

Identifying lake trout recruitment in southern Lake Michigan

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Lake trout in L. Michigan

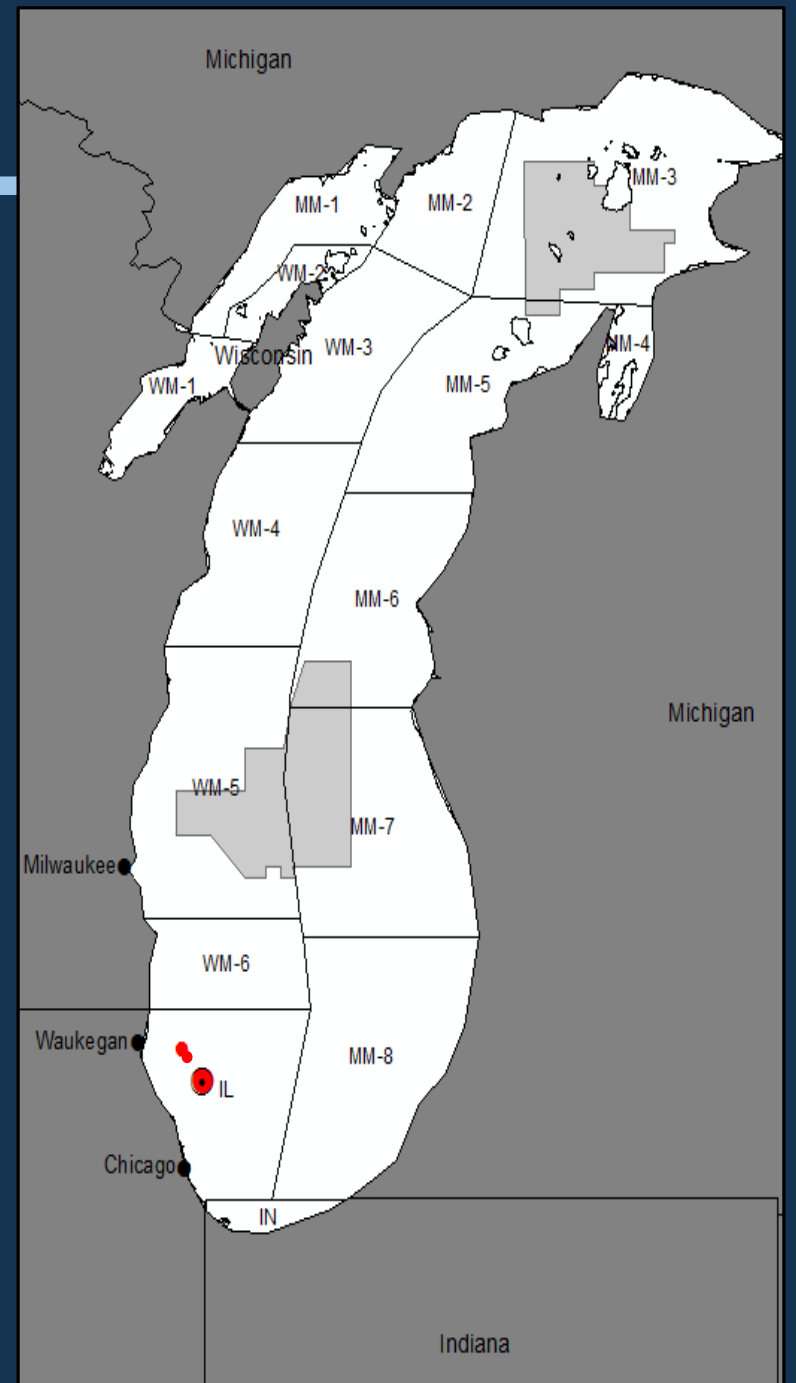


- Extirpated by 1950s
- Lamprey control & stocking in 1960s
- High mortality, low recruitment
- 1985, prioritization of deep water stocking sites
 - Midlake Refuge
 - Julian's Reef

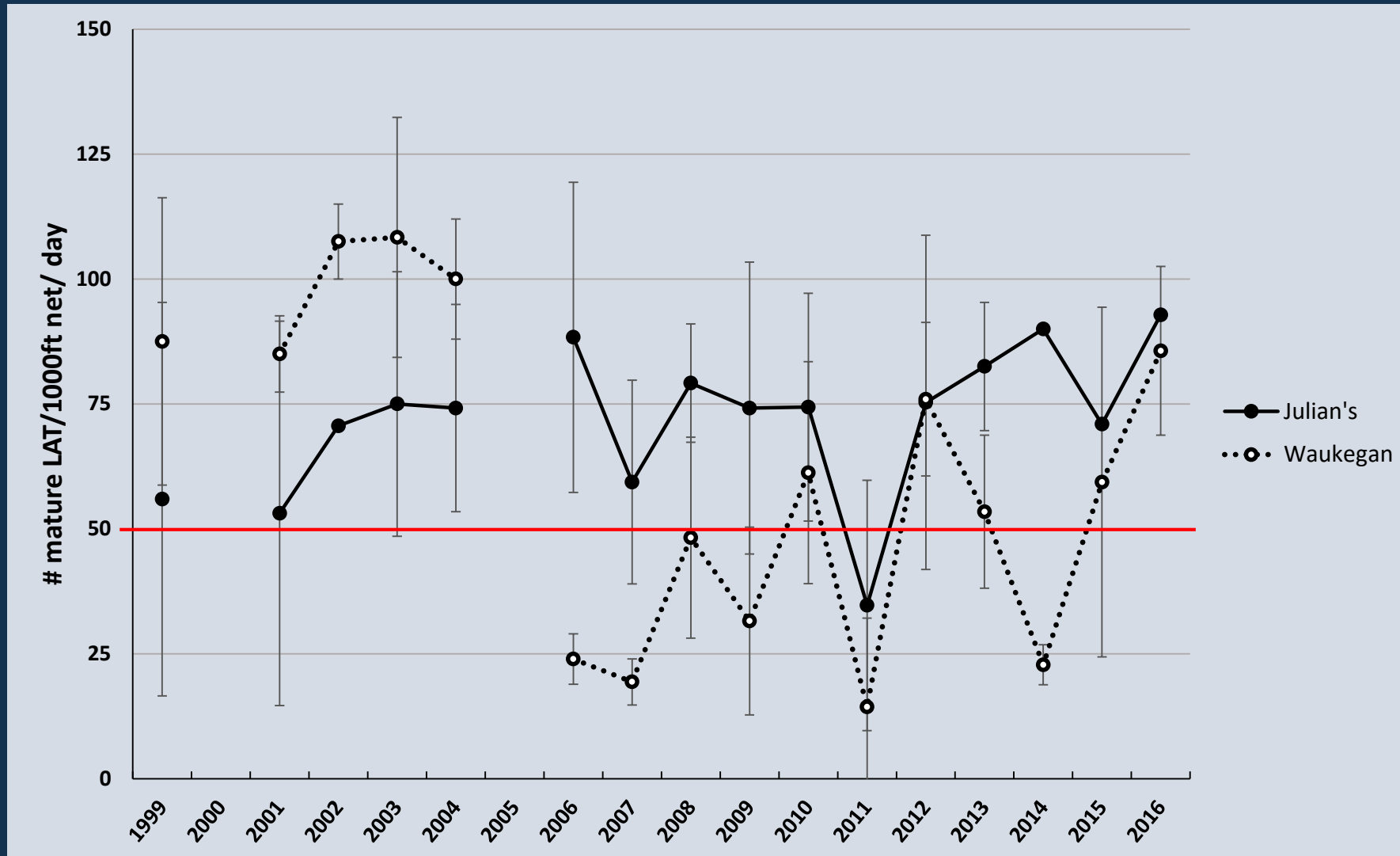


Julian's Reef

- Historical lake trout spawning reef
- Close proximity to Waukegan Reef Complex
- IL DNR annual fall assessments

