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# Towards improved benthic monitoring of the Great Lakes using underwater video

Ted Angradi, Molly Wick, and Matt Pawlowski
USEPA, CCTE, GLTED, Duluth, MN

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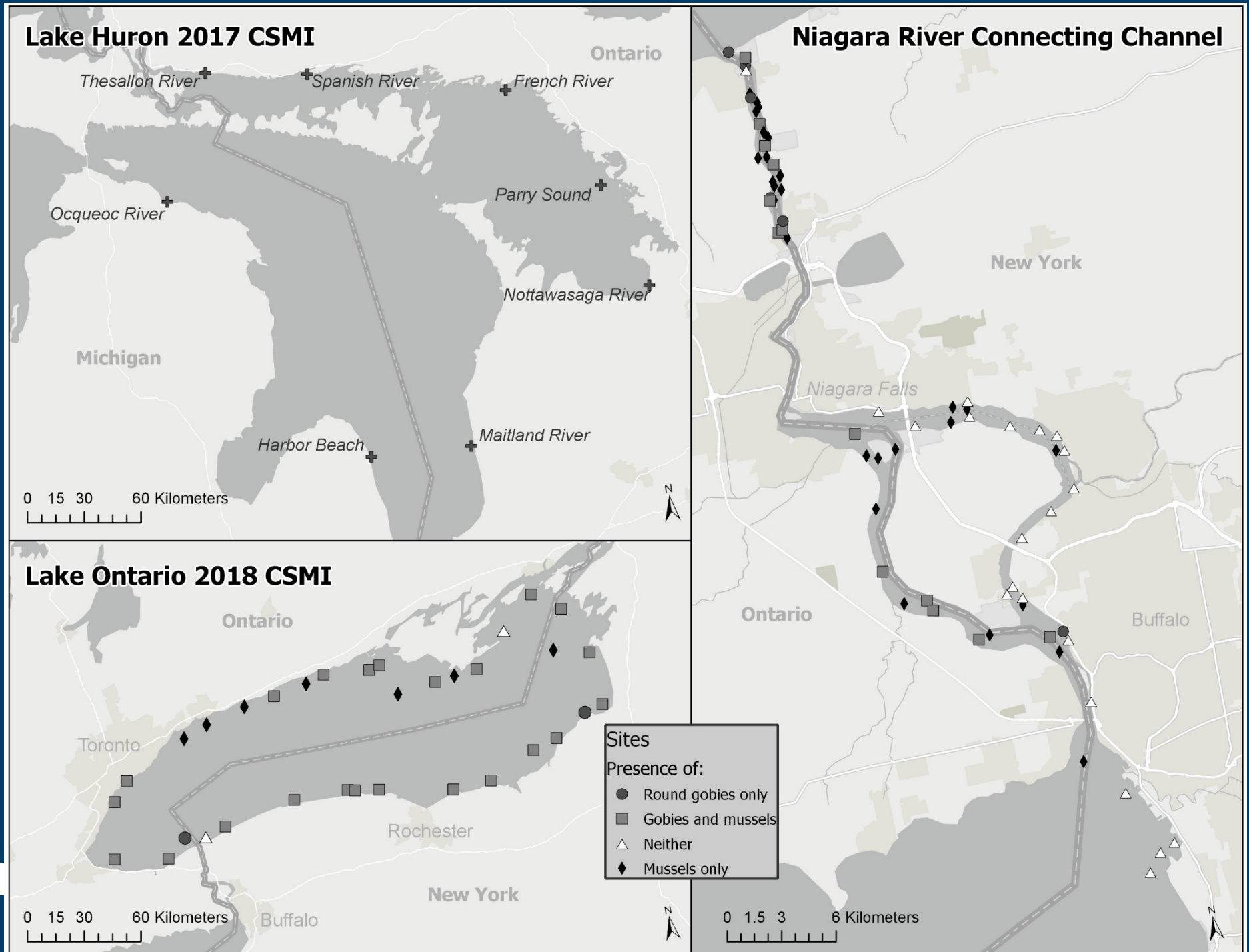
Science Priority:
Lower and upper food-web…improve quantification of benthos…including areas with rocky substrates

EPA motivation:
Poor track record with UVID quality in GL-NCCA (2010, 2015) which is EPA OW's probabilistic GL near-shore assessment supported by GLTED


