Early Invasion Dynamics of New Zealand Mudsnails

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- Michigan Department of Environmental Quality
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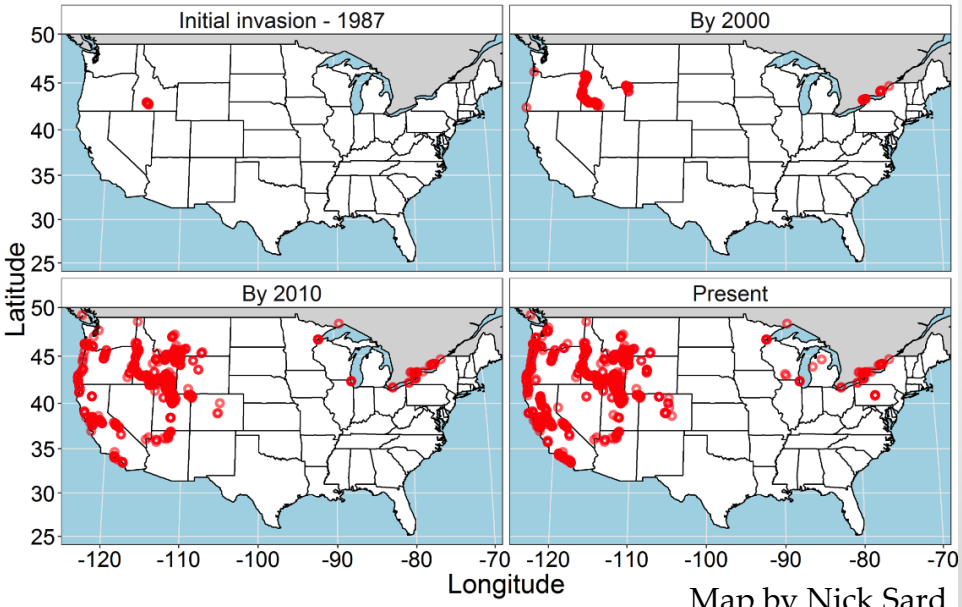
Invasion Background

- New Zealand mudsnails (NZMS) are native to New Zealand, yet world-wide invader
- Established populations are found in Australia, Asia, Europe & North America
- Came to America's west coast in the mid 1980s



Map by Nick Sard

NZMS Biology

- 2-6 mm in length
- Parthenogenic in many areas of invasion

Michigan Invasion

- First detected in the Michigan rivers in 2015
- Genetically distinct populations in MI (clones)
  - Clones present in Great Lakes differ from inland populations
  - Inland clone is the same as the one that is found in the western U.S.

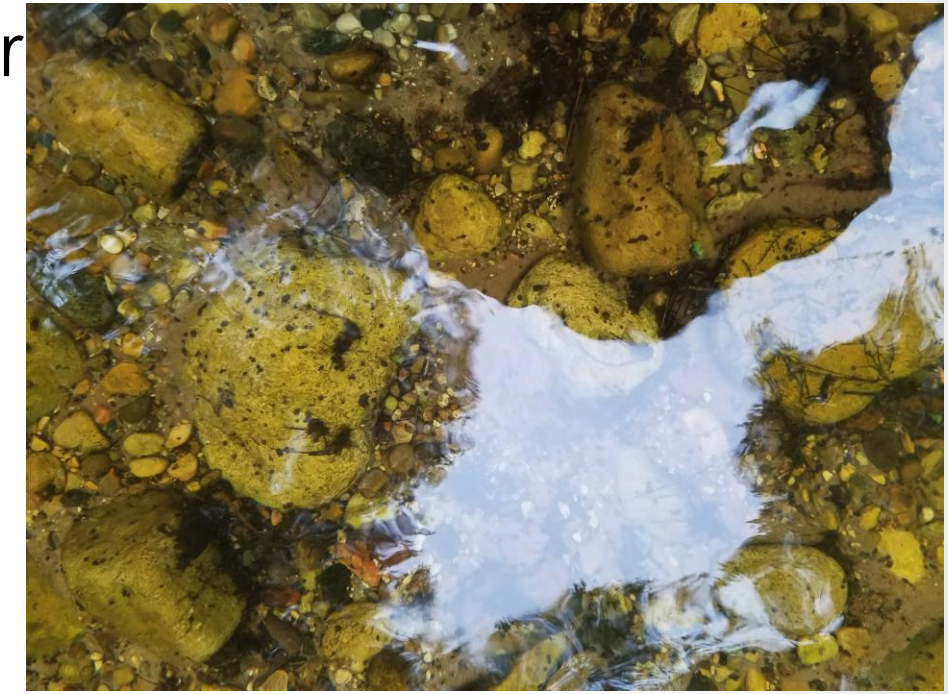
Amy Benson, USGS

Michigan Invasion

- Suspected to have traveled to Michigan's inland waters via stocking and angler vectors
  - Can survive weeks out of the water on a damp surface