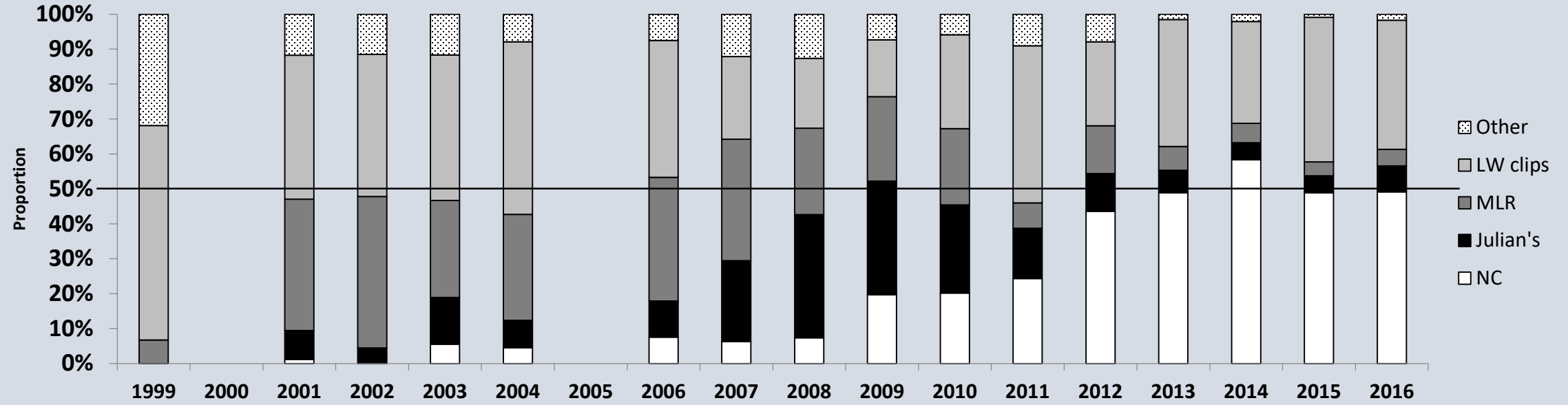


Progress toward rehabilitation

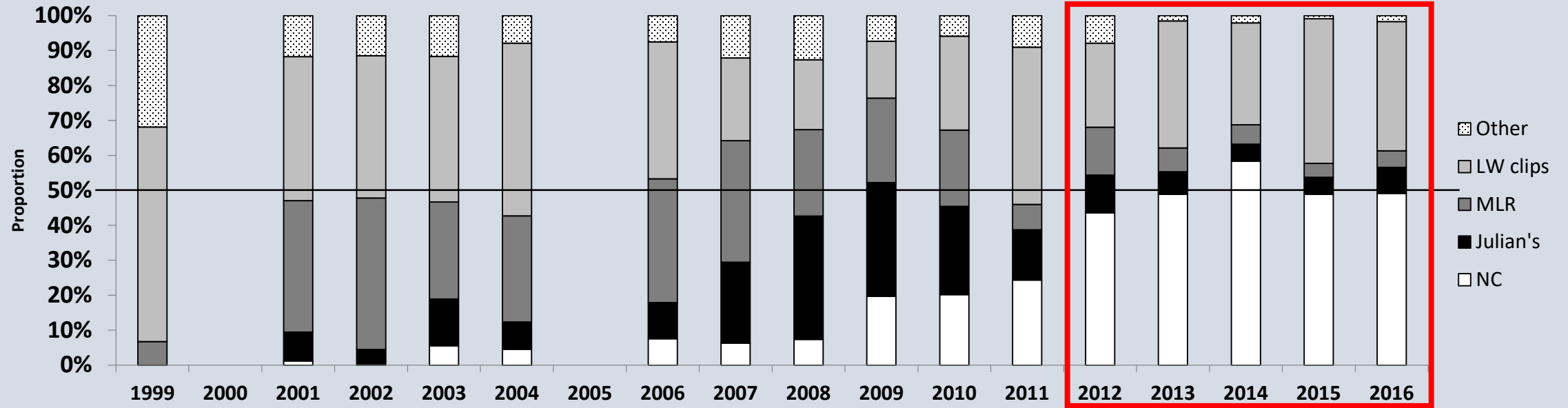


Patterson et al. 2016, Progress toward lake trout rehabilitation at a stocked and unstocked reef in southern Lake Michigan. NAJFM.

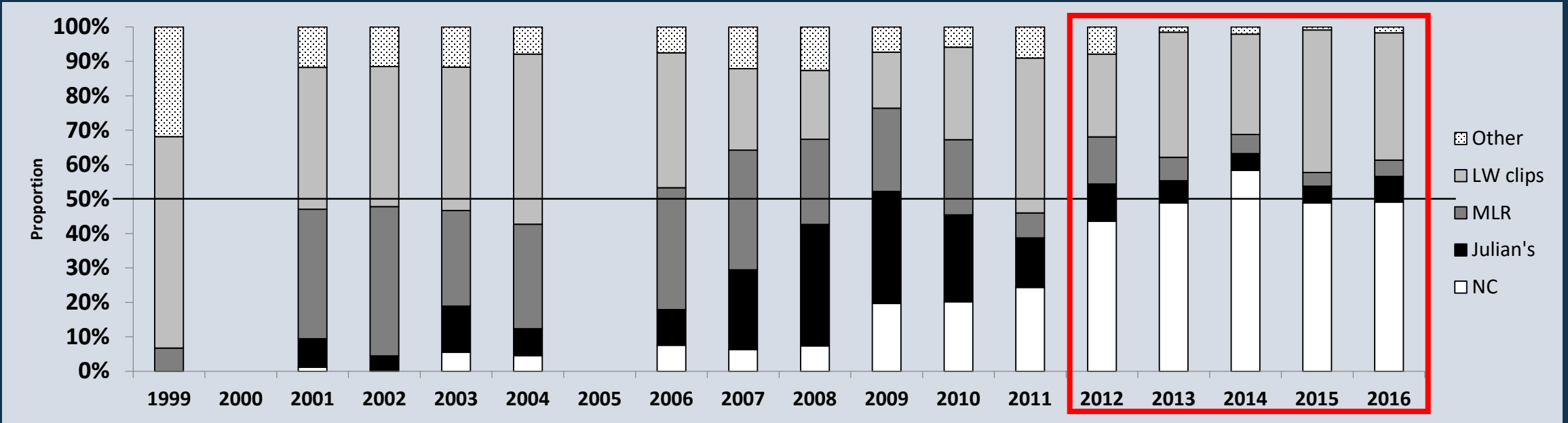
Julian's Reef



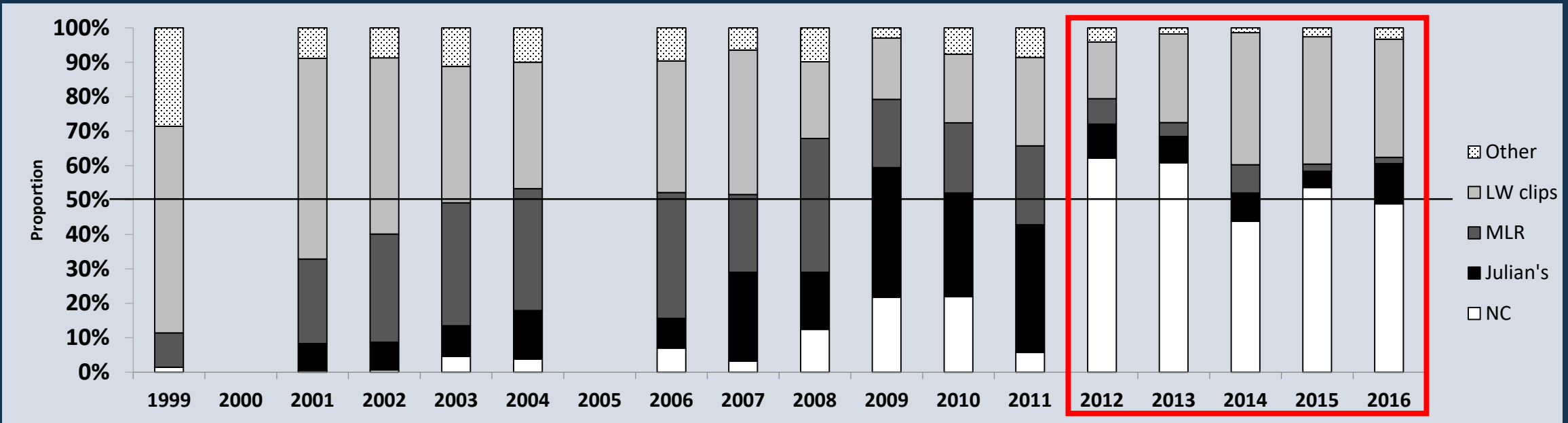
Julian's Reef



Julian's Reef



Waukegan Reef



Evidence of recruitment at Julian's Reef?



