

m DEPARTMENT OF NATURAL RESOURCES **FISHERIES LAKE MANAGEMENT PLAN**

LAKE NAME (DOW): Hanging Horn 09-0038	REGION: 2	AREA: Duluth	COUNTY: Carlton	ACRES (surface littoral): 408.7 86	CLASS: 23
Information Tier: C		Lake Priority Rank: 3 Area Priority: 8		Next Plan Revision: As Needed	
Revisions: <input type="checkbox"/> Initial Plan <input checked="" type="checkbox"/> Species <input checked="" type="checkbox"/> Goals/Objectives <input checked="" type="checkbox"/> Stocking <input checked="" type="checkbox"/> Survey <input type="checkbox"/> Other:					
Primary Species (2 maximum; *active management): Walleye and Cisco			Secondary Species (4 maximum; *active management): Northern Pike and Largemouth Bass		
<ul style="list-style-type: none"> • Management Goals: Provide a naturally reproducing Walleye fishery that offers fishing opportunities for angler-preferred sized fish. Maintain a healthy and sustainable Cisco population. Secondary fisheries for Northern Pike and Largemouth Bass will be low to moderate in abundance but anglers will have opportunities to catch quality-sized fish. 					
Management Objectives: <ul style="list-style-type: none"> • Walleye catch averaging 1.4 per gillnet lift, with the proportion of adult fish (>10 inches) over 15 inches (considered quality size) between 30% and 60%. • Cisco catch averaging 33.4 per gillnet lift. • Monitor the fish community for health and invasives. • Minimize impacts to aquatic resources by providing recommendations during permit review and violation enforcement. • Minimize impacts of climate change by following the objectives of Operational Order 131. 					
Operational Plan Summary: <ul style="list-style-type: none"> • Conduct standard surveys every 10 years beginning in 2030. • Conduct Largemouth/Smallmouth Bass spring night electrofishing assessments in conjunction with standard surveys. • Review and comment on tournament permits, stocking permits, commercial harvest permits, public waters permits, aquatic plant management permits, and environmental impact documents. • Investigate permit violations and develop restoration orders when needed. • If time allows, conduct a Score the Shore riparian habitat survey in conjunction with standard surveys. • If time allows, conduct bathymetry, substrate and vegetation mapping using latest sonar technologies. • If time allows, replicate the point-intercept aquatic plant survey. • If time allows, conduct an emergent vegetation mapping survey. 					
Additional Jurisdictions and Tribal Partners: 1854 Ceded Territory					
APPROVALS					
Area Fisheries Supervisor (e-signature):					
Regional Fisheries Manager (e-signature):					

Description of lake

Hanging Horn Lake is a 409 acre lake located near Barnum, Minnesota with 21% (86 acres) littoral area and a maximum depth of 80 feet (Figure 1). The Moose Horn River (M-50-46-28) flows through the lake and produces variable water chemistry properties and water levels, depending on rainfall and surrounding watershed land-use activities. Hanging Horn Lake is in lake class 23 and in information tier C (Established Management) with a statewide lake priority rating of 3 on a scale of 1-5 (1 being highest). The area lake priority rating is 8 on a scale of 1-14 (14 being highest).

Description of fish community

A total of 42 fish species were collected in Hanging Horn Lake using gillnets, trapnets, electrofishing, and seining between 1951 and 2020 (Table 1). Hanging Horn Lake contains the most diverse lake fish community in the Duluth Area. Gillnet catch rates in 1976 and 1977 and trapnet catch rates in 1977 were not used for comparison due to insufficient sampling effort (< 3 nets). All interquartile range comparisons are for lake class 23.

Management history

Stocking

Ten species of gamefish have been stocked into Hanging Horn between 1912 and 2021 (Table 2). The majority of stocking in recent decades has been Walleye, Lake Trout, or stream trout (Brown and Rainbow Trout). Stocking of all species has been discontinued due to poor returns, which is detailed further in individual species Status and Trends section.

Special and Experimental Regulations

None

Surveys and Evaluations Completed

Standard Surveys: 2015, 2020

Full Surveys: 1951, 1960, 1990, 2000

Population Assessments: 1971, 1983, 1996, 2005, 2010

Special Assessments: 1976, 1977, 2020

Cisco Removal Netting: 1989, 1993, 1994, 1995, 2021

Largemouth/Smallmouth Bass Electrofishing Surveys: 1992, 1996, 2000, 2015

Winter Dissolved Oxygen Monitoring: 1967

Index of Biotic Integrity Survey: 2010, 2015

Point-intercept Aquatic Plant Survey: 2015

Managed Fish Species – Status and Trends

Various life stages of Walleye have been stocked in Hanging Horn Lake between 1912 and 2005, but since 1989, biennial stocking of fingerling Walleye was most common. Walleye gillnet catch-per-unit-effort (CPUE) ranged from 0.8 to 6.3 per lift (Figure 2). All documented catch rates since 1971 have been either below or within the interquartile range (1.0-5.0). Proportional size distribution (PSD) of Walleye ranged from 8 in 1971 to 55 in 1983 and represented variable size

potential (Figure 3). Length at age-4 ranged from 12.6 inches in 1996 to 11.4 inches in 2020 and represented slow to average growth when compared to other Duluth Area lakes. Correlation between age classes and years stocked ranged from 7 to 75 percent (Table 3). Walleye recruitment and stocked fish survival remained low despite increases in stocking, and stocking was discontinued in 2005.

Cisco (Tullibee) gillnet catch-per-unit-effort (CPUE) ranged from 3.3 to 64.0 per lift (Figure 2). All documented catch rates since 1971 exceeded the interquartile range (1.3-10.4). Hanging Horn Lake is one of only a few lakes in the Duluth Area that supports a significant population of Cisco. In November of 1989, three gillnets (250" x 6' x 2.5") were set to evaluate the spawning run and the efficacy of catching Cisco during this period. A total of 161 Cisco were caught weighing approximately 97 pounds. It was postulated in prior management plan revisions that an artificial reduction in Cisco density might increase Walleye abundance. Recognizing the lake could support a significant harvest of Cisco, a Removal Permit Class "C" was granted in 1992 with the support of the area residents and the lake association. Unfortunately, the permittee was unable to net that fall. Lacking removal by an outside party, area fisheries personnel started a removal project in the fall of 1993. A goal was set at removing 4 to 7 pounds of Cisco per acre per year over the length of three years.

In 1993, 1994 and 1995, a total of 64,150 feet (12.2 miles) of 1 ¼ to 1 ¾ inch (bar) gillnet were tended and removed 14,476 Cisco weighing 7,304 pounds. Average removal per year was 2,435 pounds or 5.7 pounds per acre per year. Analysis of the scale samples randomly taken over the project length found ages three through six comprising 79% of the removed fish with the 1989 and 1990 year-classes contributing 49% of the fish (Table 3). Examination of the Cisco age structure following the 1996 population assessment found that 43% of the sample were 1989 and 1990 year-classes even though over 9,200 fish from those year classes were taken out during the removal project. The mean length of Cisco also decreased from 12.2 inches in 1994 to 9.7 inches in 1996. An exploited population should respond to increased exploitation by increasing natality and growth to adult age; however, length at age-4 of Cisco decreased from 10.5 inches in 1993 to 9.9 inches in 1996, suggesting insignificant removal effort. An expanded evaluation of Cisco age and growth was conducted in 2010 utilizing otolith aging structures. Aging from otoliths indicate that Hanging Horn supports a healthy population with individuals up to 23 years of age. A total of 17 different age-classes of Cisco were present dating back to 1987.