Reason for Concern

- Densities of >200,000/square meter the western U.S.
- Outcompete native macroinvertebrates
- Survives digestion via trout

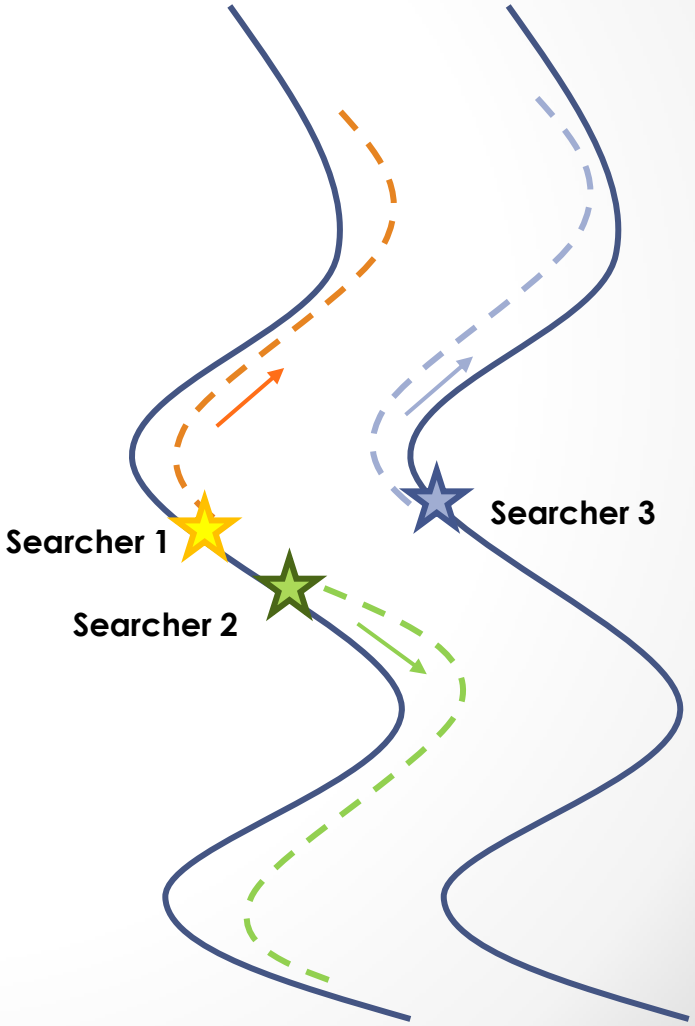


Objectives

- Qualitative survey methods
- The spatial extent of NZMS in Michigan rivers
- The spatial distribution of NZMS in the Pere Marquette River changed from 2015 to 2017
- Effectiveness of timed qualitative surveys at detecting NZMS

Survey Methods

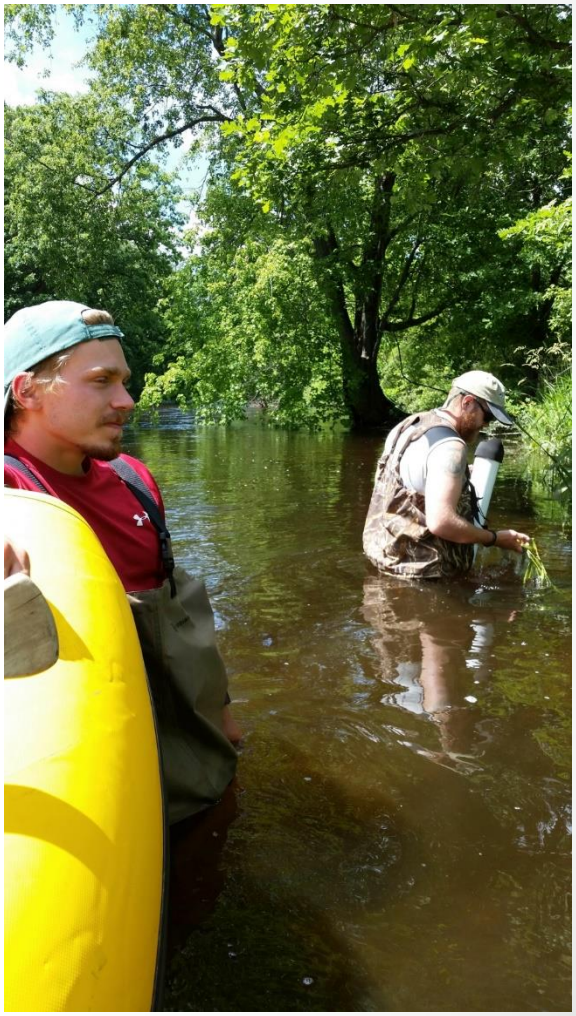
- Two to four searchers at each site
- Each did an independent 20 minute timed search
- Each searcher covered ≤ 50 meters
- Focused on near shore areas
- Collected a representative sample of NZMS and native snails found



