



Glad Lake Annual Monitoring and Maintenance Program – 2022

In part of reporting for FES Project 22-010
SVSFE Initiatives and Monitoring of Recreational
Fisheries in the Swan Valley Area

Summary

Angling opportunities for arctic char are very rare in Manitoba Lakes. There are two fisheries which have a history of producing master angler char; Snail Lake and Glad Lake, which are both located within the Swan Valley area. Snail Lake is a secluded winter fishery in the Porcupine Provincial Forest. Glad Lake is in the heart of the Duck Mountains adding a unique and accessible experience for anglers.

There are many challenges in achieving this common goal. One of the main challenges is the presence of northern pike, a top predator. Glad Lake has been stocked with various trout species since the 1940s and was a successful trout fishery on various occasions. What led to that success was the removal and maintenance of pike populations. In 2015, SVSFE resurrected the pike removal program, now referred to as the Glad Lake Maintenance and Monitoring Program. The program is comprised of an annual pike transfer, trout monitoring surveys, and review of management recommendations. Partnerships on the Glad Lake program ensures the best practices are used to restore this trout fishery.

In 2022, SVSFE carried out the 8th annual pike transfer, conducted monitoring surveys, and addressed recommendations that have been under consideration for some time. A total of 80 pike, 1 walleye, 36 white suckers and 17 yellow perch were caught. Fourteen pike and one walleye were transferred to Wellman Lake. Unfortunately, while holding pike for transport, fifty were lost due to a net failure. These fish were all destined for Hoopers Lake. Since 2015, a total of 1,432 pike have been removed from Glad Lake through early spring trap netting. In terms of the monitoring survey, a total of 29 fish were caught including 25 pike and 4 lake trout. No arctic char were observed or captured in 2022.

There is a constant reminder that altering a species composition to this degree involves commitment and patience. This report contains a review of the past management, along with findings from 2022, an overview of progress, and future recommendations. Both fisheries managers and SVSFE agree to stay committed to creating an arctic char fishery. It takes hard work from dedicated people and open minds to take on innovative projects. That approach is just that and has been a part of Glad Lake's history for over four decades.

Table Contents

Summary.....	2
List of Figures.....	4
List of Tables.....	4
List of Appendices.....	4
Glad Lake Management Review.....	5
Looking Back	5
Management Today	7
Study Objective.....	8
Methods.....	8
Pike Transfer	8
Trout Monitoring Survey	9
Results.....	11
Spring Pike Transfer	11
Northern Pike	12
Walleye and Other Game Species	14
Trout Monitoring Surveys	15
Review of Management Recommendations	16
Discussion.....	19
Pike Transfer	19
Adapting Monitoring Surveys	20
Stocking of Focus Species	22
Forage Assessments	22
Fish Habitat Improvements	23
Appendices.....	26
References.....	29

List of Figures

Figure 1: North bay of Glad lake on day one of pike transfer.....	8
Figure 2: DFO SR20 Electrofishing boat.....	9
Figure 3: Trap net locations.....	10
Figure 4: Northern pike length frequencies 2021-2022.....	13
Figure 5: Examples of northern pike caught in 2022 pike transfer.....	13
Figure 6: Northern pike age frequencies 2021-2022.....	14
Figure 7: Walleye caught during pike transfer.....	14
Figure 8: Average sized pike caught in transfer.....	19
Figure 9: Fisheries Branch staff Colton Phillips and Ethan Dobbs (The Pas, MB) holding arctic char being stocked in the spring of 2022.....	20
Figure 10: Arctic char caught during the 2011 winter netting survey on Glad Lake.....	21
Figure 11: Stomach contents found in pike during transfer - yellow perch, spottail shiner, unidentified minnows and grammarus.....	22
Figure 12: Materials sourced for creating fish habitat structures.....	23
Figure 13: Construction and examples of fish habitat structures - cribs and brush piles.....	24
Figure 14: Example of fish habitat structures at sites.....	25

List of Tables

Table 1: Pike transfer species composition 2015-2022.....	11
Table 2: Pike transfer CPUE by species 2015-2022.....	12
Table 3: Size range of pike caught during pike transfer 2015-2022.....	13
Table 4: Review of management recommendations 2015-2021.....	16

List of Appendices

Appendix 1: Glad Lake stocking history.....	26
Appendix 2: Arctic Char stocking history correlated with master angler records.....	28
Appendix 3: Rainbow trout stocking history correlated with master angler records.....	28

Glad Lake Management Review

Glad Lake is a smaller (70 ha) deep oligotrophic lake located in the Duck Mountain Provincial Park. The area is a high use recreational hub that has developed over the years. The park amenities include a large campground, lodge, cabin development on both Wellman and Glad Lake, recreational areas, and access to angling opportunities.

Glad Lake has been managed as a trout fishery since the 1940s, with a variety of trout/char introductions along with a range of management strategies. Due to the lake characteristics, and the presence of top predators, specifically northern pike, there has been challenges to overcome and maintain this trout fishery.

The most successful introduction in the past was the arctic char (*Salvelinus alpinus*). Angler returns and master angler catches peaked in the early 1990s. What truly contributed to this success of the char stocking can be difficult to define although removal programs were found to correlate with this angling success. Additionally stocking larger and lower rates of trout during removals provided quick returns.

Looking Back

In 1978, following a lake survey it was stated the lake was not suitable for pike, although the channel connecting to Wellman Lake provided pike habitat. Seine hauls found numerous blacknose shiners and iowa darters, but it was stated lack of cover limits presence of forage fish. In 1980 the outflow channel was rocked, and the first pike removal was initiated and coined "The Pike Eradication Project". This gill netting program caught over 350 pike but also removed other game species including lake trout, walleye, suckers, and yellow perch. The province continued annual removals between 1980-1982 and 1985-1988. In 1982 copper sulphate was added to the northwest bay in efforts to kill pike eggs and rotenone was considered but the cost (>\$75,000) far outweighed the benefits (rotenone studies lacked proof of success in lakes deeper >130').