The approval of an introduction of Cisco into Island Lake Reservoir initiated a removal effort from Hanging Horn in late fall of 2021. Trap nets and short term gill nets were used with some success (100 lbs harvested) but were unable to provide the full quota for the introduction (4000 lbs). As long as the population is sustainable, Hanging Horn will continue to be used as a source for Cisco in the Duluth area.

Northern Pike fry were stocked between 1912 and 1945 and yearlings were stocked in 1974 in Hanging Horn Lake (Table 2). Northern Pike gillnet CPUE ranged from 0.5 to 3.8 per lift (Figure 2). All documented catch rates were within or below the interquartile range (2.2-8.7). Northern Pike PSD ranged from 9 in 1996 to 93 in 2020 and represented variable size potential (Figure 3). Length at age-4 increased from 18.6 inches in 1996 to 24.8 inches in 2005 and represented a shift from slow to fast growth when compared to other Duluth Area lakes. Analysis of age distribution revealed consistent recruitment with few missing year-classes (Table 3).

Largemouth Bass fingerlings were stocked in Hanging Horn Lake between 1912 and 1945 (Table 2). Largemouth Bass spring night electrofishing CPUE ranged from 2.8 to 27.8 per hour (Figure 5). Only the 1992 and 2000 samples were within the interquartile range (11.0 to 72.7) when compared to other Duluth Area Largemouth Bass populations. Largemouth Bass PSD was not calculated in 1996, 2000 or 2015 because of limited sample size (< 10 fish). In 1992, PSD was 36 and represented average size potential. Length at age-4 was 10.5 inches in 1992 and 14.1 inches in 2000 and represented both slow and fast growth when compared to other Duluth Area bass populations. Analysis of age

distribution from 1992 revealed good recruitment between 1986 and 1990; however, the 2000 age distribution was highly skewed towards young individuals, suggesting a period of poor recruitment from 1992-1995 (Table 3).

Other Species

Black Crappie were stocked in Hanging Horn Lake between 1912 and 1945 (Table 2). Black Crappie trapnet CPUE ranged from 0.3 to 4.2 per lift (Figure 4). All documented catch rates except 1976 were within or above the interquartile range (0.5-2.2). Black Crappie PSD ranged from 38 to 100 and represented excellent size potential (Figure 3). Length at age-4 ranged from 7.2 inches in 1996 to 8.2 inches in 2000 and 2015 and represented average growth when compared to other Duluth Area lakes. Analysis of age distribution revealed inconsistent recruitment with several missing year-classes (Table 3).

A low density Smallmouth Bass population exists in Hanging Horn Lake. One large specimen that was 19.8 inches long was captured during the electrofishing survey in 2015 for a CPUE of 0.8 per hour of electrofishing on-time. Gillnets and trapnets have occasionally sampled Smallmouth Bass in low abundance during other surveys on Hanging Horn (Table 1).

Sunfish fingerlings were stocked in Hanging Horn Lake between 1912 and 1945 (Table 2). Bluegill trapnet CPUE ranged from 1.8 per lift in 1971 to 15.0 per lift in 1990 (Figure 4). Since 2000, all catch rates have remained within the interquartile range (7.7-43.4). Bluegill PSD ranged from 0 in 1977 to 86 in 1996 and represented variable size potential (Figure 3). Length at age-4 ranged from 3.6 inches in 1996 to 5.3 inches in 2020 and represented slow to average growth when compared to other Duluth Area lakes. Analysis of age distribution revealed consistent recruitment in most years with fish ranging from two to nine years old (Table 3).

Yellow Perch fingerlings were stocked in Hanging Horn Lake between 1912 and 1945 and again in 1986 (Table 2). Yellow Perch gillnet CPUE ranged from 0.0 per lift in 1996 to 4.3 per lift in 1971 (Figure 2). All documented catch rates except 1951 and 1971 were below the interquartile range (1.5-13.8). Yellow Perch PSD ranged from 2 in 1996 to 27 in 1977 and represented poor size potential (Figure 3). Length at age-4 was 7.4 inches in 1996 and represented fast growth when compared to other Duluth Area lakes.

Although they have never been stocked into Hanging Horn, one Brook Trout was captured in 2015 for a gillnet CPUE of 0.1 per lift. The fish was 13.7 inches in length and was from the 2011 year-class. The origin of this fish is unknown but it likely emigrated from the upstream designated trout reach on the Moosehorn River which flows through Hanging Horn Lake. Historically, one other Brook Trout was captured in Hanging Horn during an assessment in 1993 (Table 1).

Muskellunge were stocked in Hanging Horn Lake in the late 1970s and early 1980s to provide an additional top-level predator to help control Cisco population size (Table 2). Only one muskellunge was ever documented in investigations following stocking.

Stocking Lake Trout to create a two-story fishery was later postulated as an alternative way to utilize the abundant Cisco population and create angling opportunities. Lakes that are able to sustain a Lake Trout population generally have a significant volume of water where water temperatures are below 55 degrees F and dissolved oxygen concentrations are 5 mg/L or greater throughout the summer (Steve Persons, MN DNR, personal communication). According to temperature and dissolved oxygen data collected during investigations from 1990 through 2005, summer temperatures in the hypolimnion were suitable for Lake Trout survival; however, dissolved oxygen concentrations are slightly below the desired level for Lake Trout. Similar physical properties exist in other lakes managed for Lake Trout in the Grand Marais Management Area and these lakes, although marginal Lake Trout fisheries provide an environment suitable for Lake Trout survival and a unique angling opportunity. Over 25,000 yearling Lake Trout from six different year-classes were stocked into the lake from 2007 to 2015 (Table 2). Unfortunately, zero Lake Trout were captured in 2015 for a

April 2022

gillnet CPUE of 0.0 per lift. Six special deep water gillnets were also set targeting Lake Trout. No Lake Trout were captured in the deep gillnets for a CPUE of 0.0 per lift. The 2010 assessment captured two Lake Trout for a deep gillnet catch rate of 0.3 per lift, but both specimens were age-1 and had been recently stocked. These catch rates failed to meet the management plan goal of establishing a Lake Trout fishery with deep gillnet catch rate of 1.0 or greater. Recent anecdotal reports from anglers have reported zero Lake Trout captured by anglers targeting them. The lack of Lake Trout captured suggests that Hanging Horn is unsuitable for Lake Trout management. Lake Trout likely are not surviving the warm summer months due to low dissolved oxygen and thermal stress below the thermocline.

Just over 19,500 yearling Rainbow Trout were stocked into the lake in 2018 and 9,800 in 2019 and 2020 (Table 2). Approximately 1,800 Brown Trout have been stocked into the lake annually from 2017 to 2020. Zero Rainbow Trout or Brown Trout were captured in 2020 for a gillnet catch-per-unit-effort (CPUE) of 0.0 per lift. Twenty trap nets were also set in October targeting Rainbow Trout and Brown Trout. No Rainbow Trout or Brown Trout were captured in the fall trap nets for a CPUE of 0.0 per lift. These catch rates failed to meet the management plan goal of establishing a Rainbow Trout fishery with a gillnet catch rate of 2.0 or greater. The management plan goal of establishing a Brown Trout fishery with a gill net catch rate of 1.0 or greater was also not met. Recent anecdotal reports from anglers have reported zero Rainbow Trout or Brown Trout captured by anglers targeting them in the lake. However, there have been reports of anglers catching both species in the Moosehorn River both upstream and downstream of Hanging Horn Lake. The lack of either species captured in the lake suggests that Hanging Horn is unsuitable for Rainbow Trout or Brown Trout management. It is likely that both species are leaving the lake and remaining in the Moosehorn River.

