Colwell Lake
Schoolcraft County, T44N/R17W/Sec. 09
Manistique River Watershed, Surveyed 2023

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Environment

Colwell Lake is a 158-acre seepage lake in northwest Schoolcraft County, located adjacent to M-94 approximately 22 miles north of Manistique and 11 miles south of Shingleton (Figure 1). The surrounding geology is primarily comprised of coarse-textured glacial outwash sand and gravel and post-glacial alluvium. The lake itself drains a small surface area (258 acres) that includes the adjacent portions of M-94, with water passing primarily through mixed forest and woody wetlands (Figure 2). Due to its location within the Hiawatha National Forest, the shoreline and surrounding area of Colwell Lake is largely undeveloped, though a campground along the southern shoreline and a small boat launch on the western shoreline are present and managed by the U.S. Forest Service (USFS). Colwell Lake reaches a maximum depth of approximately 20 feet. The shoreline is primarily sand, and aquatic vegetation is abundant throughout. The fish community is primarily comprised of warm and cool-water fishes, including Bluegill, Pumpkinseed, Rock Bass, Northern Pike, and Largemouth Bass.

History

From 1933 to 1942, like many other lakes in the region, Colwell Lake first began receiving regular stockings of sportfish to create or bolster fisheries. During this time, Bluegill, Largemouth Bass, Smallmouth Bass, Walleye, and Yellow Perch were stocked at various life stages (Table 1). Stocking did not occur again in Colwell Lake until Northern Pike were stocked in 1967, 1968, and 1971 as spring fingerlings, fall fingerlings, and adults, respectively.

The survey history in Colwell Lake has consistently described an abundant, but slow-growing, panfish community. In 1964, light dosages of rotenone were applied to thin the population of small panfish, and reports indicated Bluegill angled in 1965 were of larger size. In 1988, a fisheries survey conducted by USFS sampled the panfish community with trap and fyke nets and documented abundant Bluegill, Pumpkinseed, and Rock Bass populations; however, all fish were very small, with nearly all Bluegill between 3-6" and Pumpkinseed and Rock Bass between 4-7". Some Yellow Perch and a few small Northern Pike were also observed. No Largemouth Bass were captured. In an effort to control the stunted panfish population, USFS partially treated with rotenone Colwell Lake in late fall of 1991. This was followed up with a single fish transfer effort (the last on record for Colwell Lake) of 170 adult Largemouth Bass (avg. length: 10") in the summer of 1993 to introduce more predators to the system and hopefully improve panfish size structure. A follow-up general inventory was conducted by USFS in 1995, in which they reported a "marginal sport fishery, but good growth rates for all species". In 1999, Colwell Lake was again surveyed by USFS, with reports from this survey indicating a "much improved sport fishery, but with very poor growth rates for all species except Northern Pike". Managers at this time were concerned that poor growth rates may be warning signs of a potential reversion to a stunted panfish population and recommended another survey be conducted in 3-5 years.
In summer 2006, USFS returned to Colwell Lake to conduct a general inventory and electrofishing survey. In these surveys, they documented increased catch rates of Bluegill (39% of total catch weight

compared to 9% in 1995) and Northern Pike (20% of total catch weight compared to 2% in 1995), and decreased catch rates of Rock Bass (3% of total catch weight compared to 26% in 1995). The Largemouth Bass population was considered undersized and slow growing, with few fish captured above the legal size of 14 inches. While Northern Pike abundance increased, size structure and growth were poor, with most fish being between 15-20". Catch rates of Yellow Perch during the survey were also poor, but this may have been due to time of year given that angler reports from the previous winter had been good. Recommendations included again stocking Largemouth Bass to improve panfish size structure; however, this never occurred.