In 1985 efforts were increased. A permanent control structure was built on the outflowing channel and the lake was heavily netted both spring and fall removing all fish prior to the initial planting of 17,000 arctic char fingerlings. The netting between 1980 and 1988 removed over 1300 pike, 750 other game species and an additional 2500 yellow perch. In October of 1985 it was stated when removal estimates were applied to the data, it indicated almost all the fish had been removed. The 1985 pike removal/char introduction was a highly collaborated initiative between many partners: The Department of Fisheries & Oceans, Manitoba Habitat Heritage, the Department of Natural Resources Fisheries, Regional Services, Manitoba Parks, Wellman & Glad Cottagers Association, Chamber of Commerce, Swan Valley Regional Secondary School, and Swan Valley Restocking Association (soon to be SVSFE).

Char received from DFO's Rockwood Aquaculture Research Centre were stocked in 1985, 1987, 1993 and 1994. 1989 marked the first appearance of char in test nets and the first master angler was registered in 1990. Test netting was completed in 1990 to continue the removal of pike. After a lot of effort, only a few pike were caught, and the project was put on hold. User groups continued efforts through fishing derbies in the early 90s, known as the "Gaitor Bowl".

By 1996 DFO's Rockwood Aquaculture Research Centre char had ceased operations and had gone privatized under Glacier Springs Fish Farms until 2004. Through discussions with Whiteshell Fish Hatchery Manager, Kevin Dyck, it was understood that in 1991, the Whiteshell Hatchery received char eggs of the Nauyak Lake strain from the centre. These fish were grown to brood stock size and in 1995 they were able to collect spawn. This resulted in the first Whiteshell Hatchery produced char stocked the following year. An additional, 40,000 eggs were stocked following the fall planting due to an excess amount of char eggs available. Char were produced and stocked from 1995-1997 annually, along side spar stocking in 1996 & 1997. The last planting of spar was in 2001 and char in 2004. The Grand Rapids Hatchery was to take over the char stocking program and in 2004 char eggs were shipped north. Kevin stated "the char thrived in the cold-water hatchery but unfortunately the fish contracted infectious pancreatic necrosis (IPN) and the char stocking was discontinued".

Regrettably, with the lack of maintenance, the pike population quickly rebounded. During this time, rainbow trout were also "added to the pot" and heavily stocked on occasion. It is believed the increased predation and competition/lack of forage in a lake almost void of structure led to the decline of arctic char in Glad Lake. By 2005 char were not present in test netting and 2007 was the last recorded master angler submission.

Management focus switched to rainbow trout and brook trout stocking with limited success. The presence of large pike within the community limited survival even with increased rates and alternative stocking methods (i.e. scatter stocking). In 2010/11 SVSFE completed early summer and winter netting surveys. Trout catches were limited and the last documented catch of arctic char at Glad Lake was during the winter of 2011 measuring 622mm (24.5") fork length, 656mm (25.8") total length and weighed 2820g (6.2lbs). Following poor results in both 2010 & 2011 netting surveys, Fisheries Branch and SVSFE partnered to develop a plan to re-introduce char to Glad Lake. In 2015, SVSFE applied to the Hunter and Anglers Preservation Fund for funding to purchase Yukon Gold arctic char eggs from the Icy Waters Hatchery in efforts to create a unique opportunity for anglers in the Parkland area. This was the beginning of the char re-introduction and the modern-day pike removal, known as the "Glad Lake Monitoring and Maintenance Program".

Management Today

The Glad Lake Monitoring and Maintenance Program has been an annual event since 2015. The program is comprised of an annual pike transfer, trout monitoring surveys, and review of management recommendations.

As an effort to increase char stocking success, the pike transfer targets spawning pike each spring when they are most vulnerable and removed from the lake. Pike removed are used to supplement other pike fisheries and, in some cases, create new ones. Monitoring surveys evaluate trout/char populations. Arctic char were stocked with 22,250 fish in 2017, 25,550 in 2020 and 18,850 in 2022 (all 18⁺cm). Surveys to evaluate stocking response have varied over the years and include either short-set gill netting (BTIN or SLIN) or fall electrofishing surveys unique to Glad Lake. These surveys have shown an increase in the lake trout population that directly correlates with the pike transfer. Limited success has been found in char survival. In 2020 a handful of recently stocked char were found in the fall electrofishing surveys. Char ranged from 245 mm to 308mm and were all estimated at age two, indicating they were from the 2020 spring planting. Anglers have reported seeing and/or catching the odd char but these reports were limited to sightings of small fish the same year char were stocked (predominately the 2020 planting).

Partnerships on the Glad Lake program ensures the best practices are used to restore this trout fishery and diversify angling opportunities in the area. The program requires collaboration between both Provincial Fisheries, SVSFE, and volunteers. Each year the program is evaluated, and recommendations are put forth.

Following the 2021 monitoring and maintenance program it was recommended to continue with the program, with the following considerations:

1. Remain consistent with an annual pike transfer.
2. Monitor trout populations through periodic SLIN and/or fall electrofishing surveys.
3. Revisit the idea of additional trout stocking - rainbow trout at a low stocking rate.
4. Incorporating forage assessments into monitoring program.
5. Enhancing fish habitat with artificial underwater structures.

Study Objective

During the Glad Lake Monitoring and Maintenance Program the first objective was to conduct the 8th annual pike transfer. The continual objective of the annual pike transfer program is to decrease predation on stocked trout and increase stocking success. The goal is met by sustaining a low maintenance program, with consistent timelines (early ice off), while removing and transferring as many northern pike as possible during spring spawning periods.

The secondary objective was to evaluate arctic char and lake trout populations. This survey was accomplished through fall electrofishing with the use of Fisheries & Oceans' (DFO) SR20 electrofishing boat. Monitoring stocking success will aid fisheries and hatchery managers in future planning for char stocking practices.

The final objective was to evaluate the remaining 2021 recommendations and determine attainable goals and valuable initiatives to undertake with fisheries managers. Topics of discussion included additional trout stocking, forage assessments, and habitat improvements. This report will summarize efforts from all three objectives completed in 2022.

Methods

Pike Transfer

Throughout the transfer programs, the key is to net as early as possible. Northern pike commonly spawn when the lake remains ice covered. Fortunately, the north bay offers opportunities to set nets early in the season, as it is typically ice free for a couple days prior to full break up. During the program two trap nets were utilized, one large mesh (2.5") trap net and one small mesh (1/4") trap net. Trap nets were monitored daily and pulled every three - four days and fished exclusively in the north end of the lake. Netting continued until catches were insignificant.