Other Projects

Information was collected on aquatic vegetation using transect methodology during the surveys conducted in 1951, 1961, 1990 and 2000. During the most recent transect survey in 2000, a total of 38 species or species groups were sampled (Table 4). The most frequently found plants were flatstem pondweed and bushy pondweed which were both found at 90% of the transects. The most common substrate types were sand and gravel. Rubble, muck, detritus and boulder were all rated as rare. A more quantitative aquatic plant survey was conducted in 2015 using point-intercept methodology. Hanging Horn Lake has a diverse near-shore plant community and species richness was greatest along the north shore of the southeastern bay (Figure 7). Rooted vegetation was found to a maximum depth of 12.1 feet but vegetation was most often found in water depths of five feet and less. Forty-seven plant species, including 23 submergent, 16 emergent and five floating leaf species were documented at point-intercept stations during the survey (Table 4). Three free-floating species were also sampled. The most frequently found plants were bushy pondweed (28.5%), variable pondweed (26.6%) and water celery (24.3%). The emergent and floating-leaf species were spread fairly evenly around the perimeter of the lake but were most dense in the northwest bay adjacent to the inlet and outlet of the Moosehorn River. Emergent and floating-leaf aquatic plant forms are particularly important for fish and wildlife habitat and must be preserved to sustain high quality fisheries. Additional plants were documented but did not fall within the designated sampling stations including; wool grass, water hemlock, square-stemmed monkey flower and cut-leaved water horehound (Table 4). Reed canary grass was the only non-native plant species documented, but this species is well established in wetland plant ecosystems across much of Minnesota.

Social Aspects

General Information

There is a city owned concrete plank back-in ramp located off County Road 138, about ¼ mile downstream of the lake on the Moosehorn River. A handicapped accessible fishing pier was constructed on Hanging Horn Lake off County Road 13 in the late 1980s.

Development on Hanging Horn Lake increased from 67 cabins in 1960 to 77 cabins in 1990. An additional 17-lakeshore homes were constructed between 1990 and 2000. It was also noted in 2000 that 33 of the developed lots had open yards that extended to the shoreline. Cumulative impacts of converting native vegetation to highly managed lawns around the shoreline results in destruction of habitat diversity and declines in quality of fish and wildlife populations. Preserving or restoring a buffer of native vegetation allows run-off to infiltrate into the soil, reduce erosion, maintain or improve water quality, and provide habitat for fish and wildlife. In addition, eliminating the use of fertilizers and chemicals, and residential septic tank compliance will also improve water quality and reduce nutrients that fuel excessive plant growth.

Lakeshore property owners have expressed concern about a perceived increase in density of aquatic macrophytes near the outlet.

Many Hanging Horn Lake residents participate in the multi-lake, Hanging Horn Lakes Area Association.

The Citizen Lake-Monitoring Program (CLMP) has been active on Hanging Horn Lake since 1983. This program combines the technical resources of the Minnesota Pollution Control Agency and the volunteer efforts of citizens to collect water quality data to monitor lake eutrophication status. The CLMP collected water quality data for Hanging Horn Lake in 1984, 1993, 1997, and 2005 and also measured water clarity from 1983 to 2014 (Figure 6).

Removal and/or destruction of any aquatic vegetation may require a DNR issued aquatic plant management (APM) permit. Impacts to aquatic vegetation should be minimized because aquatic plants improve water clarity and quality, protect shorelines and lake bottoms and provide fish and other wildlife food and habitat. Aquatic plant management permits to allow hand or mechanical removal of aquatic plants were issued in 1981, 1996, 1998, 2008, 2009, 2012 and 2013

Fishing Pressure and Other Recreational Use.

An aerial recreational use survey of 50 Duluth Area lakes was conducted between 2020 and 2021 and estimated 3,259 total angling hours on Hanging Horn Lake, of which 91% (2,971 hours) was open water angling and was categorized as low/moderate. The proportion of winter angling pressure (9% of total) was much less than observed in most other area lakes. Total recreational use was estimated at 5,668 hours, or 13.5 hours/acre.

Hanging Horn Lake is one of two lakes within the Duluth Area that is open to fall Cisco sport netting. Sport netting in Hanging Horn Lake has occurred since the early 1950s.

Public Input

A draft of this plan was made available for public review from xxxx to xxxx, 2022. Comments were solicited via news release and xxxx comments were received for consideration.

April 2022

Limiting Factors

Habitat

Since Hanging Horn Lake is an open system with the Moosehorn River flowing through it, some emigration of fish out of the lake is likely. Stocked fish are released at the Highway 13 access point, not at the public access boat ramp (below the outlet) to help minimize emigration.

Water Quality

Hanging Horn Lake is listed by MN Pollution Control Agency as impaired for aquatic consumption, specifically mercury in fish tissue. Anglers should refer to the MN Department of Health website for the most up to date consumption guidelines.

Since Hanging Horn Lake is highly developed, efforts to ensure compliance of septic systems and minimize use of chemicals and/or fertilizers will help to protect water quality. Shoreline best management practices (BMP's) should be implemented.

Fish Community

Limited littoral area (21%) favors pelagic species such as Cisco. The lake had been open to fall Cisco sport netting since the early 1950s, but participation in this activity has declined in recent years. The Cisco removal project in the early 1990s and the stocking of Muskellunge and Lake Trout as an additional top-level predator has had a negligible impact on Cisco year-class strength.

Invasive Species

Chinese mystery snails were positively identified as an exotic species in Hanging Horn Lake in 2004. Biological implications of this species are currently unknown.

Climate Change

Climate change has the potential to affect fish populations in Hanging Horn Lake. A changing climate can alter fish behavior, distribution, development, reproduction and survival. Because the rate and magnitude of climate change may exceed the adaptive capacity of fish species within Hanging Horn Lake, active (adaptive) management is required to increase resilience and reduce the impacts of climate change. Appendix A of the MN DNR Operational Order 131 was consulted to characterize potential climate effects on aquatic resources in Hanging Horn Lake. Hanging Horn is a deep lake that currently supports a naturally reproducing Cisco population. Climate change may affect the suitability of the oxythermal habitat (water temperature and dissolved oxygen) in Hanging Horn Lake for coldwater species including Cisco. The primary adaptation strategy for climate change will be to maintain a resilient and healthy watershed for Hanging Horn Lake. This will require collaboration across agencies, organizations, and jurisdictional boundaries to maintain important watershed features. Protecting important features such as groundwater, riparian wetlands, floodplains, terraces, sediment transfer areas, water storage areas, nutrient cycling capabilities, natural hydrologic regimes, and riparian corridors will help maintain system resiliency to climate change.

Fishing Mortality

Fishing harvest from Hanging Horn is unknown at this time, as the 2020-21 recreational use survey did not include collection of harvest information.

