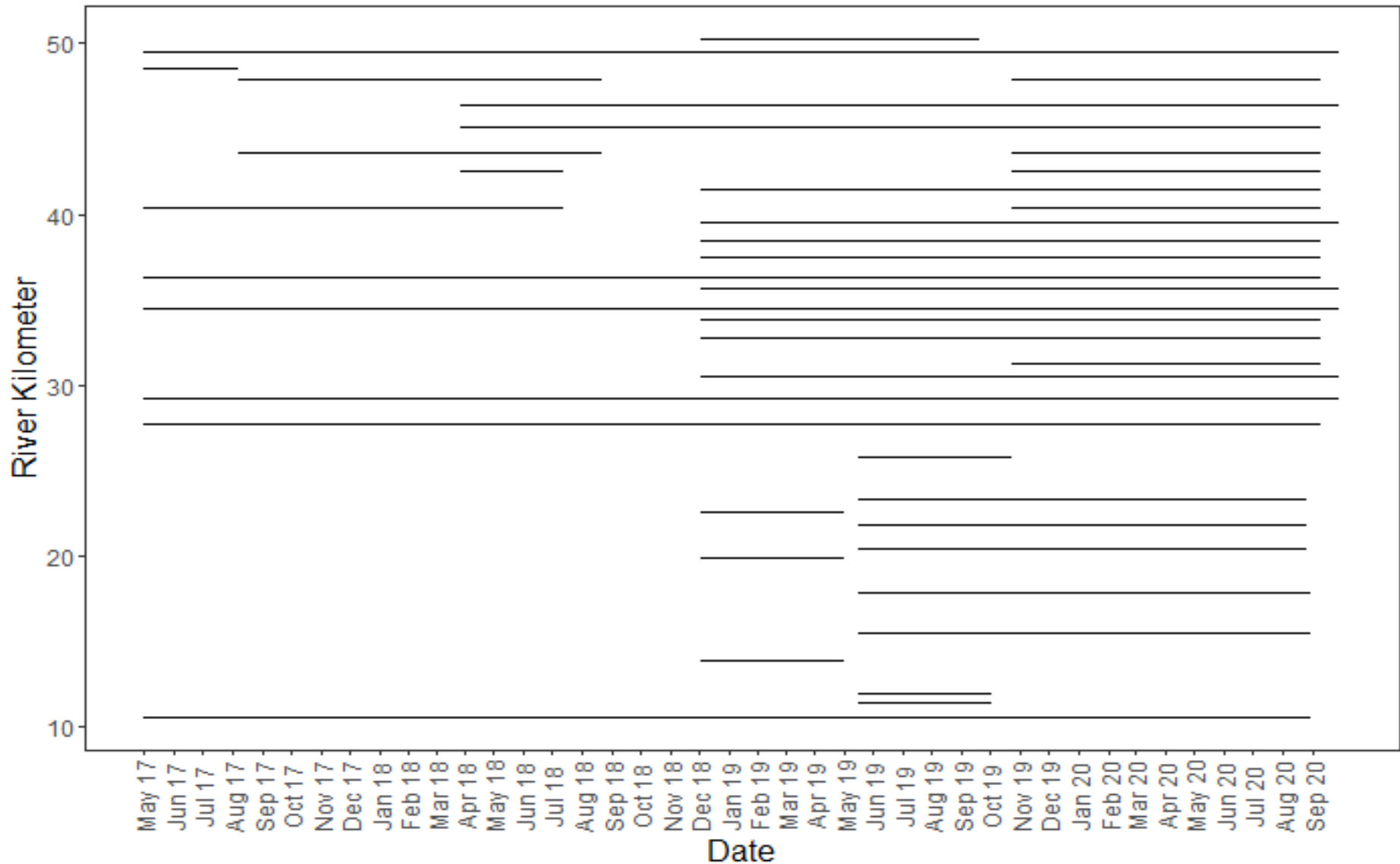
Sandusky River Emphasis

2020 receiver coverage

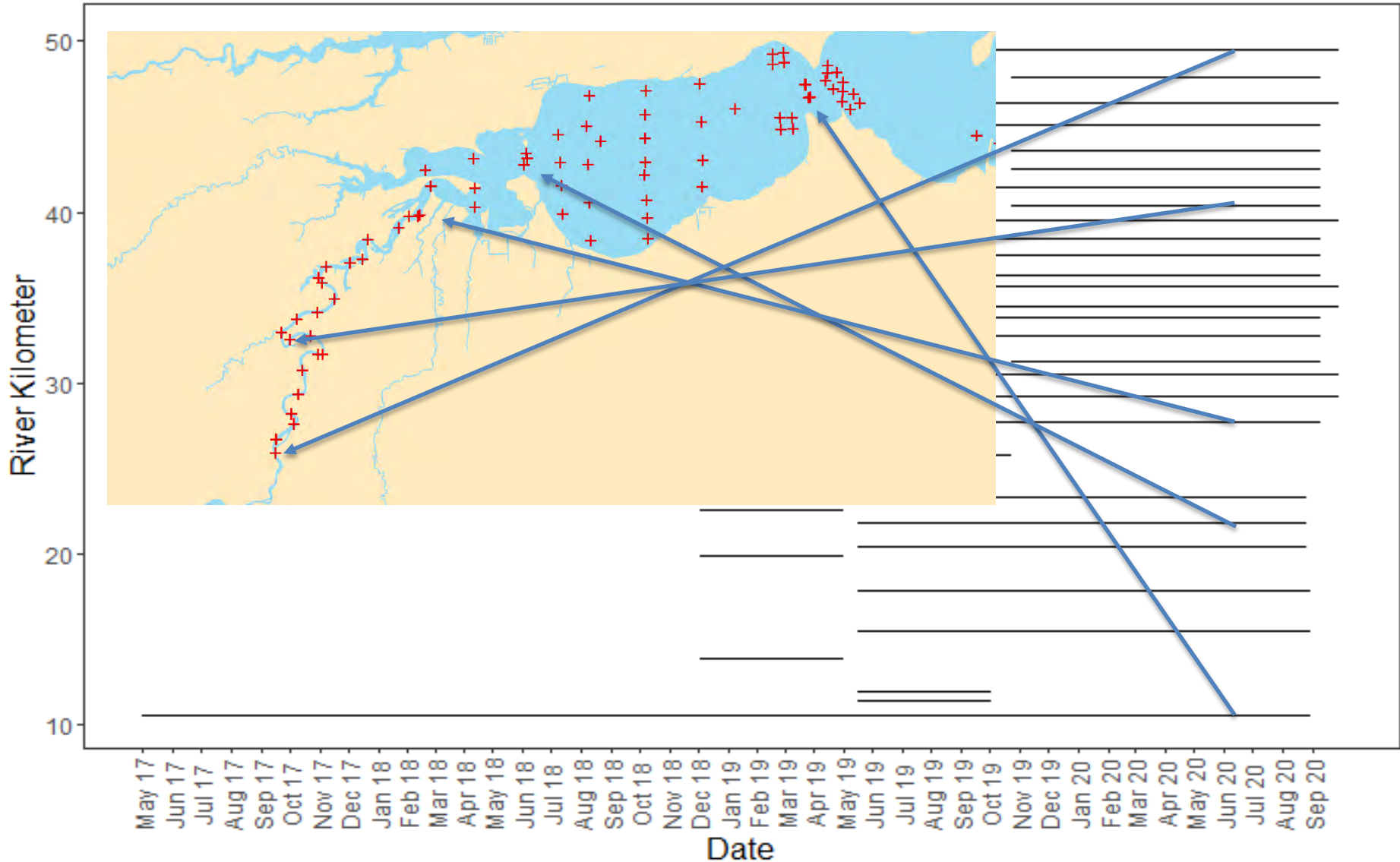
+ receiver location



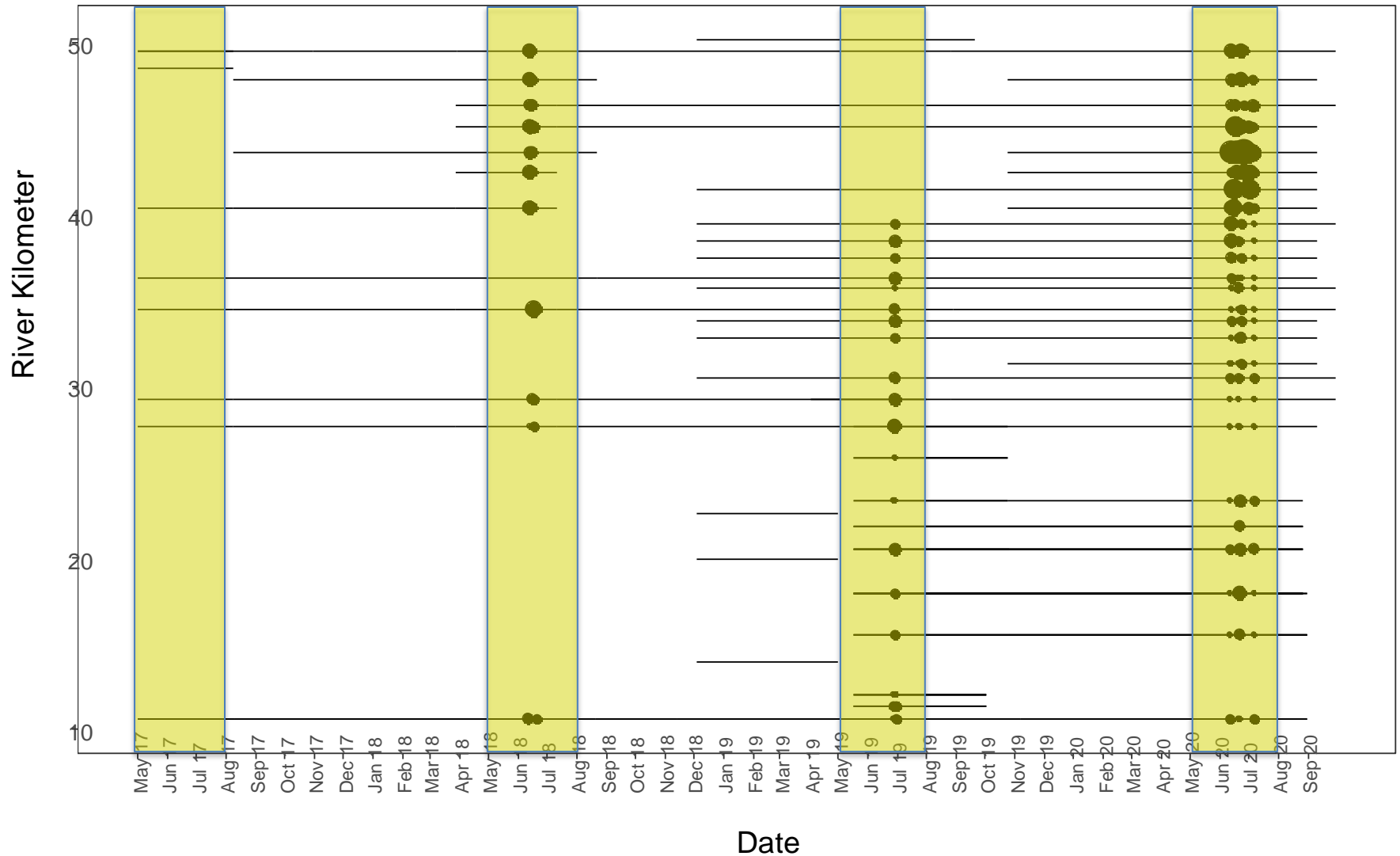
Sandusky River Emphasis



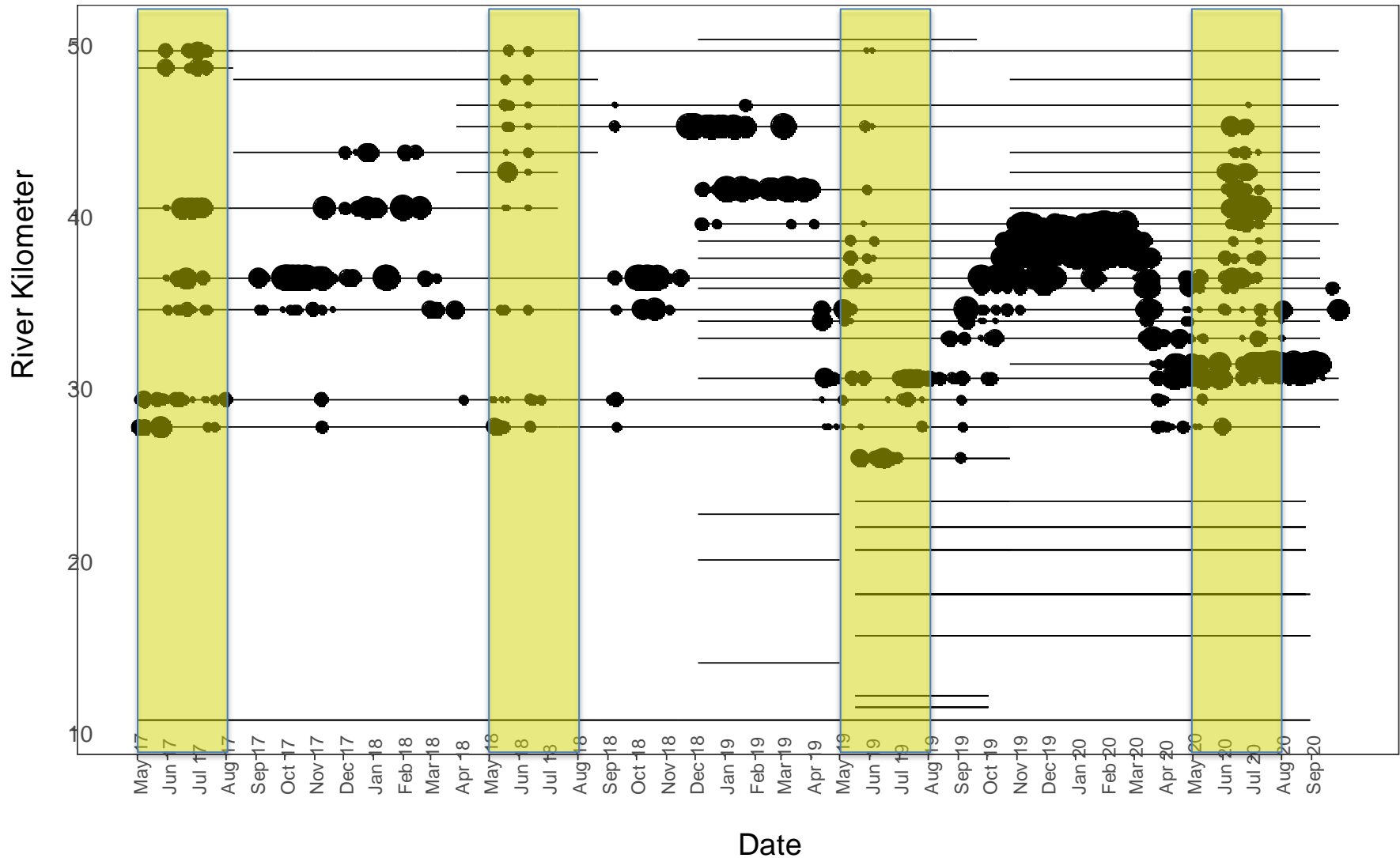
