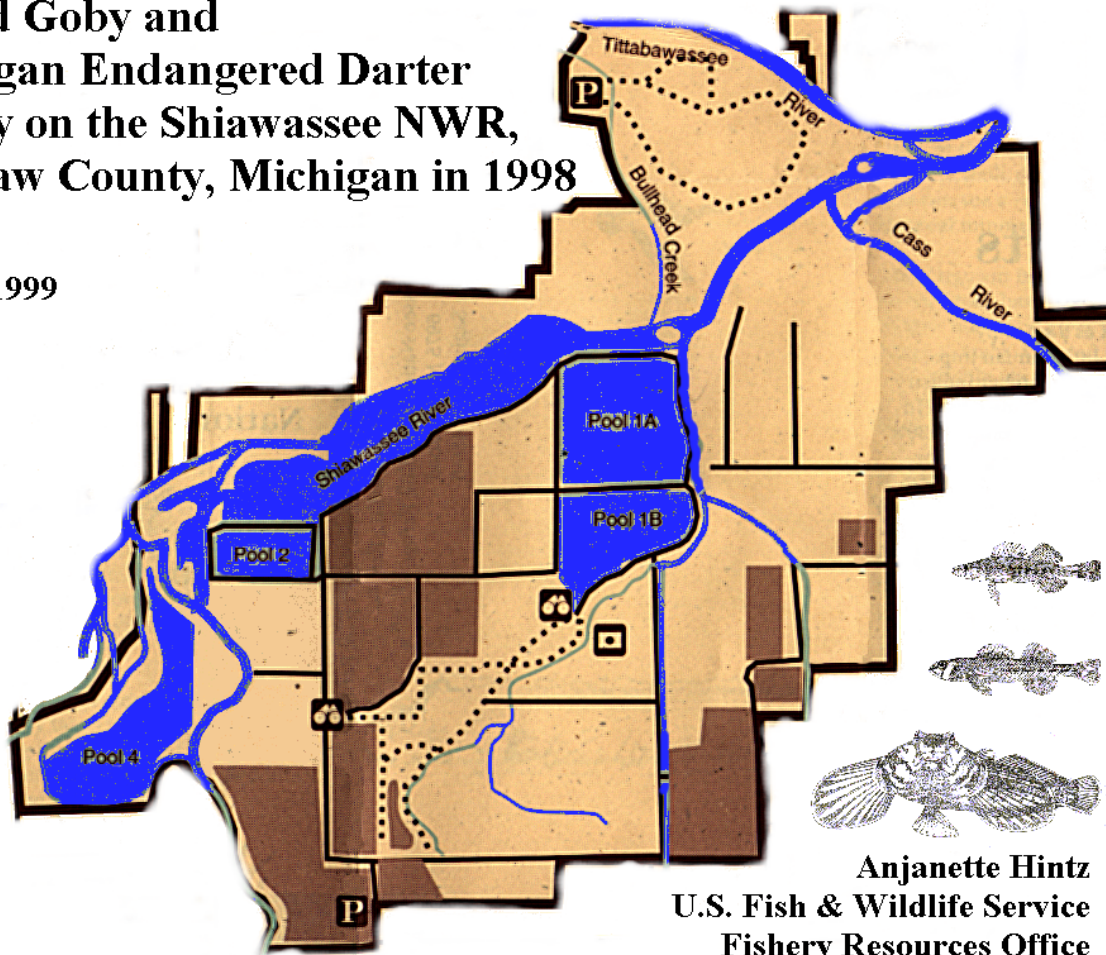


**Round Goby and
Michigan Endangered Darter
Survey on the Shiawassee NWR,
Saginaw County, Michigan in 1998**

March 1999



**Anjanette Hintz
U.S. Fish & Wildlife Service
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Provisional data, not to be cited without permission.