Survey Methods

- Surveys used range finder, Aqua-view tube, raft, visual survey

- Focused our efforts along shorelines, in vegetation and on woody debris



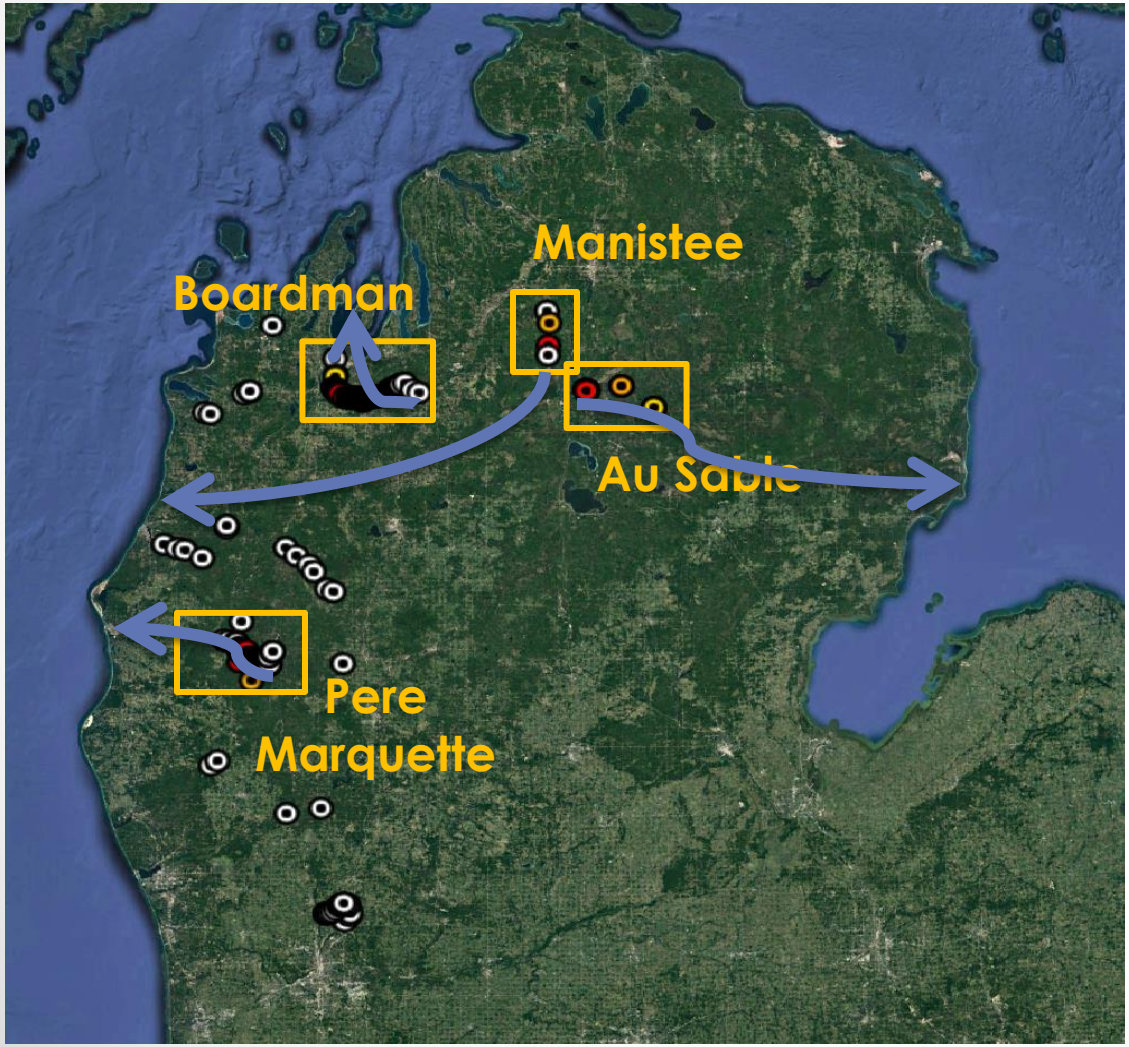
ID Characteristics

Survey Analysis

- Data recorded at qualitative level of abundance (none, low, medium, high)