Lake Huron 2017 CSMI
Ontario
Thesallon River
Spanish River
French River
Parry Sound
Ocqueoc River
Nottawasaga River
Michigan
Maitland River
Harbor Beach
0 15 30 60 Kilometers
N
Lake Ontario 2018 CSMI
Ontario
Toronto
Rochester
New York
Buffalo
0 15 30 60 Kilometers
N
Sites
Presence of:
Round gobies only
Gobies and mussels
Neither
Mussels only
Niagara River Connecting Channel
New York
Niagara Falls
Ontario
Buffalo
0 1.5 3 6 Kilometers
N

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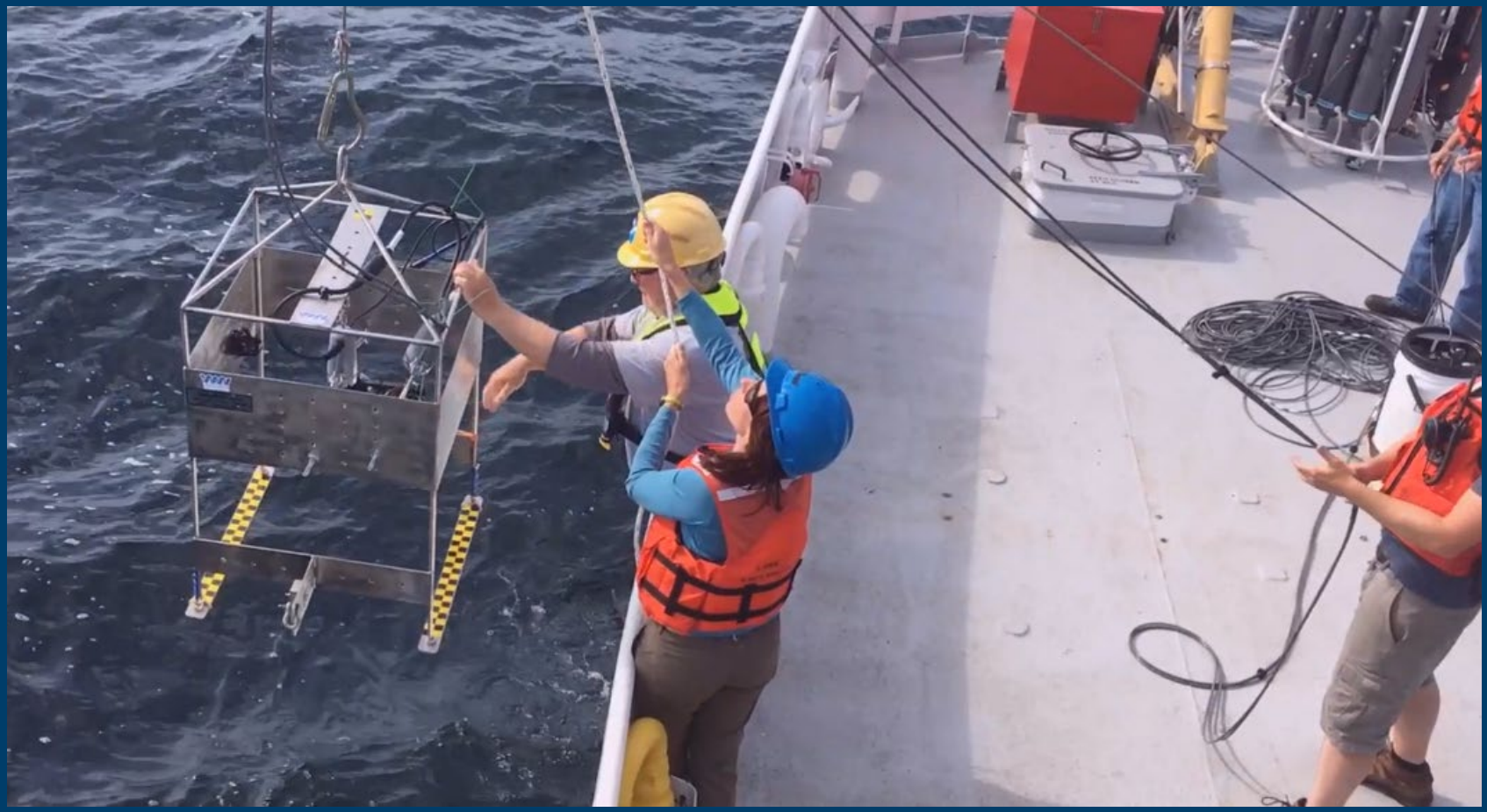