All pike caught were sampled for fork length, sex, general condition, and age structures taken. Northern pike >550mm and walleye were transferred to Wellman Lake while pike <550mm were transferred to Hoopers Lake. Hoopers Lake is a 50-



Figure 1: North bay of Glad lake on day one of pike transfer

hectare lake with a maximum depth of 10' located northwest of Beulah, MB. Western Region manager, Max Legal, requested pike as an effort to restore the pike fishery. Max stated "The lake has been used for recreation for over 100 years, but the area became neglected. In the early 2000s the Hooper's Lake Redevelopment Committee was formed to reclaim the area. Aeration was added to the lake in the early 2000s about the same time pike were being stocked in the lake. The aeration unit broke down and the lake ended up winterkilling about 4 years ago". The unit was repaired, and residents requested restoration of the fishery in 2021. Therefore, it seemed fitting as a recipient lake for the transfer. Other game fish such as yellow perch and white suckers were simply counted and released back into Glad.

Trout Monitoring Survey

SVSFE utilized Fisheries & Oceans' (DFO) SR20 electrofishing boat for method of capture. The electrofishing survey was completed by shocking the entire shoreline in depths ranging from 0.9 to 4.0 meters. Two surveys were completed on two separate evenings, one in September and one October. Trout were sampled for fork and total length and age structures collected before being released. All northern pike caught during the survey were measured for fork and total length and transferred to Wellman Lake.

