2026 Geneva Lake Nearshore Fishery Survey

Survey was completed June 25 and 30, 2026

July 2026

Survey Participants

Dave Marshall – retired WDNR – P.H. - Aquatic Ecologist, Mark Sesing – retired WDNR Lakes Program, Holly Baseman – GLEA Executive Director, Henry Huss – GLEA, Logan Madison – GLEA, Moira Gerard – GLEA, Brilie Esser – GLEA, Joanna Gerard – GLEA, Micach, Miles and Tai – GLAS, Grace, Austin and Hannah – Walworth County

Summary

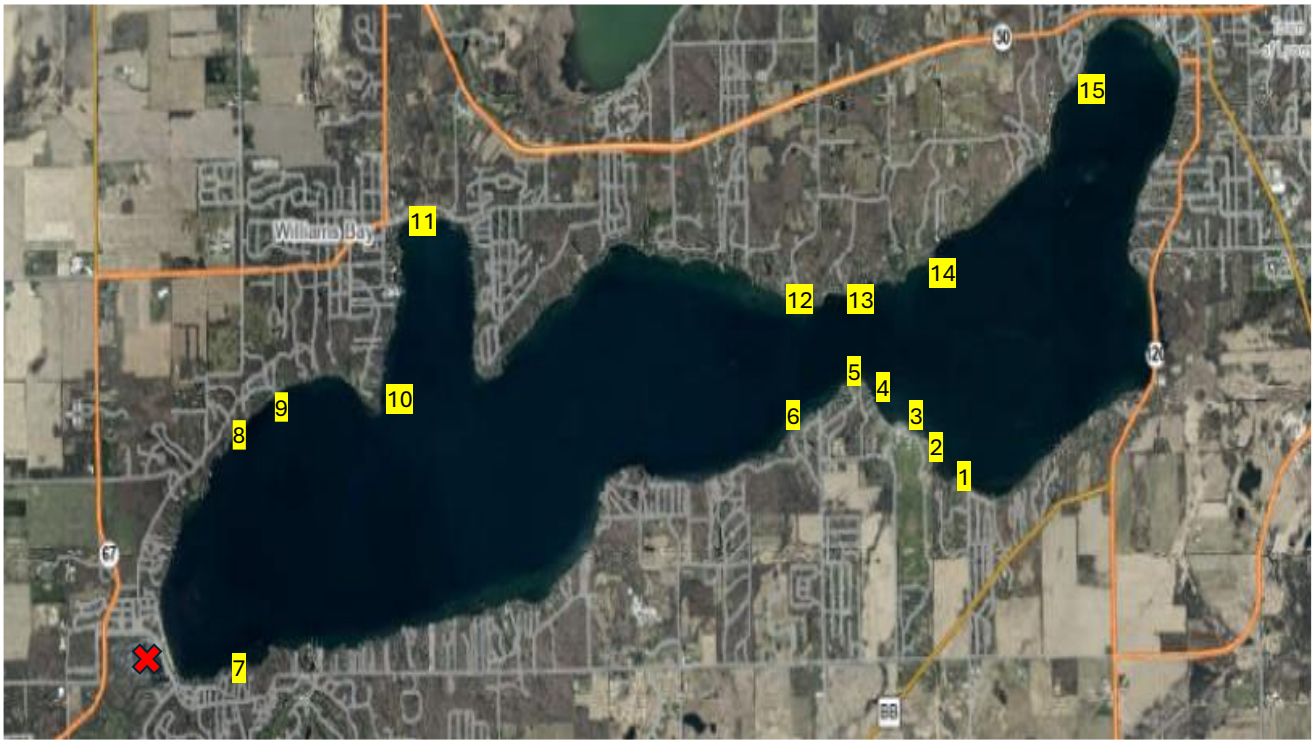
For the fourth year in a row, a nearshore fish survey was conducted on Geneva Lake to assess the distribution of shallow water fish populations. The surveys also served as a hands-on lake ecology class for students, teachers, and interns. Students and interns had an opportunity to see firsthand how nearshore habitat can affect fish survival and lake biodiversity. In 2026 the crew sampled 15 sites around the lake using either a towed DC electroshocker barge or a small mesh seine. Seventeen native fish species were found in 2026, compared to 17 in 2024 and 20 in 2023. A clear pattern has emerged where the rarest fish and highest species richness are found along natural shorelines, protected bays and sheltered areas with an abundance of aquatic plants. Fewer fish are found along deeper riprap shores where wake generated water turbulence occurs.

