

St. Louis River estuary as possible Dreissena veliger source to western Lake Superior

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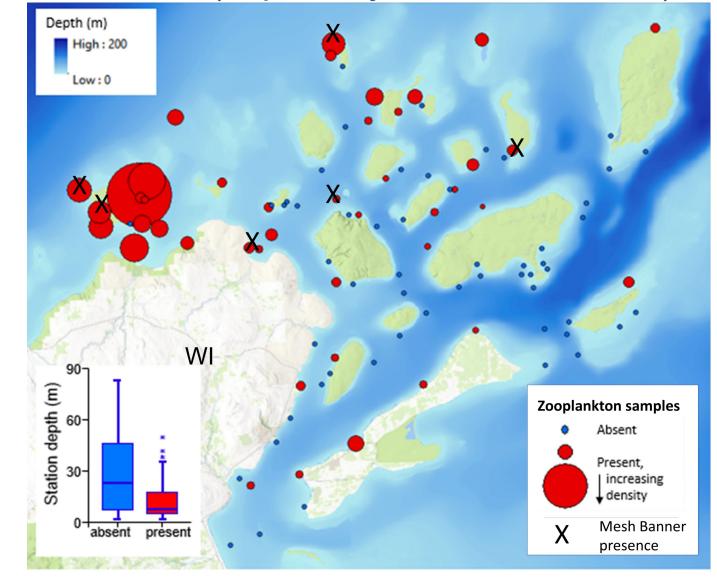
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Background

In 2017 EPA conducted early detection case study in western Lake Superior around the Apostle Islands (APIS) addressing concerns over adult Dreissena finds on shipwrecks & native mussels by Nat'l Park Service

Results:

- No settled juvenile or adult Dreissena on passive gears
- Dreissena veligers present in 44% of zooplankton samples albeit in low densities
- Finds primarily along NW side of islands (especially around Sand Is.)



Conclusions:

- Low veliger densities suggest adult Dreissenid populations are low and detected veligers may not have originated in APIS
- APIS detections point to possible transportation from longshore surface currents
- St. Louis River Estuary (SLRE) has largest and most established Dreissena population in Lake Superior
- Typical summer surface currents transport water from SLRE around APIS