- Analysis grouped into detect / non-detect to run occupancy analysis

2015-17 Combined Distribution



- Surveyed 14 rivers
  - Detected in 4
- All cold water, trout streams

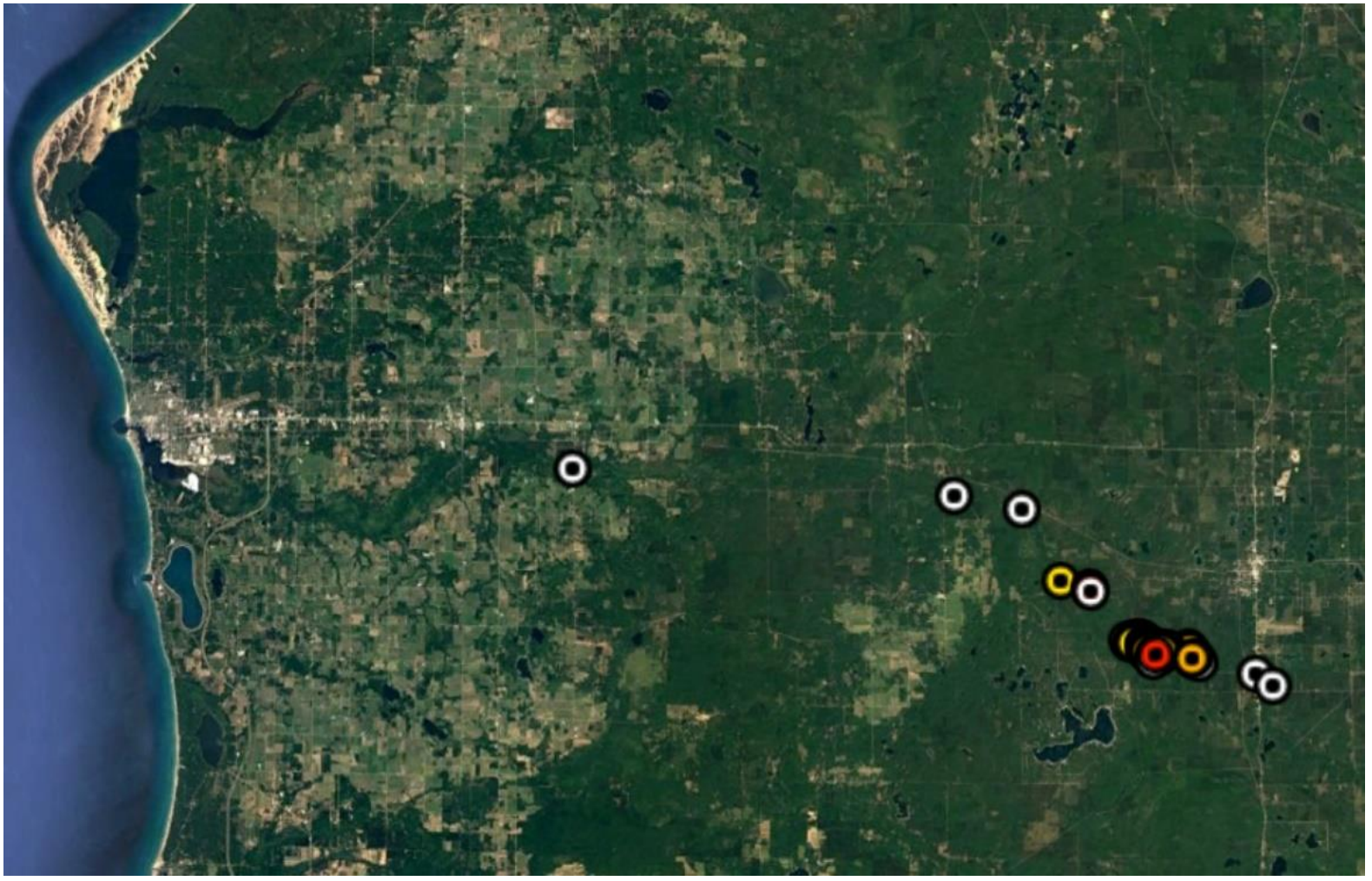
= Not detected

= Low abundance (1-10)