Current Status

In 2023, the Michigan Department of Natural Resources sampled Colwell Lake as part of a Status & Trends survey protocol to document the current status of the fishery. A shoreline habitat survey was conducted in summer (8/22/23) and limnology surveys were conducted in both the winter (3/9/23) and summer in the deepest part of the lake to document suitable habitat available for fishes during winter and summer lake stratification. The shoreline habitat survey revealed high average density of submerged trees (102 trees/km) compared to Status & Trend averages statewide (30 trees/mile; Wehrly et al. 2015), though the density was moderate compared to other lakes in the Northern Lake Michigan Management Unit. The winter limnology survey revealed low availability of suitable habitat, with dissolved oxygen concentration (DO) approaching a critical level of 3.0 mg/L - most fishes in Michigan require DO $\geq$ 3.0 mg/L (Schnieder 2002) - at 5 feet, and the bottom half of the water column being fully anoxic (Figure 3). The summer limnology survey documented much more water volume suitable for fish habitation, with moderately warm water temperatures and high DO to a depth of 15 feet (Figure 3). A sharp thermocline occurred at 16 feet and anoxic conditions existed from there to the bottom. Water quality samples for alkalinity, nitrogen, phosphorus, and chlorophyll-a concentration were also taken in August. Surface alkalinity was low (40 mg/L) compared to other lakes in Northern Michigan during the spring (80 mg/L; Fuller and Minnerick 2008), suggesting Colwell Lake has less buffering capacity than other lakes and may be more prone to acidification. Nitrogen concentration (nitrate + nitrite, 0.003 mg/L) was below average while total phosphorus concentration (0.041 mg/L) was above average for lakes in this ecoregion (Fuller and Minnerick 2008), suggesting productivity may be limited by nitrogen availability. Chlorophyll-a concentration - a proxy for algae density taken as an integrated epilimnion sample - was very low (0.003 µg/L), supporting that primary productivity in the lake occurs predominantly through aquatic vegetation.

A fish community survey was conducted from May 22-24, 2023 using a variety of gears (seines, small mesh fyke nets, large mesh fyke nets, experimental gill nets, and trap nets) to capture different species. A total of 1,183 fish were captured. Bluegill was the most abundant species - comprising 30% of the total catch - followed by Black Crappie (16%), Bluntnose Minnow (13%), and Northern Pike (10%; Figure 4). Northern Pike by far contributed the most to the total biomass sampled (40%), followed by Brown Bullhead (17%). Bluegill and Black Crappie each comprised roughly 13% of the total biomass sampled. The catch rate of Northern Pike in experimental gill nets during the survey (14.0 fish per net night) was one of the highest catch rates ever recorded in any lake in the state.

Relative size structure (understood as the amount of the catch of a species that is greater than a certain percentage of the world record length for that species) for the majority of sportfish species was poor, with very low proportions of panfish species and Northern Pike being of preferred size, and only one individual fish (a Black Crappie) being of memorable size (Table 2). The two exceptions to this poor

size structure were Brown Bullhead (95% of preferred size, n = 84) and White Sucker (100% of trophy size, n = 8). Likewise, growth rates were moderate-to-poor for most sportfish species, particularly for Black Crappie and Northern Pike, which averaged 2.3 and 5.1 inches below state average, respectively (Figure 5).

Analysis and Discussion

Colwell Lake can currently be described as an undeveloped, vegetated, mesotrophic lake supporting a modest panfish fishery and excessive abundances of Northern Pike. Limnological profiles in summer and winter were characteristic of highly vegetated lakes, with high DO availability in the summer likely due to high rates of photosynthesis producing oxygen, and low DO in the winter likely due to decomposition of aquatic vegetation depleting DO levels. However, it is worth noting that the low DO levels do not appear to be causing routine or widespread fish kills given the consistent presence of age classes for Black Crappie, Bluegill, Pumpkinseed, and Northern Pike across years (Figure 6). However, it is possible that stressful conditions may contribute to slow growth rates, as Northern Pike growth has been shown to be negatively correlated with low DO concentrations in both summer and winter (Margenau et al 1998).

The Northern Pike population is overabundant, with high catch rates (one of the highest gill net catch-per-efforts ever recorded in the state), slow growth rates, and few fish above 22 inches. This pattern is similar to the last survey conducted in 2006, which had observed declines in Northern Pike growth rates and the majority of fish being 15-20" in length. This indicates the system may be unlikely to correct itself over time, and management action is warranted. According to the Michigan Department of Natural Resources Northern Pike Management Plan, since the population falls within the 25th percentile in growth and near the maximum of the 75th percentile in catch per unit effort for gill net sets, it should be managed under the "No minimum size, 5 fish bag limit (with only one ≥ 24")" regulation (Smith et al. 2016). Colwell Lake was placed on this regulation in 2022, and this regulation should be maintained. It would be valuable to return to this lake again in the next 5-10 years to evaluate the effectiveness of this regulation on the Northern Pike population.

While it appears that the size structure of panfish has improved since the previous survey in 2006, very few appear to be attaining quality size. This may be due to competition within and among species for limited food resources and/or lack of sufficient predator regulation. Although Northern Pike are abundant, they tend to prefer to feed on shallower-bodied fishes like White Sucker and Yellow Perch (potentially why so few of these species were captured in this survey), and due to being undersized, may be unable to feed on moderate-sized panfish, effectively releasing them from predation risk once they reach a particular size. Similarly, while Brown Bullhead were prevalent and of good size, they would only be capable of feeding on smaller sunfishes. These factors may be why the most abundant size class of Bluegill, Black Crappie, and Pumpkinseed was approximately 7 inches.