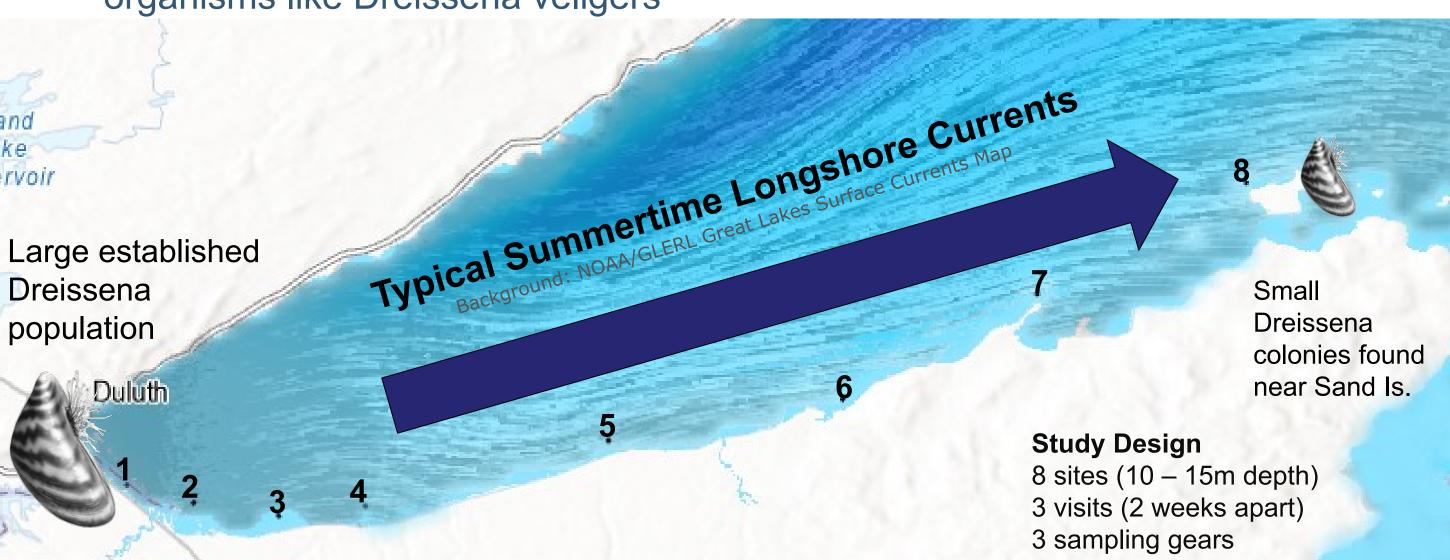


U.S. Environmental Protection Agency Office of Research and Development

Survey Overview, Design, & Methods (2019 W. Lake Superior south shore survey)

Objectives: Follow up 2017 survey by determining concentration gradient and detection of Dreissena veligers along south shore (SLRE to APIS)

- Evaluate if SLRE is a potential veliger source of APIS Dreissena and determine if a gradient of decreasing detection exists
- Evaluate modified methods for increased probability in detecting low abundance organisms like Dreissena veligers



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|---|--|---------------------------------|--|--|---|
| Week 1 (Aug. 12, 14) | | Week 3 (Aug 29) | | Week 5 (Sept 16, 17) | |
| deploy banners, collect zooplankton tows & eDNA | | collect zooplankton tows & eDNA | | retrieve banners, collect zooplankton tows & eDNA | |
| Gear | 2(2'x4') mesh banners (N = 16) | | Zooplankton tow 64µm mesh (N = 24) | | eDNA (N = 48) |
| Sampling modifications | 2, larger, more rigid banners. Sampled 1m below surface & 2m above bottom | | Composited 4 tows per sample. Saved decanted EtOH for DNA analysis | | Increased water volume sampled to 1L. Sampled 3m below surface & 2m above benthos |
| Processing & analysis | qPCR targeting Dreissena w/ Genus and species level | | Zoops: full enumeration Zoop EtOH: qPCR targeting Dreissena | | Filtered samples & qPCR targeting Dreissena using general and species- |

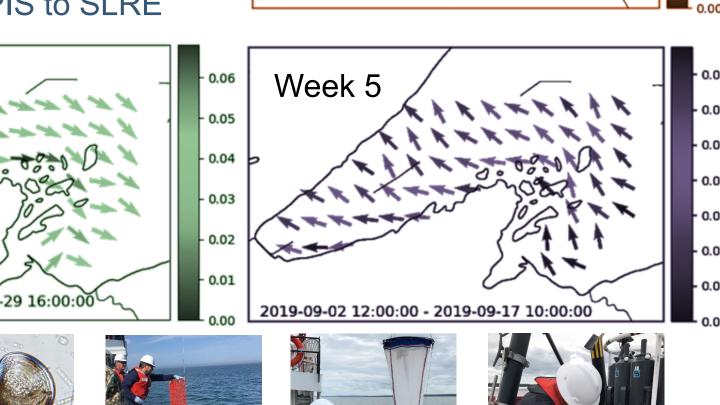
Surface current patterns leading up to each sampling week (time averaged velocity; 2wks prior to

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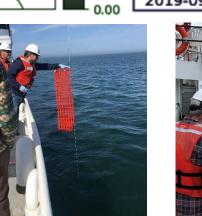
Environmental Conditions

Week 1 – SLRE to APIS Week 3 – SLRE to APIS

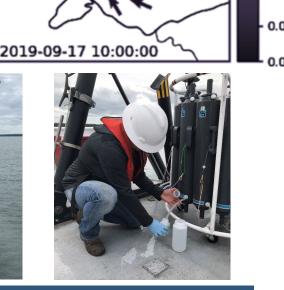
• Week 5 – APIS to SLRE











Findings (qPCR results)