Sandusky River Emphasis



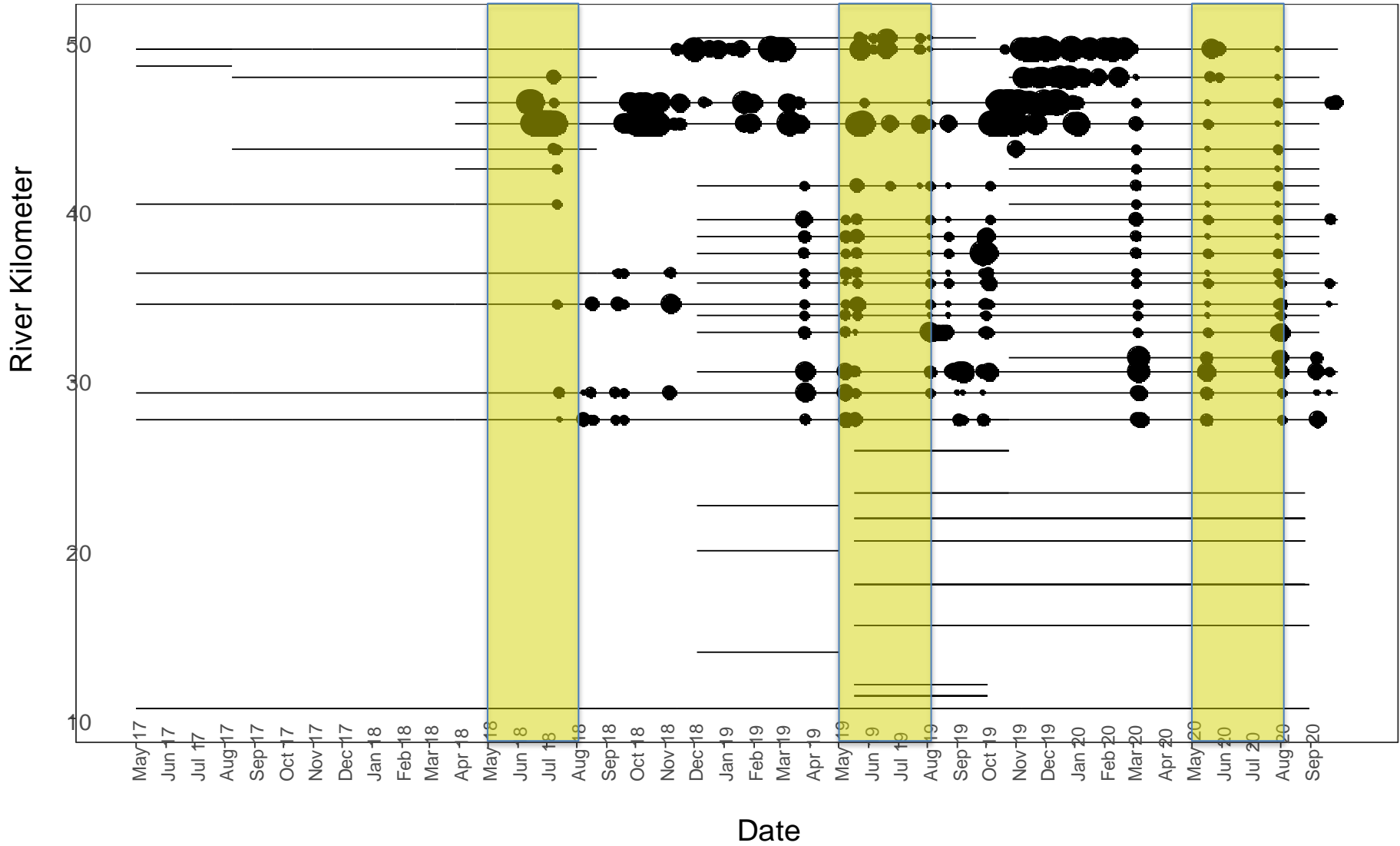
Sandusky River Emphasis



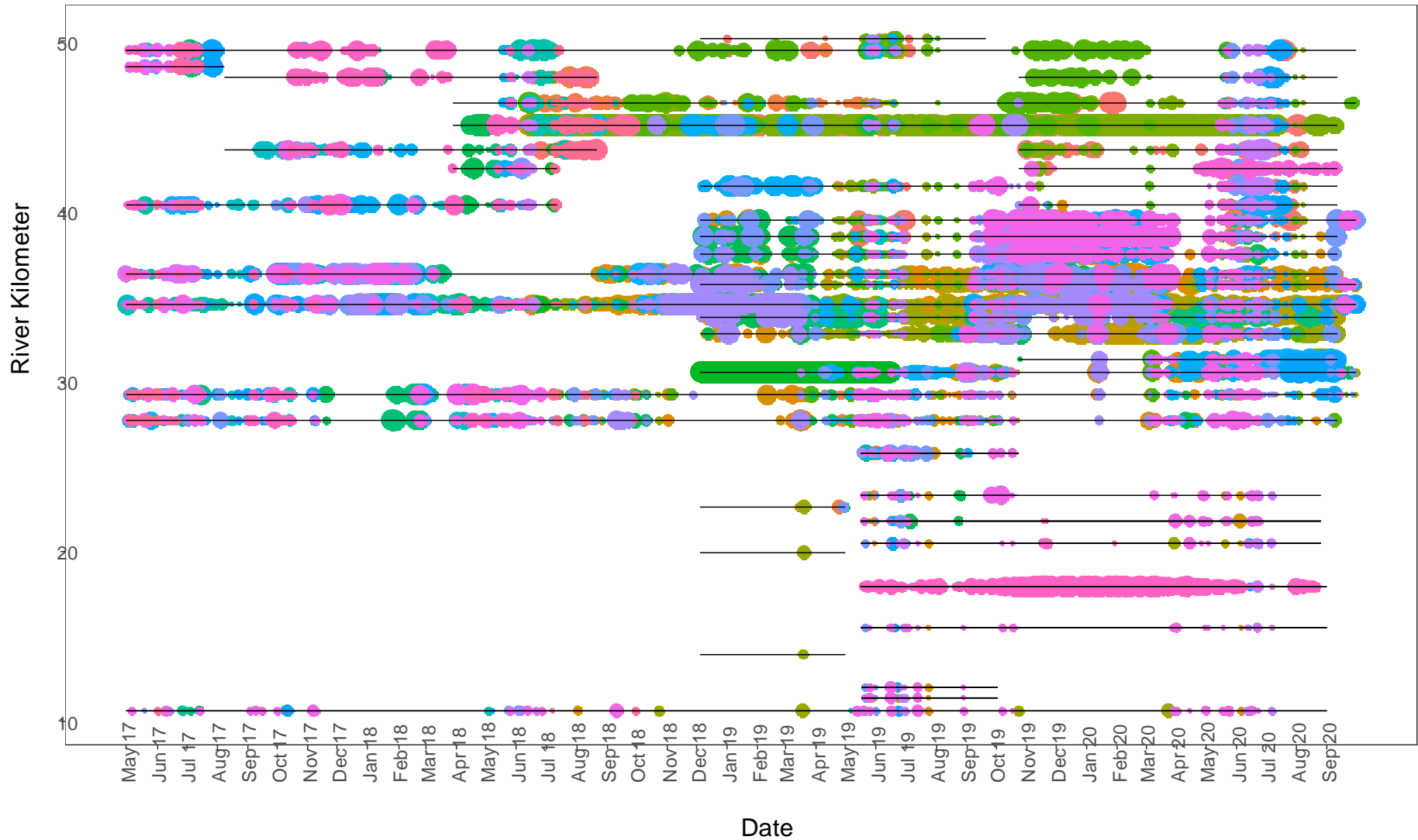
Sandusky River Emphasis



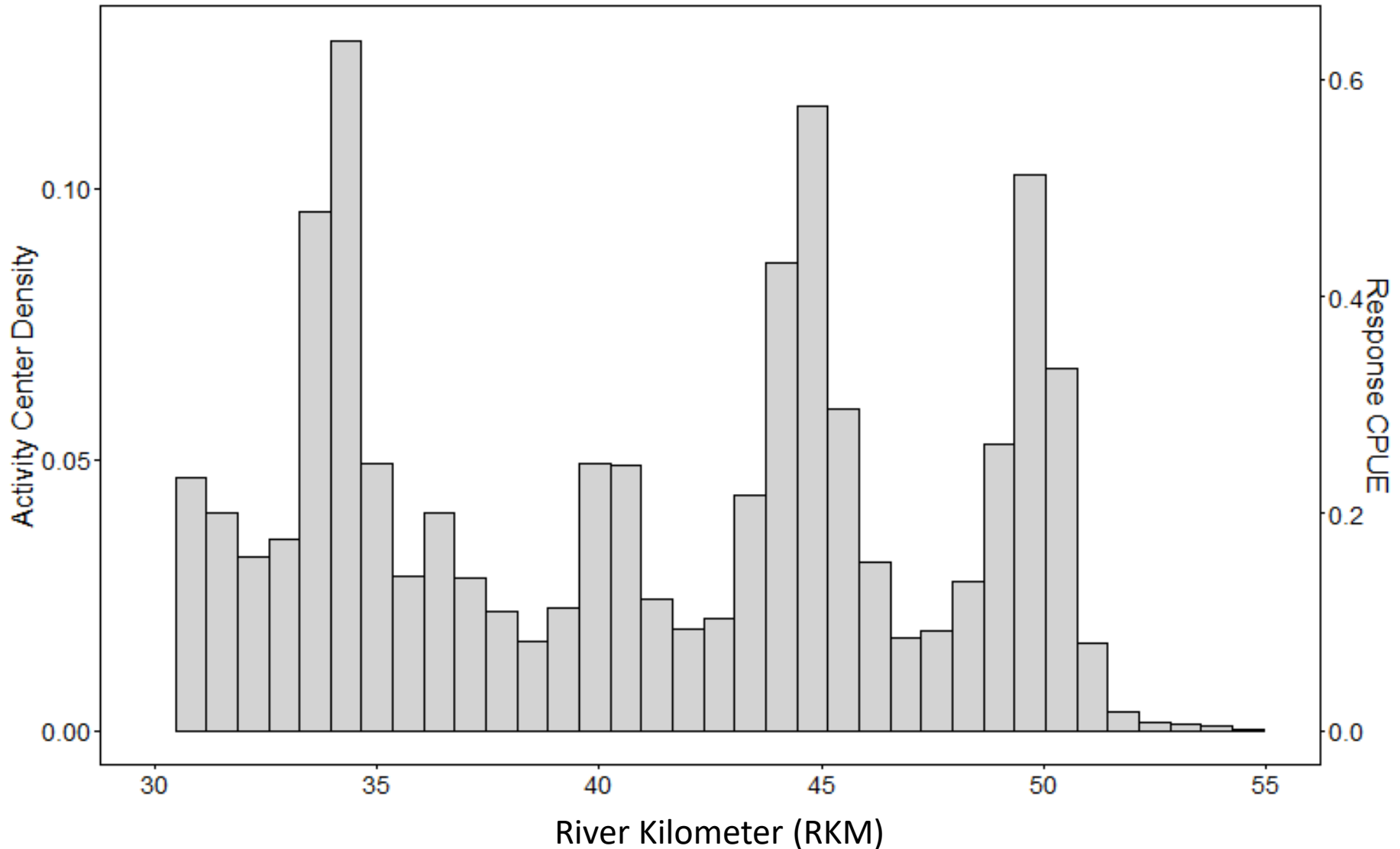
Sandusky River Emphasis



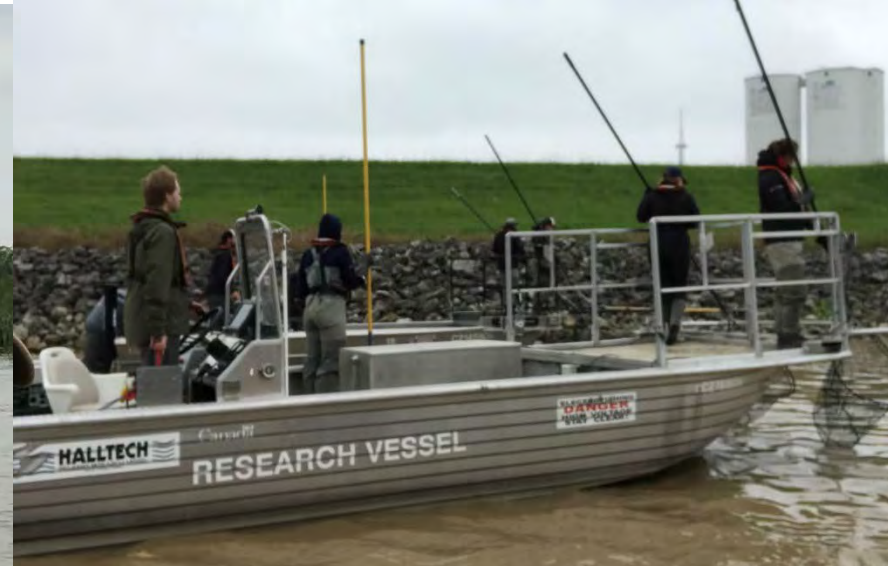