The Largemouth Bass population seems to be very limited, with only three fish total captured during the survey. It is unclear why this may be the case, although predation by Northern Pike could be a contributing factor. It is worth noting, however, that an age-2 and an age-3 Largemouth Bass were captured, indicating that successful spawning events have occurred in recent years.

Management Direction

Northern Pike in Colwell Lake should continue to be managed under the "No minimum size, 5 fish bag limit (with only one ≥ 24")" regulation, and anglers are encouraged to keep undersized Northern Pike to reduce overabundance and improve size structure and growth rates. To evaluate the effectiveness of this regulation, Colwell Lake should be surveyed again in the next 5-10 years.

In an effort to improve the quality of the panfish fishery in the absence of larger predators, anglers are encouraged to keep smaller panfish (7") to alleviate competition for resources within and among species.

References

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Wehrly, K. E., D. B. Hayes, and T. C. Wills. 2015. Status and trends of Michigan inland lake resources, 2002-2007. Michigan Department of Natural Resources, Fisheries Report 08, Lansing.

Table 1: Historical fish stocking data for Colwell Lake, Schoolcraft County (1873-2023).

Year	Species	Number	Fish/acre	Life Stage
1933	Bluegill	900	5.7	5 months
1933	Largemouth Bass	150	0.9	4 months
1933	Walleye	60,000	379.7	Swim-up fry
1934	Bluegill	1800	11.4	4 months
1935	Largemouth Bass	100	0.6	NA
1936	Bluegill	1500	9.5	5 months
1936	Bluegill	12000	75.9	6 months
1936	Smallmouth Bass	100	0.6	4 months
1936	Yellow Perch	2000	12.7	Adults
1937	Bluegill	5000	31.6	3 months
1940	Bluegill	3000	19.0	4 months
1940	Smallmouth Bass	500	3.2	3 months
1941	Smallmouth Bass	280	1.8	Adults
1942	Bluegill	1200	7.6	4 months
1942	Smallmouth Bass	600	3.8	4 months
1967	Northern Pike	190	1.2	Spring fingerling
1968	Northern Pike	950	6.0	Fall fingerling
1971	Northern Pike	122	0.8	Adults
1993	Largemouth Bass	170	1.1	Adults

Table 2: Numbers of fishes captured across all gears (i.e., “Caught”) during Status & Trends survey protocol conducted on Colwell Lake from May 22-24, 2023 separated by relative stock-density classification. “Preferred”, “Memorable”, and Trophy” sizes refer to the number of fish at the length that anglers would first begin to consider them of desirable (i.e., preferred, length set at 45-55% of world record length (WRL)), memorable (set at 59-64% of WRL), or trophy status (set at 74-80% of WRL).

Species	# Caught	# Preferred	# Memorable	# Trophy
Black Crappie	193	13	1	0
Bluegill	354	16	0	0
Brown Bullhead	84	60	20	0
Largemouth Bass	3	1	0	0
Northern Pike	122	1	0	0
Pumpkinseed	90	22	0	0
Rock Bass	87	11	0	0
White Sucker	8	0	0	8
Yellow Perch	5	1	0	0