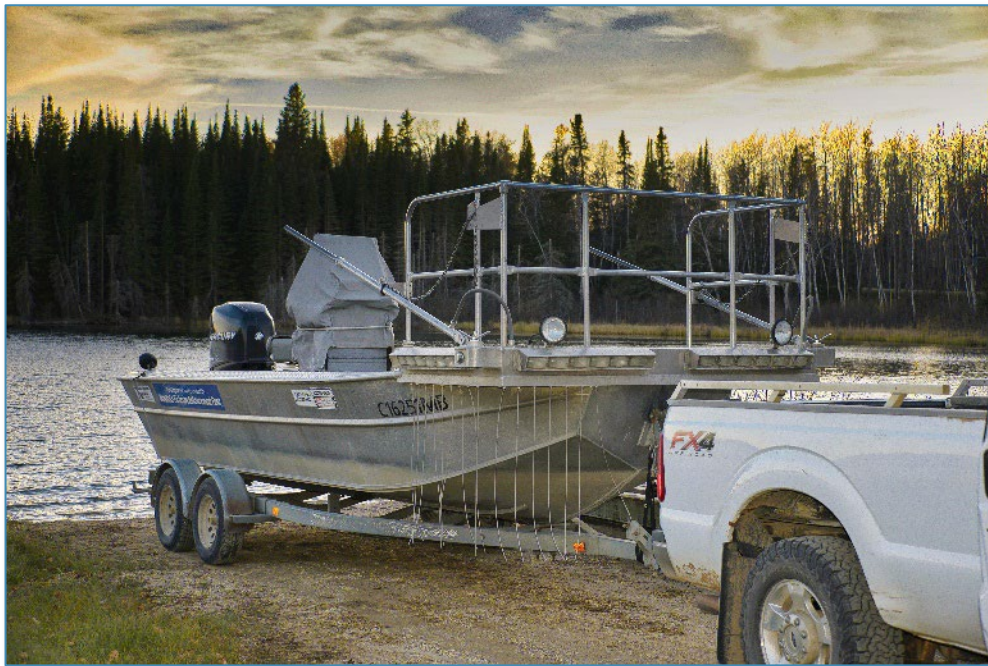


Figure 2: DFO SR20 Electrofishing boat

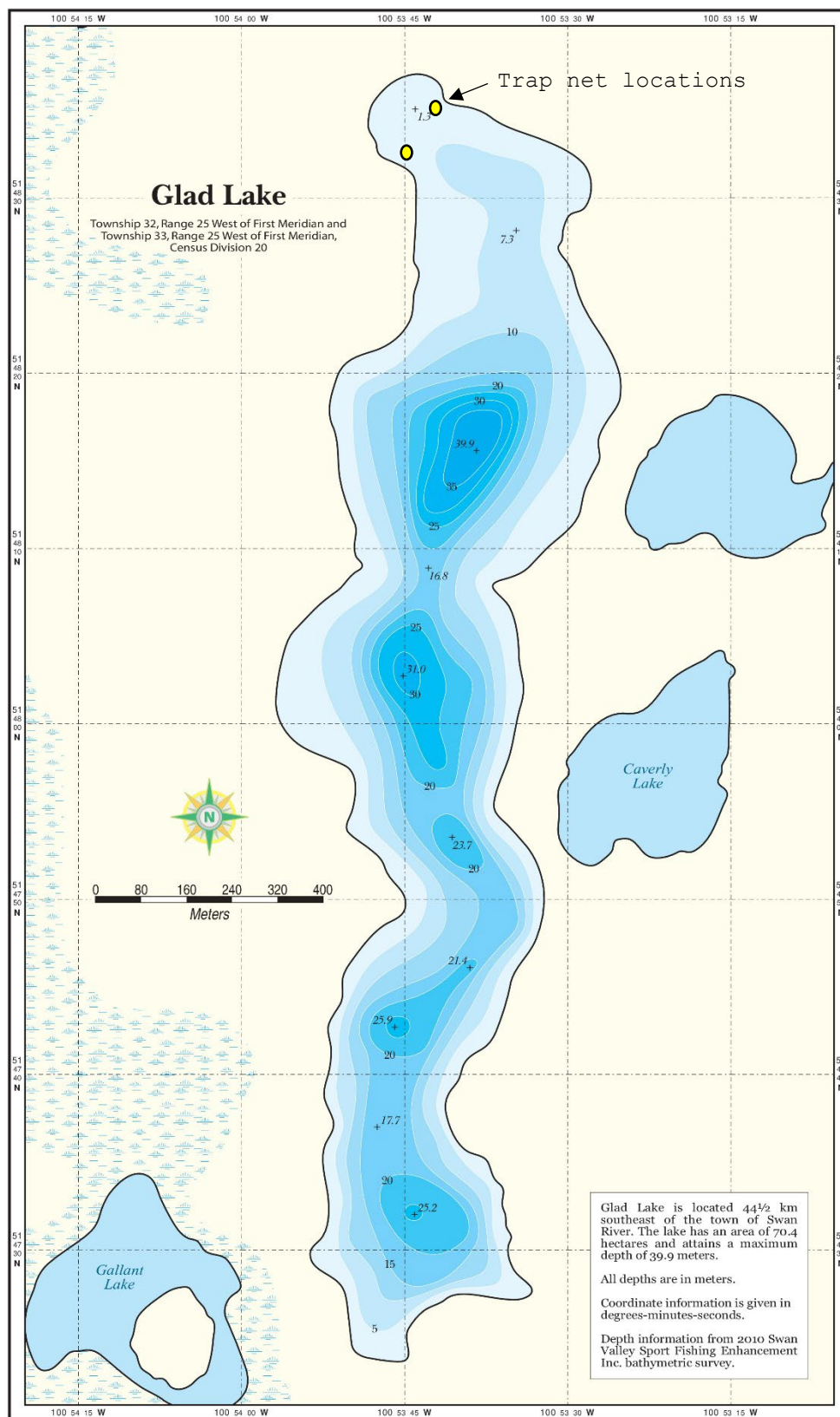


Figure 3: Trap net locations

Results

Spring Pike Transfer

In 2022, SVSFE technicians conducted the 8th Annual Pike Transfer since 2015. The netting ran for nine days from May 16th to the 25th. At that point catches decreased and concluded the 2022 transfer. Water temperatures ranged from 6°C to 9°C, and netting equated to a total of 443 hours effort. The catches were limited to northern pike, walleye, yellow perch, and white suckers. A total of 80 pike, 1 walleye, 36 white suckers and 17 yellow perch were caught. Fourteen pike and one walleye were transferred to Wellman Lake. Unfortunately, while holding pike for transport, fifty were lost due to a net failure. These fish were all destined for Hoopers Lake. The escapement wasn't discovered until the transfer day therefore regrettably only sixteen pike were transferred. In total since 2015, 1,432 pike have been removed from Glad Lake through early spring trap netting.

Relative species abundance over time is determined through catch per unit effort (CPUE) or number of fish caught per hour. The transfer program efforts appear to be maintaining pike abundance. Northern pike CPUE in 2022 was 0.180 fish/hour, slightly lower than 2021 at 0.193 fish/hour (Table 2). Walleye abundance remains low, while white sucker displays a minimal increase. Yellow perch abundance has shown a decrease to levels that were similar in 2016 & 2017. Lake trout and arctic char were not present in 2022. Comparison of species composition show pike are more dominant than previous years making up 60% of the total composition (Table 1).

Table 1: Pike transfer species composition 2015-2022

Species Composition by Percent							
Year	NRPK	YLPR	WHSC	LKTR	WALL	SMBS	Total
2015	51	2	47	0	0.5	0	100
2016	69	7	22	0	1.8	0	100
2017	61	22	17	0	0.3	0.1	100
2018	45	33	23	0	0.0	0	100
2019	12	61	27	0.2	0.5	0	100
2020	7	64	27	0.01	2.1	0	100
2021	9	89	2	0	0.0	0	100
2022	60	12	27	0	1.0	0	100

Table 2: Pike transfer CPUE by species 2015-2022

Year	EFFORT (hours)	NRPK	CPUE	WHSC	CPUE	YLPR	CPUE	WALL	CPUE	SMBS	CPUE	Trout	CPUE	Total
2015	738.9	99	0.134	104	0.141	4	0.005	1	0.001	0	0.000	0	0.000	208
2016	2482.5	398	0.160	123	0.050	34	0.014	8	0.003	0	0.000	0	0.000	563
2017	2466.1	450	0.182	125	0.051	160	0.065	2	0.001	1	0.000	0	0.000	738
2018	557.9	244	0.437	122	0.219	177	0.317	0	0.000	0	0.000	0	0.000	543
2019	540.2	74	0.137	163	0.302	370	0.685	3	0.006	0	0.000	1	0.002	611
2020	448.6	64	0.143	233	0.519	576	1.284	19	0.042	0	0.000	3	0.007	895
2021	377.3	73	0.193	18	0.048	765	2.028	0	0.000	0	0.000	0	0.000	856
2022*	443.4	80	0.180	36	0.081	17	0.038	1	0.002	0	0.000	0	0.000	134
Total	8054.9	1482		924		2103		34		1		4		4548

*50 pike of the 80 caught in 2022 were lost due to a net failure and released back into Glad Lake. All values are from spring trap netting

Northern Pike

The 80 pike caught during the transfer ranged from 230mm to 834mm (FL) with an average size of 479mm (18.8"). More importantly larger pike are becoming less frequent, and catches are typically dominated by smaller pike (Figure 4). Pike ranged between ages one and six, with higher catches of age two pike (Figure 6). During sampling pike are externally checked for sex and maturity. Not all pike can be identified if post spawn but of the 80 pike, 36 were identified with 26 found to be mature males and 10 mature females. There were a few occurrences where pike as young as age one were identified as mature in both sexes.

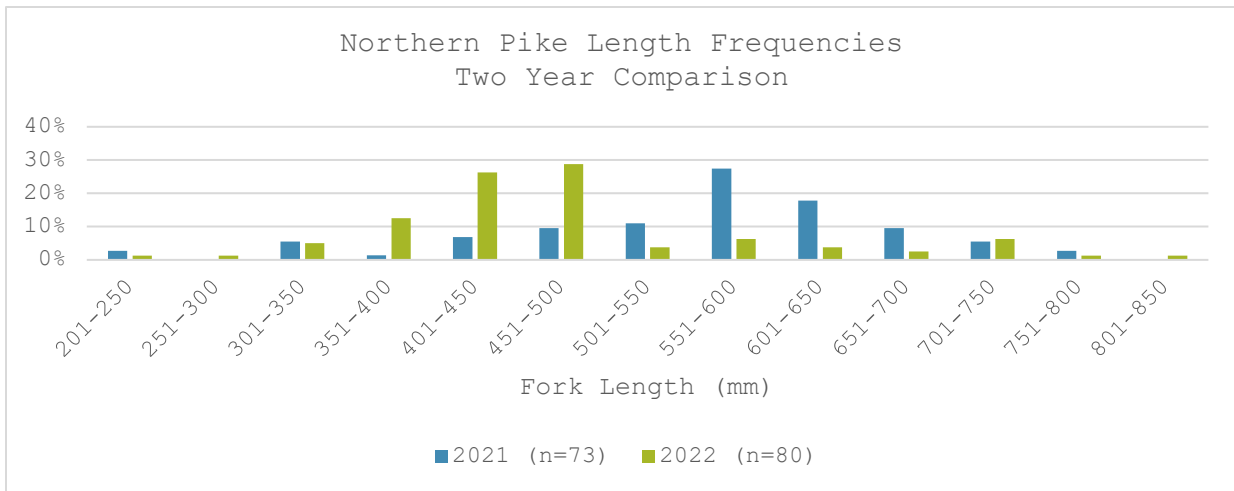


Figure 4: Northern pike length frequencies 2021-2022



Figure 5: Examples of northern pike caught in 2022 pike transfer

Table 3: Size range of pike caught during pike transfer 2015-2022

Year	Pike Fork Length (mm)		
	Min	Max	Mean
2015	230	1080	577
2016	220	940	480
2017	211	918	380
2018	287	680	431
2019	249	690	510
2020	250	940	518
2021	227	779	558
2022	230	834	479

