

Hardy Dam Pond
Mecosta and Newaygo Counties
Muskegon River Watershed; last surveyed 2021

Mark A. Tonello, Fisheries Management Biologist

Environment

Hardy Dam Pond is an impoundment on the Muskegon River in the western lower peninsula, located in eastern Newaygo and western Mecosta Counties. Hardy Dam Pond was created in 1931 when Hardy Dam was constructed by Consumers Power Company (now Consumers Energy). At full pool, Hardy Dam Pond has a surface area of 3,971 acres (Lawler, Matusky, and Skeller (LMS), 1991). Hardy Dam maintains a normal head of 100.2 feet and has an average discharge of 1,459 cfs (LMS 1991). Hardy Dam inundates a 25.1-mile reach of the Muskegon River with moderate to high gradient (O'Neal 1997). Hardy Dam is a hydroelectric dam, and it is operated by Consumers Energy and regulated by the Federal Energy Regulatory Commission (FERC). The current operating license was issued in 1994 and will expire in 2034. Hardy Dam Pond is the deepest of the impoundments on the Muskegon River, with depths exceeding 100 feet near the dam. For this report, the entire reach from Rogers Dam to Hardy Dam will be referred to as Hardy Dam Pond (HDP).

Most of the land surrounding HDP is owned by Consumers Energy. There are many public boat launches, campgrounds, and access points on HDP. There is an access site (administered by Consumers Energy) on the east shore immediately downstream of Rogers Dam, and this site is heavily utilized by shore anglers. Just over one mile downstream of Rogers Dam, there is a boat launch/access site directly beneath the US-131 crossing. This site is administered by the Michigan Department of Natural Resources (MDNR). Continuing downstream on HDP, the next access site is Davis Bridge Park, which is located just upstream of the M-20 crossing, on the east shore of HDP. Davis Bridge Park is administered by Mecosta County Parks and Recreation (MCPR) and provides a boat launch with parking for vehicles and trailers. Further downstream on the east shoreline of HDP, Brower Park also provides access. Brower Park is a large campground with boat launch facilities that is administered by MCPR. Progressing further downstream on HDP, the next site is Big Bend Park, another large campground with boat launch facilities that is located on the eastern shoreline. Big Bend Park is administered by Big Prairie Township. Almost directly across from Big Bend Park is Newaygo State Park, which is administered by MDNR. Newaygo State Park also has camping and boat launch facilities. Oxbow Park is another campground/boat launch that is administered by Big Prairie Township, located on the eastern shoreline of HDP, not far downstream from Newaygo State Park. Almost directly across HDP from Oxbow Park is Sandy Beach County Park, which is located on the western shore of HDP and is administered by the Newaygo County Parks and Recreation Commission. Sandy Beach County Park also has a boat launch. Also, on the western shoreline but directly adjacent to Hardy Dam is the Hardy Dam County Marina, which offers a boat launch and boat slips.

The terrain surrounding Hardy Dam Pond is characterized as hilly with a mix of hardwoods and conifers. The surface elevation of HDP is approximately 816 feet, while some of the hills flanking both sides of HDP reach elevations of over 1000 feet. Substrates in the impoundment consist mainly of sand, organic muck (particularly in the coves), and some gravel. Further upstream, closer to Rogers Dam, the substrates turn mostly to gravel and cobble. Most of the impoundment is defined by steep drop-offs to the river

channel, which winds through the impoundment. Stumps and woody debris that once defined the floodplain now offer fish cover. Those stumps also can present navigational hazards, particularly when the impoundment is drawn down. Drawdowns occur on an annual basis to protect human infrastructure on the shoreline of the impoundment

Several tributary streams flow into HDP, most of which are relatively small and short in length. Named tributaries to HDP include Mack's Creek, Ladner Creek, Bett's Creek, Bennett Creek, Linn Creek, South Mitchell Creek, and Rosy Run Creek. All those streams, except for Linn Creek, are Designated Trout Streams. Historical fisheries surveys (MDNR files, Cadillac office) of these streams show that Mack's, Bennett, and South Mitchell Creeks have populations of Brown Trout and Brook Trout. Bett's Creek was found to have only Brook Trout, while Rosy Run Creek had only Brown Trout. No information was available for Ladner Creek.

History

The first documented fish stocking of HDP took place in the first year of its existence, 1931, when Bluegill and Smallmouth Bass were stocked (Table 1). Starting in 1934, adult Walleye were stocked into HDP for the first time. These fish were from the so-called "Newaygo Transfer". Starting in 1923, well before Hardy Dam was constructed (Eschmeyer 1949b), fisheries personnel from the Michigan Department of Conservation (MDOC; the precursor to the MDNR of today) captured Walleye (and other fish species) by dipnets at Newaygo Dam and transferred them to upstream impoundments and other lakes in the watershed. The Newaygo Transfer continued until 1966. Over the years, tagging studies confirmed that downstream movement of Walleye through the dams was occurring (Crowe 1957, Hubbs 1932, Eschmeyer 1947, 1949a and 1949b). No Walleye have been stocked into HDP since 1966. Other species stocked into HDP over the years included Yellow Perch and Largemouth Bass, while small numbers of adult Rainbow Trout, Brown Trout, Northern Pike were occasionally included with the Walleye stocked into HDP from the Newaygo Transfer. The most recent stocking of HDP occurred in 1988, when Channel Catfish were stocked. The Channel Catfish were only stocked the one time, presumably to create a fishery. No information exists in MDNR files (Cadillac office) indicating whether the stocking was successful, or why no further Channel Catfish stocking was conducted.

