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OHSU-FS-065
 1995.

This publication is produced by the Illinois-Indiana Sea Grant Program in cooperation with the Michigan and Ohio Sea Grant College Programs as IL-IN-SG-95-10.

Round gobies invade North America

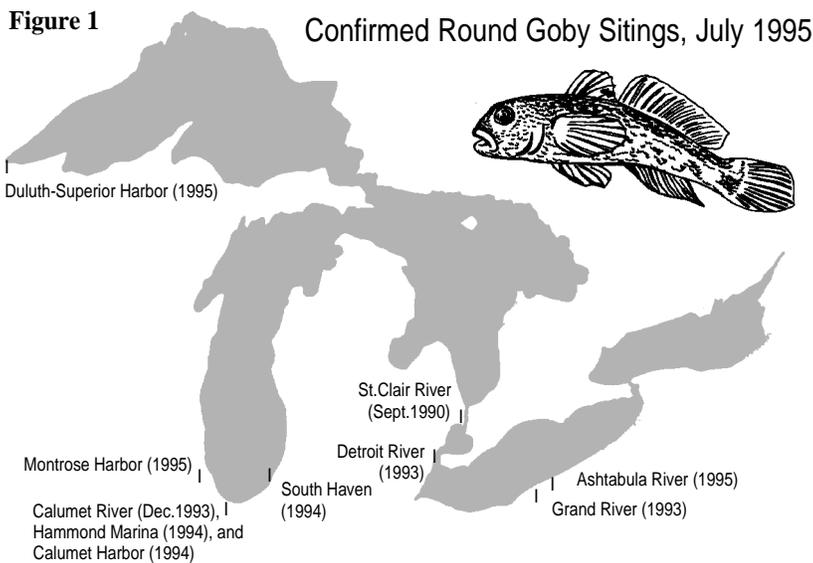
In the last decade, considerable public and scientific attention has been focused on the zebra mussel, an aquatic invader in the Great Lakes. The zebra mussel actually is a recent addition in a long history of invaders, ranging from rainbow smelt, alewife, and lamprey to the recently introduced ruffe and spiny water flea. Now another foreign species has begun to spread throughout the inland waterways. The round goby (*Neogobius melanostomus*) was discovered in the St. Clair River, the channel connecting Lake Huron and Lake St. Clair, in 1990. This species comes from the same area of the world as the zebra mussel (around the Black and Caspian Seas). Presumably, they arrived the same way as zebra mussels: in ballast water discharged by transoceanic vessels.

Although gobies belong to a family of fish with a worldwide distribution in both salt and freshwater, they had not been found in the Great Lakes prior to 1990. A second species, the tubenose goby (*Proterorhinus marmoratus*), also appeared in the St. Clair River in 1990; but this species, which is endangered in its native habitat, has remained uncommon. The more aggressive, robust round goby underwent a rapid dispersal and population expansion in the St. Clair River and Lake St. Clair. In 1993 it began to spread to other waterways, and the likelihood of its spreading to watersheds such as the Mississippi River drainage system has raised concerns over its potential effects on North American native species and ecosystems.

Exotic species, such as the round goby, have destroyed and disrupted aquatic communities across the nation. The entry of another foreign invader to the already abused Great Lakes environment is an unwelcome addition to the plethora of other problems, including habitat destruction, overfishing, pollution, and loss of native species.

Range and Spread

From 1990 to 1992 round gobies were found only in the areas adjacent to the St. Clair River: Lake St. Clair and in the first 2 km of the upper Detroit River. By 1993 round gobies were found in the Grand River near Cleveland, Ohio (Lake Erie) and in the Grand Calumet River near Chicago, Illinois (Lake Michigan). In August 1994, gobies became well established in the Central Basin of Lake Erie. Also in 1994, gobies were found 12 miles east of the Grand Calumet River at Hammond Marina and at South Haven, Michigan, on the east shore of Lake Michigan. Because the Grand Calumet River is



connected to the Mississippi River, round gobies now have access to America's largest watershed. By 1995, they had spread to Duluth-Superior Harbor, in Duluth, Minnesota (Lake Superior), Montrose Harbor north of Chicago (Lake Michigan), and Ashtabula River in Ohio (Lake Erie).

After they reach a new area, gobies are capable of rapid population growth. Densities of gobies in rocky areas at Calumet Harbor already exceed 20 per square meter—equivalent to 20 fish in a space the size of a bathtub. The fish in this harbor range from 12 to 140 mm (0.5 to 5.5 inches) in length, and likely represent two age groups.

Identification

Round gobies are bottom-dwelling fish that perch on rocks and other substrate. They can grow to 250 mm (10 inches) as adults. Gobies have large heads, soft bodies, and dorsal fins lacking spines; they slightly resemble large tadpoles (Figure 1). The gobies' unique feature is their fused pelvic (bottom) fins, which form a suction disk. In flowing water habitats, this suction disk aids in anchoring the fish to the substrate. Young round gobies are a solid slate gray; larger individuals have blotches of black and brown over their bodies, and their dorsal fin may be tinged with green.

Round gobies look similar to sculpins, a native, bottom-dwelling fish occasionally caught by anglers. Sculpins (*Cottus bairdi* and *C. cognatus*), also called muddlers or Miller's thumb, are usually solid brown or mottled. Both sculpins and goby males can appear almost solid black during spawning. Round gobies have a distinctive large black spot on the front dorsal fin; and sculpins often have a dark spot in the same location. Sculpins can most easily be distinguished from gobies by their separate pelvic fins (Figure 2).

Characteristics and Habitat

Round gobies possess four characteristics that make them effective invaders.