- Objectives:
 1. Identify spawning success (viable eggs)



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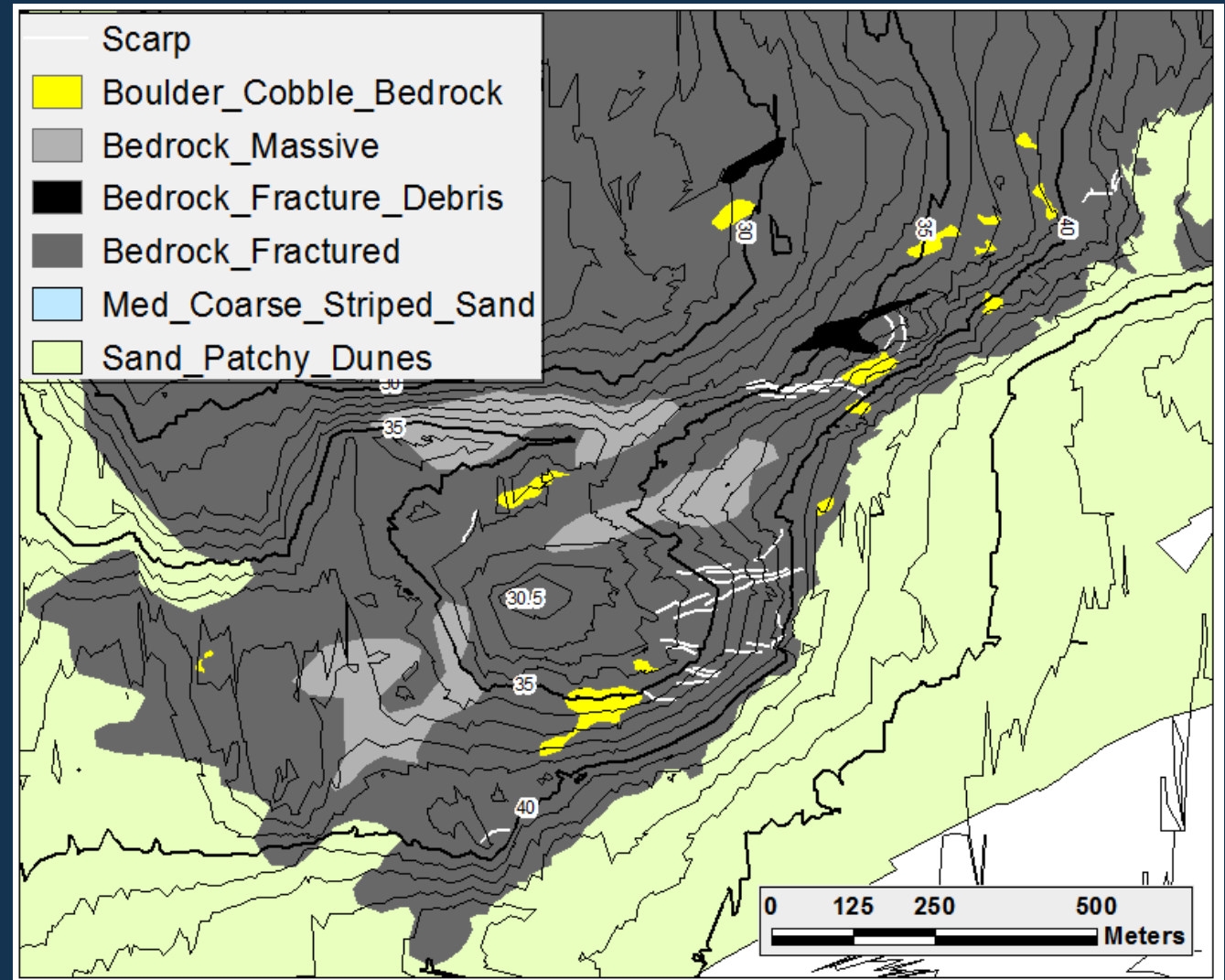
3. Characterize habitat features where recruitment is successful