Sandusky River Emphasis



Grass Carp Home Range Centers



Sandusky River Strike Teams



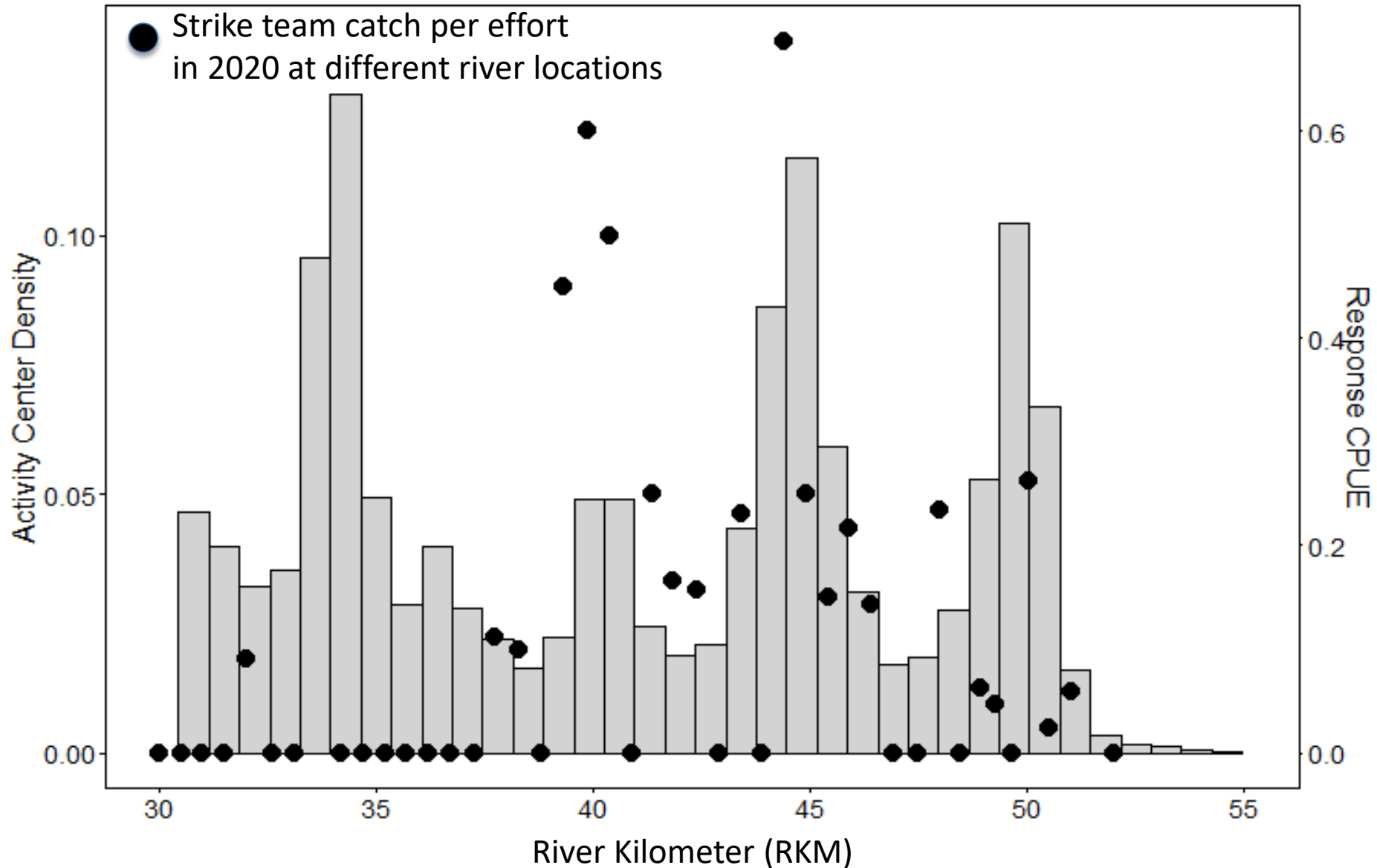
Sandusky River Strike Teams



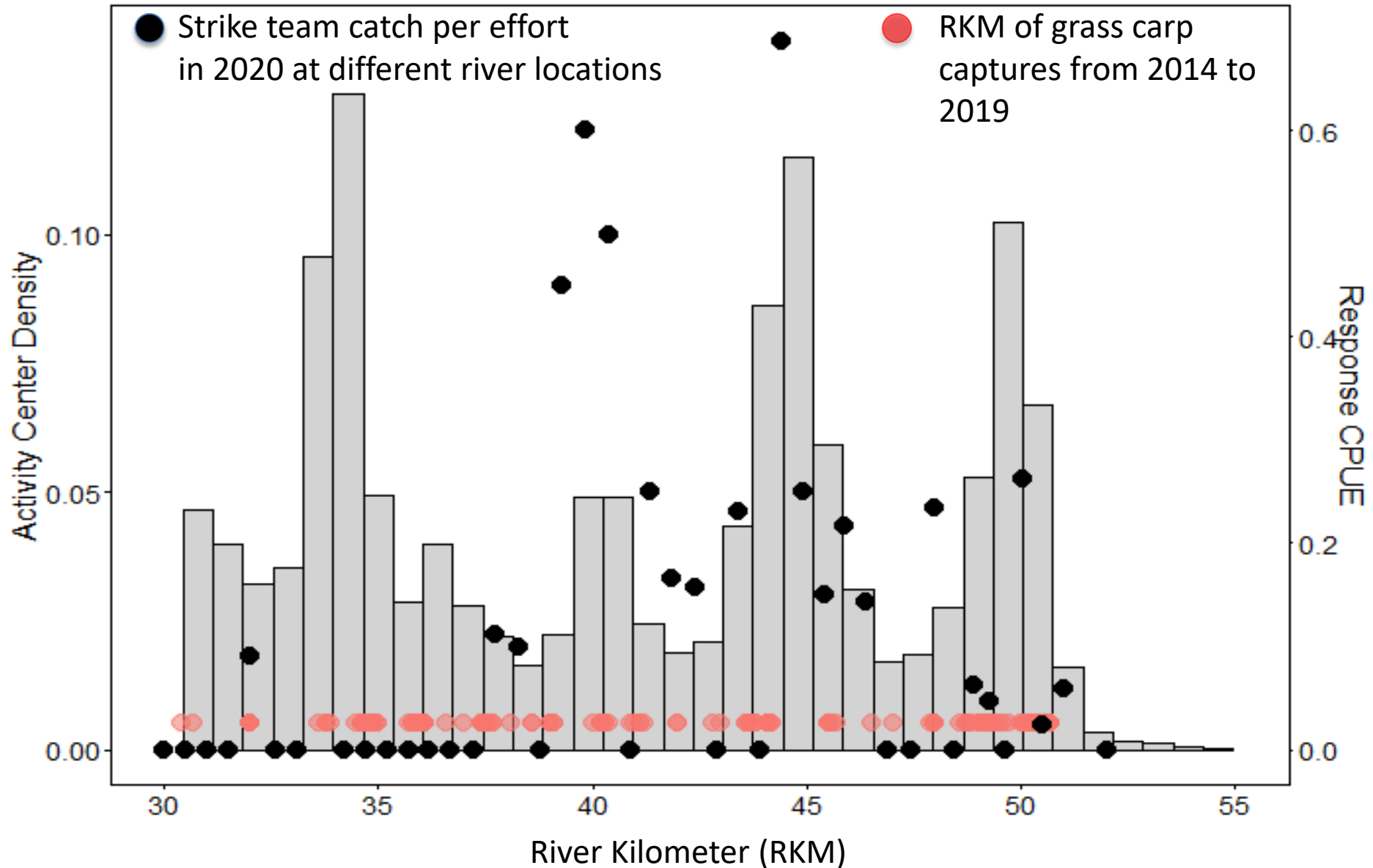
Sandusky River Strike Teams