Tow

PCR based DNA Concentration:

Detection of target DNA with qPCR (45 total cycles)

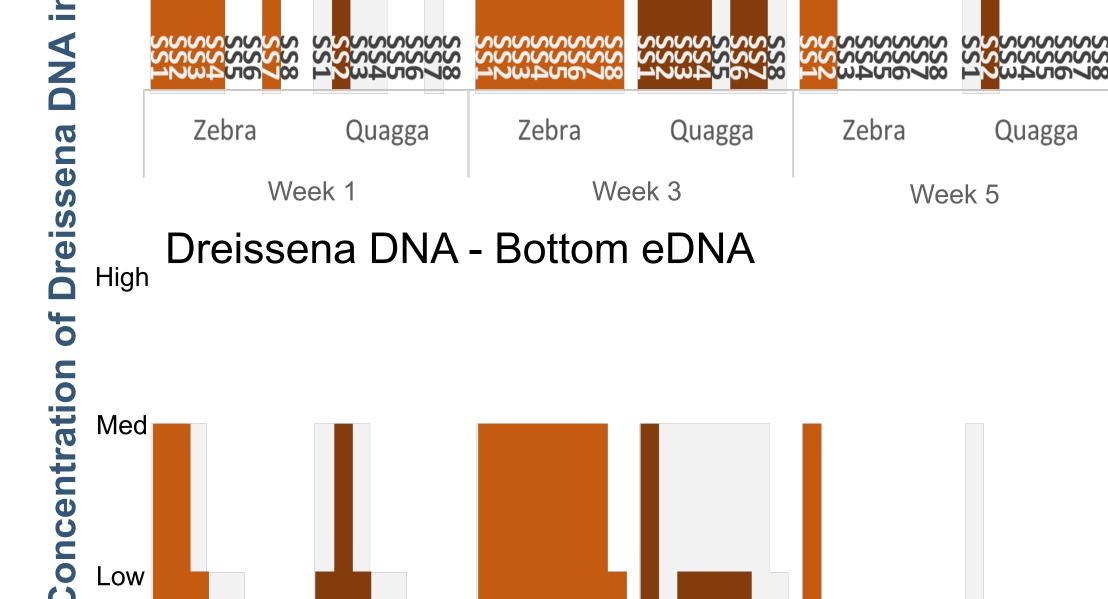
• Fewer PCR cycles to detect target = higher DNA concentration in sample

Dreissena DNA - Zooplankton EtOH Dreissena DNA - Surface eDNA Assessing EtOH preservative = minor Both species found; More zebra than quagga DNA; DNA conc. highest closest to SLRE; Surface eDNA stronger correlation to zoop. tow conc.; Gray bars conc. with Dreissena marker