This was the seventh Geneva Lake nearshore fishery survey since this type of fish sampling began in 1978. Consistent with four other surveys conducted since 2004, fish species richness had declined since 1978 when the first nearshore fishery survey was conducted. Environmental stressors such as piers, motorboat wake turbulence, and armored shorelines likely contributed to the decline in nearshore fishes we have observed.

Introduction

The shallow water perimeters of deep glacial lakes, 0 – 2', are essential for biodiversity and food web energy flow. In Geneva Lake, the nearshore habitat zone, extending out to a water depth of about 2' is less than 1% of the lake's surface are but is critical for sustaining the lake ecosystem. This essential but relatively small area is also the most altered portion of the lake, as shoreline development such as piers, moored boats, shoreline armoring, plant removal and boat wake turbulence alter habitat.

Figure 1: June 2026 sampling sites



Geneva Lake is one of the few Wisconsin lakes that has been regularly surveyed for nearshore fish. Why survey shallow areas with mostly minnows and darters, instead of larger, well-known fish? This is a common question. Besides the fact that native nongame fish are part of our natural heritage, they are also essential links in lake food chains (Marshall et al. 2022). Actually, most fish species inhabit shallow zones as needed for reproduction, early life stage development and food (Vander Zanden et al 2011). Popular sport fish are dependent on nongame fish for growth and survival. Declines in small fish species can reduce the growth rates and survival of popular sportfish. The small shiny minnows and bottom-dwelling darters, described as “canaries in the coal mine” (Gaumnitz 2005), are sensitive to habitat changes. Minnesota DNR has recognized this fact and developed systematic approaches using nongame fishes as indicators to calculate the lake IBI or Index of Biotic Integrity as a measure of lake environmental health (Bacigalupi et al. 2021).

The initial Geneva Lake nearshore fishery survey was part of the DNR Wisconsin Fish Distribution Study (Fago 1992). The study was ended by the early 1980s since the information was considered "lower priority" compared routine census of popular gamefish and panfish. The "Comprehensive Fish Survey Report for Geneva Lake" (Roffler et al. 2015) is an example of fish management surveys that DNR routinely conducted across Wisconsin, using boomshocking motorboats and fyke nets designed to sample larger fish. In contrast, nearshore survey methods target the small nongame fish populations along with juvenile stages of "sportfishes." Nongame fish species demonstrate the complexity of lake ecosystems while fish biologists must focus solely on the status of popular sportfishes with important ecosystem details missing (Clancy et al. 2025).

In 2004, DNR resampled a subset of the 1978 Fish Distribution Study sites in high-quality calcareous glacial lakes including Geneva Lake. The study was initiated after lake managers grew concerned over the rapid pace of shoreline development and potential impacts to habitat. The high-quality (mesotrophic) lakes were selected to eliminate pollution as a significant environmental variable. Long-term water chemistry data indicated minimal changes in water quality in the study lakes over time, while aerial photography demonstrated significant shoreline development over the same period. Shoreline habitat changed while water quality remained unchanged. Findings from the 2004 study demonstrated that native species richness declined by 85% and rare/environmentally sensitive fish declined by 31% compared to the 1978 survey (Marshall and Lyons 2008). While the Wisconsin DNR no longer conducts this type of analysis, the Minnesota DNR recently found negative impacts to lake ecosystems at pier densities averaging 15/mile (Dustin and Vondracek 2017). In 2004, the pier count around Geneva Lake was 37/mile. Piers alter nearshore habitat (Garrison et al. 2005) but also function as loci for other habitat-changing forms of development and human activities (Radomski et al. 2010).