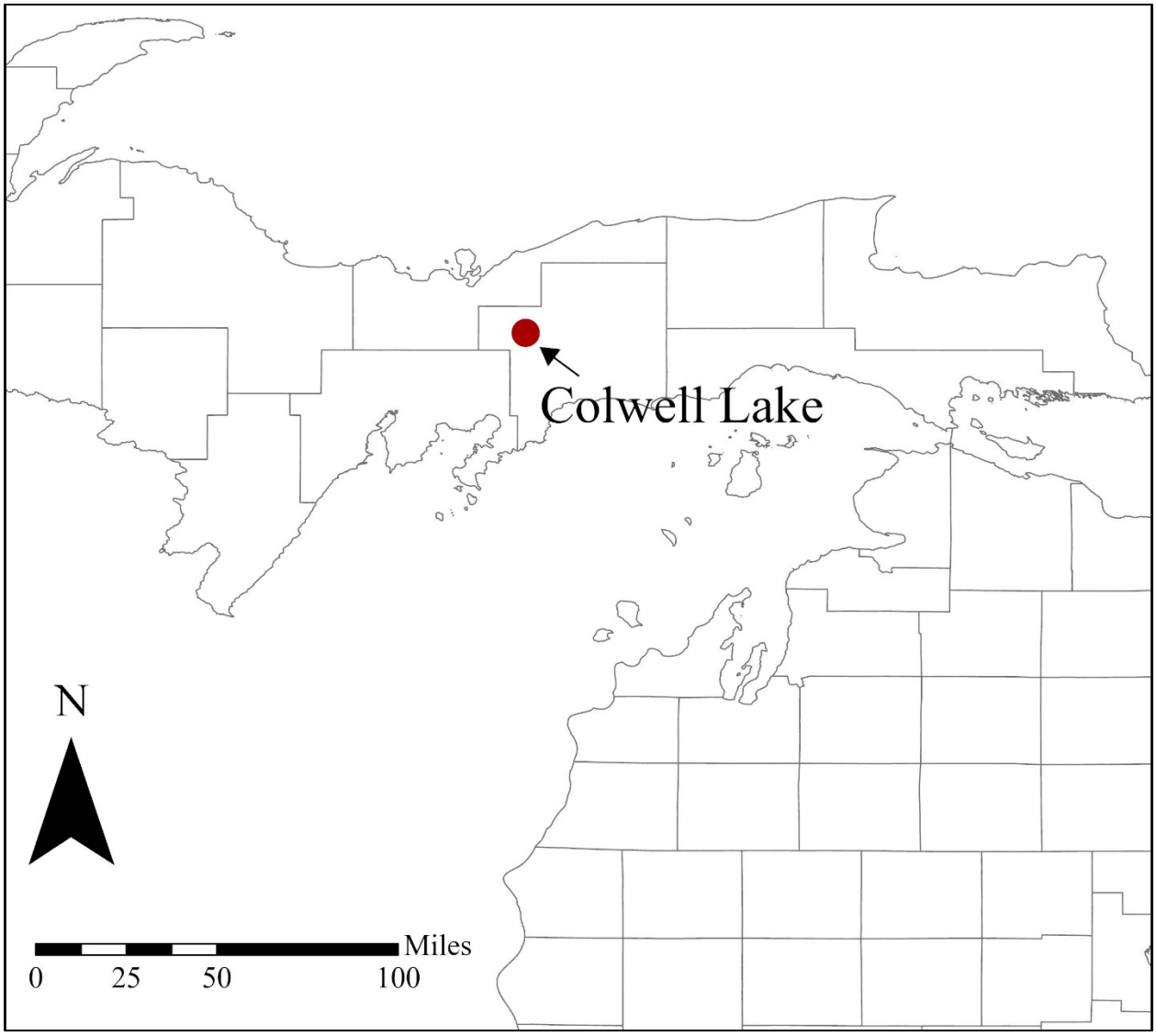

Figure 1: Location of Colwell Lake in Schoolcraft County, Michigan.