Rationale for Management Species Selection, Goals, and Objectives

Information Tier and Lake Priority Rank Comments

Information tier C is the best fit for Hanging Horn since it will no longer be stocked and is not a large or sentinel lake. Both statewide and area priority rankings support a 10 year survey frequency.

Primary and Secondary Management Species

Attempts have been made to create a two story fishery with stockings of Lake Trout, Rainbow Trout, and Brown Trout, and none were successful. The lake will be managed for self-sustaining populations of species naturally present.

Goals and Objectives

Management goals were set at a level representing the average gillnet catch rate of self-sustained populations of Walleye (2010 to present), Cisco, Northern Pike and Largemouth Bass in this lake, based on historic netting results.

Operational Plan Detail

Stocking

Stocking is not recommended. Goals for managed fish populations have been met solely through natural reproduction.

Regulations

No special regulations are recommended at this time.

Habitat Development and Protection

Minimize impacts to aquatic resources by providing recommendations during permit review.

Outreach

Meet with Lake Association if requested after new survey information is obtained or to address specific concerns.

Surveys and Evaluation

Conduct standard surveys every 10 years.

Conduct Largemouth/Smallmouth Bass spring night electrofishing assessments in conjunction with standard surveys.

If time allows, conduct a Score the Shore rapid riparian habitat assessment in conjunction with standard surveys.

If time allows, conduct bathymetry, substrate and vegetation mapping using latest sonar technologies.

If time allows, replicate the point-intercept aquatic plant survey.

If time allows, conduct an emergent vegetation mapping survey.

Supporting Tables, Figures, and Appendices

Table 1. Species sampled in Hanging Horn Lake, 1951-2020. Survey Type: FS=Full Survey; PA=Population Assessment; SA=Special Assessment; SS=Standard Survey and species captured during IBI surveys are indicated with an (*).

Species	1951	1960	1971	1976	1977	1983	1989	1990	1992	1993	1994	1995	1996	2000	2005	2010	2015	2020
	FS	FS	PA	SA	SA	PA	SA	FS	SA	SA	SA	SA	PA	FS	PA	PA*	SS*	SS
Bigmouth Buffalo			x	x														
Black Bullhead		x												x				
Black Crappie	x	x	x	x	x	x		x		x	x		x	x	x	x	x	x
Blacknose Shiner								x										
Bluegill	x	x	x	x	x	x		x					x	x	x	x	x	x
Bluntnose Minnow	x															x		
Brook Trout										x							x	
Bullhead sp.			x															
Burbot				x			x	x		x	x	x				x	x	
Central Mudminnow																	x	
Channel Catfish						x									x			
Chestnut Lamprey								x			x		x				x	
Common Shiner														x		x		
Fathead Minnow																	x	
Golden Redhorse	x							x					x					
Golden Shiner																	x	
Green Sunfish		x						x						x				
Hybrid Sunfish																	x	x
Iowa Darter																x		
Johnny Darter	x	x						x						x		x	x	
Lake Trout																x		
Largemouth Bass		x						x	x				x	x	x	x	x	x
Logperch	x	x						x						x		x	x	
Longnose Dace																	x	
Mimic Shiner	x																	
Mottled Sculpin																x	x	
Muskellunge						x												
Northern Pike	x	x	x	x	x	x	x	x		x	x		x	x	x	x	x	x
Northern Redhorse	x	x																
Pumpkinseed		x			x	x		x		x			x	x	x	x		
Rock Bass	x	x			x			x		x				x		x	x	x
Shorthead Redhorse	x		x	x	x	x		x					x	x	x	x	x	x
Silver Redhorse													x	x	x	x	x	x
Smallmouth Bass	x				x	x								x	x	x	x	
Spottail Shiner		x																x
Tadpole Madtom		x														x	x	
Tullibee		x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x
Walleye	x	x	x		x	x		x		x	x	x	x	x	x	x	x	x
White Crappie	x							x										
White Sucker	x	x	x	x	x	x		x		x	x	x	x	x	x	x	x	x
Yellow Bullhead	x				x	x		x			x			x	x	x	x	
Yellow Perch	x	x	x		x	x		x		x		x	x	x	x	x	x	x

Table 2. Stocking history for Hanging Horn Lake, 1912-2021. Age of fish: FGL=Fingerling; YRL=Yearling; ADL=Adult.

Year	Walleye					Northern Pike		Muskellunge		Lake Trout	Largemouth Bass	Black Crappie		Sunfish	Yellow Perch	Brown Trout	Rainbow Trout
	CANS	FRY	FGL	YRL	ADL	FRY	YRL	FGL	YRL	YRL	FGL	CANS	FGL	FGL	FGL	YRL	YRL
1912-45	15	2,982,742	910			20,000					3,435	5	4,140	1,750	300		
1947			3,000														
1948		200,000	5,625														
1949		200,000	3,500														
1950			2,700														
1951			12,000														
1954			7,250														
1955			6,750														
1961		400,000															
1963		400,000	23,000														
1965			11,340														
1966			10,155														
1967		300,000															
1973		800,000															
1974				437			437										
1977		800,000						400									
1978									250								
1979								180									
1981		800,000															
1983		800,000						500									
1984			3,996														
1986															17,023		
1987		400,000															
1989			2,692														
1991					14												
1993			2,740														
1995			4,680														
1997			2,573														
1999			848	1,380	155												
2001			8,100														
2003			9,589	279													
2005			10,426														
2007										4,123							
2009										4,082							
2010										4,175							
2011										4,682							
2013										4,065							
2015										4,435							
2017																1,800	
2018																1,800	19,600
2019																1,800	9,800
2020																1,800	9,800
2021																1,800	9,800

Table 4. Aquatic plants sampled in Hanging Horn Lake, Carlton County (09-0038-00) 1951-2015.

Life Form	Common Name	1951	1961	1990	2000	2015 Frequency (%)
SUBMERGED	Bushy Pondweed			x	x	28.5%
	Variable Pondweed	x	x	x	x	26.6%
	Water (wild) Celery			x	x	24.3%
	Large-leaf Pondweed			x	x	14.5%
	Chara sp.					12.6%
	Robbins' Pondweed			x	x	10.7%
	Clasping-leaf Pondweed			x	x	6.5%
	Stonewort Group				x	6.1%
	Flat-stem Pondweed			x	x	5.1%
	Narrow-leaf Pondweed Group			x	x	4.2%
	Canada Waterweed			x	x	3.3%
	Snailseed Pondweed				x	3.3%
	Northern Milfoil	x	x	x	x	2.8%
	Coontail			x	x	2.3%
	Water Marigold				x	2.3%
	Quillwort Group				x	2.3%
	Nuttall's Pondweed				x	0.9%
	Freshwater Sponge					0.9%
	White-stem Pondweed	x	x	x		0.5%
	Sago Pondweed					0.5%
	Bladderwort					0.5%
	Greater Bladderwort					0.5%
Water Moss					0.5%	
Fries Pondweed			x			
White Water Buttercup Group				x		
FLOATING LEAF	Yellow Waterlily	x	x	x	x	15.0%
	White Waterlily	x	x	x	x	8.4%
	Floating-leaf Burreed			x	x	1.4%
	Watershield	x	x	x	x	0.9%
	Little Yellow Waterlily			x		0.5%
	Floating-leaf Pondweed	x	x	x		
EMERGENT	Spikerush			x	x	7.5%
	Arrowhead Group	x	x	x	x	7.5%
	Swamp Horsetail			x	x	6.5%
	Softstem Bulrush				x	2.8%
	Pickerweed			x	x	1.4%
	Bulrush sp.	x	x			1.4%
	Swamp Candle					0.9%
	Reed Canary Grass					0.9%
	Hard Stem Bulrush			x	x	0.9%
	Three-way Sedge			x		0.5%
	Smartweed Group					0.5%
	Swamp Fivefinger				x	0.5%
	Eastern Burreed					0.5%
	Willow Group					0.5%
	Water Plantain Group					0.5%
	Wild Rice				x	0.5%
	Cut-leaved Water Horehound					x
	Giant Water Hemlock				x	x
	Marsh St. Johns-wort				x	
	Blue-flag Iris				x	
	Water Horehound				x	
	Stiff Wapato			x	x	
	Narrow-leaf Cattail			x	x	x
	Common Cattail	x	x	x	x	
	Sedge sp.			x	x	
	Square-stemmed Monkey Flower					x
	Wool Grass					x
FREE FLOATING	Lesser Duckweed					1.9%
	Star Duckweed				x	1.4%
	Filamentous Algae					0.9%