= Medium abundance (11-100)

= High abundance (>100)

Pere Marquette 2015



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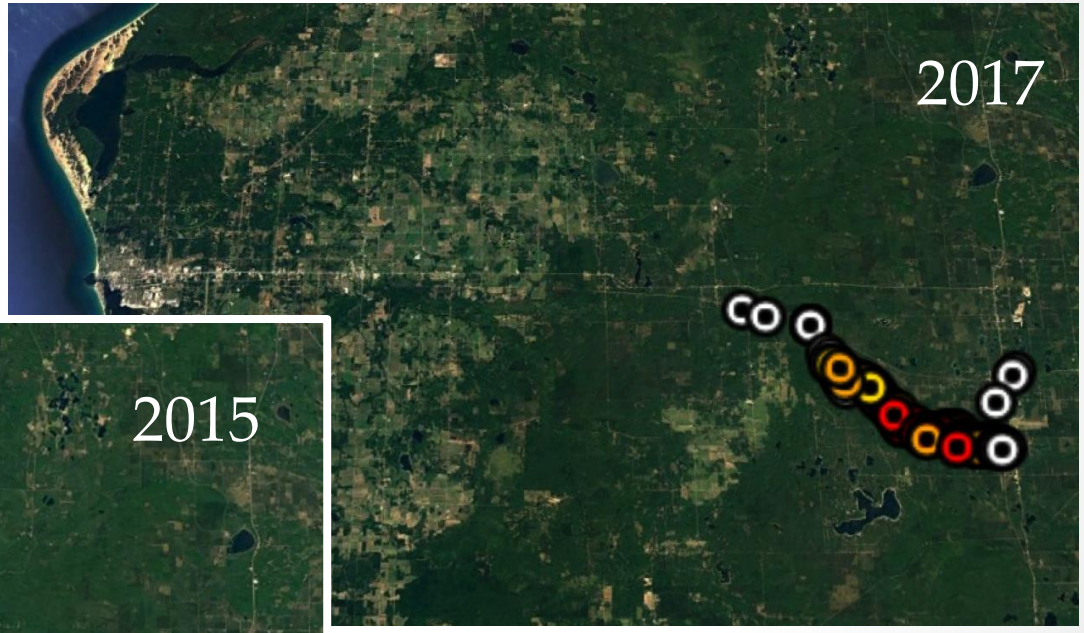
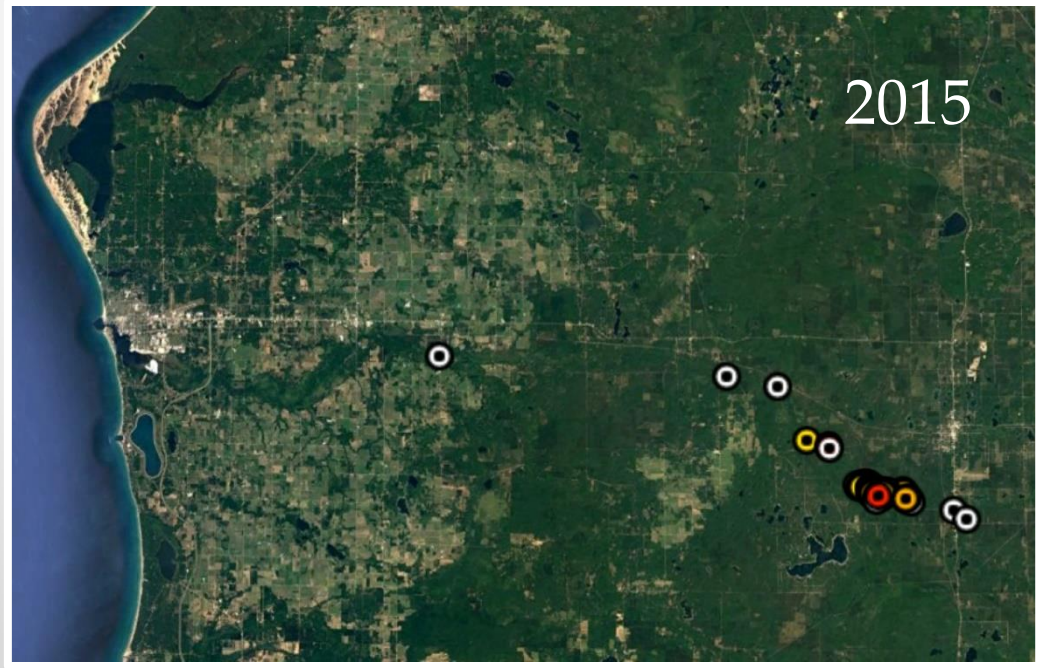
Pere Marquette 2015/17 Distribution Changes