Quagga

Week 5

Zebra Bottom

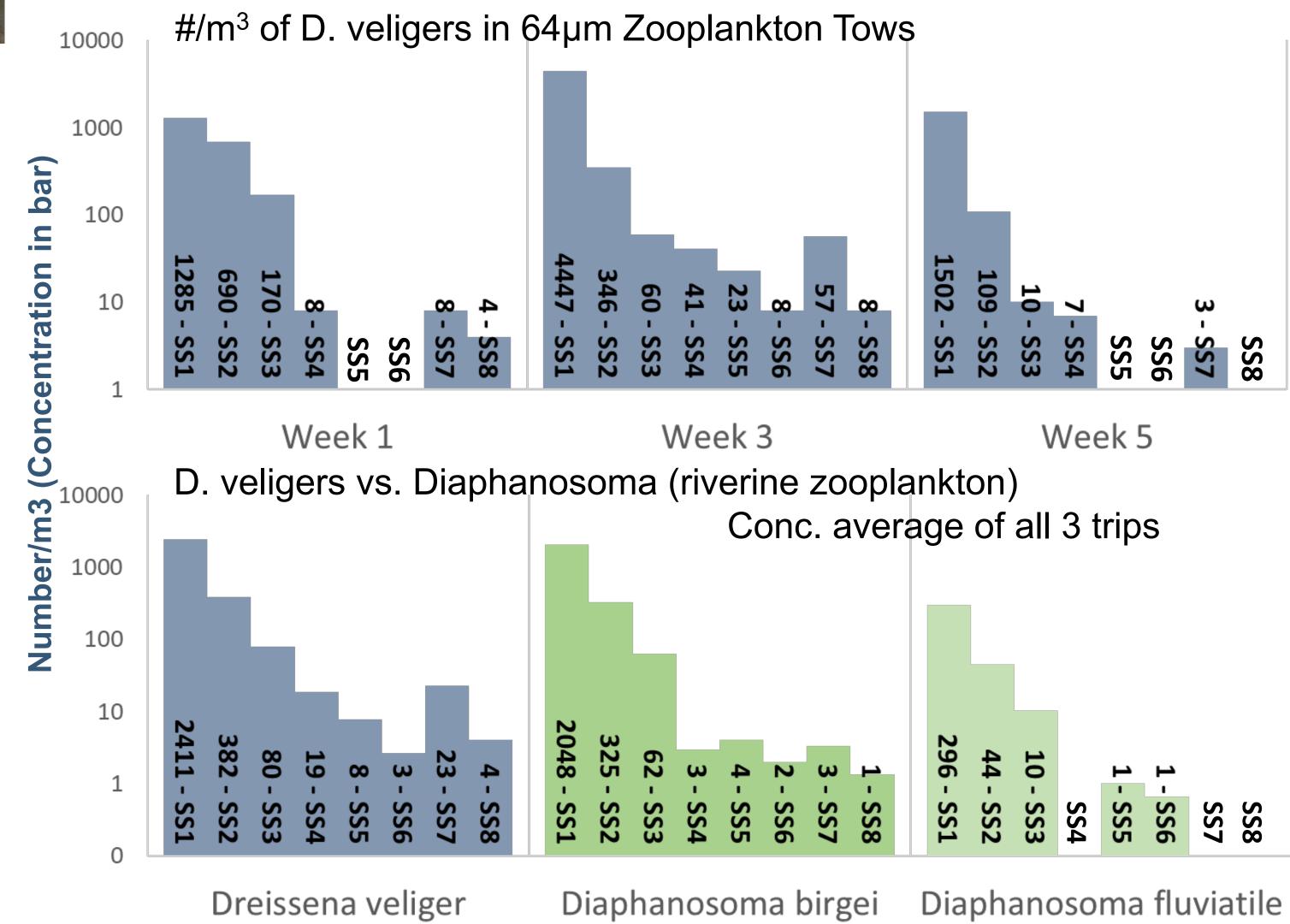


DNA concentration: High=DNA detected < 29 PCR cycles; Med=DNA detected 29-37 cycles; Low=DNA detected 38-40 cycles

inconsistencies w/ Zoop tows (i.e. wk1-SS6); Bottom mesh provided better detection SS8 SS7 SS6 SS5 SS3 SS3 Dreissena DNA Week 5 Week 3 Dreissena DNA - Mesh Banner Low

Findings (Zooplankton Tows)

Veliger concentration: decreasing concentration of veligers from SLRE to APIS; Pattern similar to non-open-lake SLRE species like D. birgei



Conclusions

- Consistent decrease in D. veliger concentration along south shore in zooplankton enumeration
- Diaphanosoma species (invasive to SLRE riverine) follow similar trends as D. veligers
- Zebra mussel eDNA found more consistently and in greater concentration w/ eDNA
- Surface eDNA more consistent with zoop, tows than bottom eDNA
- Environmental factors play large role in detection (wk5 currents & eDNA)

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Quagga Surface