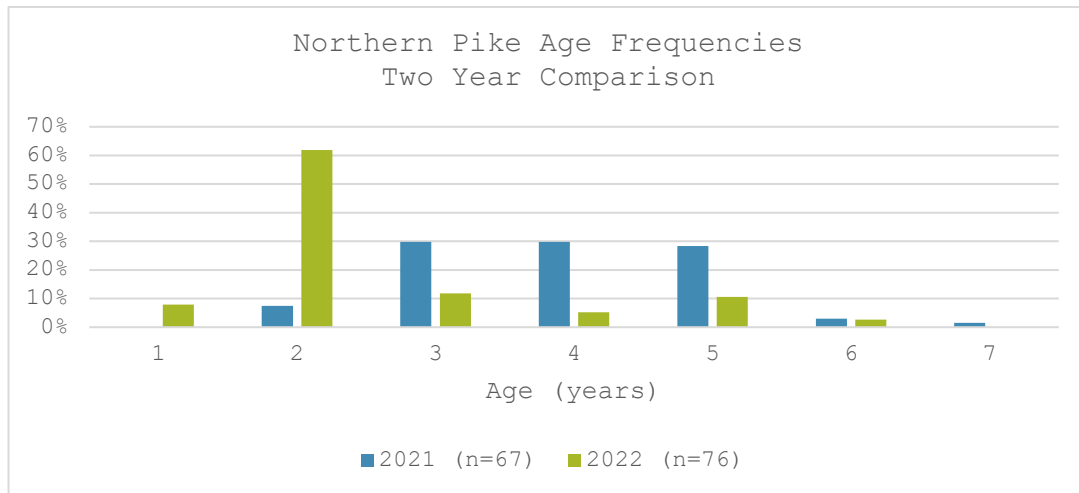


Figure 6: Northern pike age frequencies 2021-2022

Walleye and Other Game Species

Only one walleye was captured measuring 534 mm fork length (21") with an estimated age of six (Figure 7). This fish was transferred to Wellman Lake and is well within the protected slot limit. Yellow perch and white suckers were simply counted and released back into Glad. Majority of perch were of smaller size and caught within the fine mesh trap net.



Figure 7: Walleye caught during pike transfer

Trout Monitoring Surveys

The 2022 fall electrofishing survey consisted of electrofishing the entire shoreline (~6km) and, was conducted on two separate occasions. Once on the night of September 20th and again on night of October 18th. The survey was replicated due to unfavorable conditions the night of September 20th. Rain and windy conditions created poor visibility which is crucial for sampling effectiveness. The additional survey also provided opportunities to evaluate whether sampling for char would be better during different sampling periods. On September 20th, water and air temperatures were 13.5°C and 12°C, respectively and effort equated to 2.5 hours. On October 18th water temperatures had dropped to 6°C while air temps dipped to freezing (0°C), and effort equated to 2.8 hours.

A total of 29 fish were caught between the two nights. The September survey caught six pike, while a total of 19 pike were caught in the October survey along with four lake trout. Several hundred yellow perch and a few dozen white suckers were observed during shocking. No arctic char were observed or captured in 2022. Pike ranged from 140 to 370 mm and were transferred to Wellman Lake. The lake trout found during the October survey were still exhibiting spawning behaviour therefore only a few were collected and analyzed for length and age before quickly returning the fish to the lake. Of these lakings, three were mature males and one was female. Lake trout ranged between 570mm and 760mm (FL). Age estimates indicated fish were between 5 and 6 years but estimates held low confidence levels.

Between spring trap netting and fall electrofishing methods, considering the 50-escapee pike, catches equated to 55 pike transferred in 2022. Since 2015, a total of 1432 pike have been removed via trap netting with an additional 159 caught in experimental gill netting, angling or electrofishing.

Review of Management Recommendations

Many recommendations have been developed over the eight years this program has been in operation. As SVSFE and Fisheries address these points, become more familiar with the fishery, build partnerships, and learn more, the recommendations build and change over time. The one objective that has remained the same is to create a unique arctic char fishery in the Duck Mountains. To illustrate the progress and work a brief review of the recommendations and progress are listed below:

Table 4: Review of management recommendations 2015-2021

Year	Recommendation	Status
2015	Develop an efficient long term removal program	Complete - The removal program is a annual program that captures and transfers spawning pike prior to or shortly after ice out. Removals are efficient and the program is supported through strong partnerships
2015	Designate trout stocking to solely arctic char (focus species) and lake trout	Complete - In 2019, requested 15,000 char be stock every 2 years in Glad. The Whiteshell Hatchery has committed to providing char on a biennial basis. This regime grows ~ 5000 fingerling char for Snail Lake and sometimes upwards of 25,000 18+cm char for Glad Lake, stocked on alternate years. First planting in 2017 of 22,250 char (funded by HAPF), 22,250 in 2020 & 18,850 in 2022.
2015	Impose a catch and release regulation for arctic char	Complete - In 2017 Fisheries Branch approved the catch and release regulation for arctic char and pike regulations allowing anglers six northern pike with regular licence and 4 with a conservation licence - one may exceed 75 cm
2015	Develop an alternative focus species. List potential species suitable for Glad Lake if char become unavailable	Complete - In 2017 SVSFE recognized rainbow trout as the best alternative. It was suggested to hold off on stocking rainbows to lower any interspecific competition while char establish. 2018 report stated if rainbow trout stocking is pursued, rates must remain low. MNR recommends 2-25 yearling/acre in multi species oligotrophic lakes. In 2019, reviewed brookies and browns though both species are known to cause potential interactions or impacts to arctic char and/or lake trout. Furthermore in 2019 recommended if rainbows were stock to plant on alternate years of arctic char plantings. In 2020 and 2021 still recommended to wait on stocking rainbows to restrict competition of recently stocked char. Review stocking options for 2023 prior to establishing other management strategies.

