Feasibility of using acoustic telemetry to determine spatial use of Round Goby at artificial spawning reefs built for native fishes

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ABSTRACT:

Artificial spawning reefs (ARs) have been constructed in many areas around the Great Lakes, including the St. Clair–Detroit River System, to support reproduction of native fishes. However, invasive Round Goby (*Neogobius melanostomus*) frequently colonize these rocky habitats and may negatively affect restoration goals through predation on eggs and larval fish. Traditional sampling methods, e.g., trapping, cannot reliably describe fine-scale Round Goby movements at ARs, creating uncertainty about their spatial use and potential interactions with native species. This pilot study evaluated the feasibility of using acoustic telemetry to monitor Round Goby behavior using an artificial reef in the Detroit River as a study site.

We deployed a Vemco Positioning System (VPS) array of HR2 receivers and surgically implanted Round Goby (n = 40) with dual-mode acoustic transmitters that alternated between pulse position modulation (PPM) and high residency (HR) transmission schemes. Objectives were to (1) determine receiver spacing required for positioning, (2) quantify detection ranges of PPM and HR transmissions, and (3) describe Round Goby use of reef habitat via position estimates and home range analyses.

Drift tests and sync tag deployments indicated that ~75 m spacing was needed to generate positions, which necessitated a reduction in the total reef area covered to approximately half of the reef. Both transmission schemes provided reliable detections, with HR tags performing slightly better at extended ranges and PPM tags showing marginally higher close-range efficiency.

Tagged Round Goby were successfully monitored for the duration of transmitter life, producing ~24.8 million detections and over 670,000 VPS position estimates across both transmission schemes. Minimum convex polygon (MCP) analyses indicated slightly smaller home ranges derived from PPM signals, though kernel utilization distributions (KUDs) showed no significant difference between schemes for either 95% or 50% areas. Overall, Round Goby exhibited small, localized home ranges, consistent with benthic, site-attached behaviour for this species.

This study demonstrates that acoustic telemetry can be used to monitor fine-scale movements of small-bodied invasive fishes in artificial reefs and in large riverine habitats. The dual-transmission approach highlighted potential trade-offs between detection efficiency and sampling density, providing guidance for future telemetry studies of Round Goby and other benthic fishes, though both transmission schemes were successful at detecting Round Goby. Findings also emphasize the importance of careful receiver placement, consideration of reef coverage, and recognition of potential post-release outcomes (mortality, predation, emigration). From a management perspective, the ability to track Round Goby residency at ARs raises critical questions about their potential to interfere with native fish

reproduction, underscoring the need for further research on temporal overlap between goby presence and native spawning activity.