The first MDOC fisheries survey on HDP was conducted in 1947 (Eschmeyer 1947). The survey was part of a comprehensive study of all the Muskegon River impoundments. On HDP, multiple efforts were conducted between early April and early August. Species recorded in the survey included Black Crappie, Bluntnose Minnow, Common Carp, Common Shiner, Creek Chub, Johnny Darter, Largemouth Bass, Logperch, Mimic Shiner, Northern Pike, Rainbow Trout, Redhorse spp., Rock Bass, Smallmouth Bass, Walleye, White Sucker, and Yellow Perch (Table 2). Gear used included one trap net, numerous gill net sets, and multiple seine hauls. The survey was conducted for two purposes- first to conduct a general fisheries inventory of HDP, and second to investigate the Walleye population (referred to as "yellow pikeperch" at that time), particularly regarding the effects of the transfer of adult Walleye upstream and into HDP. Many of the Walleye transferred in 1947 had been tagged. With the combined results of the 1947 fisheries surveys of the Muskegon River impoundments and tag returns from anglers, the investigators found that while approximately 60% of the Walleye transferred upstream stayed in the body of water they were stocked into, the remainder successfully migrated downstream through the dams (sometimes through multiple dams). The 1947 Eschmeyer report also documented some mortality of fish that had attempted to move downstream through the turbines but had not survived (also known as "entrainment").

In 1948, another survey of HDP was conducted in similar fashion to the 1947 survey, again in conjunction with surveys of the other Muskegon River impoundments. The results were similar to the 1947 survey with further downstream movement of transplanted adult Walleye documented (Eschmeyer 1949). New species observed in HDP in 1948 included Bowfin, Brown Bullhead, and Yellow Bullhead.

Further fisheries surveys were conducted on HDP by MDOC from 1952 to 1954, although only the catch data from the 1953 survey is available (Table 2). The surveys targeted Walleye, which were tagged to determine downstream movement rates. In the 1952 and 1953 surveys, trap nets were used primarily to capture Walleye for tagging. In 1954, the researchers instead operated a dip net below Hardy Dam in April to target the Walleye spawning run (Crowe 1957). As with the earlier tagging studies, Crowe found that at least some of the transferred Walleye were able to successfully move downstream despite the dams, and in some cases passing through multiple dams. He also found that anglers were targeting and catching the transferred fish in the impoundments.

Another fisheries survey, which consisted of 32 gill net lifts, was conducted by MDNR in 1975. A total of 9 species were captured in the survey (Table 2). While it seems that no report was ever produced from the survey effort, MDNR Fisheries Biologist Bernie Ylkanen remarked in survey notes that HDP had "good Walleye, Yellow Perch, and Smallmouth Bass populations". He recommended no further fisheries management.

The next MDNR fisheries survey of HDP was conducted in 1984. This survey was more comprehensive than the 1975 survey and included inland gill nets, large mesh fyke nets, and small mesh fyke nets. A total of 11 species were caught in the survey (Table 2). In a brief synopsis of the survey, MDNR Fisheries Biologist Ralph Hay commented that HDP had good fisheries for Walleye, Yellow Perch, and Smallmouth Bass. The survey documented good growth rates for Walleye and Yellow Perch. Hay remarked that Bluegill were rare, likely due to a lack of aquatic vegetation, and that while there was a large population of "rough" fish (likely including Common Carp, Redhorse spp., and White Sucker), they did not appear to be inhibiting the gamefish populations.

An electrofishing survey was conducted on HDP by MDNR in September of 1988. The survey targeted Largemouth and Smallmouth Bass as part of a study on the effects of early season fishing on bass populations (Schneider et al. 1991). HDP had been selected as one of six Michigan lakes included in the study, which created a legal catch and release fishing season from April 1 through the opening of the standard fishing season (the Saturday prior to Memorial Day). While the results of the September 1988 fisheries survey were unimpressive (modest numbers of both species were caught), the Schneider et al. study eventually helped lead to the fishing regulation change of 2016, in which year-round, catch and immediate release fishing for bass was made legal statewide.

Another comprehensive fisheries survey was conducted on HDP by MDNR in 1989. This survey included inland gill nets, trap nets, and electrofishing. A total of 15 different fish species were caught in the survey (Table 2). Highlights of the survey included an impressive Walleye catch (the catch per effort or CPE was twice the rate of the 1984 survey). The Walleye ranged from 4 to 24 inches in length. This survey marked the only time that Brown Trout and Chinook Salmon were ever caught in fisheries surveys of HDP, and only the second time that Rainbow Trout were caught. In survey notes, MDNR Fisheries Biologist Rich O'Neal commented that the Chinook Salmon came from an upstream rearing facility. In

his report for the survey, O'Neal (1990) primarily discussed the abundant Walleye population of HDP. The Walleye caught in the 1989 survey did have a strong component of sublegal (smaller than 15 inches) fish, but growth rates were good for all age classes. O'Neal also discussed the strong population of Yellow Perch in HDP, and the popular fishery that existed year-round for that species.

The next fisheries survey of Hardy Dam Pond was conducted in 1990 as part of the relicensing effort for Hardy Dam. The 1990 survey was conducted by a consultant retained by Consumers Energy (LMS 1991). The only method used was seining. A total of 5,292 fish representing 13 species were captured in 9 seine hauls (Table 2). This survey effort produced four species that have not been captured from Hardy Pond in any other surveys. These included Blackchin Shiner, Golden Shiner, Sand Shiner, and Spotfin Shiner.