Bryan and Scarnecchia (1992) found that aquatic plant habitats were reduced and fish species richness was lower along developed shorelines compared to undeveloped shorelines in an Iowa glacial lake. Christensen et al. (1996) measured reduced woody debris, necessary for fish and macroinvertebrate production, along developed shorelines compared with undeveloped

shorelines. Elias and Meyer (2003) reported reduced floral complexity and woody debris where development occurred in northern Wisconsin lakes. Radomski et al. (2001) found reduced floating-leaf and emergent vegetation in most Minnesota lakes where shorelines were developed. Fish species richness and environmentally sensitive fish declined near developed shores (Kaufmann et al. 2014c, Whittier et al. 1997a). Assessing the potential cumulative impacts of development on habitat loss has become standard for understanding the impacts of incremental shoreline development (Jennings et al. 1999, Jennings et al. 2003).

Table 1: 2025 Geneva Lake Nearshore Fish Survey Results – 17 species

Site	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Longnose gar		1													
Fathead minnow														1	
Bluntnose minnow		6			5									1	4
Mimic shiner					2									14	
W. banded killifish	2	8	6	2	9		1	1			3	2			
Yellow bullhead														1	
Bluegill	17	20		11	5		2	7	11			157	18		1
Green sunfish		1													1
Pumpkinseed	1	5	1	2											
Hybrid sunfish	1														
Largemouth bass		1	1						1	1					
Smallmouth bass														1	
Rock bass			1				1	1							
Yellow perch	1	7		6	3			5	17		1	41	9	1	2
Fantail darter														8	
Iowa darter															1
Johnny darter														1	
Rainbow darter														2	

Sites 2, 10, 14 and 15 were sampled with towed DC electroshocker. The remaining sites were sampled with a 20’ small mesh seine.

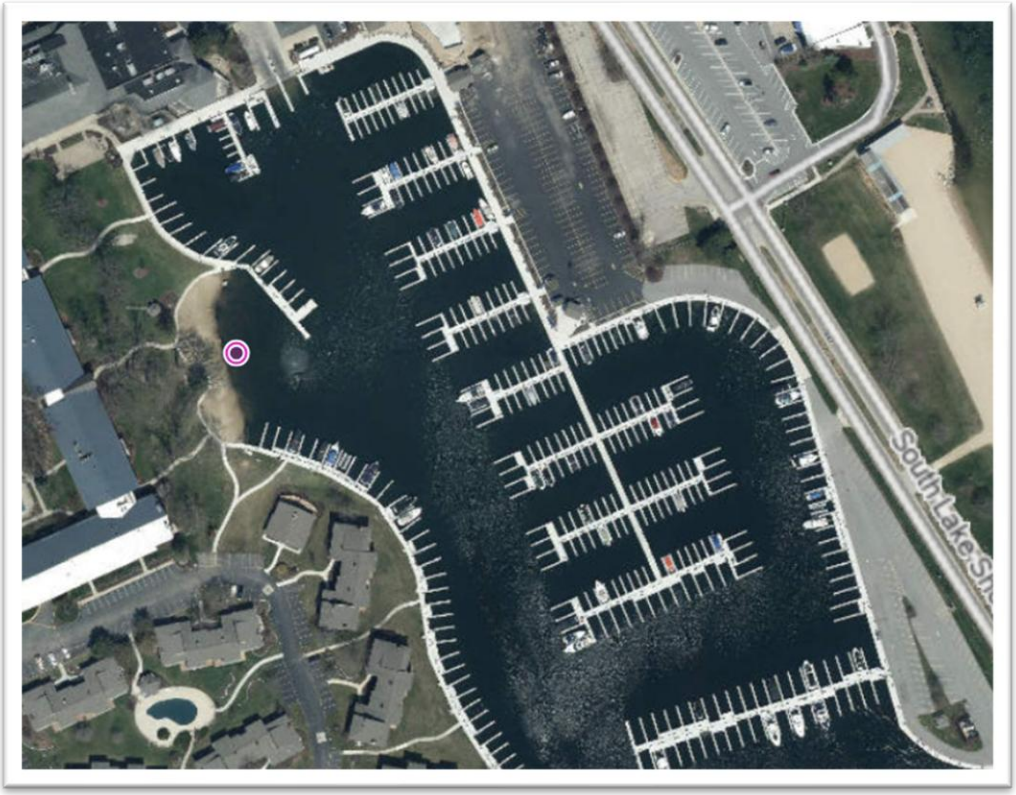
Methods

We sampled 15 sites around Geneva Lake in June 2025 (Figure 1). Many of the sites were established during the 1978 Fish Distribution Study but some sites were gradually replaced as newer piers and other structures filled the former sampling areas. In addition to the towed DC electroshocker barge, a 20’ small mesh seine was used to sample offshore fish and provide