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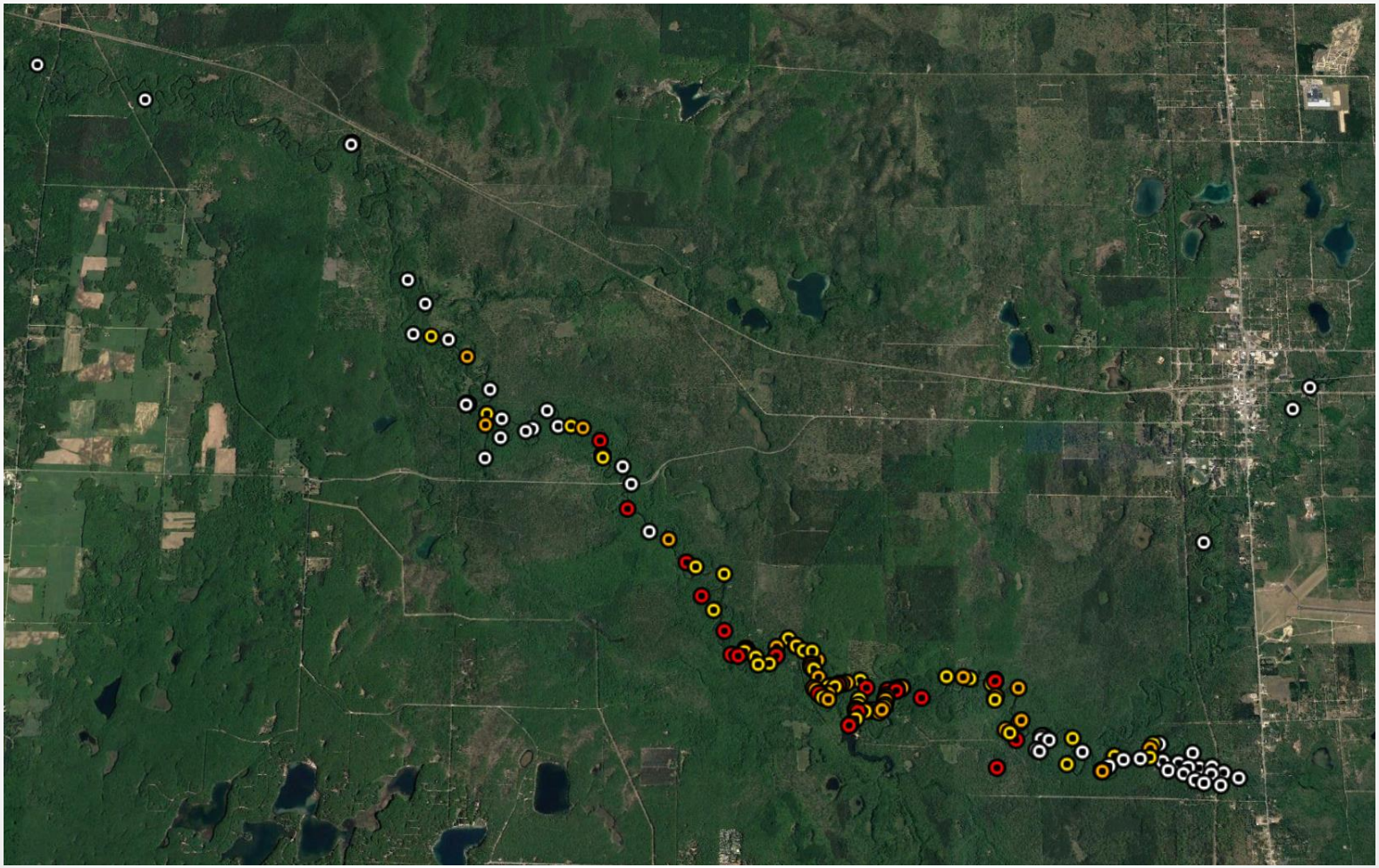
2017 Pere Marquette Distribution