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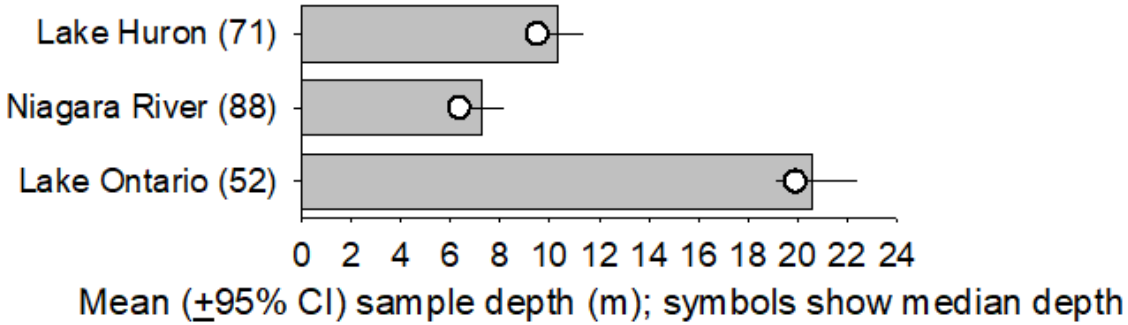
A

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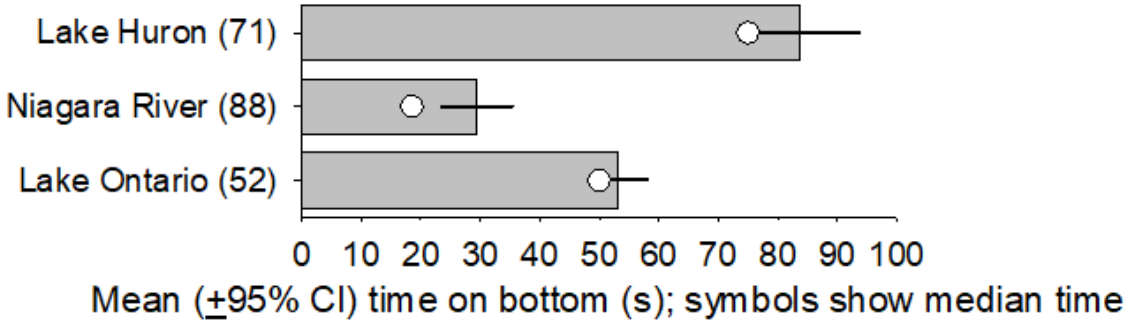


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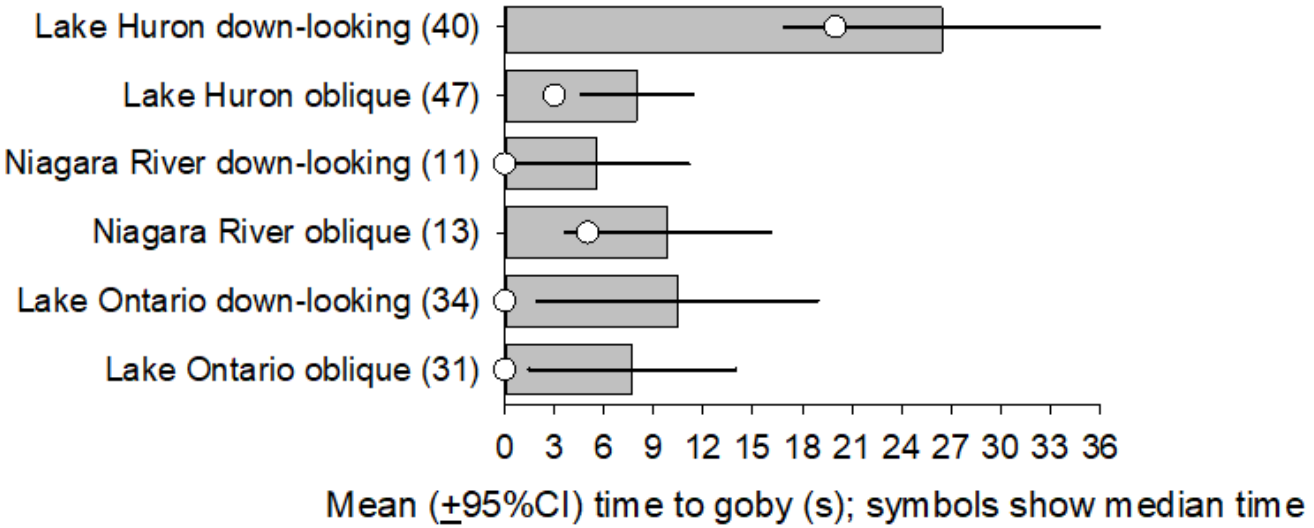