hands on experience for the students. Dissolved oxygen and temperature were measured with a YSI ODO meter calibrated to barometric pressure and air temperature.

The Abbey Bay site was eliminated due to the recent loss of valuable aquatic plant habitat, which is a direct threat to state special concern least darters. Northern watermilfoil, coontail and white waterlilies were eliminated from the site. Wading through the much-reduced Chara habitat would have placed an additional stressor on the rare fish.

Figure 2: Abbey Bay site was eliminated in 2025 and 2026 to avoid disturbing the remaining Chara habitat used by the declining state special concern least darter population. White waterlily, coontail and northern watermilfoil were completely eliminated from the site.



Results

Table 1 lists the species found during the survey and abundance at each site. We collected one young-of-the-year longnose gar at Site 2. Darter species continued to be scarce in the lake, despite favorable water quality and numerous rocky shores. At Sites 6 and 10, rocky shorelines

appeared very favorable for most darter species and many other fish, however we didn't find a specimen at those locations. Motorboat wake turbulence was very strong at these and other sites that may have been a factor. At Site 14 we found the first rainbow darter species since the original 1978 survey. The shallow rocky natural habitat at the site was ideal for rainbows and other darter species. Dissolved oxygen and water temperature measurements ranged from 8.1 – 14.5 mg/l and 20.7 – 23.7 C respectively and both parameters increased as the day progressed.

Table 2 updates seven years of nearshore survey species inventories. Western banded killifish, a species that has been declining across its range, continues to be common in Geneva Lake. Figure 3 compares the total number of native fish species collected each survey year since 1978. The native species count remains lower for all 21st century surveys, even when including towed electroshocking gear that revealed new species, such as fantail darters in the lake.

