MICHIGAN STATE UNIVERSITY

Quantitative Fisheries Center (QFC) Completed Project Briefing

Efficiency of Down-Looking Cameras for Detecting Round Goby over Varying Substrates in Laboratory Microcosms

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Caption: Profile of a round goby. Image courtesy of Z. Slagle, Ohio Department of Natural Resources

Goal: Evaluate detection efficiency of down-looking camera systems for round goby across substrates of differing structural complexity to inform and improve camera-based monitoring approaches

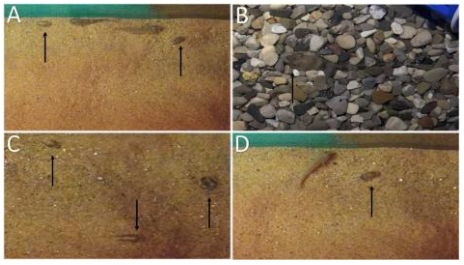
Objectives:

1. Examine differences in detection efficiency of down-looking cameras for round goby between sand and cobble substrates under controlled laboratory conditions
2. Evaluate potential magnitude of bias and variability in camera-based detection across differing habitat complexities

Management Implications: Since invading the Great Lakes, round goby have become a dominant benthic prey species requiring accurate monitoring, yet traditional sampling gear (e.g., trawls) is believed to have low detection efficiency. Camera-based methods show promise for estimating round goby density, but laboratory and field evaluations are needed to quantify potential biases and precision.

Methods:

- Conducted controlled laboratory microcosm experiments with known numbers of round goby using down-looking cameras over sand (low structure) and cobble (high structure) substrates
- Collected time-lapse images at regular intervals under daylight conditions and quantified detections through image annotation and consensus review
- Modeled detection efficiency using a generalized linear mixed-effects framework accounting for repeated-measurements of microcosms



Caption: Examples of round goby burrowed in fine substrates (A) Two round goby burrowed in sand (heads exposed). (B) A round goby burrowed in pea stone. (C) Three round goby burrowed in sand (heads exposed). (D) A burrowed round goby in sand (head exposed) next to a fully exposed round goby.

Key Findings:

- Detection efficiency of down-looking cameras was greater over sand (≈98.6%) than cobble (≈55.3%), showing that habitat structure strongly affects visibility and detection
- Statistical model showed strong predictive performance (AUC = 0.85) with little variability across trials or enclosures, indicating results were consistent and not driven by experimental artifacts
- Despite reduced performance in complex habitats, camera-based methods still compare favorably to traditional sampling techniques and may offer a promising tool for monitoring

Deliverables: Yeager, N.J., T.O. Brenden, P.C. Esselman, K.A. Schulz, and A.T. Tilley. In press. Efficiency of down-looking cameras for detecting round goby (*Neogobius melanostomus*) over varying substrates in laboratory microcosms. Journal of Great Lakes Research

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