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2016 Boardman Distribution

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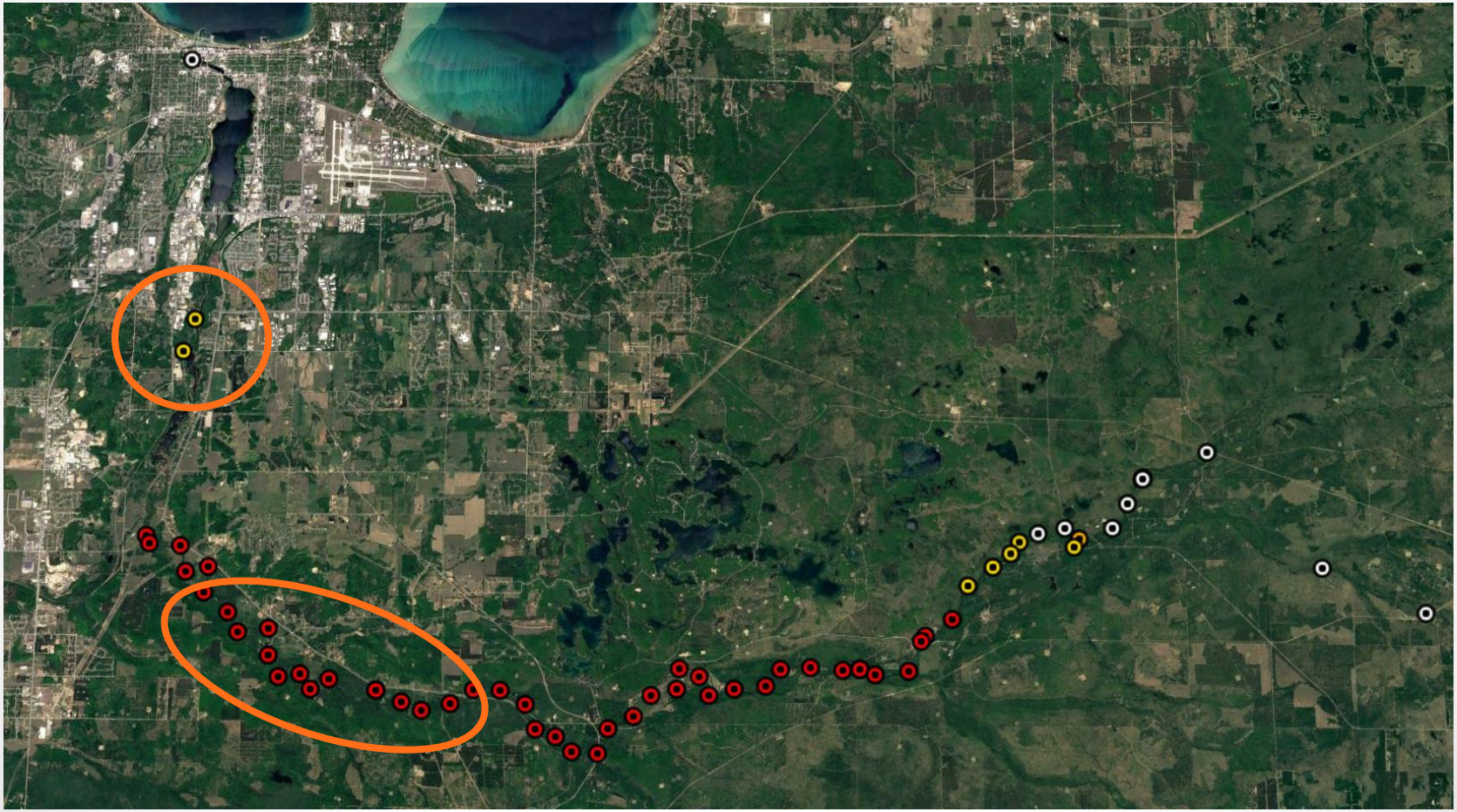
2017 Boardman Distribution