During the open water season of 2006, MDNR conducted a creel census survey on HDP (O'Neal and Kolb 2014). The survey ran from April 1 through October 31. A total of ten fish species were recorded as caught by anglers during the survey, with harvest reported for seven of those species. The most popular harvested species were Yellow Perch and Bluegill. Walleye were also popular, with an estimated harvest of 1,523 for the season, with another 5,650 released. Over the survey period, a total of 97,100 angler hours were generated, leading to an estimated fishery value of nearly \$800,000 at that time.

In the fall of 2016, two nighttime electrofishing survey efforts were conducted on HDP (O'Neal 2017). The first was conducted on September 20, and the second on November 1. The surveys were conducted to assess the relative abundance and condition of Largemouth and Smallmouth Bass in response to angler reports indicating poor fishing for Smallmouth Bass and poor health of the few individuals that had been caught. A total of 13 species were encountered in the surveys (Table 2). Robust numbers of both Largemouth and Smallmouth Bass were caught, with no sick or emaciated fish observed. Largemouth Bass ranged from 3 to 18 inches, while the Smallmouth Bass ranged from 3 to 21 inches. Walleye were also abundant, with over 100 individuals caught in the two surveys, ranging from 4 to 24 inches in length. Age and growth evaluation of the Walleye showed that they were growing slowly.

Starting in approximately 2018, anglers began reporting numerous incidental catches of Muskellunge in HDP. The reports have included catches of both sub-legal and legal (larger than 42 inches) Muskellunge. One fish that was photographed and released by an angler was approximately 48 inches in length and estimated at 38 lbs. Since the 2018 regulation change requiring harvested Muskellunge to be reported to MDNR, three Muskellunge have been reported as harvested from HDP. While reports of Muskellunge have come from throughout HDP, one hotspot seems to be the reach just below Rogers Dam, particularly in the spring when anglers are targeting Walleye there.

Since 1994, a total of 69 exceptional fish caught from HDP have been entered in the MDNR Fisheries Division Master Angler program. A total of 17 different species have been entered for HDP (Table 3). Black Crappie was the most numerous species entered, with 12 entries, followed by Bluegill with 11 entries, Northern Pike with 9 entries, and Smallmouth Bass, with 8 entries. While only four Quillbacks from HDP have been entered into the Master Angler program, HDP is known as a hotspot for large Quillbacks. Between 2012 and 2015, four consecutive Michigan state record Quillbacks were caught from HDP. The most recent Michigan state record Quillback was caught from HDP in 2020, and it weighed 9 lbs 15 oz.

Current Status

The most recent comprehensive fisheries survey of HDP was conducted in the spring and summer of 2021. The purpose of the 2021 fisheries survey was to assess the overall fish community in HDP. MDNR Status and Trends netting protocols (Wehrly et al. 2009) were used for most portions of the survey. The netting portion of the survey took place from June 7 through June 10, 2021. Gear used included four large-mesh fyke nets (16 net-nights), 2 trap nets (7 net-nights), and 4 experimental graded-mesh inland gill nets (16 net-nights). Seining and electrofishing were conducted on June 16 and 17. A total of six seine hauls were completed, along with six ten-minute electrofishing transects conducted with an 18-foot electrofishing boat. In this portion of the survey, a total of 2,885 fish were caught, representing 23 different species (Tables 4 and 5). Age and growth analysis was conducted by counting growth rings present in cross sections of spines taken from each fish (Table 6).

Another electrofishing survey was conducted on September 28, 2021. While the rest of the survey was spread over the entirety of HDP, the September electrofishing effort focused only on the one-mile reach immediately downstream of Rogers Dam. A total of 301 fish representing 22 different species were caught in this portion of the survey (Tables 7 and 8). Age and growth analysis was also conducted on the eight sport fish species caught in this portion of the survey (Table 9).

Previously recorded fish species that were not present in the 2021 survey of HDP included Blackchin Shiner, Bluntnose Minnow, Chinook Salmon, Golden Shiner, Mimic Shiner, Rainbow Trout, Sand Shiner, Spottfin Shiner, and Warmouth (Table 2). Species caught in the 2021 survey that were not present in previous surveys of HDP included Blackside Darter, Hybrid Sunfish, Northern Hog Sucker, River Redhorse, Shorthead Redhorse, and Silver Redhorse.

Shoreline data were collected on HDP by MDNR Fisheries personnel during August 2021 according to protocols outlined in Wehrly et al. (2009). Data collected included the number of docks, submerged trees, and houses observed per kilometer of shoreline, as well as how much of the shoreline is armored or hardened with a structure to prevent erosion. While the fisheries survey covered the entire reach of HDP from Hardy Dam to Rogers Dam, the shoreline survey only extended to approximately ½ mile upstream of Brower Park. That reach of HDP averaged 2.9 docks, 45.4 submerged trees and 0.3 houses per kilometer of shoreline. Armoring structures and materials were present along only 0.9% of the lake shoreline (Table 10). A temperature/dissolved oxygen profile was collected on August 9th, 2021. The profile was taken in the deepest part of the impoundment, close to the dam. Oxygen levels suitable for fish were found to a depth of 21 feet (Table 11). Secchi depth was measured at 9.5 feet on August 9th, 2021.

Analysis and Discussion

The 2021 MDNR fisheries survey of HDP showed relatively healthy fish populations. Most popular fish species showed multiple year classes (an indication that natural reproduction is occurring regularly) and modest growth rates. The popular fish species for anglers on Hardy Dam Pond include Bluegill, Black Crappie, Largemouth Bass, Northern Pike, Smallmouth Bass, Walleye, and Yellow Perch. Muskellunge have also been reported by anglers in increasing numbers in recent years, although none were captured in the 2021 MDNR survey of HDP.