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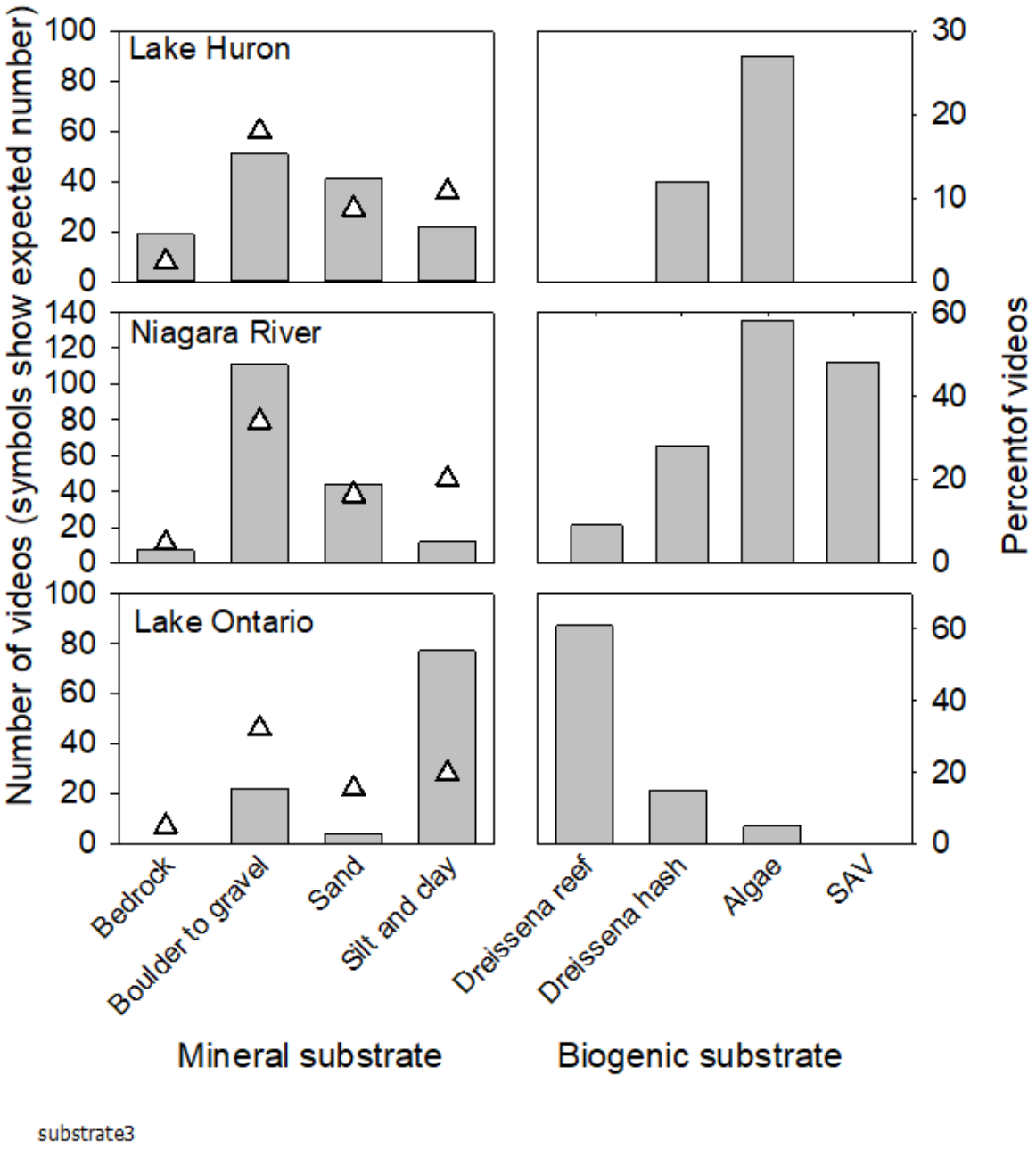
# CMECS classification




FGDC (Federal Geographic Data Committee). 2012. Coastal and Marine Ecological Classification Standard. June 2012. https://www.fgdc.gov/standards/projects/cmecs-folder/CMECS_Version_06-2012_FINAL.pdf/view