Figure 3 compares total native fish species collected since 1978

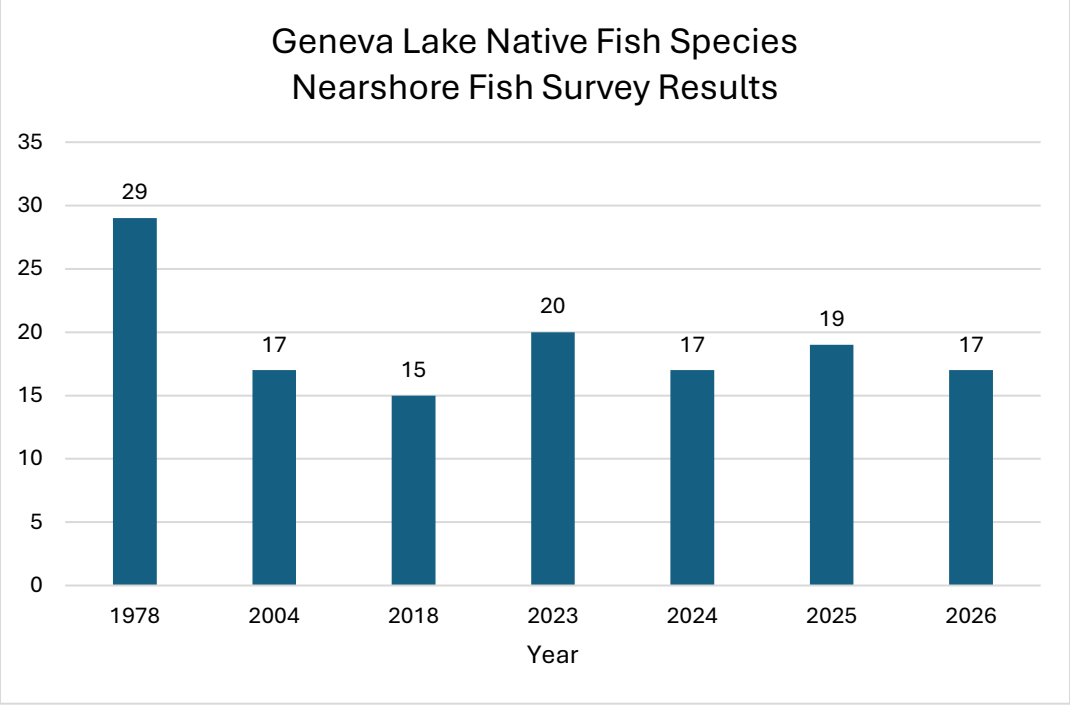


Table 2: Comparison of Nearshore Fish Survey Results 1978 - 2026

Species	June ‘26	Aug ‘25	June ‘24	June ‘23	Aug ‘17	June ‘04	June 1978
Longnose gar	1	4	0	1	0	0	1
Bowfin	0	1	2	0	0	0	1
Central stoneroller	0	0	0	0	0	0	4
Spotfin shiner	0	0	0	0	0	0	1
Common shiner	0	0	0	0	0	0	1
Golden shiner	0	0	0	0	0	1	149
Emerald shiner	0	0	120	0	0	0	20
Spottail shiner	0	0	0	0	0	0	1
Mimic shiner	3	1	200	6	2	5525	436
Bluntnose minnow	16	>300	69	7	54	158	226
Fathead minnow	1	0	0	2	1	3	193
Creek chub	0	0	0	1	0	1	3
White sucker	0	3	1	0	0	1	83
Black bullhead	0	1	0	0	2	1	87
Yellow bullhead	1	>102	1	4	7	0	0
Brown bullhead	0	0	0	0	0	0	18
Northern pike	0	0	4	2	0	3	0
Muskellunge	0	1	0	0	0	0	0
Cisco	0	0	0	0	0	0	2
W. Banded killifish	48	77	44	3	6	34	98
Brook stickleback	0	1	0	0	0	0	81
Rock bass	3	7	4	12	20	4	43
Green sunfish	2	1	5	20	32	0	101
Pumpkinseed	9	10	14	5	30	89	146
Bluegill	233	>422	49	51	288	290	146
Sunfish hybrids	1	1	0	2	4	1	5
Smallmouth bass	1	3	1	27	67	25	93
Largemouth bass	4	24	2	12	134	19	16
Rainbow darter	2	0	0	0	0	0	8
Iowa darter	1	0	1	6	0	4	5
Fantail darter	8	6	0	40	1	0	0
Least darter	0	0	9	13	52	66	3
Johnny darter	1	0	0	1	0	0	2
Yellow perch	92	>159	198	30	241	509	1023
Native species	17	19	17	20	15	17	29
Total catch	427	>1,142	724	265	956	6,751	3,025
Gear	Both	Both	Both	Both	Both	Seine	Seine

Both = towed barge electroshocking and seining

Discussion

Shoreline development affects the most productive areas in a lake for both gamefish and nongame fish, functioning as an essential link in the food web. A reduction of small benthic fish, primarily darters (Percidae family) and some minnow species (Cyprinidae family) can alter energy flow from shallow littoral zones to pelagic areas and affect lake ecosystems (Vander Zanden and Vadeboncoeur 2020).

Piers can directly destroy lake habitat (Garrison et al. 2005) and are often the loci for other forms of nearshore human disturbances (Radomski et al. 2010). In 2004, the WDNR compared pier densities (number of piers per mile) with the number of environmentally sensitive and rare fish species in southeast Wisconsin lakes. A strong negative relationship was found between pier numbers and number of small, environmentally sensitive fish species (Figure 4). Table 3 contains the list of environmentally sensitive small nongame fish species historically found across southeast Wisconsin lakes.