Walleye were particularly abundant in the 2021 survey of HDP (Tables 4 and 6). Consistent year classes were present, even though no Walleye have been stocked into HDP in many years. This is an indication that Walleye are naturally reproducing on an annual basis in HDP. Growth rates for Walleye were somewhat on the slow side in the 2021 survey, with Walleye typically reaching the legal size of 15 inches by age 5 (Tables 6 and 9). Despite this, Walleye larger than 15 inches were abundant in the 2021 survey catch. These findings correspond with historical fisheries knowledge of HDP, which has shown excellent natural reproduction but slow growth rates for Walleye since the impoundment was created. The Walleye of HDP are extremely popular with anglers, and HDP is known as one of the better lakes for Walleye fishing in the western Lower Peninsula.

The 2021 MDNR fisheries survey showed abundant, healthy populations of both Largemouth Bass and Smallmouth Bass. HDP is a very popular for bass fishing, with multiple tournaments held each year. While Largemouth Bass have recently become abundant in HDP, this was not always the case. In the 1953 survey for example, only one Largemouth Bass was caught. In the 2006 creel survey, no Largemouth Bass were harvested, and only 1,234 were released. This was in contrast with Smallmouth Bass, of which 168 were harvested and 15,423 released (O'Neal and Kolb 2014). In the 2016 fisheries survey however, far more Largemouth Bass were caught in the September electrofishing effort than Smallmouth Bass (O'Neal 2017). Also, data from the 73 bass tournaments conducted on HDP from 2016-2020 showed that 68.5% of the fish weighed-in were Largemouth Bass, while only 31.5% were Smallmouth Bass (Tom Gonica, MDNR, personal communication). This increase in Largemouth Bass abundance is not unprecedented in Michigan lakes. A similar phenomenon was documented on both Lake Cadillac in Wexford County and Fife Lake in Grand Traverse County. While these lakes were historically dominated by Smallmouth Bass and had very few Largemouth Bass, recent fisheries surveys have documented that Largemouth Bass had become far more abundant than Smallmouth Bass (Tonello 2012 and 2013). It is likely that climate change may be playing a role in the surge of Largemouth Bass abundance in some Michigan lakes, as they tolerate warmer water temperatures better than Smallmouth Bass.

The Yellow Perch fishery of HDP is well-known by anglers and is heavily utilized. The 2021 survey showed good numbers of "keeper" sized Yellow Perch between 7 and 12 inches. While the Yellow Perch from the netting portion of the survey were growing slightly better than the state average, those sampled in the September electrofishing effort (conducted in the mile below Rogers Dam) were growing extremely fast (Tables 6 and 9). Rock Bass were extremely abundant in the 2021 fisheries survey, with good numbers present up to 10 inches. While Bluegill and Black Crappie were present in lesser numbers, those species still provide viable fisheries for those anglers willing to search for them. Large individuals of both species were present, with Bluegill up to 10 inches and Black Crappie up to 14 inches caught in the survey.

Although none were caught in the 2021 fisheries survey of HDP, Muskellunge have been increasingly reported by HDP anglers in recent years. It is likely that the Muskellunge being caught from HDP are migrants from MDNR stocking efforts in the upper Muskegon River, at the M-55 and Leota Bridges. The upper Muskegon River Muskellunge stocking effort began in 2012, with fish also stocked in 2013, 2014, 2015, 2018, and 2021. The goal of the program was to create a fishery in the upper Muskegon River, which is lightly fished but has abundant forage for Muskellunge. However, instead of staying in the upper Muskegon River, it appears that the Muskellunge instead migrate downstream. Angler reports of Muskellunge have been most common from Hardy Pond, but a few reports have also come from the

Muskegon River between Big Rapids and Rogers Pond, in addition to Rogers Pond itself. The strain of Muskellunge which has been stocked in the upper Muskegon River is the Great Lakes strain. The migration of the stocked Muskellunge noted in the Muskegon River is similar to behavior seen in other Michigan watersheds in which Great Lakes Muskellunge have been stocked in recent years, including the Grand River watershed.

Compared to other lakes in Michigan, HDP is sparsely populated with docks and dwellings (Table 10). HDP had 0.3 dwellings per kilometer while the average large deep lake in Michigan has 9.2 dwellings per kilometer (Wehrly 2015). HDP also had only 2.9 docks per kilometer of shoreline, while the average large deep lake in Michigan had 4.3 docks per kilometer (Wehrly et al. 2015). HDP also had much more submerged woody debris (45.4 trees/km) than other large lakes in Michigan (average =8.4 trees/km; Wehrly et al. 2015). HDP also had very little shoreline armoring (0.9%) than other large, deep, inland lakes in Michigan (average=24.2%). The lack of development on HDP is because much of the shoreline is owned by Consumers Energy and has been kept in a relatively natural state. Due to its largely undeveloped nature, HDP offers a scenic fishing experience that is not found on many other northwestern Lower Peninsula lakes.

Management Direction

HDP continues to provide an excellent fishery for Walleye, as it has since it was created. It has excellent spawning habitat for Walleye, and the 2021 fisheries survey documented consistent naturally produced year classes. Therefore, HDP should continue to be managed as a self-sustaining Walleye fishery. Walleye stocking is simply not necessary in HDP and would likely lead to even slower Walleye growth rates.