Availability of suitable habitat



- Fractured bedrock reef
- ~45m deep, crests at 30m and 25m
- 2.6 km²

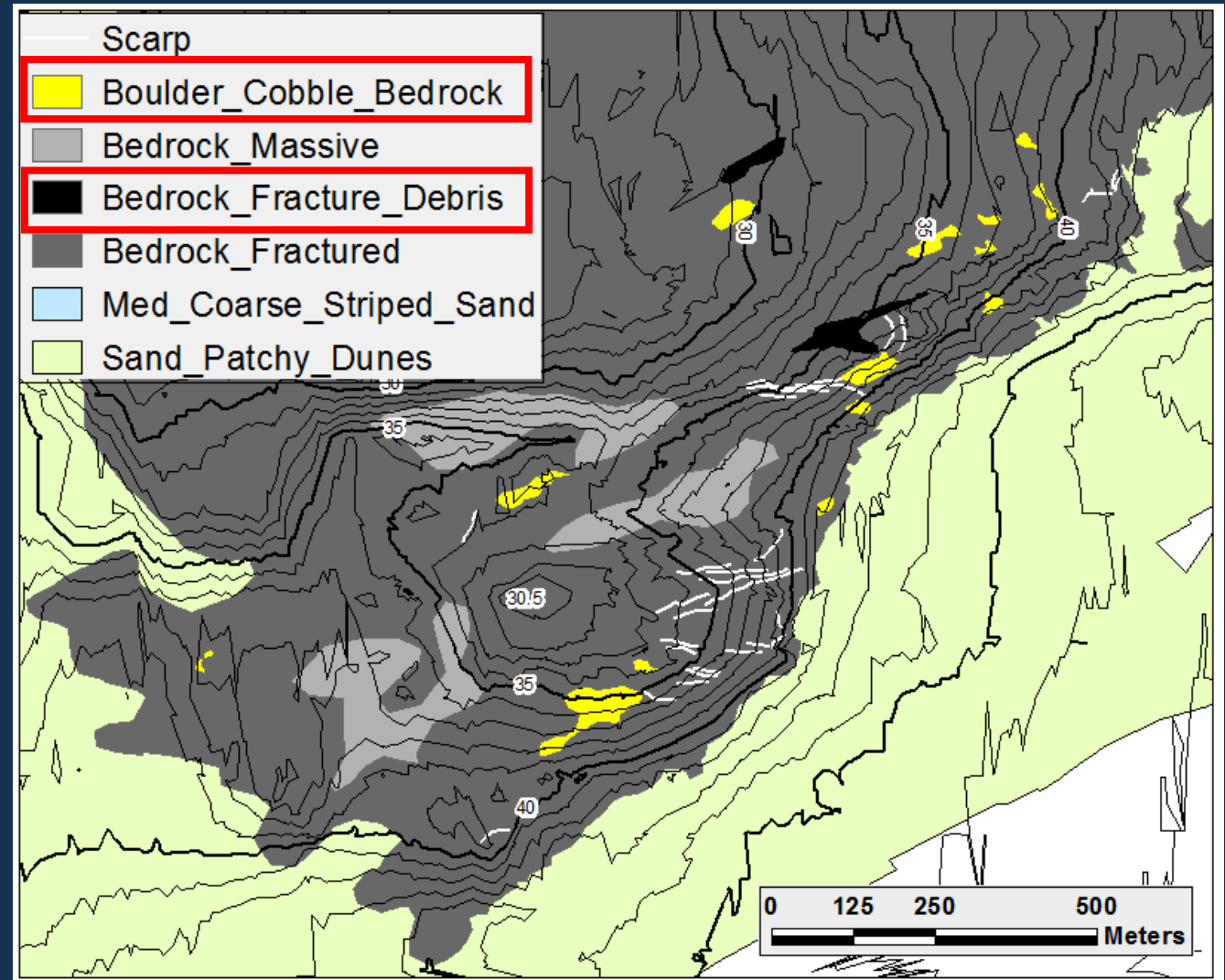


Redman et al. 2017

Availability of suitable habitat

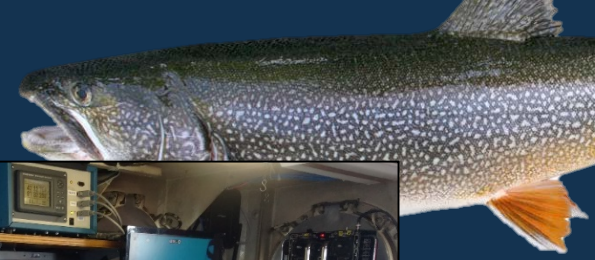


- Putative spawning substrate
 - Boulder cobble
 - Fractured debris
 - Total = < 1%
- Priority spawning habitat
 - Slope 15-60° < 0.5%



Methods:

Identifying recruitment

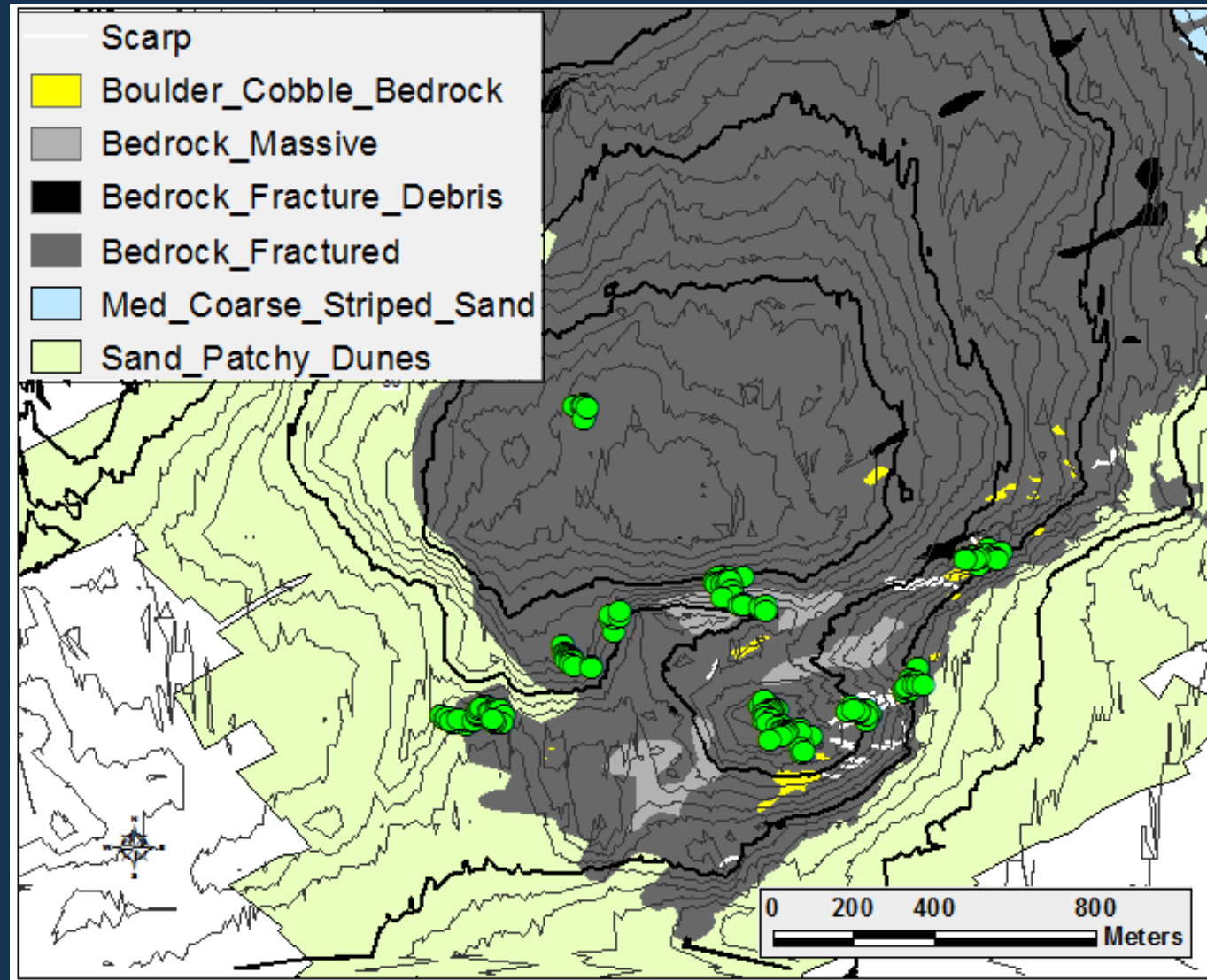


- Remotely operated vehicle (ROV)
- E-shocker w/ suction
 - Collect LAT fry & predators
- Microscale habitat ID



Methods:

Identifying recruitment



Findings: Dreissenid cover



1990



Edsall et al., 1996



Edsall & Kennedy. 1993

Findings: Dreissenid cover



1990



Edsall et al., 1996



Edsall & Kennedy, 1993

2016



ROG



Findings:

Round goby and sculpin



- Densities up to 25/m²
- 65 gobies, 11 slimy sculpin collected
- No fry predation observed