Figure 4: Native Intolerant-Rare Nongame Fish versus Pier Density

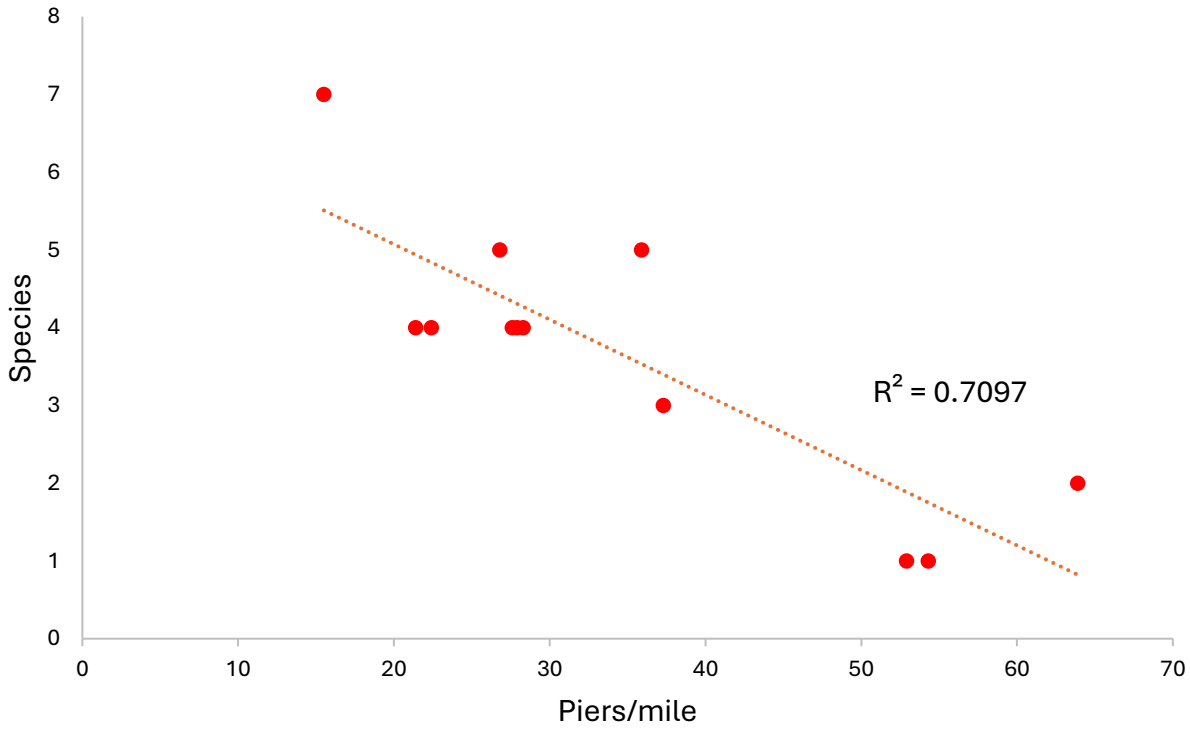
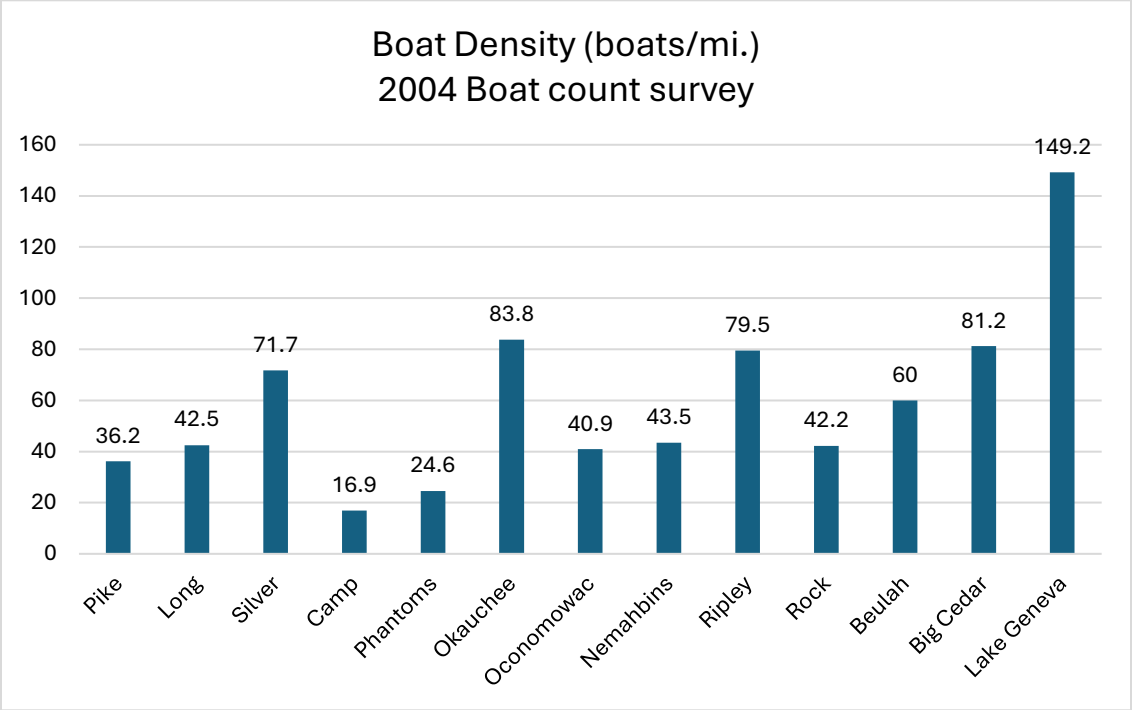