On the contrary, a stocking program for Muskellunge should be commenced on HDP. Muskellunge stocked far upstream in the Muskegon River have migrated to HDP and have thrived there, growing to large sizes, and providing opportunity for anglers. Muskellunge prefer soft-rayed forage like White Sucker, which are extremely abundant in HDP (Smith et al. 2016; Table 4). Numerous studies in the past have also shown that Muskellunge typically do not negatively affect the populations of other fish species preferred by anglers (Knapp et al. 2020). While the recommended stocking rate for Muskellunge in Michigan is 1.5/acre, a much smaller number stocked far upstream has created a noticeable fishery on HDP. Therefore, we should stock fall fingerling Great Lakes strain Muskellunge into HDP at a rate of 1/acre (4,000 fish) for three consecutive years, and then follow up with a similar number once every three years. It is unlikely that Muskellunge will reproduce successfully in HDP. The Muskellunge stocking program for the Upper Muskegon River will also be continued.

It is highly unlikely that another fisheries survey will be conducted on HDP any time in the near future, so it will be critical for MDNR Fisheries personnel to continue communicating with HDP anglers. In particular, it will be important for MDNR to communicate with Muskellunge anglers to verify the success of the stocking program once it begins. Fisheries Division personnel should also continue to monitor the results of fishing (for both bass and Walleye) on HDP. Mandatory reporting for bass and Walleye tournaments and mandatory reporting for Muskellunge harvest should help with this endeavor.

Drawdowns have been a recent topic of discussion on HDP. Drawdowns have been conducted for many years by Consumers to protect infrastructure on HDP and allow maintenance to be conducted on Hardy Dam. In the past HDP had been brought back to full pool in the spring, allowing anglers and boaters to

access the pond. However, an upcoming large spillway upgrade project (mandated by the FERC) for Hardy Dam may require extended drawdowns into the primary fishing/tourist season. Therefore, we recommend that Consumers modify the existing public boat ramps to foster public access during these lower water periods.

HDP has had issues with frequent blue-green algae blooms over the last several years. Unfortunately, the blue-green algae produce very high concentrations of the algal toxin microcystin, which can be harmful to both humans and pets. There is a combination of factors that make HDP conducive to blue-green algae blooms, including the location of HDP in the watershed, the physical characteristics of HDP, and the zebra mussel infestation (Aaron Parker, EGLE, personal communication). Impoundments like HDP tend to act as "sinks" for all the nutrients (likely from agricultural activity) that originate upstream. Also, impoundments like HDP tend to have a lot of shallow coves where historical tributary valleys were flooded. These shallow areas warm up faster than the main waterbody and because there is often little/no flow in these areas they also tend to stagnate, leading to blue-green algae bloom formation. Finally, Microcystis blue-green algae tends to dominate in waterbodies with zebra mussels (Aaron Parker, EGLE, personal communication). Unfortunately, there is no simple solution for the algae blooms in HDP. EGLE, the US Geological Survey, and the local health department plan to frequently conduct water testing on HDP in the summer so that the public can be warned if harmful algae blooms occur.

While the shorelines of many Michigan lakes and impoundments are heavily developed with manicured lawns, seawalls, and rock riprap, this is not the case on HDP. Much of the HDP shoreline remains in an undeveloped state, with natural vegetation in place. This benefits HDP both in terms of habitat for fish, reptiles, amphibians, mammals, and birds, in addition to scenic value. Since most of the shoreline is owned by Consumers Energy, we commend them for maintaining the shoreline of HDP in this fashion, and we recommend that they continue to do so.

References

- Crowe, W. R. 1957. Movement and harvest of native Walleyes from impoundments on the Muskegon River. Institute for Fisheries Research Report 1518. Michigan Department of Conservation, Ann Arbor.
- Eschmeyer, P. H. 1947. Observations on certain waters of the Muskegon River drainage, with particular reference to the annual transfer of adult Yellow Pike-Perch to these waters from the river below Newaygo Dam. Institute for Fisheries Research Report 1142. Michigan Department of Conservation, Ann Arbor.
- Eschmeyer, P. H. 1949a. Reproduction and migration of the Yellow Pike-Perch (*Stizostedion vitreum vitreum*), in Michigan. PHD Dissertation, University of Michigan, Ann Arbor.
- Eschmeyer, P. H. 1949b. A review of Pike-Perch tagging experiments in Michigan, with particular reference to studies on the Muskegon River. Institute for Fisheries Research Report 1222. Michigan Department of Conservation, Ann Arbor.
- Hubbs, C. L. 1933. Results of tagging experiments on the Muskegon River, 1932. Institute for Fisheries Research Report 195. Michigan Department of Conservation, Ann Arbor.

Knapp, M. L., S. W. Mero, and D. F. Staples. 2021. Are Muskellunge affecting fish communities in waters where they've been introduced? A re-examination of Minnesota's stocked Muskellunge waters. *North American Journal of Fisheries Management* 41:229-241.

Lawler, Matusky and Skeller Engineers. 1991. Application for license for major project-existing dam, Muskegon River, Hardy project, FERC project #2452. Prepared for Consumers Power Company, Jackson, Michigan.

O'Neal, R. P. 1990. Status of the Fishery Report with Management Plan- 1990. Hardy Dam Impoundment, Newaygo and Mecosta Counties. Michigan Department of Natural Resources, Cadillac.

O'Neal, R. P. 1997. Muskegon River Assessment. MI Department of Natural Resources, Fisheries Division, Special Report Number 19. Ann Arbor, MI.