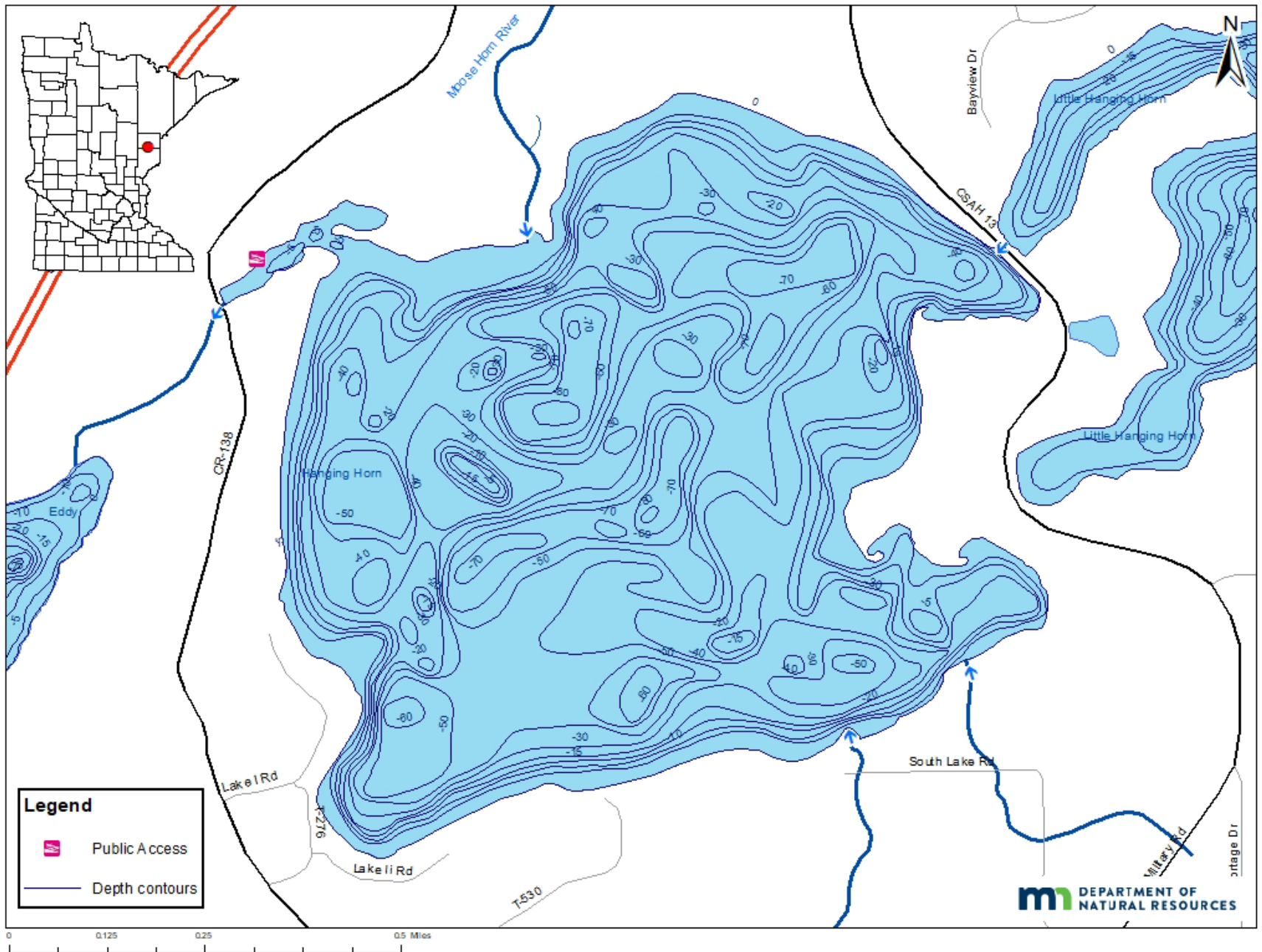


Figure 1. Map of Hanging Horn Lake 09-0038-00.