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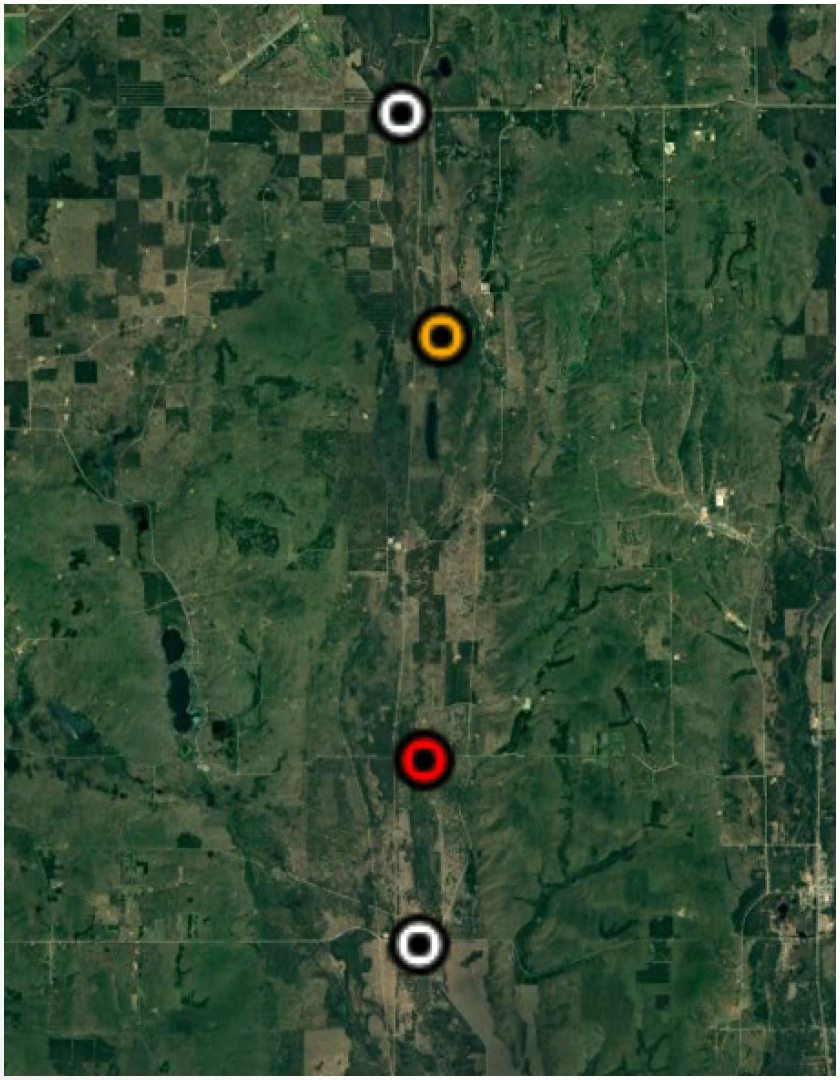
2017 Manistee Distribution



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Survey Effectiveness

	Searcher 2 Detect	Searcher 2 Non-detect
Searcher 1 Detect	**91**	**16**
Searcher 1 Non-detect	**19**	**101**

227 total independent surveys

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Detectability per searcher = 0.84

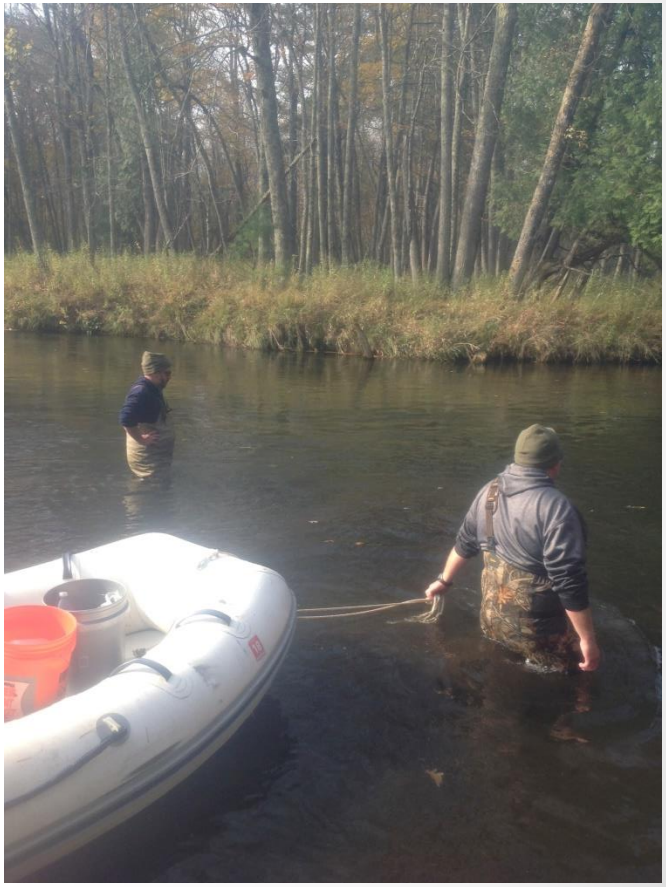
Detectability for 2 independent searchers = 0.975

Conclusions

- NZMS present in 4 of the rivers surveyed in Michigan
- Spread in Pere Marquette from 2015 to 2017 appears minimal
- Distribution pattern varies between river
- Qualitative sampling methods highly effective at detecting NZMS

Moving forward

- Continue with early detection surveys at sites likely of infestation
- Evaluate eDNA as another detection method



Questions?