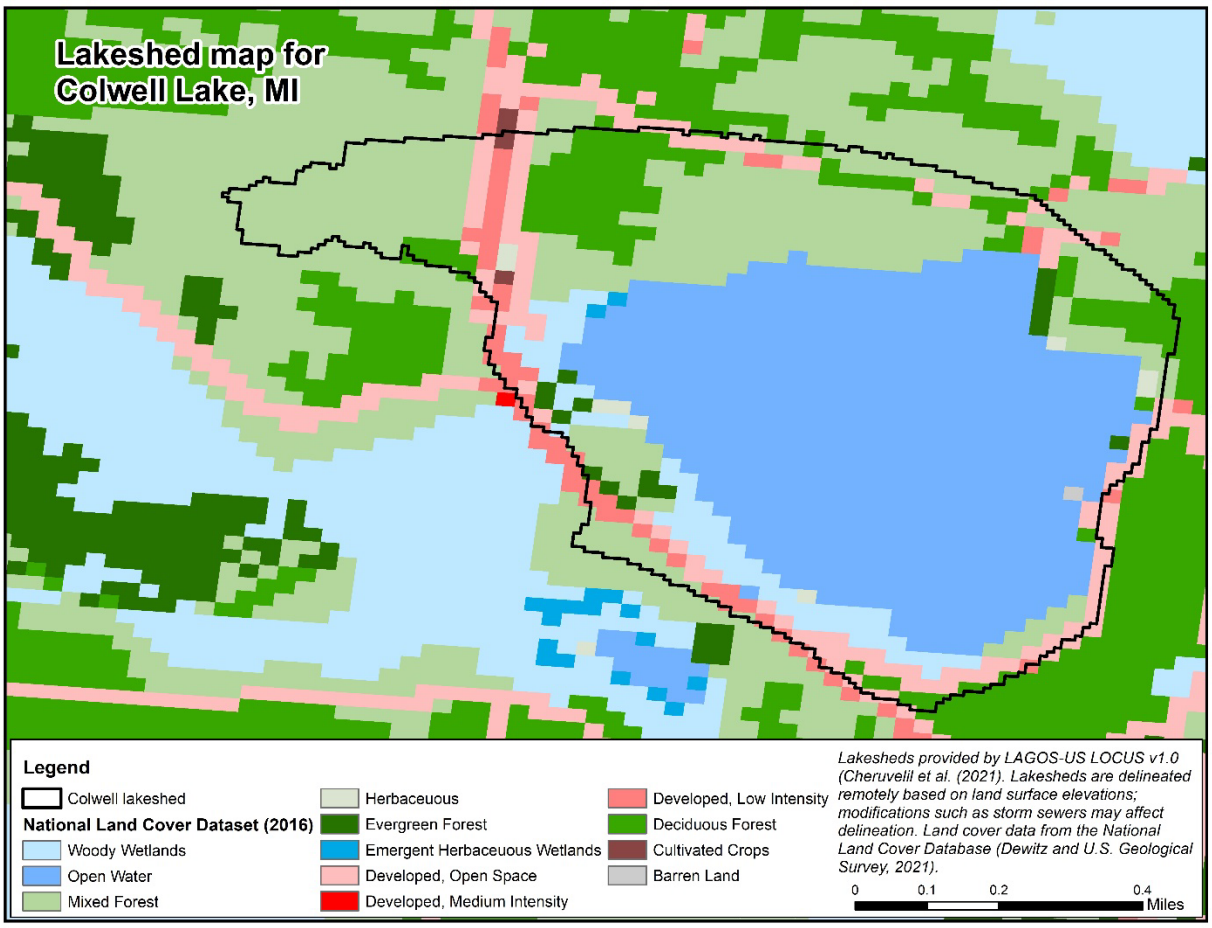

Figure 2: Lakeshed catchment outline (black line) and land cover map (colors) of Colwell Lake, Schoolcraft County.