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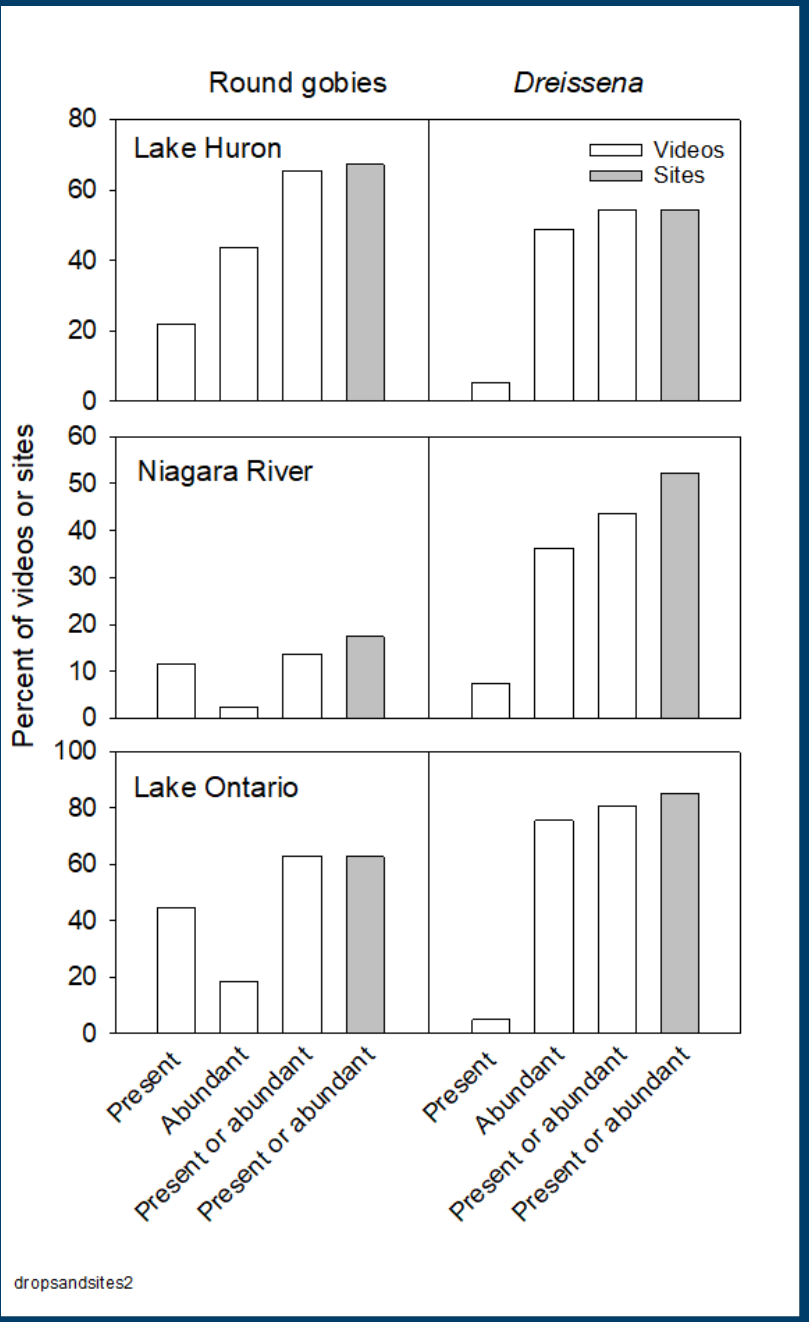
# Huron vs. Ontario: More gobies, fewer mussels

But not an unbiased sample



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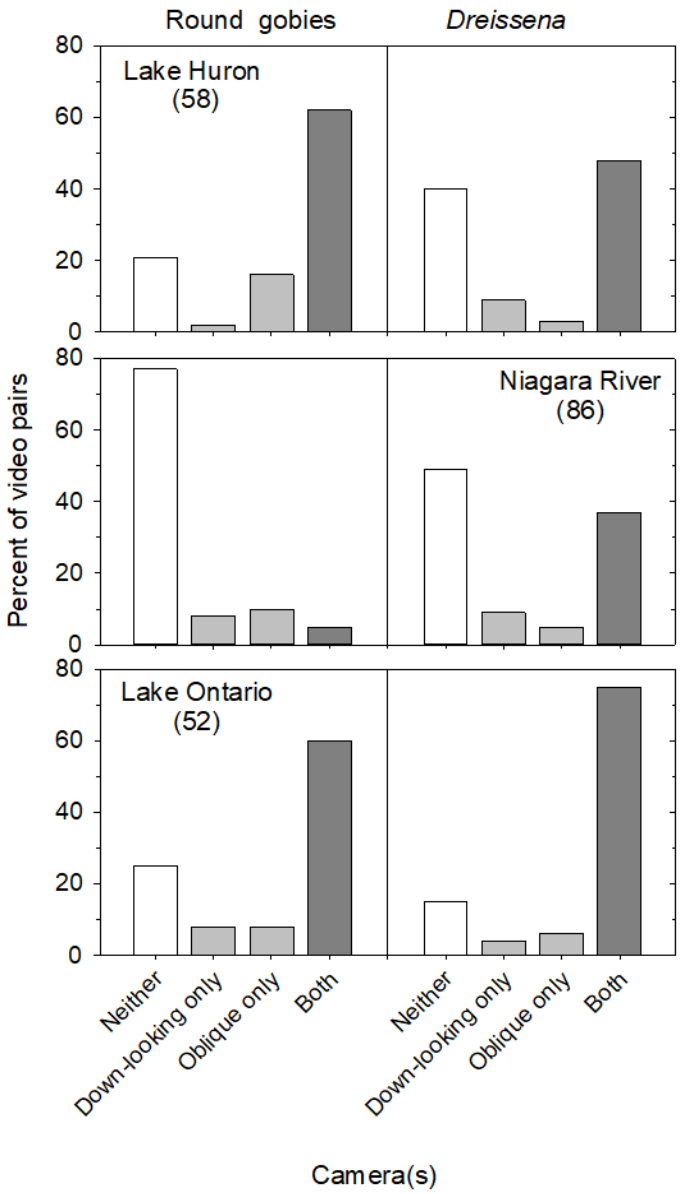
# Including both down-looking and oblique cameras increases Goby and *Dreissena* detection