INTRODUCTION

The Shiawassee National Wildlife Refuge (NWR) in Saginaw, Michigan contains an expansive area of wetland habitat that may currently be used by the exotic round goby *Neogobius melanostomus* (goby), a recent Great Lakes invader, as well as native Michigan endangered darters.

The goby (Figure 1) is native to Eurasia and was first reported in the Great Lakes in 1990 by anglers who captured it in the St. Clair River (Jude et al. 1992). It was likely introduced with discharged ballast water brought onboard from ships traveling from Eurasia. Since the introduction of the goby, it has spread to each of the Great Lakes (Charlebois et al. 1997). The goby is an aggressive fish that can become abundant quickly due to production of multiple broods (Jude et al. 1992). It competes for food and spawning resources with native fish, particularly benthic fishes like darter and sculpin (Jude et al. 1995). Its aggressive behavior allows it to quickly locate prey; thus it has become a nuisance to sport fishermen who catch large numbers of goby rather than preferred species.

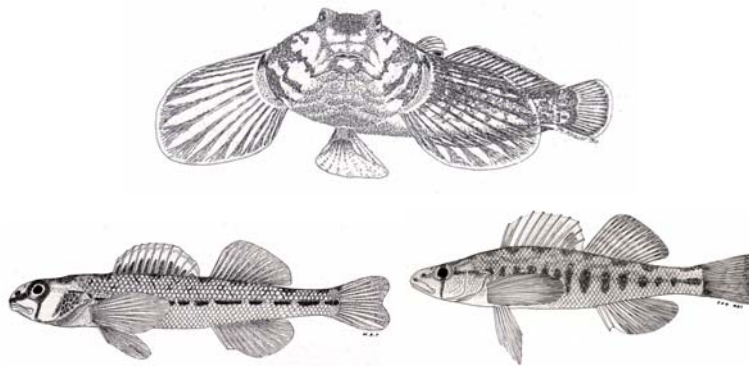


Figure 1. The round goby (top) is an aggressive, bottom dwelling exotic fish that competes for food and habitat with native fish species (after Charlebois et al. 1997). The channel darter (bottom left) and river darter (bottom right) are both endangered in Michigan (after Trautman 1981).

Goby were found in the Shiawassee River near Fenton in 1996 (Jude 1997) and in the Flint River in 1997 (D. Jude, University of Michigan, personal communication). Both rivers flow through

the refuge. They were also captured downstream from the Shiawassee River at the mouth of the Saginaw River in October 1997 (A. Hintz, U.S. Fish and Wildlife Service, unpublished data) and in 1998 (J. Baker, Michigan DNR, personal communication). Goby may be present in refuge waters due to the direct vector from up or downstream infested sites. The refuge also has an abundance of rocky crevices and riprap dikes, which provide preferred goby habitat (Jude and DeBoe 1996).

Michigan state endangered channel darter *Percina copelandi* and river darter *Percina shumardi* (Figure 1) inhabited waters upstream from the Shiawassee NWR (Michigan DNR 1994). The darters were last captured from the Cass River in 1941 (Latta 1996; Michigan Natural Features Inventory 1999). Darter habitat is thought to exist on the refuge; although, actual habitat and presence of the darters in refuge waters is unknown.

In 1998, staff from the U.S. Fish and Wildlife Service (Service) Shiawassee NWR and Fishery Resources Office (FRO) in Alpena, Michigan worked with partners to survey key areas of the refuge for the presence of round goby and endangered darter species. This survey also provided information on the current fish community present on the refuge.

MATERIALS AND METHODS

Sampling of the Shiawassee NWR was conducted in May, July, and September of 1998. Diked riprap margins of the Shiawassee River were sampled with boom electrofishing gear (Figure 2). Three locations (sites 1, 2, and 5) were each fished with two fifteen-minute passes with boom electrofishing gear during the day, for a total effort of 30 minutes per site per sample date. The electrofishing unit was set to deliver 354 volts of pulsed DC current at 60 Hz and 3.5 MS and adjusted to achieve 7 amps of current. Two netters operating from the front of the boat captured fish.