O'Neal, R. P. 2017. Hardy Impoundment 2016 Fisheries Survey Report. Michigan Department of Natural Resources, Cadillac.

O'Neal, R. P., and T. Kolb. 2014. Hardy Impoundment 2006 Angler Survey Report. Michigan Department of Natural Resources, Cadillac.

Schneider, J. C., J. R. Waybrant, and R. P. O'Neal. 1991. Results of early season, catch-and-release bass fishing at six lakes. Fisheries Technical Report No. 91-6. Michigan Department of Natural Resources, Institute for Fisheries Research, Ann Arbor.

Smith, K. M., M. V. Thomas, and P. A. Hanchin. 2016. Management Plan for Muskellunge in Michigan. Fisheries Division Special Report 12. Michigan Department of Natural Resources, Lansing.

Tonello, M. A. 2012. Status of the Fishery Report 2012-149: Lake Cadillac, Wexford County. Michigan Department of Natural Resources, Lansing.

Tonello, M. A. 2013. Status of the Fishery Report 2014-181: Fife Lake, Grand Traverse County. Michigan Department of Natural Resources, Lansing.

Wehrly, K.E., G.S. Carter, and J.E. Breck. 2009 Draft. Standardized sampling methods for the inland lakes status and trends program. Chapter 27 in *Manual of Fisheries Survey Methods*. Michigan Department of Natural Resources, Fisheries Division internal document, Ann Arbor.

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. Institute for Fisheries Research, Ann Arbor.

Table 1. Fish stocked in Hardy Dam Pond, Newaygo, and Mecosta Counties, 1931-2021.

Year	Species	Number	Size/Age
1931	Bluegill	560	5 mo.
	Smallmouth Bass	7,800	5 mo.
1934	Walleye	5,746	adults
1935	Rainbow Trout	38	adults
	Smallmouth Bass	5,000	4 mo.
	Yellow Perch	41,000	7-8 mo.
	Walleye	4,819	adults
1936	Largemouth Bass	300	yearlings
	Rainbow Trout	4	adults
	Smallmouth Bass	3,000	4 mo.
	Walleye	1,095	adults
1937	Northern Pike	3	adults
	Rainbow Trout	15	adults
	Walleye	932	adults
	Yellow Perch	21,500	adults
1938	Brown Trout	1	adults
	Rainbow Trout	30	adults
	Walleye	1,094	adults
1939	Northern Pike	1	adults
	Rainbow Trout	2	adults
	Walleye	551	adults
1940	Northern Pike	11	adults
	Smallmouth Bass	1	adults
	Walleye	90	adults
	Yellow Perch	1	adults
1941	Bluegill	75,000	3 mo.
1942	Walleye	1,323	adults
1943	Northern Pike	1	adults
	Rainbow Trout	4	adults
	Walleye	1,992	adults
1944	Bluegill	15,000	4 mo.
	Rainbow Trout	2	adults
	Walleye	623	adults
1945	Smallmouth Bass	2,000	4 mo.
1950	Brown Trout	1	adults
	Northern Pike	2	adults
	Rainbow Trout	2	adults
	Walleye	1,818	adults
1951	Walleye	60	adults
1954	Northern Pike	3	adults
	Rainbow Trout	5	adults
1955	Walleye	3,468	adults
	Northern Pike	2	adults
	Rainbow Trout	3	adults
	Walleye	3,995	adults

Table 1, continued.

1956	Brown Trout	4	adults
	Northern Pike	6	adults
	Walleye	4,171	adults
1957	Brown Trout	1	adults
	Northern Pike	4	adults
	Rainbow Trout	3	adults
	Walleye	1,752	adults
1958	Walleye	2,700	adults
1959	Walleye	1,710	adults
1960	Walleye	3,337	adults
1961	Walleye	616	adults
1962	Walleye	1,274	adults
1963	Walleye	1,080	adults
1964	Walleye	433	adults
1965	Walleye	562	adults
1966	Walleye	384	adults
1988	Channel Catfish	37,460	fall fingerlings

Table 3. Michigan DNR Master Angler awards issued for fish caught from Hardy Dam Pond, Newaygo and Mecosta Counties, Michigan, 1994-2021.

Species	Number of Master Angler awards issued
Black Crappie	12
Bluegill	11
Northern Pike	9
Smallmouth Bass	8
Yellow Perch	6
Channel Catfish	4
Quillback	4
Bullhead	3
Common Carp	2
Walleye	2
Rock Bass	1
Hybrid Sunfish	1
Pumpkinseed	1
White Sucker	1
Bowfin	1
Redhorse	2
Flathead Catfish	1
Total:	69

Table 4. Number, weight, and length of fish collected from Hardy Dam Pond with small mesh fyke nets, large mesh fyke nets, trap nets, experimental gill nets, seining, and electrofishing, June 7-17, 2021.