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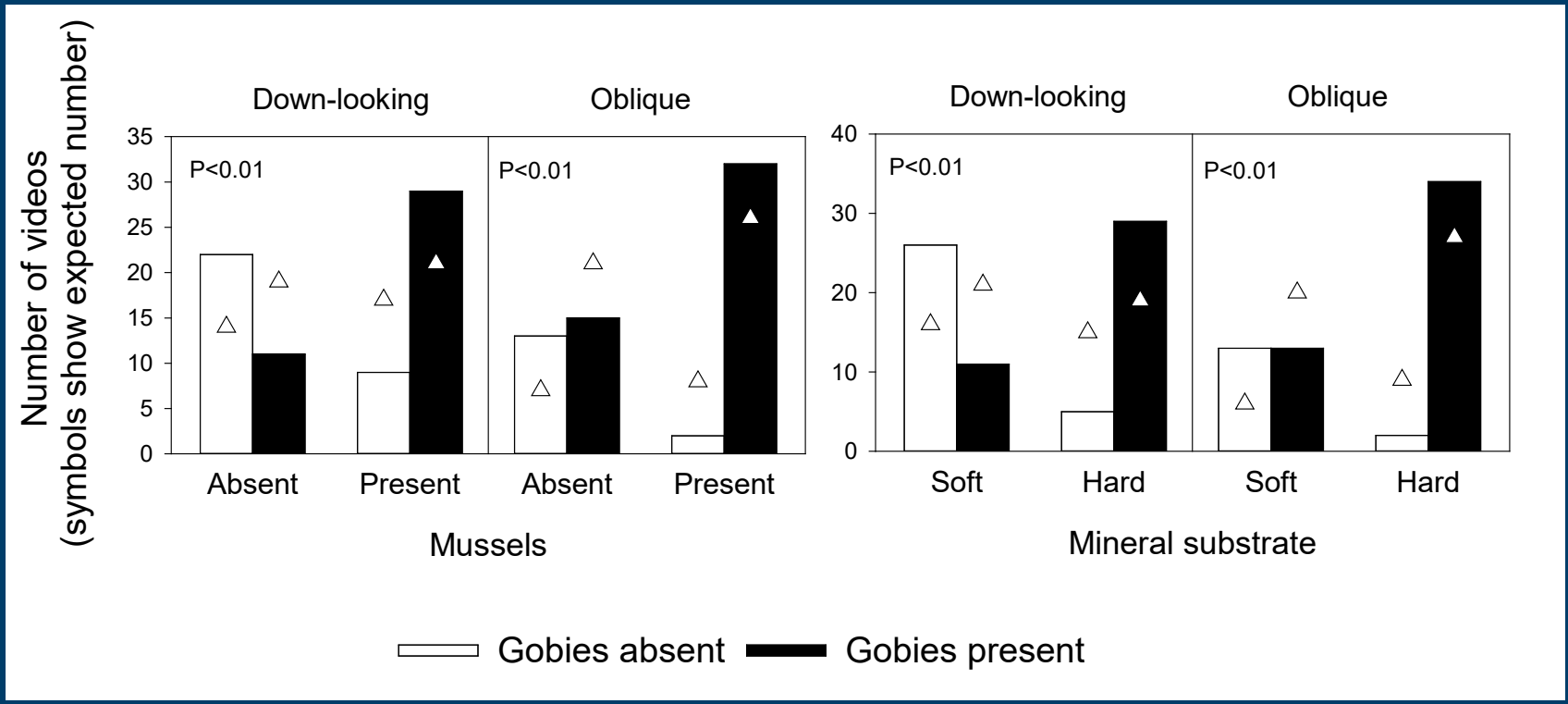


