You Have to Get Wet:

A Case Study of the Nonindigenous Great Lakes Fish, Round Goby

By Robert G. Wickett and Lynda D. Corkum

Aquatic researchers have a plethora of techniques available to sample the underwater world (Wetzel and Likens 1991; Hauer and Lamberti 1996; Murphy and Willis 1996) whether an ephemeral pond, swift-moving river, or a Great Lake. Although various tools (SCUBA, cameras) exist for underwater techniques, researchers tend to lose sight of the benefit of direct observations. Instead, scientists often rely on indirect methods. Samples are taken from the natural environment to be bagged, tagged, and preserved for later analysis.

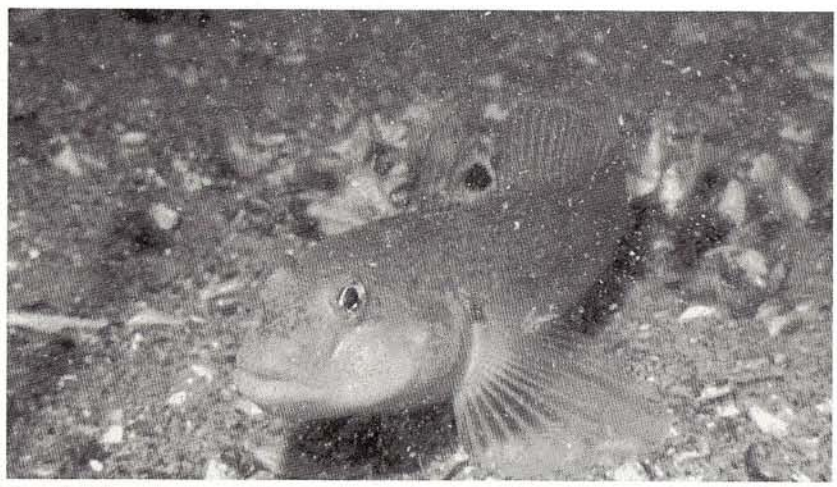
In elementary school we learned that science is a human activity in which we search for knowledge about the natural world. We learned the steps in the scientific method: observations, hypotheses, tests, and predictions. Later, at the university level, hypotheses testing and experimental designs were emphasized. Too often, though, only brief mention is made of the first step in the process-observation. While you should match "the tool with the task" (W. L. Fisher, Oklahoma Cooperative Fish and Wildlife Research Unit, pers. comm.), we believe aquatic researchers would benefit from a greater reliance on field observation.

In an interview with Sylvia Earle, a former chief scientist at the National Oceanic and Atmospheric Administration who has logged more than 6,000 h of underwater observations, she described the detective work required to study oceans by examining fragments collected in nets, bottles, and dredges. She compared this to dragging nets and dredges through a city. What would we really learn about urban life using such techniques? We think the most overlooked method in standard sampling and experimental design is direct observation.

In this essay we use a nonindigenous fish, the round goby (*Neogobius melanostomus*), as a case study of what direct underwater observation can tell us. Round gobies are bottom-dwelling fish characterized by a fused pelvic fin and, typically, a black spot on the dorsal fin. They are found on hard substrates along with another nonindigenous species, the zebra mussel (*Dreissena polymorpha*). Zebra mussels dominate the diet of larger (> 70 mm) round gobies (Ray and Corkum 1997). Round gobies are aggressive, cavity spawners that reproduce repeatedly throughout the spring and summer. These habits of round gobies have harmed mottled sculpins (*Cottus bairdi*) and are likely to affect other cavity spawners (Jude et al. 1995; Dubs and Corkum 1996).

Round gobies were first reported by anglers in the St. Clair River in 1990 (Jude et al. 1992). The species was probably brought to the Laurentian Great Lakes in ballast water of ships originating in the Black and Caspian seas of southern Europe. Since then, round gobies have successfully colonized all five Great Lakes (Charlebois et al. 1997). Researchers have been monitoring the spread of round gobies and are attempting to assess their impacts on the Great Lakes ecosystem. Here, we present some of our observations.

A. SCUBA divers conducting a shipwreck survey first found round gobies in western Lake Erie. Despite earlier trawling surveys in the area, fish managers did not confirm the presence of round gobies in western Lake Erie until 1996 (Charlebois et al. 1997). Since we observe round gobies occupying rocky habitats, and trawls are usually conducted over more even substrates, it is likely that round gobies were present earlier in the Great Lakes but not found because of the limitations of sampling gear.



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Round gobies occur most often on hard substrates with zebra mussels, which form a substantial part of their diet.

B. Nests of round gobies are constructed under rocks or logs, or within any other suitable cavity. Parental males, with characteristic charcoal coloration, guard nests in which eggs of several females are deposited.

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Scientists thought nesting locations were restricted to shallow water (< 1.5 m) (Charlebois et al. 1997), but our 1997 observations of shipwrecks and natural reefs in western Lake Erie showed that round gobies spawn at much greater depths than previoiusly reported. We saw breeding males, gravid (swollen) females, and young-of-the-year round gobies at depths of up to 11 m.

C. The literature indicates that eggs of females are deposited on the ceiling of nests. Cone-shaped eggs are packed together in a single layer, enabling the male to fan eggs efficiently. The hanging position of eggs and their shape aid in cleansing since water then flows around the eggs, and particles are easily shed. However, through underwater observation, we have seen several instances in which eggs are deposited on the bottom or floor of the nest.

D. Using SCUBA and an underwater camera, we examined interactions between intruders (potential predators) and a parental male that guarded an exposed nest located on the schooner, *M. I. Wilcox*, a shipwreck in western Lake Erie. The guarding male usually positions himself with his head at the entrance of a nest, and the fish nips at intruders. We removed the nest covering (an iron pulley) to observe the maximum interactions between intruders and the resident male. The guarding round goby male approached and chased rock bass (*Ambloplites rupestris*), smallmouth bass (*Micropterus dolomieu*), and other round gobies away from the exposed nest. Once, the round goby left its nest, entered the water column, and hit a rock bass; however, small round gobies fed on eggs at the nest periphery when the guarding male was distracted by other fishes. Although it is unusual for nests to be exposed, we believe this to be the first time this type of behavior has been recorded.

E. Using direct observation, we sought to determine whether or not aggregations of round goby nests occur. According to Svetlana Rudnicka (Institute of Fisheries in Varna, Bulgaria, pers. comm.), the standard distance between nests in their native habitat is 5 m–10 m. In our surveys of shipwrecks, we saw round goby nests within centimeters of one another. When we removed the tops of the nests, neighboring males engaged in extended fighting bouts. Our preliminary findings suggest that there is a positive association between habitat complexity and nest density. We conclude that the increased habitat complexity offered by shipwrecks likely reduces interactions among nearby parental males. If so, shipwrecks may be nurseries for this nonindigenous fish.

Our simple observations challenge some of what we thought we knew about round gobies in the Great Lakes. Although snorkelers and SCUBA divers are actively involved in studies of artificial reefs (Bortone 1998) and in other scientific ventures, we maintain that more of us in the fisheries field need to examine fish in their natural habitats to help ensure that the hypotheses we test are realistic. In C. Lavett Smith's (1994) delightful outdoor guide to freshwater fishes, he advocates grabbing binoculars to go fish watching. We go a step further and say to our colleagues, "You've got to get wet!"

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Underwater observation reveals the techniques of parental males (with characteristic charcoal coloration) from adjacent nests fighting to protect their exposed nests. Eggs are deposited (upper part of photograph) in a single layer.

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