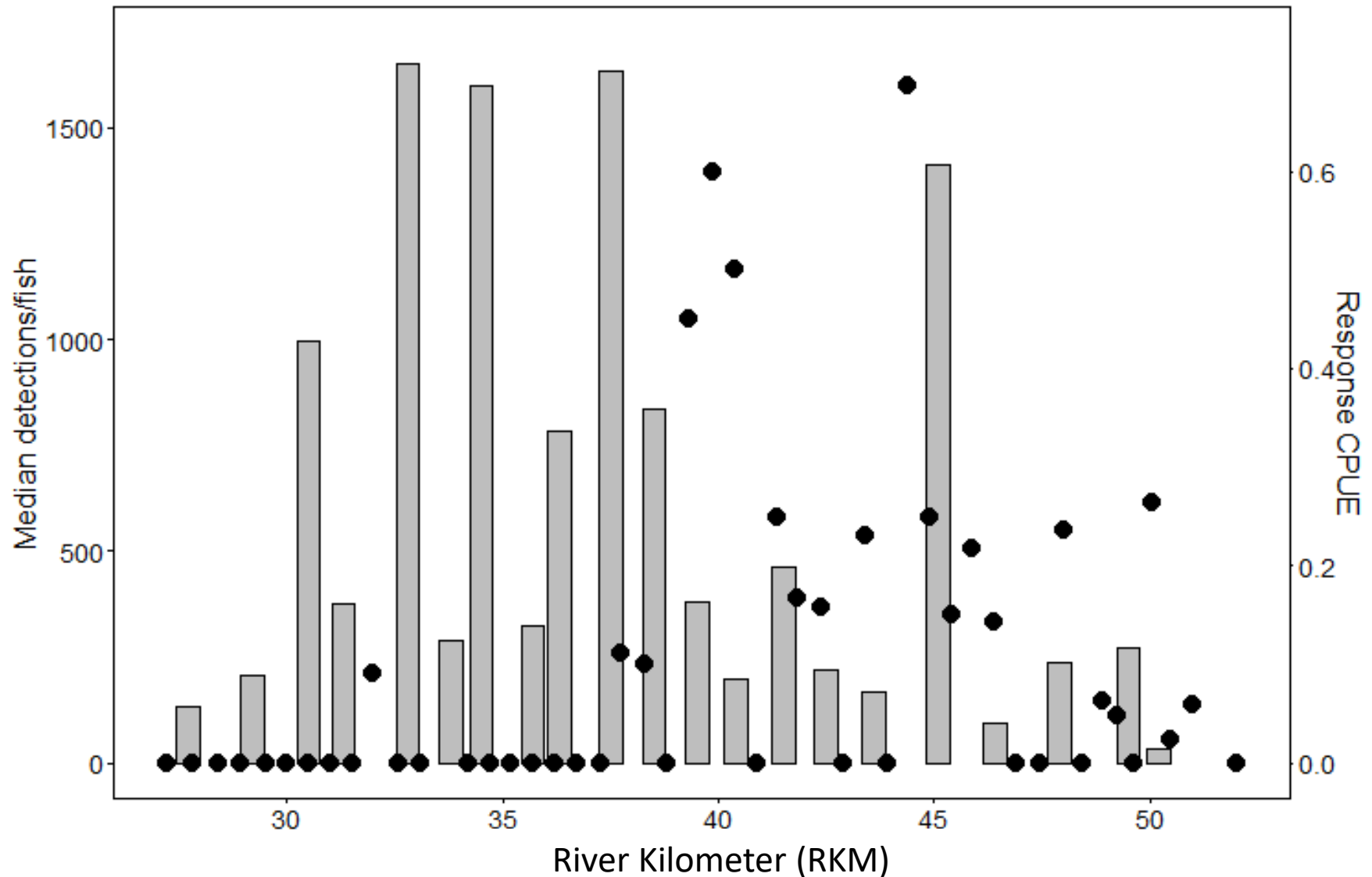
Grass Carp Home Range Centers



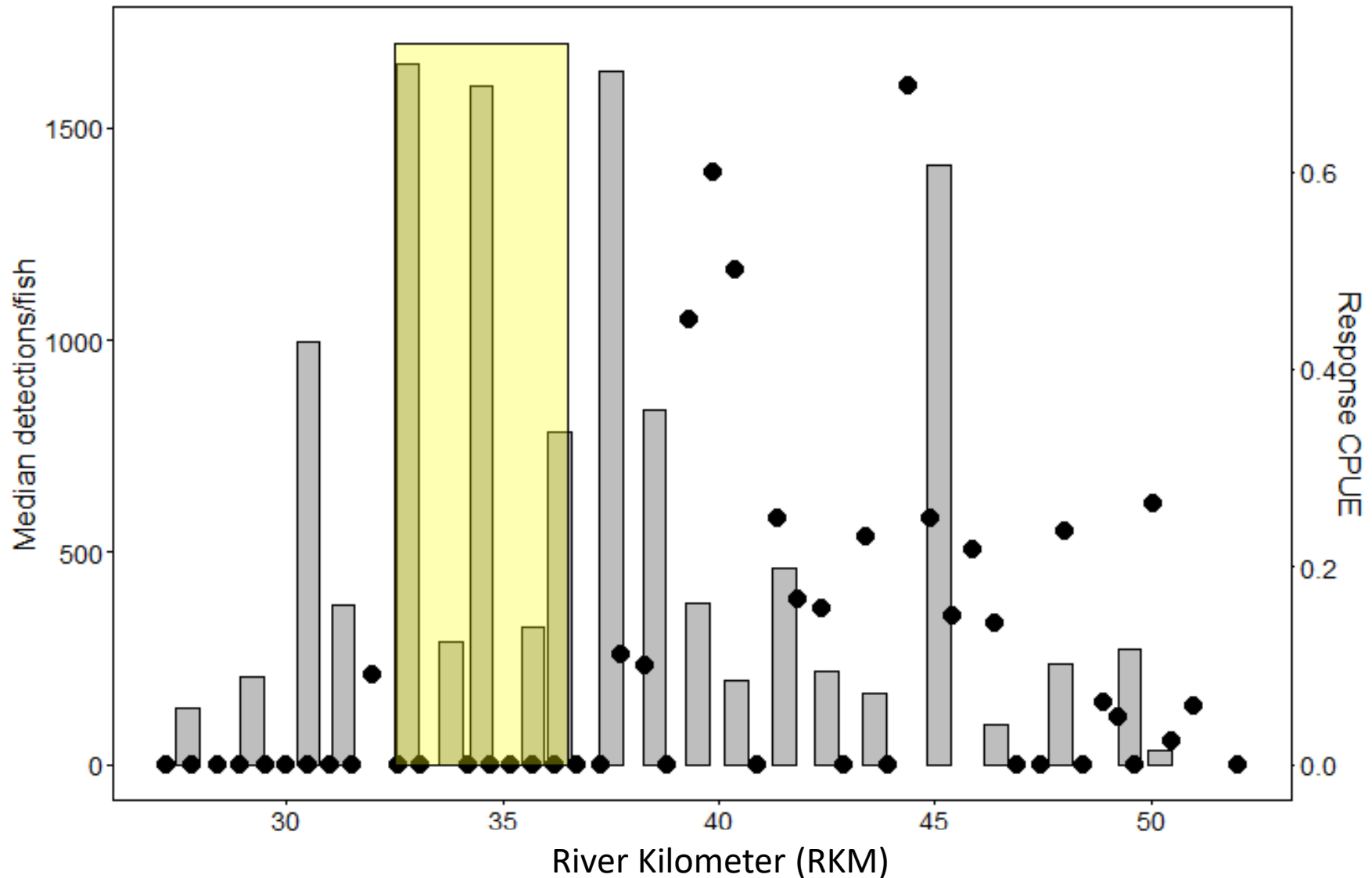
Grass Carp Home Range Centers



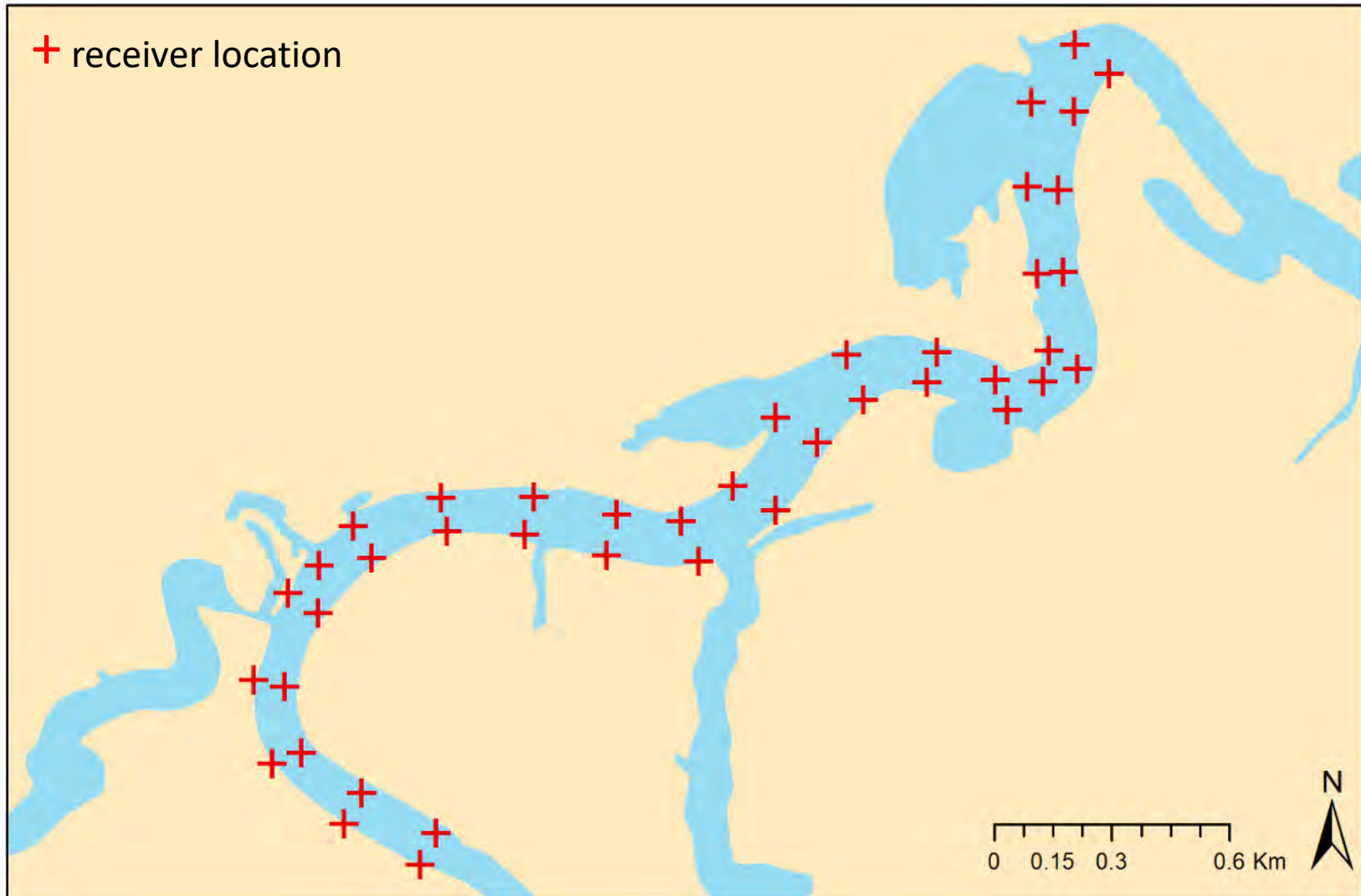
2019-2020 Summer Grass Carp Detections



2019-2020 Summer Grass Carp Detections



2-D Positioning Array in the Sandusky River in 2020



2-D Positioning Array in the Sandusky River in 2020



Number of Grass Carp Captures in Lake Erie by Agency Personnel

Main Take Home

- Telemetry research is being conducted to improve efforts to eradicate grass carp from Lake Erie
- Research was requested by Michigan DNR and continuing work has broad support of the Lake Erie Committee
- Regular updates are provided to management agencies to support response efforts to remove grass carp from the lake
- Future plans include increased receiver coverage in other Lake Erie tributaries to inform response efforts in those areas

Number of Fish

18

1



Acknowledgments

- Michigan State University – Cleyo Harris, Jason Fischer, Chris Vandergoot, Chuck Krueger
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- USGS – Richard Kraus, Jamie Roberts
- University of Toledo – Strike Team Members
- US Fish and Wildlife Service – Ryan Young, Strike Team Members
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