# Presence of round gobies not independent of mussels or hard substrate

| Region → | North Channel | | Georgian Bay | | | Main Basin | | |
|---|---|---|---|---|---|---|---|---|
| Location → | Thesallon River | Spanish River | French River | Parry Sound | Nottawasaga River | Harbor Beach | Maitland River | Ocqueoc River |
| Bedrock | 0 | 0 | 70 | 67 | 0 | 0 | 0 | 0 |
| Coarse/gravel | 0 | 8 | 30 | 33 | 20 | 100 | 79 | 4 |
| Fine hard (sand) | 11 | 0 | 0 | 0 | 80 | 0 | 21 | 84 |
| Fine soft (silt and mud) | 89 | 92 | 0 | 0 | 0 | 0 | 0 | 13 |
| *Dreissena* reef | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Dreissena* shell hash | 11 | 0 | 0 | 28 | 25 | 0 | 0 | 0 |
| Algae | 56 | 0 | 0 | 0 | 15 | 0 | 11 | 71 |
| SAV | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | |
| Gobies present | 0 | 25 | 0 | 39 | 10 | 33 | 37 | 13 |
| Gobies common | 0 | 17 | 90 | 56 | 10 | 52 | 53 | 58 |
| | | | | | | | | |
| *Dreissena* present | 22 | 8 | 0 | 6 | 0 | 0 | 11 | 4 |
| *Dreissena* abundant | 0 | 33 | 100 | 67 | 20 | 100 | 58 | 13 |
| | | | | | | | | |
| Depth (m; ±95% CI) | 9.3 (1.7) | 10.8 (1.6) | 11.4 (2.0) | 17.1( 2.5) | 7.6 (0.9) | 8.3 (0.9) | 10.4 (0.6) | 9.3 (1.3) |
| N (videos) | 9 | 12 | 10 | 18 | 20 | 21 | 19 | 24 |

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NOAA Site NC79: no *Dreissena* in 2002,2007,2012, or 2017
NOAA Site NC73: *Dreissena* <1mm in 2017

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# Large *Dreissena* at Spanish River in 11m

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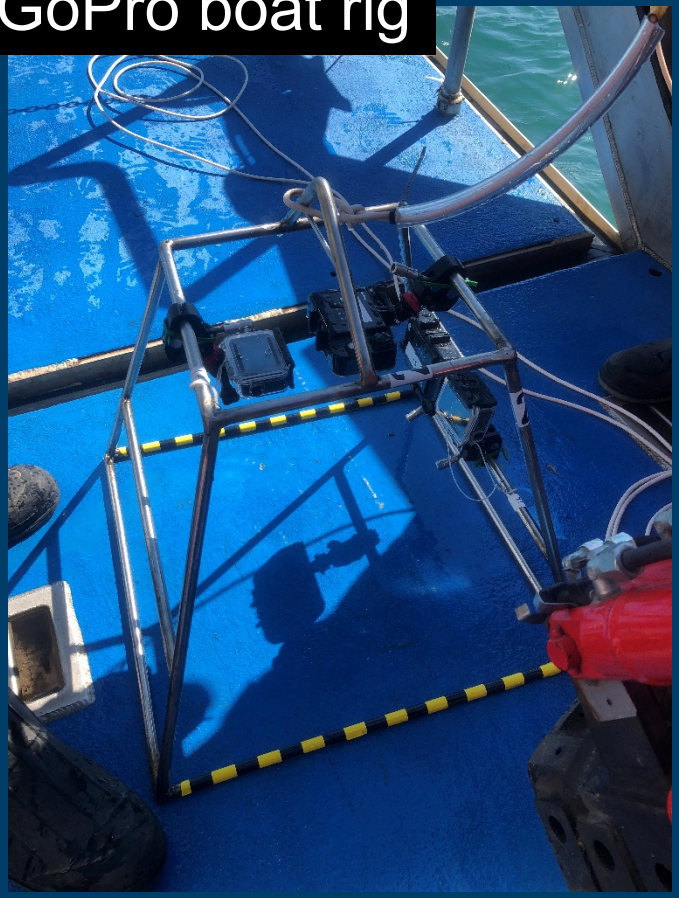
## GoPro boat rig