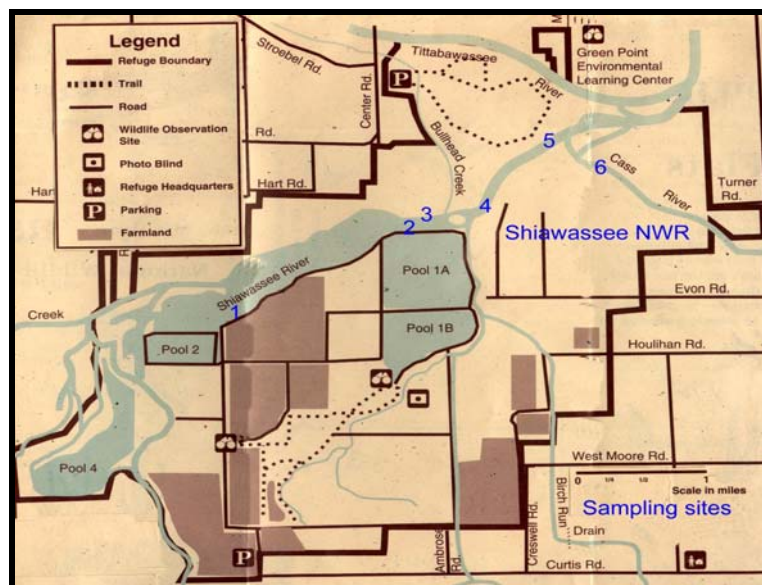


Figure 2. Six locations on the Shiawassee NWR were sampled for the presence of goby, channel darter, and river darter in 1998.

Deep mid-channel areas of the Shiawassee and Cass Rivers were sampled with a 3.0 m bottom trawl (3.81 cm stretch mesh body and a 31.75 mm stretch mesh cod end with 12.7 mm stretch mesh inner liner) to survey for channel and river darters. Two locations in the Shiawassee River (sites 3 and 4) were each fished with two five minute passes with bottom trawling gear, for a total of 10 minutes effort per site per sample date. One location in the Cass River (site 1) was fished with two four-minute passes, for a total of 8 minutes of effort per site per sample date.

Abiotic factors were measured at the time of sampling and included: water depth (m), surface and bottom water temperatures (°C), bottom dissolved oxygen (mg/l), transparency (m), and weather conditions. Fish were sorted by species and measured to the nearest millimeter. When numerous fish were captured, twenty-five specimens of each species were measured to the nearest millimeter and weighed to obtain an average weight per fish. The remaining fish were weighed and a total number determined based on the average weight per fish. Sportfish weights were recorded and scale samples were taken from 10 fish per 20 mm size grouping per species for age analysis. Sex was recorded if it could be determined through observation of released of sex products. Unknown fish were preserved in alcohol and later identified to species. Data were entered onto a database at the Alpena FRO.

RESULTS

No round goby or Michigan endangered darters were captured following 390 minutes effort electrofishing and 84 minutes effort bottom trawling on the Shiawassee NWR in 1998. Information was recorded and summarized for 1,308 captures from 27 species of the fish community (Table 1). The largest and most diverse catch was in September, and consisted mainly of young-of-the-year fish. Young-of-the-year gizzard shad *Dorosoma cepedianum* was the most abundant species captured overall, with greatest catches in July and September. Common carp *Cyprinus carpio* was the second most abundant species overall with the greatest catch occurring in May corresponding with spawning.