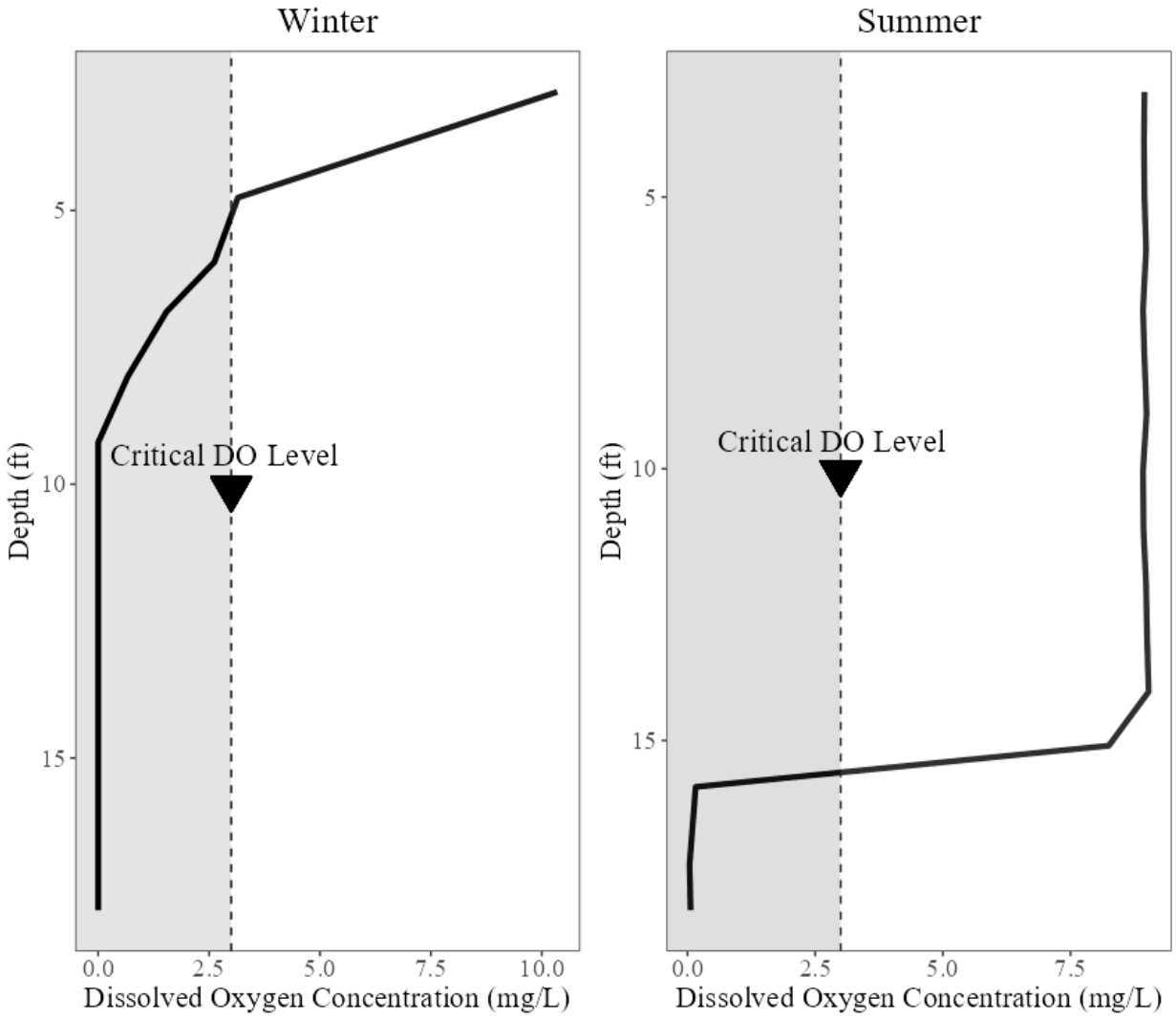

Figure 3: Dissolved oxygen concentration (DO) profiles conducted in Colwell Lake in March (winter, under ice) and August 2023 (summer, open water). White areas represent water with sufficient DO concentrations to be habitable for most Michigan fishes and gray areas represent water with insufficient DO to be habitable to most fishes (Schneider 2002).