Findings:
Lake trout fry



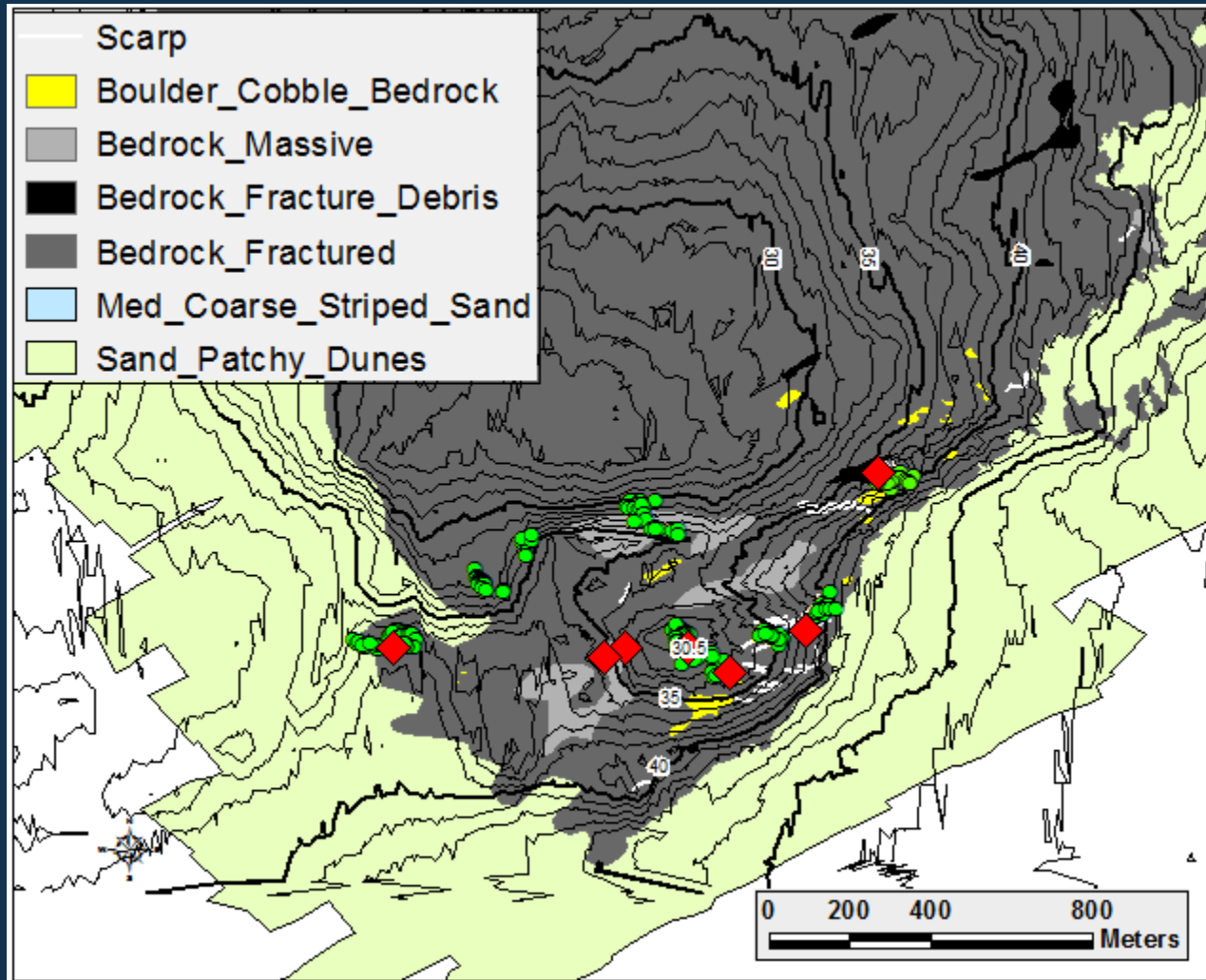
lake trout fry



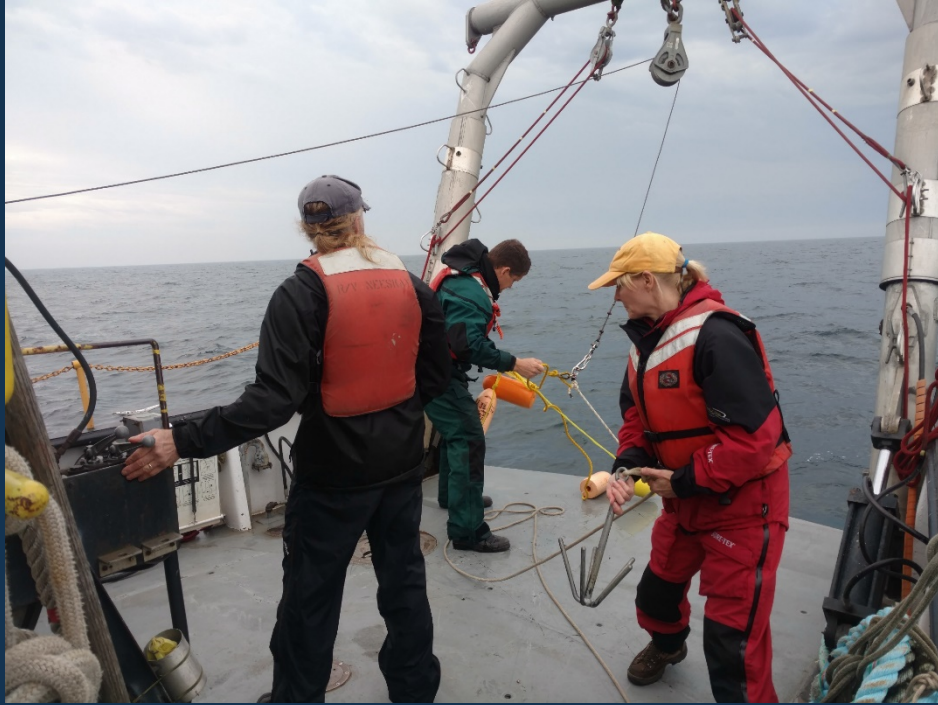
Findings:
Lake trout fry



Methods: Spawning success



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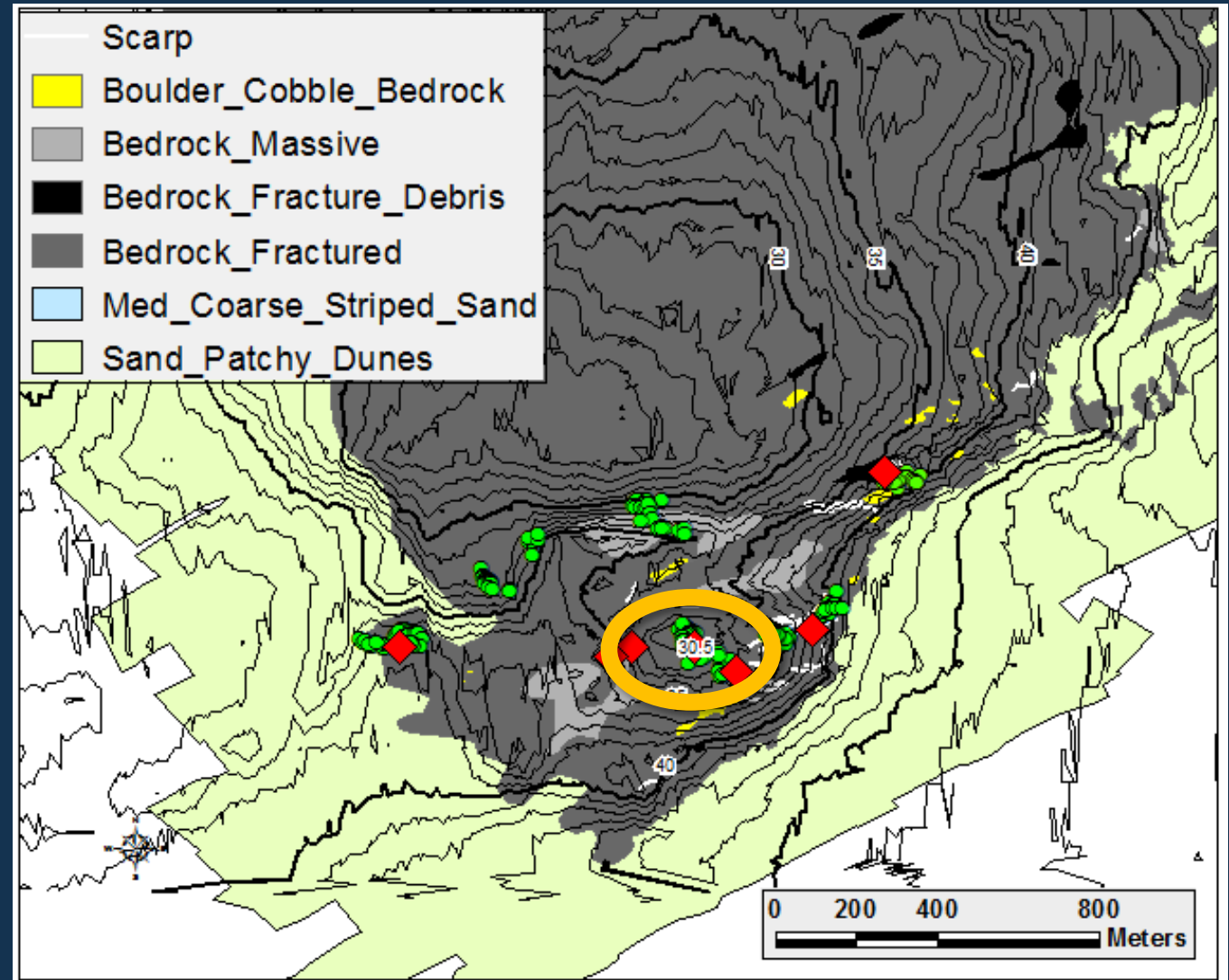