Table 3: List of Southeast Wisconsin Nongame Fish Species in Figure 4

Common name	**Scientific Name**	**Classification**
pugnose shiner	*Notropis anogenus*	State Threatened
pugnose minnow	*Opsopoeodus emiliae*	Rare
blackchin shiner	*Notropis heterodon*	Intolerant
blacknose shiner	*Notropis heterolepis*	Intolerant
lake chubsucker	*Erimyzon sucetta*	State Special Concern
banded killifish	*Fundulus diaphanus menona*	Rare
starhead topminnow	*Fundulus dispar*	State Endangered
least darter	*Etheostoma microperca*	State Special Concern
Iowa darter	*Etheostoma exile*	Intolerant
rainbow darter	*Etheostoma caeruleum*	Intolerant

Figure 5: 2004 DNR Pier Inventory Among 13 Southeast Wisconsin Lakes



Some states have considered purchasing conservation easements to reduce habitat fragmentation by removing or clustering piers. This effort has not been attempted in Wisconsin and removing piers is unlikely. Wake disturbance in some areas appears to be affecting habitats and may be an opportunity for study and habitat protection. As part of the 2024 nearshore fish survey, a study was recommended to assess if constructing nearshore barrier reefs or breakwaters can reduce chaotic wake disturbances along selected shorelines. This approach to habitat protection and restoration may be more feasible than attempting to change existing

structures on the water. In Figure 5, WDNR demonstrated in 2004 that motorboat densities were the highest among the study lakes and very large wake producing boats was observed. Wakes from large watercraft may be an additional stressor on nearshore aquatic communities.

Recommendations

Seek lake grants to assess the effects of boat wakes on nearshore fishes, macroinvertebrates and aquatic plants to better understand the observed changes in the littoral zone fishery assemblages.

Given the potential effects of boat wakes on habitat and fish assemblages, undeveloped shorelines and weedy bay habitats around the lake should be protected, including Site 2 (Abbey Bay) and Williams Bay. Encourage nearshore habitat restorations.

The historic sampling location in Abbey Bay holds most of the lake's least darter population and the habitat has been degraded due to loss of the northern watermilfoil and floating-leaf plants. A strategy and perhaps an investigation may be necessary to protect this native plant habitat that is essential for sustaining state special concern least darters in Geneva Lake.