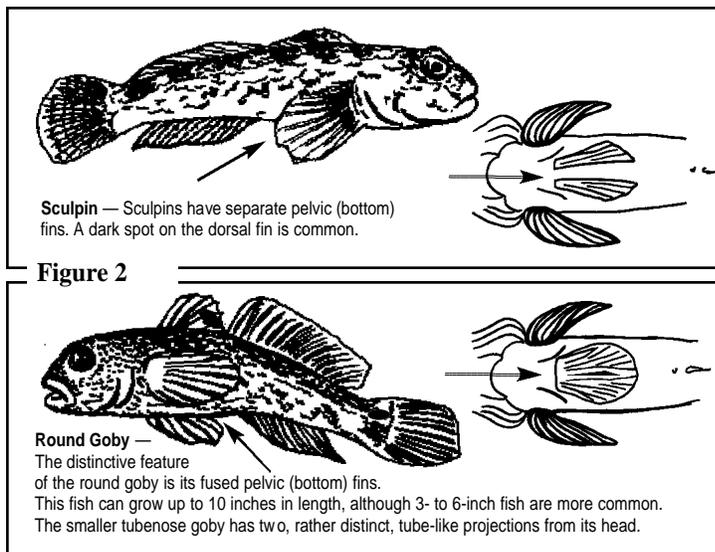
1. Round gobies are aggressive, pugnacious fish. They feed voraciously and may eat the eggs and fry of native fish such as sculpins, darters, and logperch. They will aggressively defend spawning sites in rocky habitats, thereby restricting access of native species to prime spawning areas.
2. They have a well-developed sensory system that enhances their ability to detect water movement. This allows them to feed in complete darkness, and gives them a major competitive advantage over native fish in the same habitat.
3. They are robust and are able to survive under degraded water quality conditions. This ability and their propensity to swim into holes and other crevices probably allowed round gobies to enter and survive in the ballast water of ships.
4. Round gobies spawn over a long period during the summer months so they can take advantage of optimal temperature and food conditions. Females mature at 1 to 2 years and males mature at 3 to 4 years. Spawning can occur frequently from April through September. Each female produces from 300 to 5,000 large (4 x 2.2 mm [0.16 x 0.09 inch]) eggs; these eggs are deposited in nests on the tops or undersides of rocks, logs, or cans; they subsequently are guarded by the males.

Round gobies prefer a rocky or gravel habitat; they hide in crevices or actively burrow into gravel when startled. In the Black and Caspian Seas, gobies generally inhabit the nearshore area, although they will migrate to deeper water (up to 60 m [197 feet] depth) in winter. They also are found in rivers and in slightly brackish water. In Europe, the diet of round gobies consists primarily of bivalves (clams and mussels) and large invertebrates, but they also eat fish eggs, small fish, and insect larvae. In the United States, studies have revealed that the diet of round gobies includes insect larvae and zebra mussels.

Potential Impacts

Gobies may compete successfully with native benthic fish such as sculpins and darters. Substantial reductions in local populations of sculpins already have been reported from areas in which gobies have become established. Gobies may compete with sculpins for food or drive them from their preferred habitat and spawning area. In laboratory experiments, gobies will eat darters and other small fish. Of perhaps more concern is their predation on the eggs and fry of lake trout, which has been observed in laboratory experiments. The reproduction of the lake trout in the Great Lakes is extremely limited.

On the positive side, round gobies eat large quantities of zebra mussels, an invader that is causing an increasingly large number of problems because of its huge reproductive output. Zebra mussels are an important component of the gobies' diet in their native range; and, in laboratory studies in North America, a single round goby can eat up to 78 zebra mussels a day. However, it is unlikely that gobies alone will have a detectable impact on zebra mussels. The round goby is expected to be one of several species



(including ducks, crayfish, diseases, and other fish species) that eventually will reduce the abundance of zebra mussels. Gobies are preyed upon by several sport fish species (e.g., smallmouth and rock bass, walleyes, yellow perch, and brown trout). Because the diet of round gobies consists predominately of zebra mussels, there may be a direct transfer of contaminants from gobies to sport fish.

Gobies affect anglers in several ways. These fish aggressively take bait from hooks. Anglers in the Detroit area have reported that, at times, they can catch only gobies when they are fishing for walleye.

What can be done?

Unfortunately, eliminating a species after it has become established usually is impossible. However, it may be possible to slow the spread of these unwanted species into our waterways. Ballast water exchange is one method of reducing additional introductions of foreign organisms. Ballast dumping regulations within North American waterways may help to prevent the spread of exotic species. Anglers and others can avoid accidentally spreading these species by dumping bait buckets only in areas where they were filled, and by not taking unusual animals home to add to an aquarium. Note: there may be a temptation to take gobies for a home aquarium or home fish pond; however, transportation of gobies or other exotic species across state lines is illegal.

What can you do?

Learn to identify gobies (see illustration that indicates fused pelvic [bottom] fins). To enable biologists to track the spread of round gobies, up-to-date information on new sightings is needed. Your assistance is extremely important. If you catch a round goby outside the areas noted on the map indicating goby range, preserve the fish either in alcohol (grocery store rubbing alcohol is fine) or by freezing it. Then contact your state Sea Grant office, fisheries management agency, or the Illinois Natural History Survey (847/872-8676). Be prepared to describe when and where you caught the fish (the name of the lake or stream, and the nearest town). New sightings can be confirmed only by identification of a captured fish. Verbal reports cannot be used because sculpins can be easily mistaken for gobies.

For other publications, newsletter, conference, and workshop announcements, or for advice from local experts, contact the Sea Grant program or state natural resources management office nearest you. Phone numbers for the Great Lakes Sea Grant programs follow.

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