Findings: Spawning success



Egg traps

- 3 gangs yielded evidence of spawning
 - 2 chorion
 - 2/3 sculpin w/ eggs

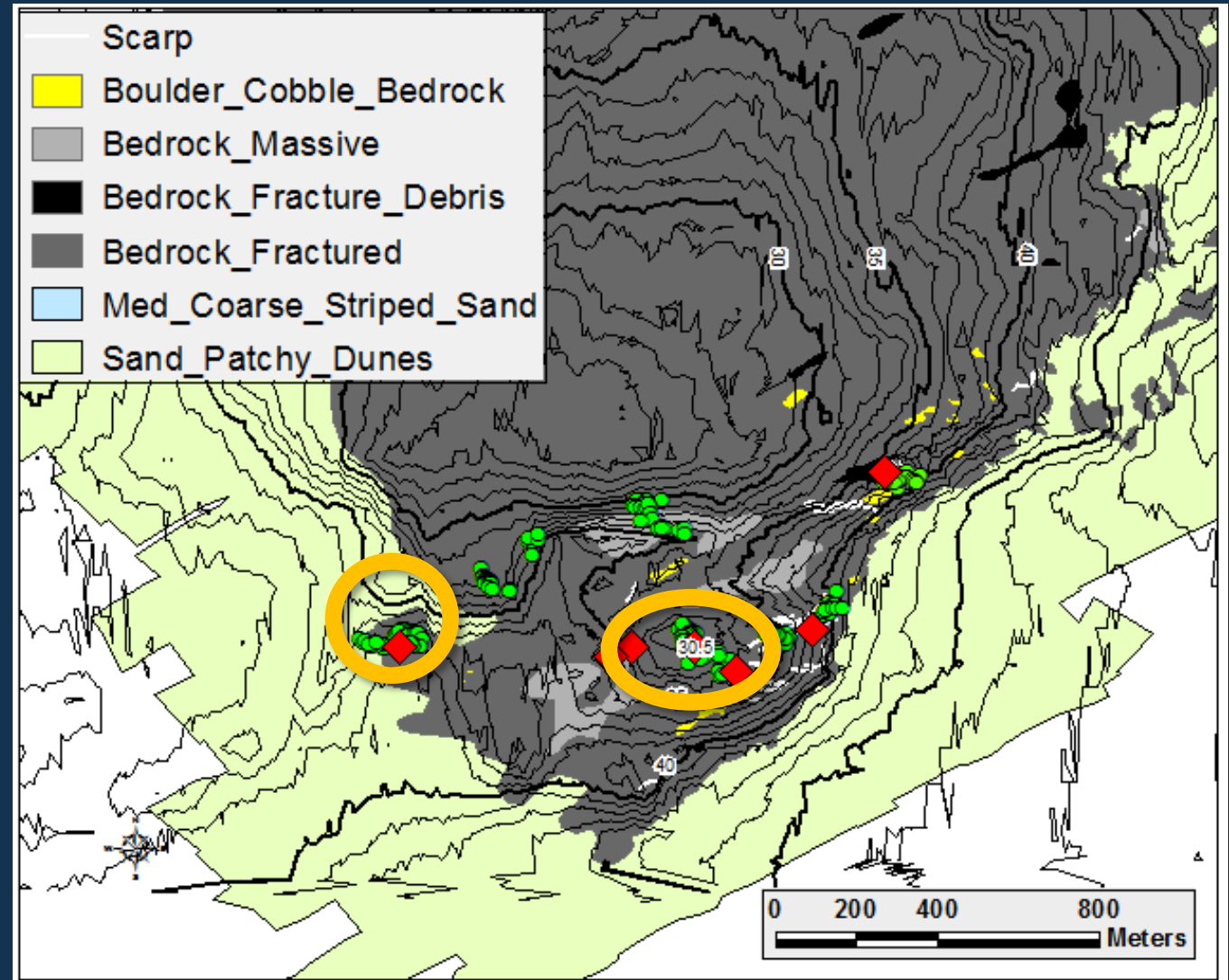


Findings: Spawning success



Egg traps

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Findings: Spawning success



Adult LAT
clip

03NOV16 037.7 145930
T 5.92

164

R00

Findings:
Spawning success



LAW
school

03NOV16 038.0 144753
T 5.99

171

R00

03NOV16 035.8 190107
T 5.71

LAW
Single

123

R00

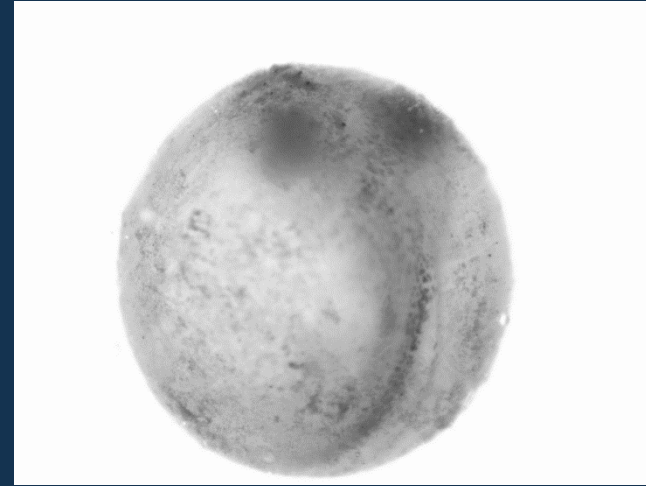


Findings: Spawning success



ROV sampling - suction

- 2 transects
 - 37 eggs collected
 - 8 raised to eyed stage

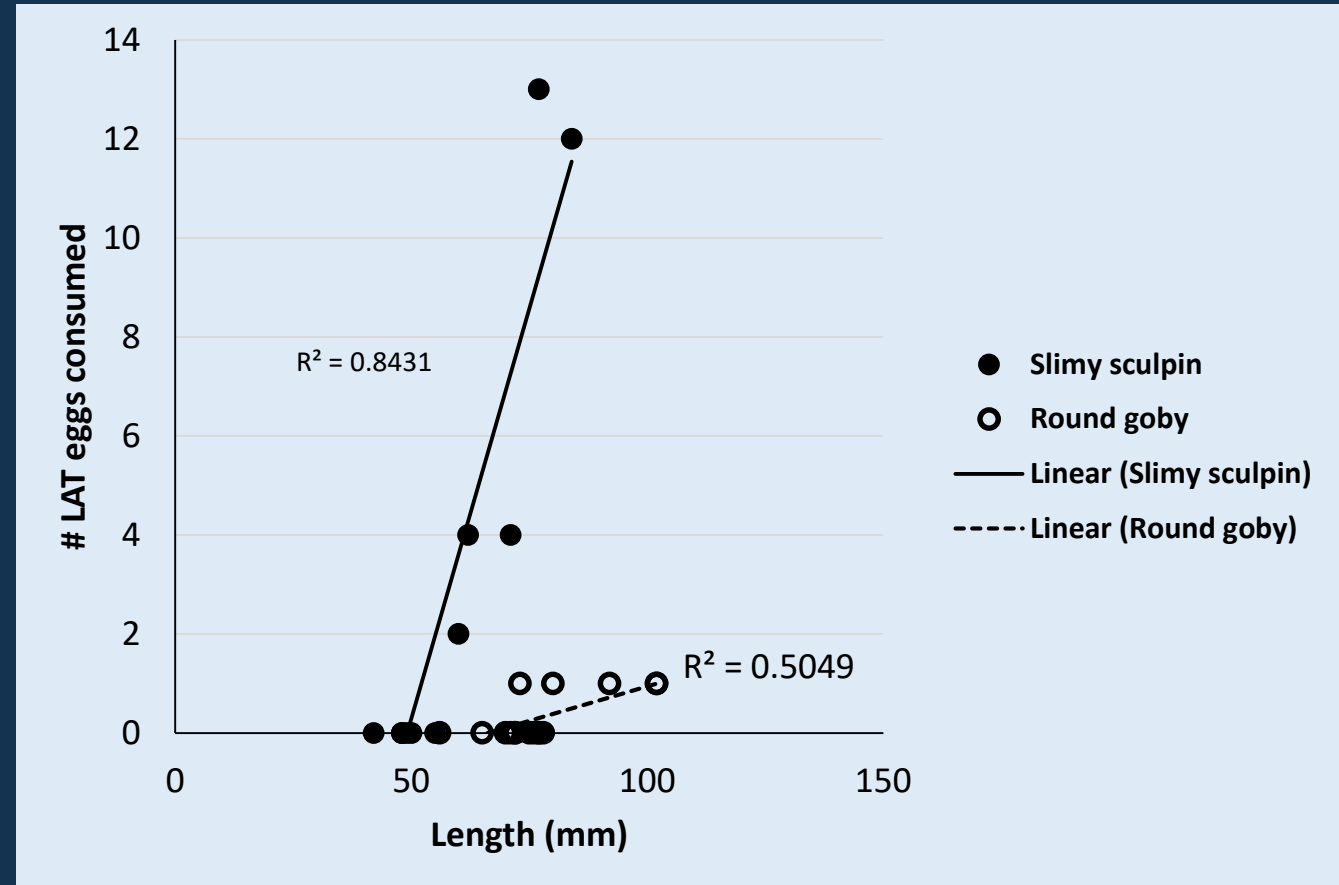


Findings: Spawning success



ROV sampling - shocking

- 2 roving shock transects
 - 14 round goby
 - 10 slimy sculpin



Findings: Spawning success



ROV sampling - shocking

- 2 shock transects
 - 14 round goby
 - 10 slimy sculpin
- Egg predation by whitefish & burbot confirmed from gillnets



Summary



Obj. 1: Spawning success

- Viable eggs collected
- Potentially high density of eggs considering limited suction time and observed predation

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Obj. 2: Recruitment

- Fry collected and observed

Obj. 3: Characterizing habitat features

- Locations of adult trout, egg deposition, and fry recruitment are in agreement

Discussion:

Spawning site



- Rubble and cobble on the reef is considered quality spawning substrate, but:
 - Dreissenids altered substrate
 - May impede settlement into interstices
 - Zebra mussels previously damaged eggs