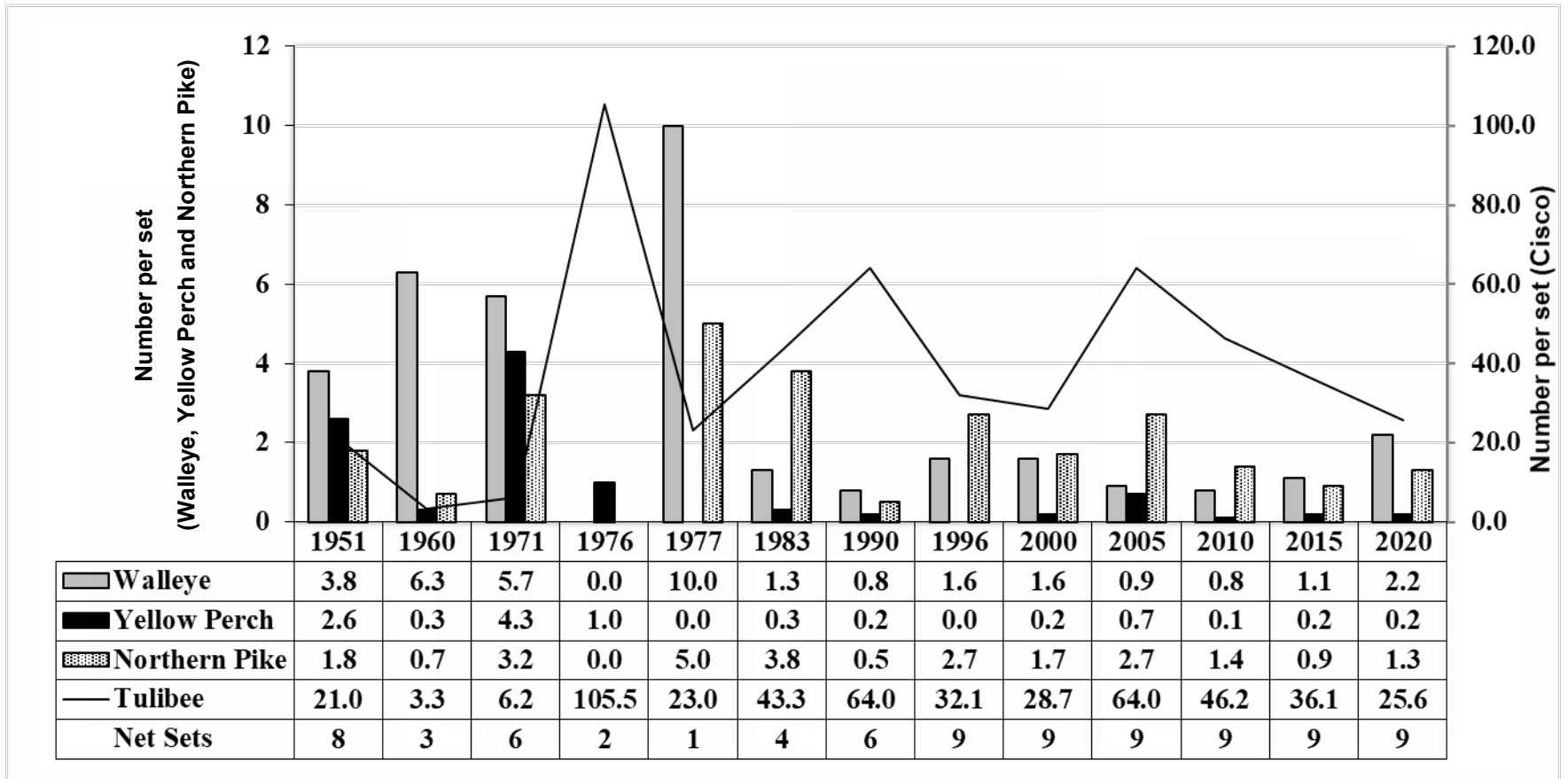


Figure 2. Historical gillnet catch rates from Hanging Horn Lake, 1951-2020.

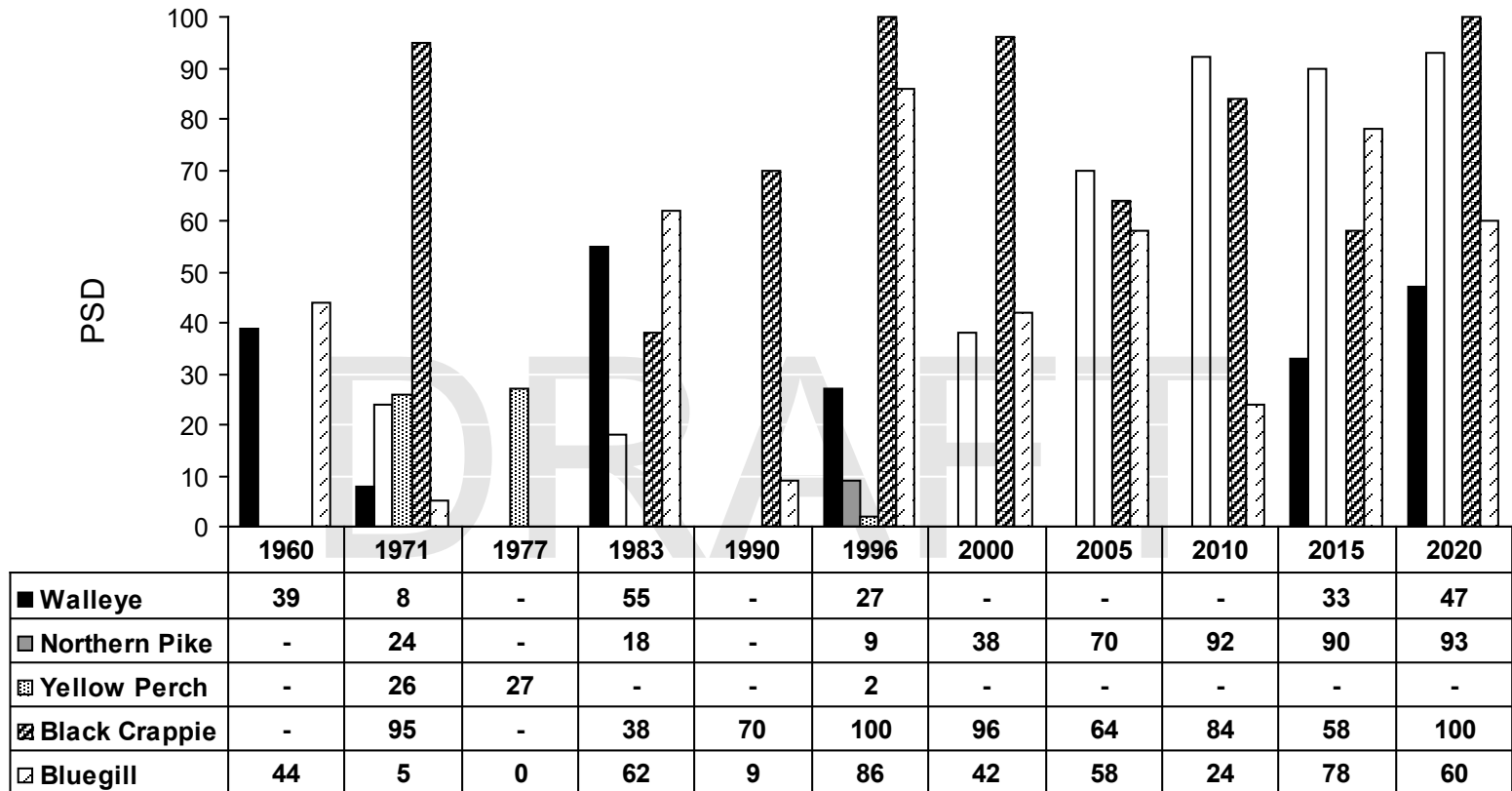


Figure 3. Historical proportional size distribution (PSD) for fish sampled from Hanging Horn Lake, 1960-2020. (-) indicates that PSD was not calculated due to sample size less than 10.