Year	Recommendation	Status
2015	Evaluate need and success of lake trout stocking. Develop a better monitoring program for trout populations.	Complete - Lake trout were last stocked in 2013 and stock has become limited in the province. Recommended to monitor lake trout populations. If stocking is required and available suggested stocking rate was 20 fish/acre annually for fingerling stocking or once every two years for yearling trout. 2019 BTIN survey indicated evidence of natural recruitment of lake trout in recent years. Following surveys, it was not recommended to stock lake trout. 2021 SLIN survey also indicated recruitment and healthy mature population. SLIN survey to be replicated every few years in conjunction with the pike transfer.
2015	Investigate the status of the control structure and rock screen on the outflow to Wellman Lake	Complete - In May of 2017 SVSFE installed an aluminum grate under the Glad Lake hiking trail boardwalk where the rock screen was created in 1980. There was no barrier installed at the secondary structure on the outlet of the waterbody east of Glad. Parks expressed beaver activity at this location and felt a barrier would allow the beavers to become problematic.
2016	Evaluate all levels of available forage. Lack of forage could be the contributing factor to poor trout survival	Ongoing - Forage assessments have been minimal over the years and it is recommended to conduct a thorough baseline surveys that can be incorporated into future monitoring. In 2021, protocol discussions were still under review.
2016	Implement stocking strategy for trout species	Complete - Stocking is restricted to spring scatter stocking of trout 18+cm or larger
2017	Utilized the electrofishing boat for trout monitoring surveys when available	Complete - The electrofishing boat was first available in 2018 and is utilized when available to evaluate char stocking success, remove pike, and collect biological data on lake trout. Coordinate surveys on years when the electrofishing boat is available for other programs (i.e. Beautiful Lake Walleye Transfer)

Year	Recommendation	Status
2018	Create habitat improvements to build complex fish cover for all trout species and increase forage base.	Ongoing - Glad Lake lacks quality fish cover that has been documented for over 50 years. Habitat improvements first recommended in 2018 and annually thereafter. In 2021 it was recommended to conduct a shoreline cruise to identify bottom types, fish habitat, areas in need of improvement. Furthermore, identify cover types that would benefit the fish community and review options for artificial structures beneficial to Glad Lake.
2019	Review recipient lakes	Ongoing - Wellman Lake has been the recipient lake for large pike since 2015 as it lacked a larger pike population. Following assessments on Wellman Lake in 2019, it was noted that the pike population had benefited from the introductions. Chain Lake, Kulhavy Lake, Bench Lake, and Hoopers Lake have been recipients for smaller pike. Anecdotal reports indicate positive results. Recipient lakes are chosen and reviewed by managers and all transfers are approved by the Introductions and Transfers Committee.
2019	Char remain elusive. Need to develop or test out various protocols/strategies suitable for monitoring char	Ongoing - Char are a long-lived slower growing species but low catches cause questions to survey methods. In 2019, suggested targeting char during the closed water season due to their superiority of higher activity at lower water temperatures. In 2021 it was believed if the 2020 char planting was successful, anglers and researchers should start seeing results in 2023 at the earliest.

Discussion

It is apparent there are objectives that are ongoing or still require attention. This includes ongoing review of the transfer and recipient lakes, reviewing and adapting monitoring surveys to evaluate the char stocking success, review of stocking strategies of focus species, forage abundance, and the improvement of fish habitat.

Pike Transfer

The management practices over the last four decades display how quickly the pike population can bounce back with lack of maintenance, but in the same sense indicates the potential of Glad Lake to produce a top-quality fishery if pike populations are maintained. The recent transfer program is maintaining pike populations. CPUEs are consistent with previous years. Pike are primarily small younger pike displaying effectiveness in limiting pike numbers.



Figure 8: Average sized pike caught in transfer

Maturity of pike is reviewed each year as pike display a direct response to the removal. Research states "in situations with high exploitation rates and high natural mortality rates, males mature at age two, and females at age three"(Diana 1995). Typically, maturity occurs at age three to four for males, and ages four to five for females. "This change in maturation is believed to be due to selective pressure by angling and removal of large northern pike, resulting in the change in the reproductive life history of the fish. In this situation, fast growing and early maturing pike are more common in the population" (Diana 1995). The pike population continues to display this stress response. 2022 has shown the youngest maturation yet. A few pike, both female and male, were documented as mature and age estimates indicating they were merely 1+. Understanding this effect on the population dynamics, displays the importance of maintaining strategies to target pike of all sizes. Recipient lakes for the 2023 transfer will remain as Wellman Lake and Hoopers Lake as pike introductions will still benefit both fisheries.

Adapting Monitoring Surveys

Since 2015, SVSFE has conducted various surveys including, Brook Trout Index Netting, Spring Littoral Index Netting, Electrofishing surveys along with trap netting through the transfer program. It is believed one of these scientific methods may be suitable to evaluate char success. Low catches may indicate the methods are not ideal for the current life stage or behaviour of the char or it might indicate poor survival. The char planted in 2017, 2020, and 2022 were all Yukon Gold strain from Icy Waters Hatchery and raised by the Whiteshell Fish Hatchery prior to stocking. When reviewing the current char strain in comparison to the past it was discovered that there were four strains raised at the Rockwood Aquatic Research Centre; the Nauyak Lake, Tree River, Labrador, and the Norway strains (Tabachek 1990). In the 80s and 90s the Nauyak Lake strain was stocked with char received from both the RARC and Whiteshell hatchery. What makes this interesting is when the RARC shut down in 1996, the two strains; Nauyak Lake and Tree River were sent to Icy Waters Hatchery in the Yukon which are now marketed under the Yukon Gold trademark name (Icy Waters Yukon Gold). These fish today are grown with exceptional genetics and would be similar if not a better strain than the char stocked in the past. This provides confidence that the strain of char should not affect stocking success.