Data were collected on 289 sportfish from 16 species (Table 1). Sportfish species included: black crappie *Pomoxis nigromaculatus*, white crappie *Pomoxis annularis*, bluegill *Lepomis macrochirus*, green sunfish *Lepomis cyanellus*, pumpkinseed *Lepomis gibbosus*, rockbass *Ambloplites rupestris*, smallmouth bass *Micropterus dolomieu*, largemouth bass *Micropterus salmoides*, northern pike *Esox lucius*, white perch *Morone americana*, white bass *Morone chrysops*, yellow perch *Perca flavescens*, walleye *Stizostedion vitreum*, black bullhead *Ictalurus melas*, brown bullhead *Ameiurus nebulosus*, and channel catfish *Ictalurus punctatus*. Most sportfish were collected from the Shiawassee River with electrofishing gear. Pumpkinseed and channel catfish were the most abundant sportfish captured. Pumpkinseed were most abundant in September and channel catfish were most abundant in May and July. Crappie and northern pike were among the least represented sportfish species. The majorities of sportfish were present as young-of-the-year and captured in September.

DISCUSSION

ROUND GOBY

Round goby were not captured during sampling efforts. It is possible that the round goby has not become established in sampled areas of the refuge, or that their numbers may not be high enough

Table 1. Number of fish captured electrofishing and bottom trawling from May to September 1998 on the Shiawassee National Wildlife Refuge, Saginaw County, Michigan.

Family & Common	Scientific Name	1998		
		May	July	September
AMIIDAE				
Bowfin	<i>(Amia calva)</i>	1	0	0
CATOSTOMIDAE				
Ouillback	<i>(Carpiodes cyprinus)</i>	3	1	3
White sucker	<i>(Catostomus commersoni)</i>	1	2	0
CENTRARCHIDAE				
Black crappie *	<i>(Pomoxis nigromaculatus)</i>	1	0	0
White crappie *	<i>(Pomoxis annularis)</i>	0	1	2
Bluegill *	<i>(Lepomis macrochirus)</i>	1	1	4
Green sunfish *	<i>(Lepomis cyanellus)</i>	0	0	55
Pumpkinseed *	<i>(Lepomis gibbosus)</i>	0	5	89
Rockbass *	<i>(Ambloplites rupestris)</i>	0	0	2
Smallmouth bass *	<i>(Micropterus dolomieu)</i>	0	0	4
Largemouth bass *	<i>(Micropterus salmoides)</i>	0	0	2
CLUPEIDAE				
Gizzard shad	<i>(Dorosoma cepedianum)</i>	19	302	226
CYPRINIDAE				
Bluntnose minnow	<i>(Pimephales notatus)</i>	1	3	8
Common carp	<i>(Cyprinus carpio)</i>	199	65	55
Goldfish	<i>(Carassius auratus)</i>	1	2	21
Emerald shiner	<i>(Notropis atherinoides)</i>	2	0	3
Spottail shiner	<i>(Notropis hudsonius)</i>	2	2	1
ESOCIDAE				
Northern pike *	<i>(Esox lucius)</i>	1	0	0
ICTALURIDAE				
Brown bullhead *	<i>(Ameiurus nebulosus)</i>	0	5	6
Black bullhead *	<i>(Ictalurus melas)</i>	0	0	1
Channel catfish *	<i>(Ictalurus punctatus)</i>	31	24	16
Stonecat	<i>(Noturus flavus)</i>	1	0	0
PERCICHTHYIDAE				
White bass *	<i>(Morone chrysops)</i>	1	2	1
White perch *	<i>(Morone americana)</i>	0	0	12
PERCIDAE				
Yellow perch *	<i>(Perca flavescens)</i>	4	10	6
Walleye *	<i>(Stizostedion vitreum)</i>	1	1	0
SCIAENIDAE				
Freshwater drum	<i>(Aplodinotus grunniens)</i>	27	51	17
Total Catch		297	477	534
Number of Species		18	16	21

* Indicates common sportfish species.

to be effectively sampled with electrofishing or trawling gear. Poor water clarity may have made observation of electroshocked goby difficult to see and capture. Netting shocked fish was difficult during sampling in 1998 due to the turbidity of the water, which was limited to an average depth of 0.19 m (approximately 7 inches). Round goby lack swim bladders and tend to roll along the bottom in and among the rocks when they are electrically shocked (A. Hintz, U.S. Fish and Wildlife Service, personal observation) making their capture difficult in addition to the limited visibility.