Species	Number	Percent by number	Weight (pounds)	Percent by weight	Length range (inches) ¹	Average length	Percent legal size ²
Black Bullhead	3	0.1	2.8	0.2	8-14	12.2	100 (7")
Black Crappie	36	1.2	20.0	1.2	4-14	9.2	86 (7")
Bluegill	87	3.0	25.5	1.5	3-10	6.7	82 (6")
Bowfin	11	0.4	52.0	3.0	18-28	23.4	
Brown Bullhead	73	2.5	75.6	4.4	4-15	12.6	93 (7")
Common Carp	36	1.2	413.3	24.0	12-34	28.9	
Chestnut Lamprey	1	0.0	0.1	0.0	9-9	9.5	
Johnny Darter	1	0.0	0.0	0.0	2-2	2.5	
Largemouth Bass	29	1.0	46.1	2.7	1-18	11.2	55 (14")
Logperch	19	0.7	0.3	0.0	3-3	3.5	
Northern Pike	101	3.5	280.5	16.3	15-31	22.9	35 (24")
Pumpkinseed	5	0.2	1.6	0.1	5-8	7.1	100 (6")
Quillback	19	0.7	79.1	4.6	14-23	20.1	
River Redhorse	6	0.2	13.5	0.8	15-20	18.5	
Rock Bass	483	16.7	143.8	8.3	2-10	7.0	76 (6")
Shorthead Redhorse	78	2.7	175.1	10.2	13-21	17.6	
Silver Redhorse	16	0.6	43.0	2.5	15-24	20.0	
Smallmouth Bass	49	1.7	41.3	2.5	1-19	9.4	20 (14")
Spottail Shiner	74	2.6	1.4	0.1	3-5	3.9	
Walleye	173	6.0	119.4	6.9	2-21	11.0	23 (15")
White Sucker	1,176	40.8	90.1	5.2	1-23	2.0	
Yellow Bullhead	97	3.4	72.9	4.2	5-14	11.5	99 (7")
Yellow Perch	312	10.8	25.1	1.5	1-11	4.7	19 (7")
Total	2,885	100	1722.5	100			

¹Note some fish were measured to 0.1 inch, others to inch group: e.g., "5"=5.0 to 5.9 inch, "12"=12.0 to 12.9 inches; etc.

²Percent legal size or acceptable size for angling. Legal size or acceptable size for angling is given in parentheses.

Table 5. Length frequency distribution for gamefish caught from Hardy Dam Pond with small mesh fyke nets, large mesh fyke nets, trap nets, experimental gill nets, seining, and electrofishing, June 7-17, 2021.

Inch Class	Black Crappie	Bluegill	Largemouth Bass	Northern Pike	Pumpkin-seed	Rock Bass	Smallmouth Bass	Walleye	Yellow Perch
1			10				6		91
2						2		2	
3		1				3	2		23
4	5	5				31	4		46
5		10			1	79	3	41	39
6		18			1	151		25	53
7	4	27			2	86	4		34
8	12	21			1	71	10	2	13
9		4				45	4	4	10
10	6	1	2			15	1	9	2
11	2							9	1
12	4						1	10	
13	2		1					12	
14	1		3				2	19	
15				2			2	17	
16			2	1			6	5	
17			6	1			2	3	
18			5	4			1	3	
19				5			1	6	
20				7				4	
21				17				2	
22				20					
23				9					
24				11					
25				7					
26				13					
27				1					
28									
29				2					
30									
31				1					
Total	36	87	29	101	5	483	49	173	312

Table 6. Average total weighted length (inches) at age, and growth relative to the state average, for fish sampled from Hardy Dam Pond with small mesh fyke nets, large mesh fyke nets, trap nets, experimental gill nets, seining, and electrofishing, June 7-17, 2021. Number of fish aged is given in parenthesis. A minimum of five fish per age group is statistically necessary for calculating a Mean Growth Index, which is a comparison to the State of Michigan average.

Species	Age										Mean Growth Index
	I	II	III	IV	V	VI	VII	VIII	IX	X	
Black Crappie	4.5 (5)	8.1 (15)	10.4 (6)	12.8 (1)	12.2 (3)	12.4 (4)			11.2 (2)		+1.3
Bluegill		5.6 (21)	7.4 (14)	8.3 (10)	8.1 (1)	9.5 (4)			10.1 (1)		+1.9
Largemouth Bass		10.2 (2)	13.5 (1)	14.7 (2)	14.2 (1)	17.4 (2)	17.3 (5)	18.1 (6)			+0.5
Northern Pike	16.1 (4)	20.5 (14)	22.8 (43)	25.0 (18)	25.8 (5)	28.4 (3)		21.7 (1)			+0.8
Pumpkinseed				5.5 (1)		6.9 (2)	7.8 (2)				--
Smallmouth Bass	4.8 (7)	8.6 (19)	12.9 (1)	16.0 (3)	16.6 (7)	15.3 (2)	16.6 (1)	17.4 (1)			+0.3
Walleye	5.9 (20)	9.5 (9)	12.0 (22)	13.1 (9)	15.1 (28)	16.6 (10)	16.5 (6)	19.8 (5)	20.0 (1)	21.1 (1)	-2.7
Yellow Perch	4.2 (12)	5.7 (7)	6.8 (30)	7.6 (11)	9.5 (5)	9.8 (4)	11.4 (1)				+0.3

Table 7. Number, weight, and length of fish collected from the Muskegon River below Rogers Dam by electrofishing, September 28, 2021.