 - Pseudofeces and syphoning by dreissenids may alter water quality within interstices

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- Bleached shell deposits may be novel spawning substrate?
 - Damage to eggs, and ability for eggs to penetrate shells unknown
 - Massive egg loss if winter weather disturbs shell windrows
 - Accessible to egg predators
 - Mussel deposits, if successful habitat for recruitment, could increase availability of spawning habitat on reefs

Discussion:

Predation



- High egg predator burden
 - Densities of gobies can impact toll as epibenthic egg predator
 - Sculpin present and effective interstitial egg predator
 - Lake whitefish observed foraging on eggs
 - Effective epibenthic predator, but also observed rooting into mussel bed

Discussion: Predation



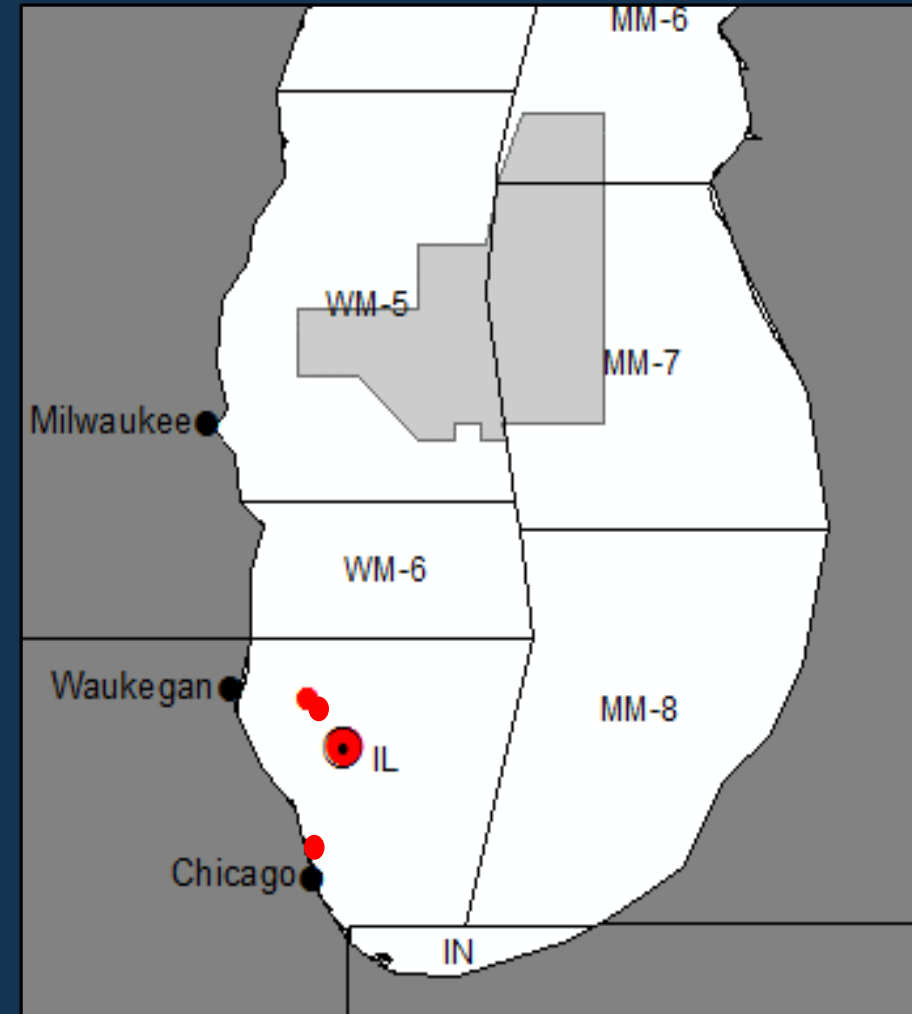
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 - Sculpin present and effective interstitial egg predator
 - Lake whitefish observed foraging on eggs
 - Effective epibenthic predator, but also observed rooting into mussel bed
- Ecological importance of lake trout spawning?
 - Pre-winter forage base for sculpin, whitefish, and other native species
 - Seasonal movements of whitefish for foraging opportunity?

Discussion:

Multiple reef complexes



- Successful spawning and recruitment to fry stage confirmed, but:
 - Similar abundances (CPE) and composition of spawners
 - Recent mapping of Waukegan South identified spawning habitats
 - Spent lake trout captured at Morgan Shoal
 - Addt'l reefs identified but not explored