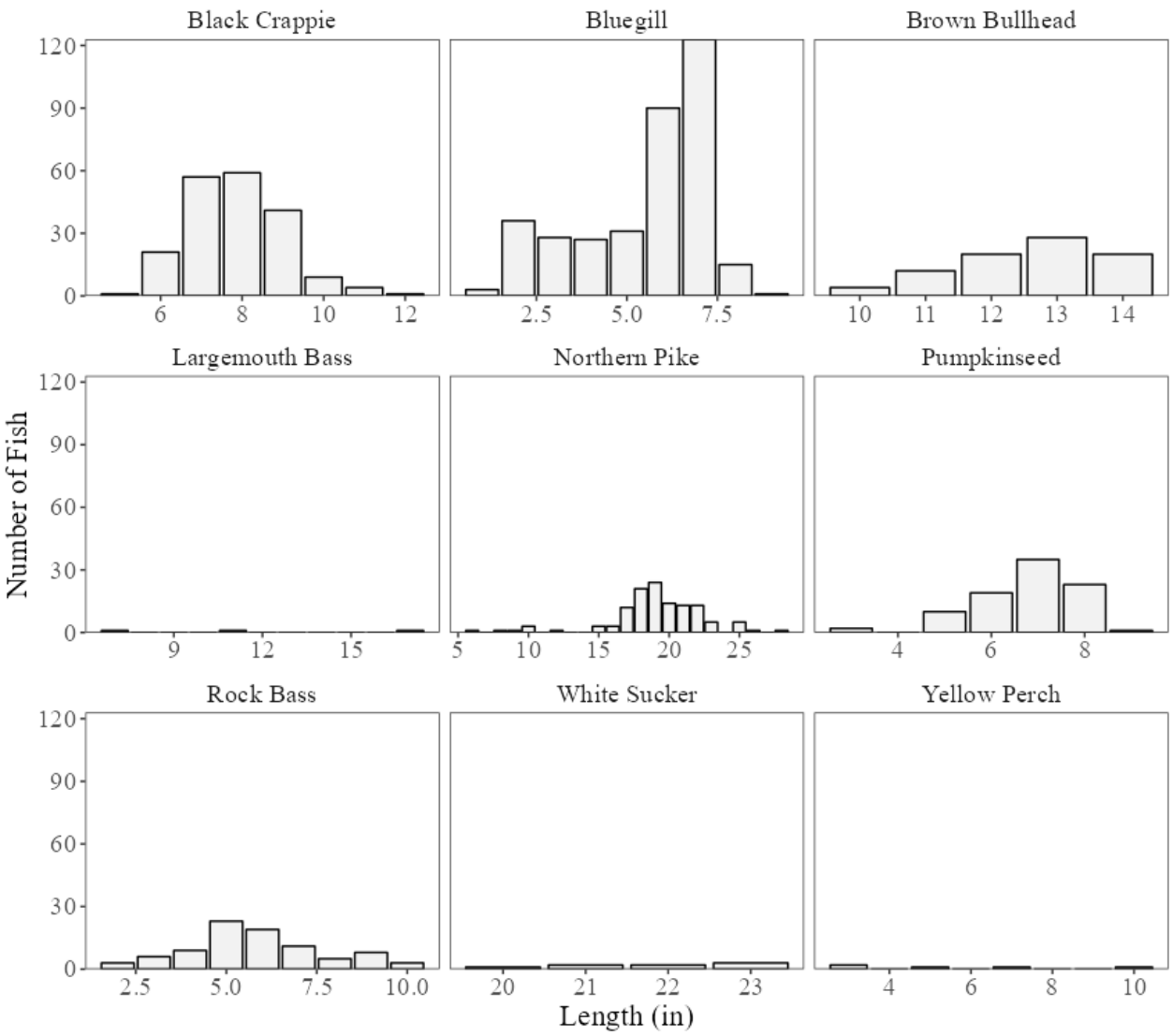

Figure 4: Length frequency of catch across all gear types (seines, small mesh fyke nets, large mesh fyke nets, experimental gill nets, and trap nets) during a Status & Trends survey conducted May 22-24, 2023 by Michigan Department of Natural Resources in Colwell Lake, Schoolcraft County.

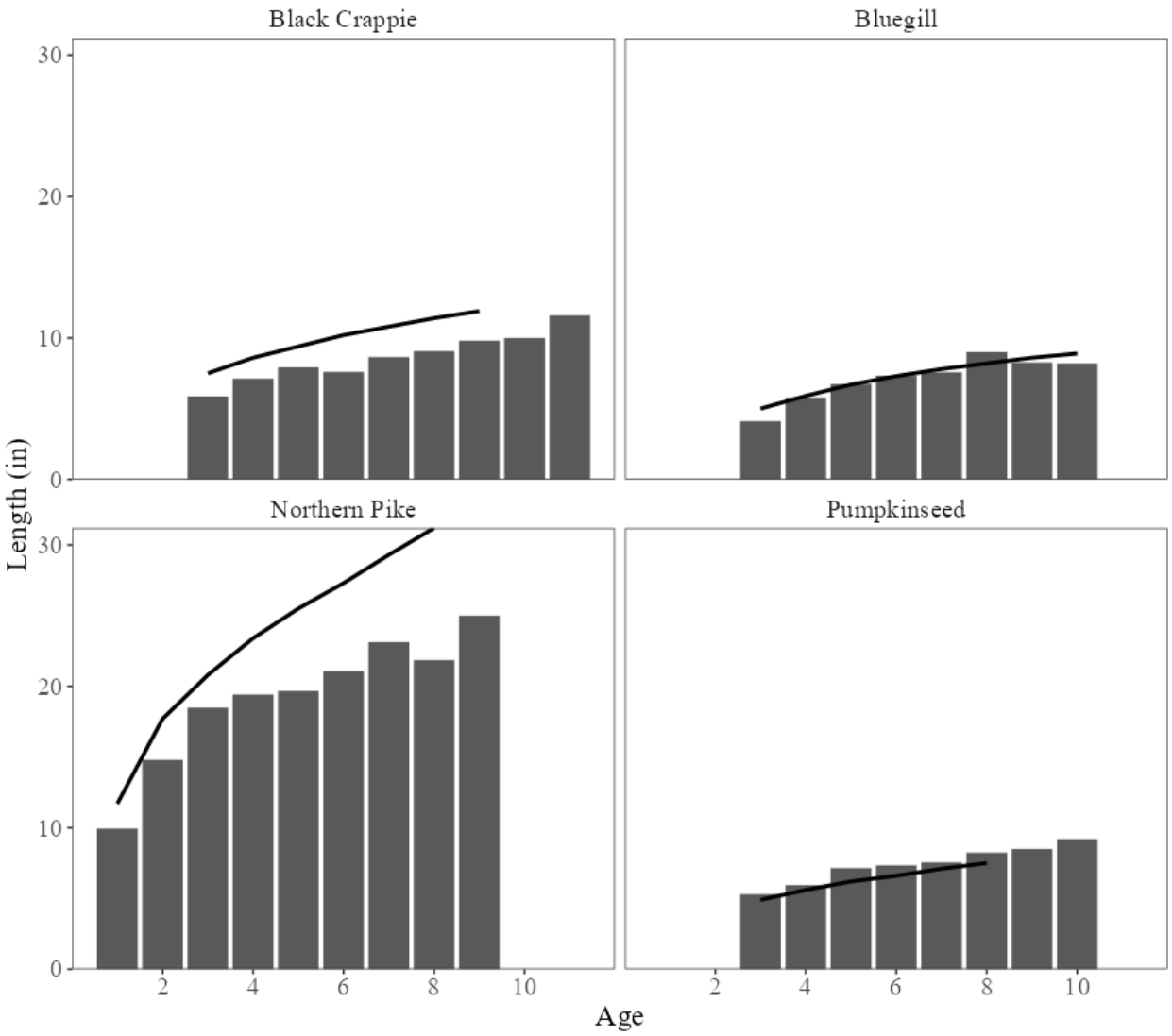

Figure 5: Average lengths-at-age (bars) for Black Crappie, Bluegill, Northern Pike, and Pumpkinseed captured during a Status & Trends survey in Colwell Lake in May 2023 compared to the state-average lengths-at-age (lines).