## GoPro ship rig

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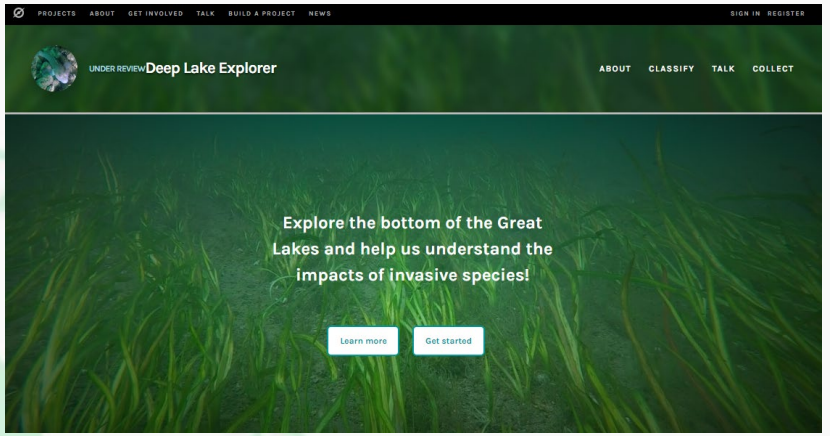
## 2020 NCCA

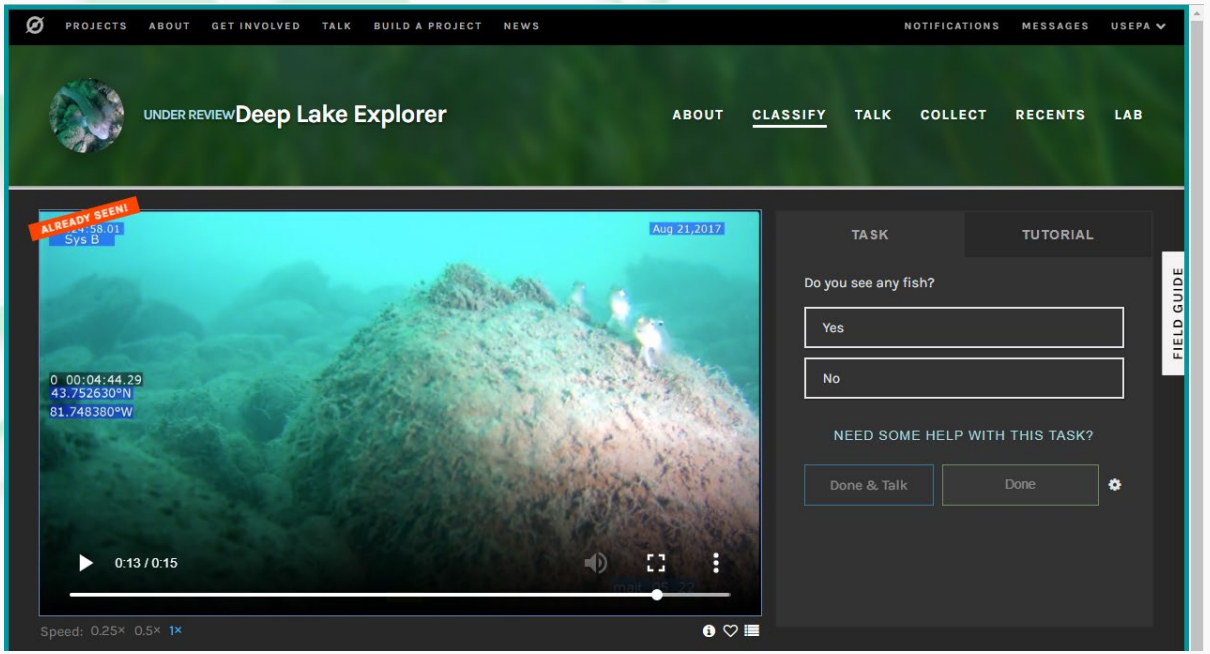
- Includes US GL nearshore, Green Bay, National Parks
- Outfitting all crews with GoPro boat rigs with updated hardware (GP7)

# Deep Lake Explorer

- To crowdsource analysis of large video datasets
- ORD Innovation grant
- Partnership with R5, R2, OW, and GLNPO, advised by stakeholder team from all GL states
- Hosted on Zooniverse.org
- Tested on ~200 LH, LO and Niagara videos this summer




| Attribute | DLE-expert agreement |
|---|---|
| Round goby | 90% |
| Zebra/quagga mussels | 80% |
| Vegetation | 90% |
| Substrate | 77% |




**https://www.zooniverse.org/projects/usepa/deep-lake-explorer**


- All videos available from wick.molly@epa.gov
- 2 papers in prep that will give all details and analyses and will link to videos on YouTube
- Some extra gear available for loan to collaborators