Figure 9: Fisheries Branch staff Colton Phillips and Ethan Dobbs (The Pas, MB) holding arctic char being stocked in the spring of 2022

When reviewing stocking events, the 2020 and 2022 stocks did exceptionally well in the hatchery compared to the 2017 stock and were much larger at the time of stocking. There has been very little evidence of the 2017 planting and it is believed survival was minimal. The 2020 char have appeared in angler reports and early electrofishing surveys, though strong evidence validating stocking success is lacking. The Alaska Department of Game and Fish stated, "char are slow growing species. Some char have been known to live for over 20 years. Maximum size may vary greatly, depending on the productivity of the lake and the presence of other fish species".

Establishing a new species in a fishery takes time but understanding the degree of success can aid in future strategies. It was stated to try targeting char in the winter as they are superior to higher activity at lower water temperatures. This method has not been recently attempted but in 2011 was successful in locating a large mature char measuring 27" total length and weighed 6.2lbs. Obviously the char are far from that stage but incorporating winter netting into the monitoring regime might provide some merit.



Figure 10: Arctic char caught during the 2011 winter netting survey on Glad Lake

Stocking of Focus Species

Since 2015 the priority objective was to create an accessible arctic char fishery. This has required several years of investment which will only continue. Therefore, the effects of management practices influencing this species should always be reviewed. With annual transfers removing pike and management focused on slower growing trout species (lake trout and arctic char), some feel there are minimal angling opportunities in Glad Lake at this time. The introduction of rainbow trout has been a hot topic within the SVSFE membership. The species was identified as the alternative if char were unavailable or unsuccessful. But there is a constant reminder that altering a species composition to this degree involves commitment and patience.

Rainbow trout were stocked in Glad Lake from the late 80s up to the last planting in 2013. The lake was noted as the most heavily stocked lake in the north portion of the Duck Mountains in 2005. Although, this stocking did not result in any real return to the anglers. It is believed that stocking multiple species at once in a lake with little habitat and a top predator, is the reasoning to the short-lived success of trout stocking. With the investment to date and the distinctive objective in play, both fisheries managers and SVSFE agree to stay committed to creating an arctic char fishery.

Forage Assessments

Trap netting through the pike transfer does provide information on the current forage base. Fine mesh trap nets can capture various minnow species which have been documented but not evaluated by abundance on a regular basis. Over the past 50 years researchers have stated that lack of forage may be the contributing factor to poor trout survival. It is recommended to incorporate more fine mesh trap net sets into the transfer program to monitor forage abundance and responses. This will help understand the need and or response required for management strategies in future years.



Figure 11: Stomach contents found in pike during transfer - yellow perch, spottail shiner, unidentified minnows and grammarus

Fish Habitat Improvements

The creation of underwater structures benefits all trophic levels of a fishery. The structures provide fish with shaded area to rest, safe places for recently stocked trout/char, areas to escape from predators, spawning areas (in some cases), and attract invertebrate/forage fish as a food source. Improving fish habitat within Glad Lake has been a recommendation for the past five years. If you were to ask most people, they would agree that Glad Lake is void of suitable structure and fish cover. It was time to take the next step of action.

In late 2022, this initiative took flight and plans were started. SVSFE partnered with Fisheries Branch on this creative project. After thorough discussions and research on structure types, it was decided to develop two styles of structures; fish cribs and brush piles. Fish crib designs were taken from Wildlife Unlimited of Iron County's fish crib project in Wisconsin and the brush pile designs were taken from Watersheds Canada Fish Habitat Enhancement Toolkit - In-water brush piles in Ontario. These structures are known to last 20 years or more. Sites were chosen in depths of approximately 18-24ft of water, shallow enough to allow light exposure for algae growth and deep enough to not compromise boat traffic safety.



Figure 12: Materials sourced for creating fish habitat structures

On the week of February 13th, Fisheries staff from The Pas, Swan River, and Brandon, MB, along with SVSFE technicians and volunteers completed a "one of a kind" fish habitat improvement project. Four days were dedicated to the collection of materials and construction of the fish structures. Efforts involving materials included unloading over 50 - 16' logs by hand, collecting 150 trees, sorting a trailer full of rough lumber (over 200 pcs), shovelling 144 sandbags, transporting 42 cinder blocks, tying over 500' of rope and hauling everything plus various tools and hardware to sites. Materials were all transported to sites via snowmobile from the boat launch locations which was cleared of snow thanks to the Wellman Lake Lodge. Signage (material donated by Sign Here and MB Parks) was put in place at the launch and access points to warn snowmobilers of the structures and inform the community of the project benefits.

The cribs were built with roughly 6" diameter x 8' long logs donated by Lucan Logging stacked in a log cabin design. Layers of wooden slats donated by Spruce Products Ltd. and conifer tops (some donated by individuals and the Town of Swan River) were attached to provide complexity to the structures. Each structure was weighed down with over 700lbs in sandbags, sand donated by Cook Bros Cartage Ltd and bags from Jacobs Bag Corporation. Once completed, logs were strapped tight with a metal banding device donated by Spruce Products Ltd typically used for bundling lumber. Brush piles were built in various fashions either with



Figure 13: Construction and examples of fish habitat structures - cribs and brush piles

bundles of trees tied tight to cinder blocks/sandbags or attached in a line along a weighted piece of lumber to allow slight floatation of trees before they become waterlogged. Additional "mini cribs" were built with leftover lumber and decorated with conifer tops to enhance structure complexity.

With a great team, great things are possible. In total 25 structures, a variation of fish cribs, mini cribs, and/or brush piles, were placed at seven different sites. All involved are excited to follow-up on the development of these structures. If found successful, there are plans to expand sites even further with the addition of more underwater habitat. It is believed these sites will not only become popular areas for the fish but also the angling community.

The Glad Lake Maintenance and Monitoring Program can be simply described as unique. It takes hard work from dedicated people and open minds to take on innovative projects. Each year there is more to learn and additional validation that efforts are making a difference. By following through with initiatives and having patience it is believed Glad Lake will become a Parkland destination on many anglers lists.