Species	Number	Percent by number	Weight (pounds)	Percent by weight	Length range (inches) ¹	Average length	Percent legal size ²
Black Crappie	4	1.3	0.7	0.3	6-7	6.8	25 (7")
Blackside Darter	2	0.7	0.0	0.0	3-3	3.5	
Bluegill	1	0.3	0.1	0.0	4-4	4.5	0 (6")
Brown Trout	1	0.3	0.1	0.0	6-6	6.5	0 (8")
Channel Catfish	1	0.3	13.5	5.4	33-33	33.5	100 (12")
Common Shiner	3	1.0	0.2	0.1	4-6	5.5	
Creek Chub	2	0.7	0.1	0.0	5-5	5.5	
Emerald Shiner	3	1.0	0.0	0.0	3-3	3.5	
Hybrid Sunfish	2	0.7	0.3	0.1	5-6	6.0	50 (6")
Largemouth Bass	1	0.3	0.8	0.3	11-11	11.5	0 (14")
Logperch	7	2.3	0.2	0.1	4-4	4.5	
Northern Hog Sucker	8	2.7	7.3	2.9	7-15	12.4	
Northern Pike	17	5.6	63.3	25.5	21-35	25.0	47 (24")
Pumpkinseed	1	0.3	0.1	0.0	4-4	4.5	0 (6")
Rock Bass	3	1.0	1.0	0.4	6-8	7.5	100 (6")
Shorthead Redhorse	35	11.6	33.9	13.6	7-21	12.6	
Silver Redhorse	1	0.3	1.3	0.5	15-15	15.5	
Smallmouth Bass	47	15.6	36.3	14.6	3-18	9.5	21 (14")
Spottail Shiner	2	0.7	0.1	0.0	4-4	4.5	
Walleye	85	28.2	68.1	27.4	4-17	12.9	34 (15")
White Sucker	4	1.3	4.0	1.6	4-19	11.3	
Yellow Perch	71	23.6	17.1	6.9	3-12	7.4	56 (7")
Total	301	100	248.5	100			

¹Note some fish were measured to 0.1 inch, others to inch group: e.g., "5"=5.0 to 5.9 inch, "12"=12.0 to 12.9 inches; etc.

²Percent legal size or acceptable size for angling. Legal size or acceptable size for angling is given in parentheses.

Table 8. Length frequency distribution for gamefish caught from the Muskegon River below Rogers Dam by electrofishing, September 28, 2021.

Inch Class	Black Crappie	Bluegill	Brown Trout	Channel Catfish	Hybrid Sunfish	Large-mouth Bass	Northern Pike	Pumpkin-seed	Rock Bass	Small-mouth Bass	Walleye	Yellow Perch
3										7		12
4		1						1		2	1	8
5					1					1	3	3
6	3		1		1				1	7	1	8
7	1								1	7	1	7
8									1	3		10
9											9	6
10										3	11	13
11						1					8	3
12										3	4	1
13										4	12	
14										2	6	
15										2	14	
16										3	13	
17										2	2	
18										1		
19												
20												
21							3					
22							5					
23							1					
24							1					
25							2					
26							2					
29							1					
30							1					
33				1								
35							1					
Total	4	1	1	1	2	1	17	1	3	47	85	71

Table 9. Average total weighted length (inches) at age, and growth relative to the state average for fish sampled from the Muskegon River below Rogers Dam with electrofishing, September 28, 2021. Number of fish aged is given in parenthesis. A minimum of five fish per age group is statistically necessary for calculating a Mean Growth Index, which is a comparison to the State of Michigan average.

Species	Age							Mean Growth Index	
	0	I	II	III	IV	V	VI		VII
Black Crappie			6.7 (3)	6.4 (1)					--
Bluegill			4.8 (1)						--
Brown Trout		6.7 (1)							--
Largemouth Bass				11.8 (1)					--
Northern Pike			22.8 (1)	22.9 (5)	24.2 (7)	26.3 (2)		30.9 (2)	-0.4
Smallmouth Bass	4.6 (1)	7.5 (17)	11.3 (5)	14.0 (5)	16.1 (5)	16.8 (1)	17.5 (1)	18.1 (1)	+1.5
Walleye	5.3 (4)	9.3 (11)	10.8 (16)	13.6 (17)	15.7 (15)	15.7 (11)			-1.8
Yellow Perch		6.3 (16)	8.8 (19)	10.2 (13)	11.9 (2)		11.9 (1)		+2.3

Table 10. Shoreline data for Hardy Dam Pond, Newaygo and Mecosta Counties, compared with that for other large, deep (deeper than 35') depth lakes in Michigan (from Wehrly et al. 2015). Sampling was conducted by MDNR Fisheries personnel in August 2021.

	Total docks per km	Dwellings per km	Percent shoreline armoring	Submerged trees per km
Hardy Dam Pond	2.9	0.3	0.9	45.4
Michigan statewide average for large, deep depth inland lakes	4.3	9.2	24.2	8.4

Table 11. Temperature and dissolved oxygen profile for Hardy Dam Pond, Newaygo County, on 8/9/2021.

Depth (feet)	Temperature (F)	O2 (ppm)
0	77.1	8.19
3	76.9	8.19
6	76.6	7.92
9	76.2	7.76
12	76.1	7.45
15	75.7	7.18
18	75.5	6.88
21	75.3	6.52
24	74.0	0.84
27	73.0	0.00
30	72.5	0.00
33	71.9	0.00
36	71.3	0.00
39	70.3	0.00
42	69.6	0.00
45	68.7	0.00
48	67.7	0.00
51	66.9	0.00
54	66.5	0.00
57	65.8	0.00
60	64.7	0.00
63	63.9	0.00
66	63.4	0.00
69	62.9	0.00
72	62.6	0.00
75	61.9	0.00
78	61.2	0.00
81	60.7	0.00
84	60.2	0.00
87	59.7	0.00
90	58.7	0.00
93	57.1	0.00
96	55.1	0.00
99	54.4	0.00

Received June 1, 2022; published November 4, 2022

Scott Heintzelman, Unit Review and Approval

Sara Thomas, External Reviewer

Tim Cwalinski, SFR Facilitator

Randall M. Claramunt, Desktop Publisher and Approval