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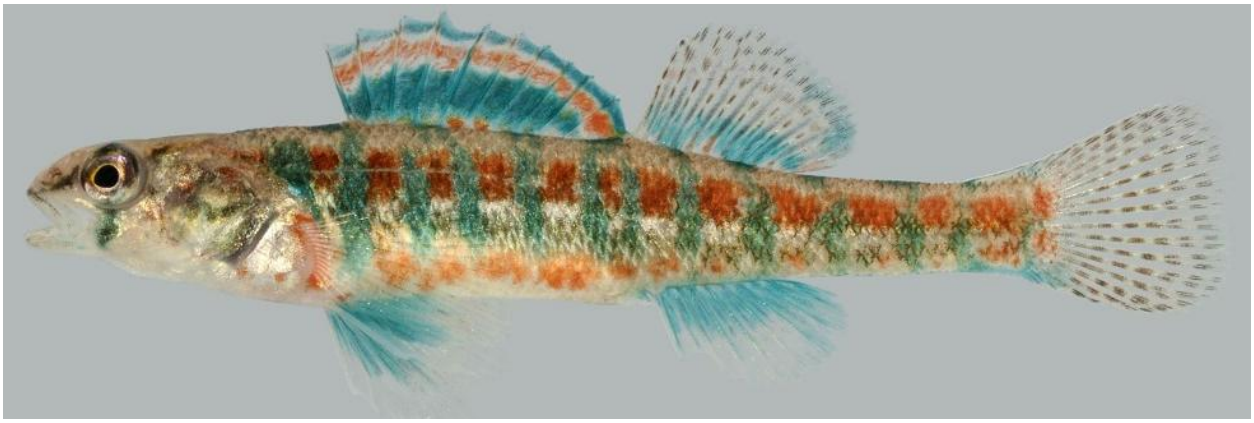
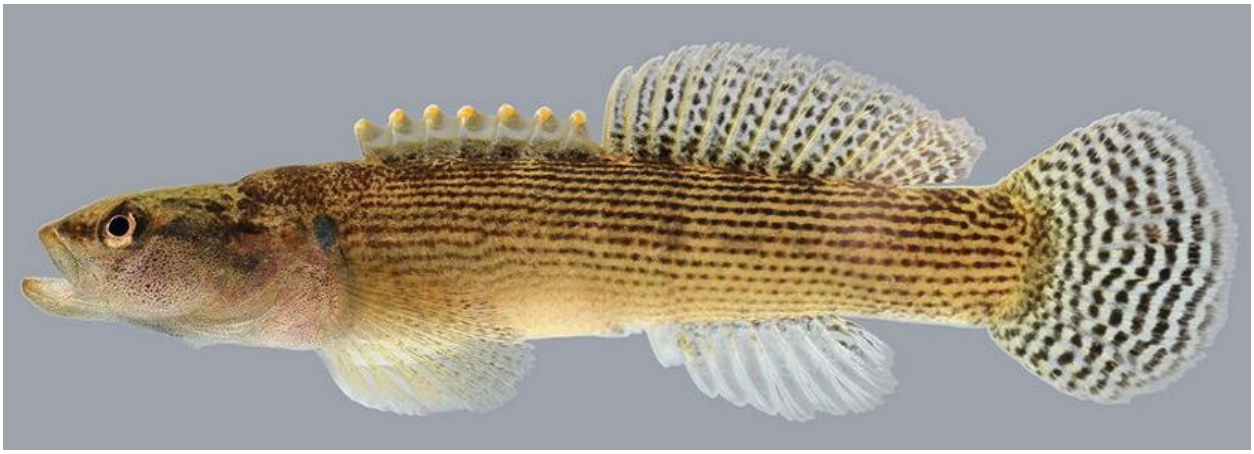
Nongame Fishes of Geneva Lake

Rainbow darter (*Etheostoma caeruleum*) ~ 3”

Least darter (*Etheostoma microperca*) ~ 2”



Iowa darter (*Etheostoma exile*) ~ 2.5”



Fantail darter (*Etheostoma flabellare*) ~ 3”

Johnny darter (*Etheostoma nigrum*) ~ 2.5”

Longnose gar – young of year “living fossil” (*Lepisosteus osseus*)

Bowfin ~ 43” “living fossil” (*Amia calva*)

Western banded killifish (*Fundulus diaphanus menona*) ~ 3.5”

Mimic shiner (*Notropis volucellus*) ~ 2.5”