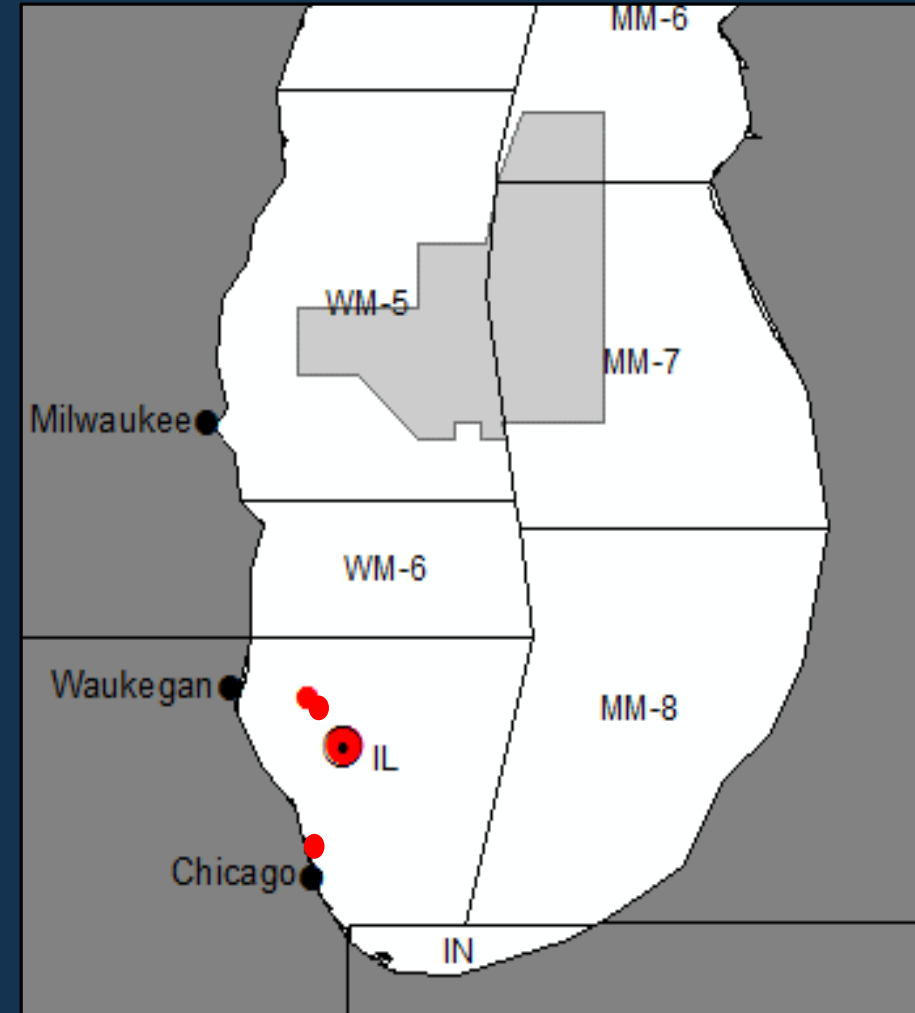


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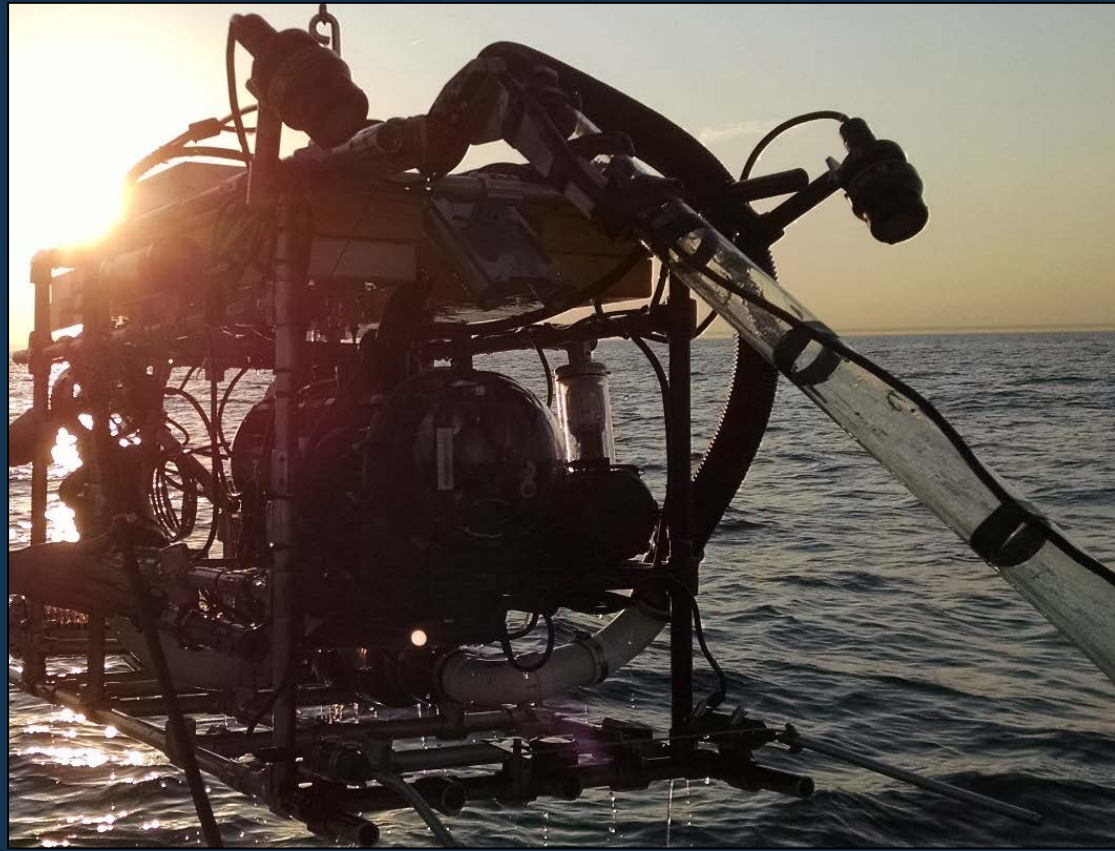
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 - Similar abundances (CPE) and composition of spawners
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- Do multiple, diverse reef complexes facilitate spawning success and maximize recruitment?



Ongoing activities:
Assessing recruitment



- Upcoming field seasons for spring fry & fall egg collection



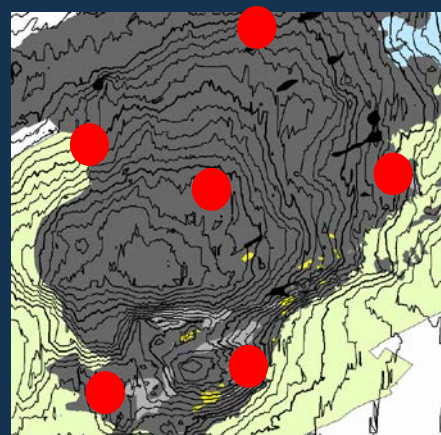
Proposed activities:

Fine- & course-scale habitat use

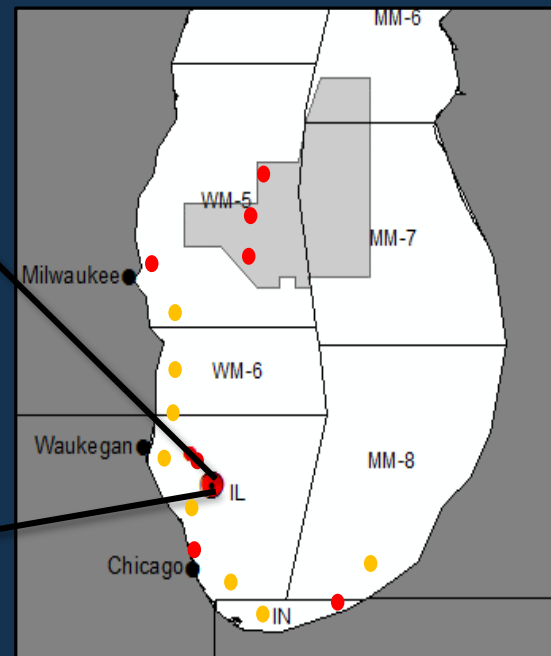



- Research questions:

1. How are spawning lake trout utilizing microhabitats at Julian's reef?
2. Do adult lake trout utilize multiple reef complexes within and across spawning seasons?
3. Are lake whitefish movements timed to capitalize on lake trout eggs as forage?



VPS array



- 
- Funding: Great Lakes Fish and Wildlife Restoration Act
PIs: Stein, Janssen, Patterson, and Czesny
 - R. Paddock and A. Hamm - ROV operators
 - Crew of *R/V Neeskay*
 - Great Lakes Expeditions & crew of *R/V Double Jameson*
 - S.Czesny, R. Redman, and J. Dub - INHS
 - S. Robillard, D. Makauskas, and V. Santucci - IL DNR

QUESTIONS?