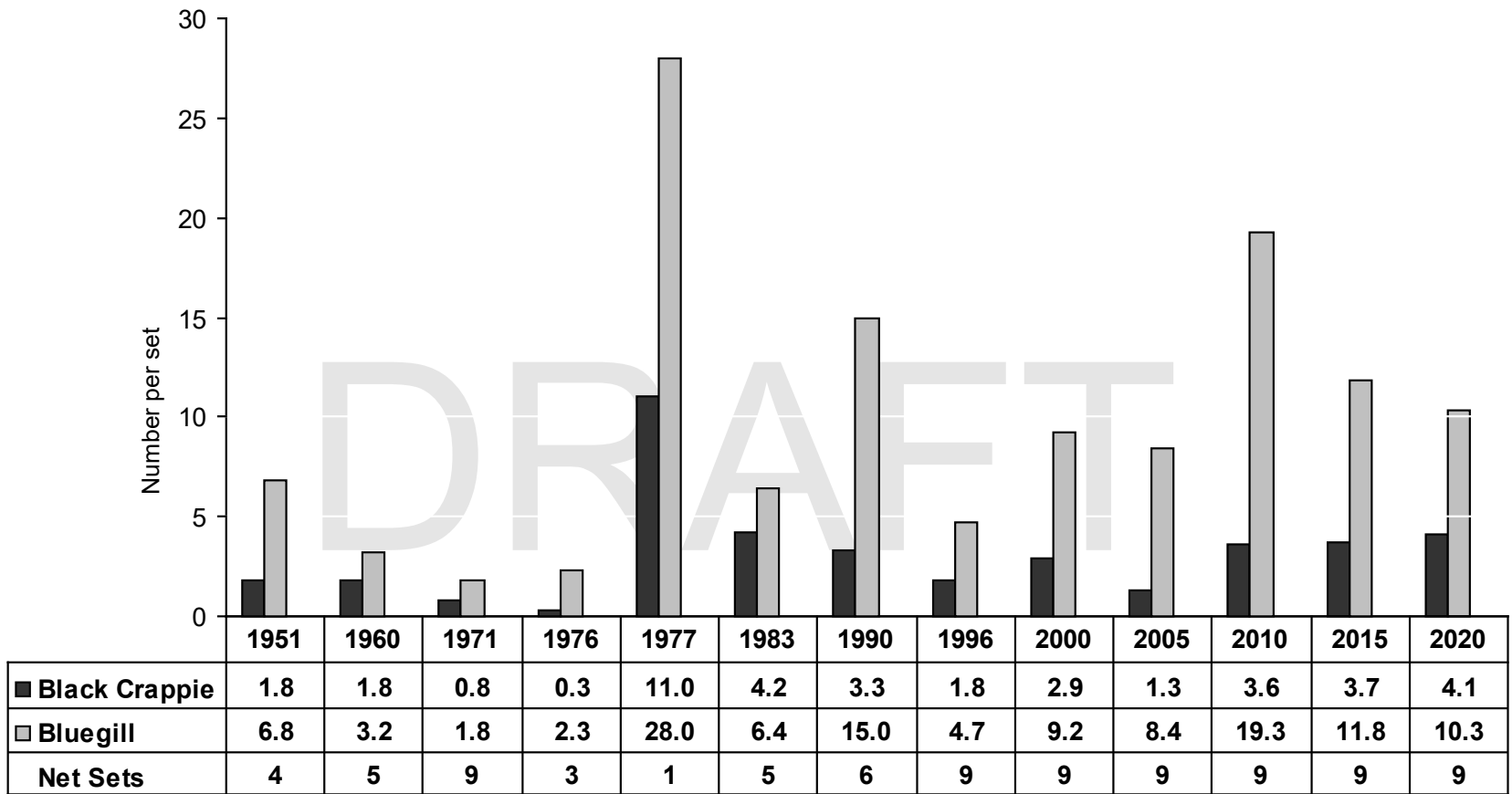


Figure 4. Historical trapnet catch rates from Hanging Horn Lake, 1951-2020.

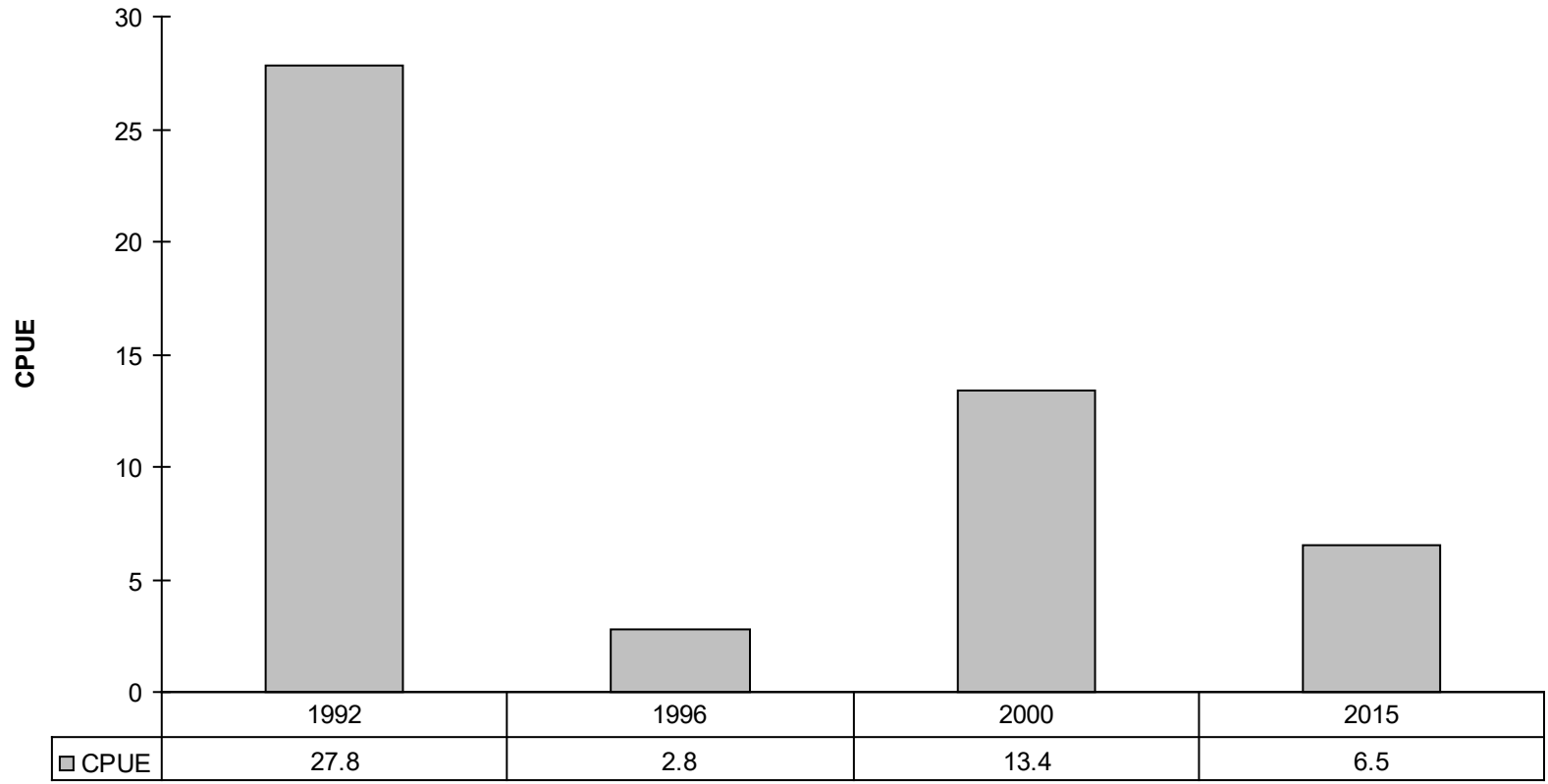


Figure 5. Historical Largemouth Bass electrofishing CPUE sampled from Hanging Horn Lake, 1994 – 2015.