Goby are suspected to have been introduced to upstream areas of the Shiawassee River through an accidental bait release (Jude 1997); and are thought to be deterred from readily spreading downstream due to predation in Shiawassee Lake, which may be acting as a natural barrier (D. Jude, University of Michigan, personal communication). Round goby have also colonized the Flint River, which provides access to the Shiawassee River on the refuge from the Spaulding Drain and the Flint River proper. The Flint River serves as a potential vector for round goby to enter refuge waters.

No barrier exists from preventing upstream migration of round goby from the mouth of the Saginaw River. The current range of the goby in the Saginaw River is unknown. It is possible they may be present just below the junction of the Shiawassee and Saginaw Rivers due to shipping transport, or on the refuge due to simple unassisted range expansion. Ballast hauling ships reach docks in Saginaw within a mile from the refuge.

Should the round goby be present in refuge waters it could be a detriment to the native fish community. The goby is an aggressive fish that can reach up to 10 inches in length and live for 5 years (Jude 1997). Researchers have speculated that round goby could have a detrimental effect on other nest guarding species such as the bluegill and large and smallmouth bass because of their use and aggressive defense of similar spawning areas (Jude 1997). Rockbass, pumpkinseed, green sunfish, bluegill, small and largemouth bass, black and white crappie; as well as some species of darters guard their nests (Goodyear et al. 1982) and could be impacted by round goby should they colonize the refuge.

Goby are a nuisance to fishermen where they are found because they are non-selective for preying on bait (Ghedotti et al. 1995). Their curious, aggressive nature allows them to quickly sense and prey on bait - dominating angling and keeping fishermen from catching preferred fish (Ghedotti et al. 1995). They have been found to prey on fish comparable to their own body size (A. Hintz, U.S. Fish and Wildlife Service, personal observation). They may also be a vector for contaminant transfer between zebra mussels and sportfish. Goby prey on zebra mussels (Jude et al. 1995, Ray & Corkum 1997), which filter the water and possibly concentrate harmful contaminants and pollutants into their body mass (Bruner et al. 1994). The potential for food bioconcentration of harmful substances from the zebra mussel to the round goby to sportfish that prey on round goby exists. Common sportfish known to prey on round goby include rock bass, smallmouth bass, walleye, and yellow perch (Jude 1997).

MICHIGAN ENDANGERED DARTERS

Neither the channel darter nor the river darter was captured during bottom trawling surveys in the Cass and Shiawassee Rivers during 1998. Bottom trawling for darters was difficult in the Cass River because of large woody debris; therefore effort was limited. It may be that the

darters are present but in small number or in a limited area. The status of the darter in refuge waters continues to be unknown.

REFUGE FISH COMMUNITY

The survey captured 25 of 71 species documented by the Michigan DNR as occurring in the rivers that flow into the Shiawassee NWR (U.S. Fish and Wildlife Service 1996). The survey captured two additional species, brown bullhead and white perch, which were not listed among the 71 potential species. Refuge waters of the Shiawassee River support a diverse fish community that is composed of both predator and forage fish species, including a variety of sportfish. The refuge also appears to be a nursery area for forage and sunfish species. Along with the rest of the Saginaw River system, it is likely an important fish production area for Saginaw Bay, Lake Huron.

CONCLUSION

Neither goby or Michigan endangered darters were found on the Shiawassee NWR during survey efforts in 1998. Efforts will continue to be made to survey refuge waters for the goby using alternate sampling gears. Seining and angling will be employed to sample riprap and natural areas along the Shiawassee, Flint, and Cass Rivers. Goby have been effectively sampled kick seining (D. Jude, University of Michigan, personal communication) and are particularly vulnerable to angling due to their aggressive behavior. Darters are commonly captured with seine gear.

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