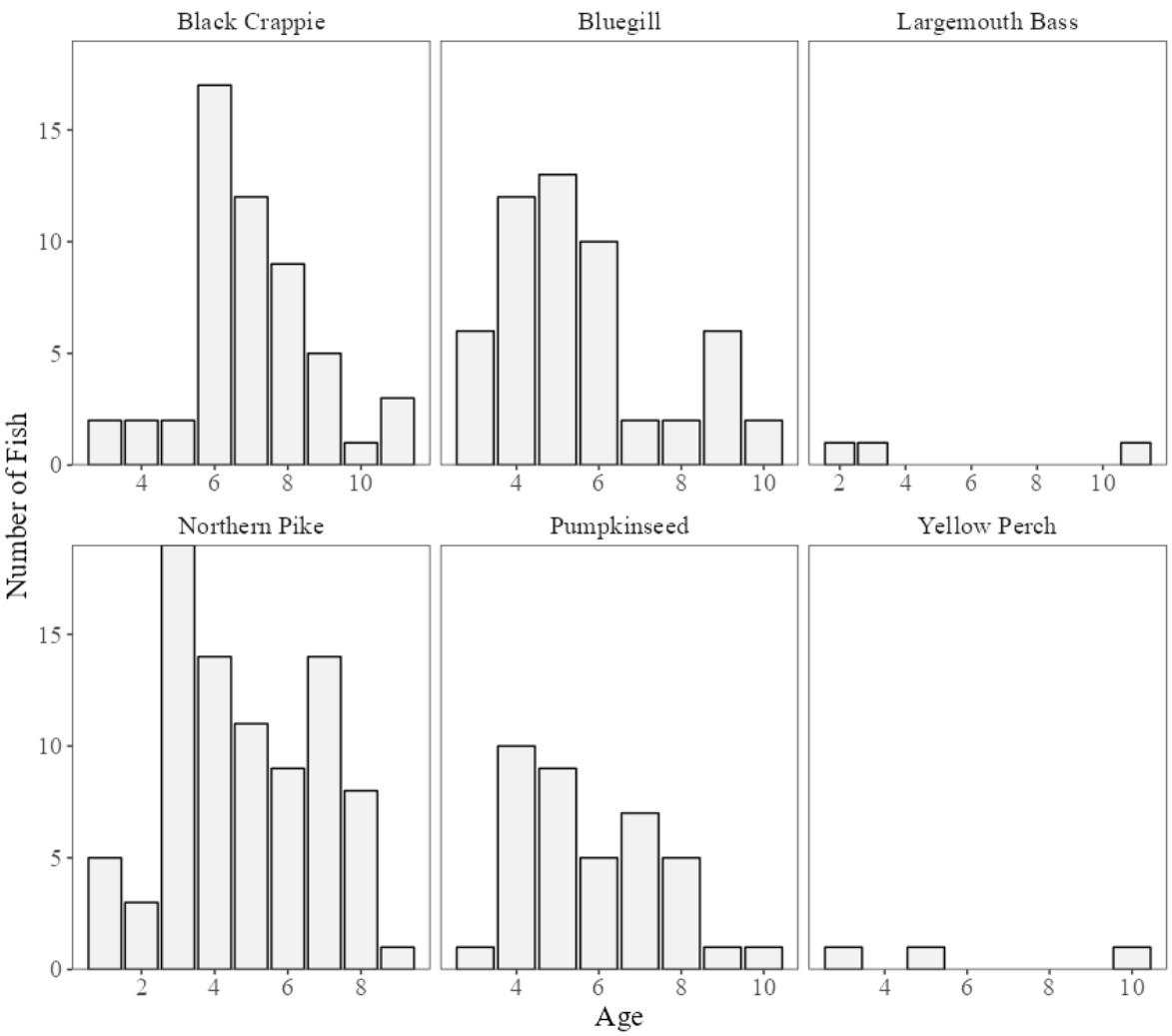

Figure 6: Age frequency of species of interest captured during a Status & Trends survey in Colwell Lake in May 2023.

Received March 13, 2024; Approved May 1, 2024
Steve Lenart, Unit Review and Approval
Jan-Michael Hessenauer, External Reviewer
John Bauman, SFR Facilitator
John Bauman, Desktop Publisher and Approval