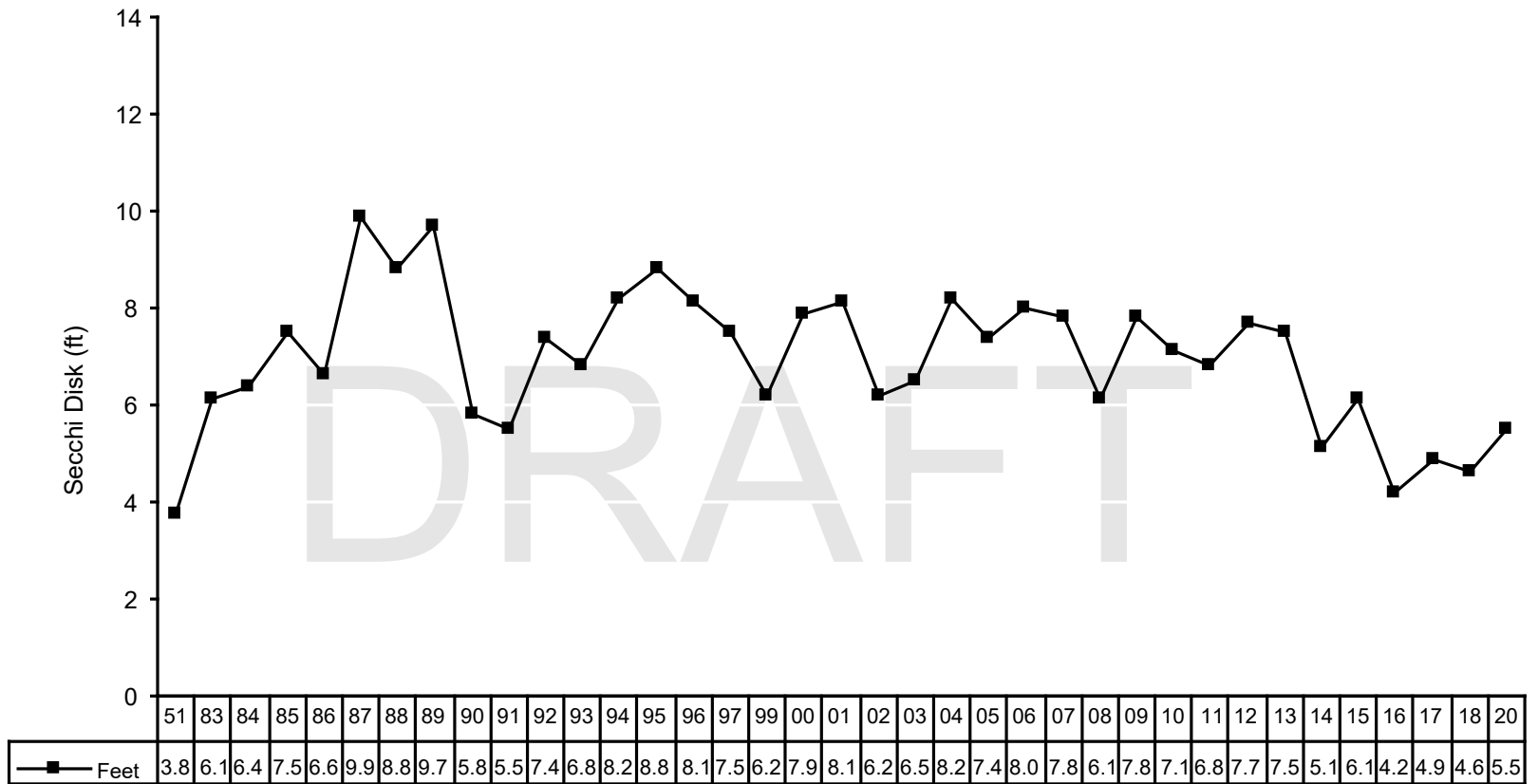


Figure 6. Average June-September secchi reading (feet) in Hanging Horn Lake from 1983 to 2014. (Data collected by Citizen Lake Monitoring Program and MN DNR)

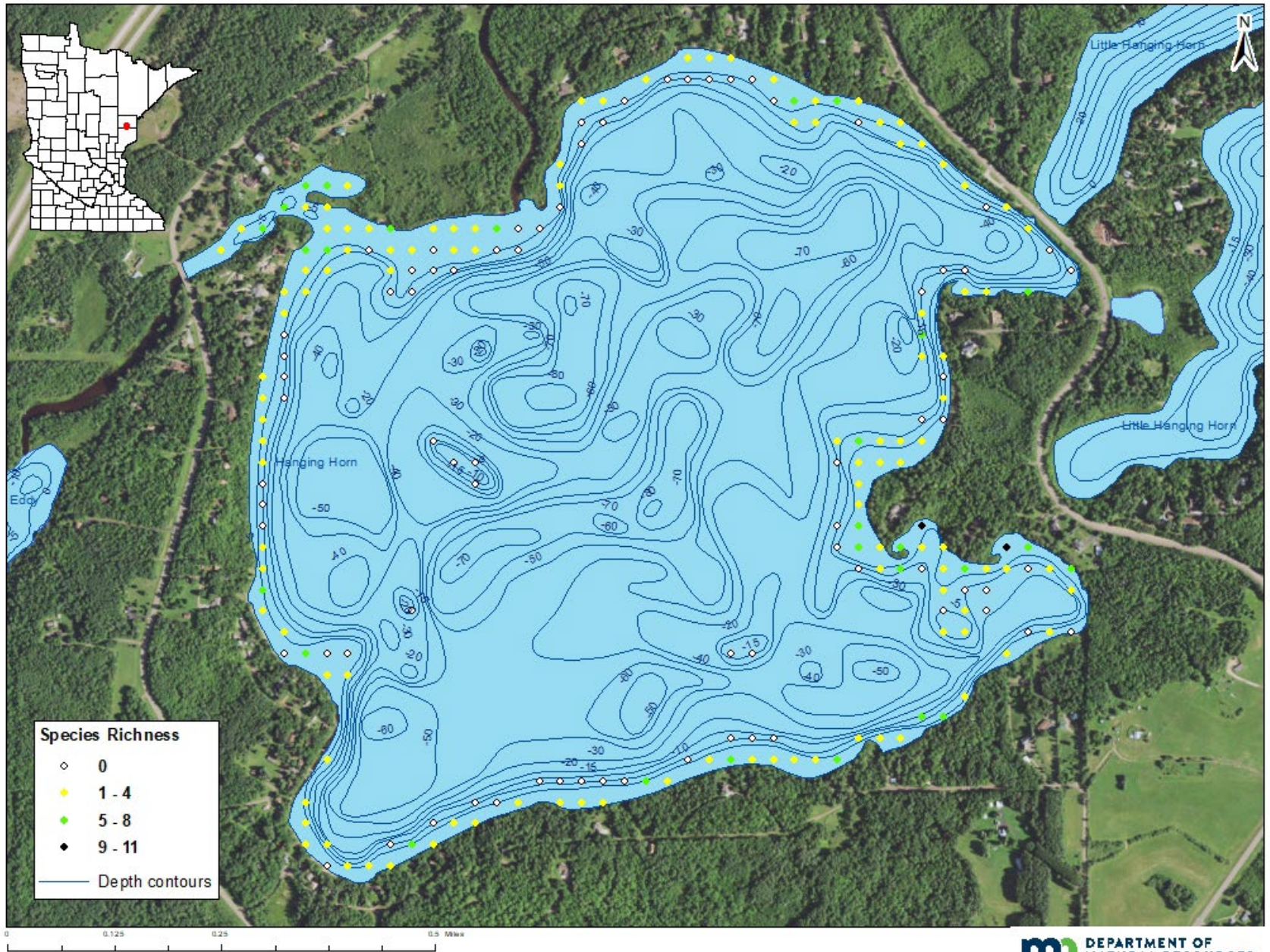


Figure 7. Aquatic plant species richness for Hanging Horn Lake (09-0038), July 2015.