Figure 14: Example of fish habitat structures at sites

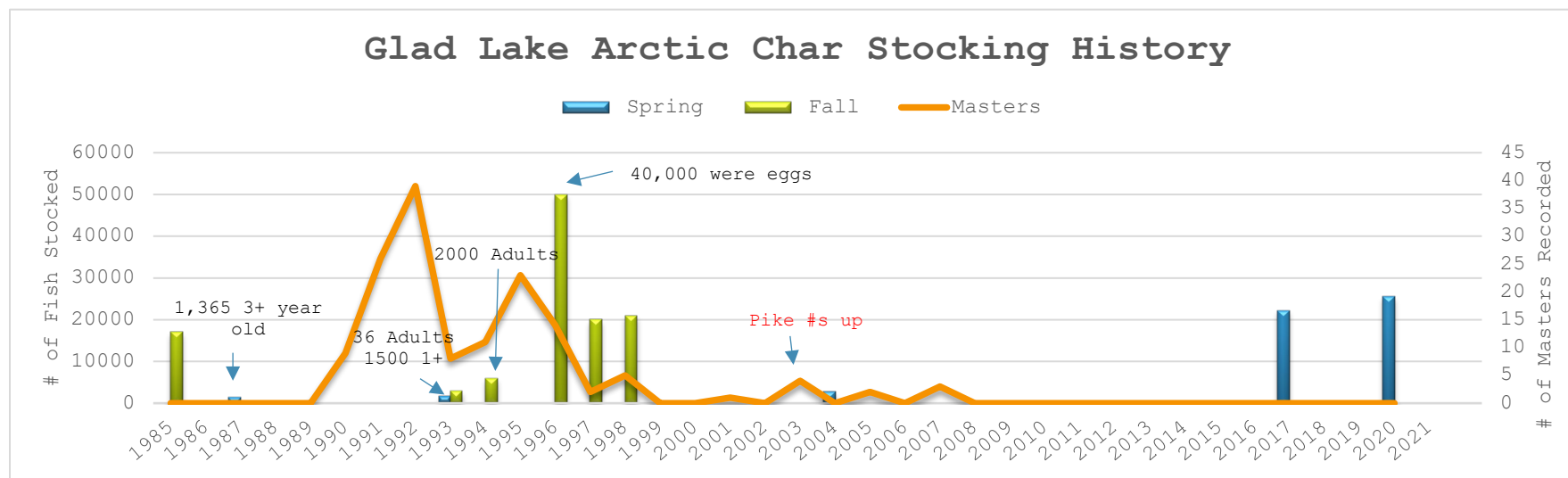
Appendices

Appendix 1: Glad Lake stocking history

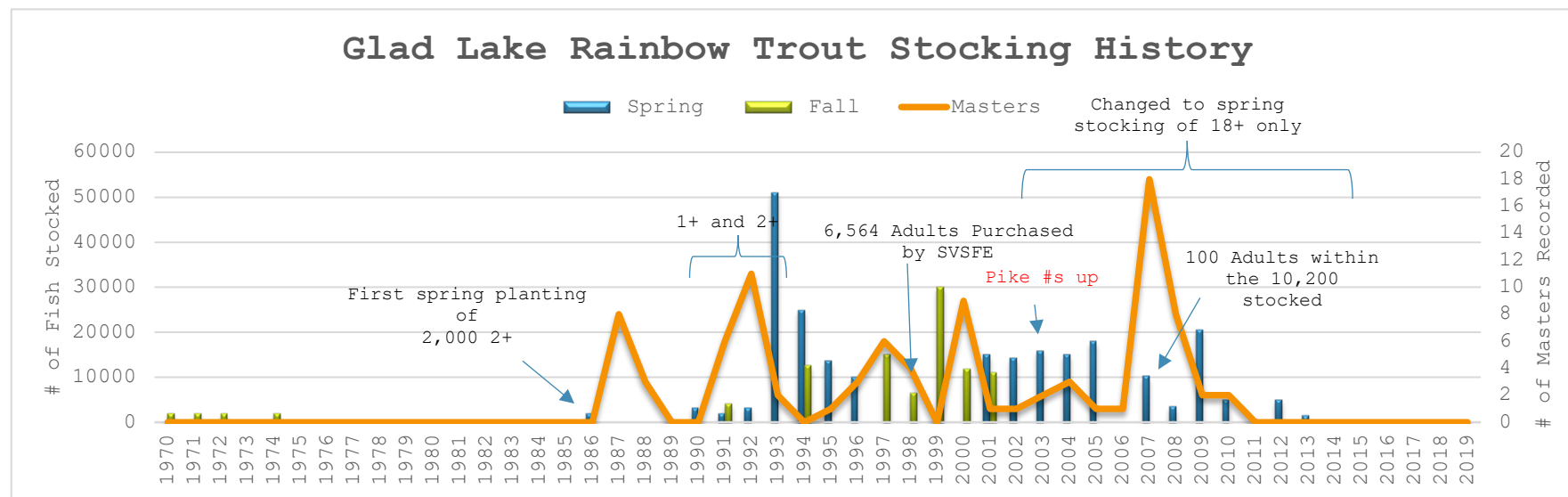
Year	Lake trout	Splake	Rainbow Trout	Cutthroat	Brook Trout	Arctic Char	Sparr
1944	60	-	-	-	-	-	-
1945	78	-	-	-	-	-	-
1953	5,000	-	-	-	-	-	-
1954	4,000	-	-	-	-	-	-
1956	10,000	-	-	-	-	-	-
1957	5,700	-	-	-	-	-	-
1958	7,500	-	-	-	-	-	-
1959	17,000	-	-	-	-	-	-
1960	19,130	-	-	-	-	-	-
1961	20,000	-	-	-	-	-	-
1962	20,000	-	-	-	-	-	-
1965	1,000	-	-	-	-	-	-
1966	1,000	-	-	-	-	-	-
1967	1,000	-	-	-	-	-	-
1968	-	2,000	-	-	-	-	-
1969	-	2,000	-	-	-	-	-
1970	-	2,000	2,000	-	-	-	-
1971	-	2,000	2,000	-	-	-	-
1972	-	2,000	2,000	-	-	-	-
1973	-	2,000	-	-	-	-	-
1974	-	3,000	2,000	-	-	-	-
1975	3,000	-	-	-	-	-	-
1976	2,000	-	-	-	-	-	-
1980	-	-	-	75,000	-	-	-
1981	-	-	-	35,900	7,100	-	-
1985	-	-	-	-	-	17,000	-
1986	-	-	2,000	-	-	-	-
1987	-	-	-	-	10,700	1,365	-
1990	-	-	3,200	-	-	-	-
1991	-	-	6,000	-	-	-	-
1992	-	2,000	3,200	-	-	-	-
1993	-	-	51,000	-	-	4,536	-
1994	-	-	37,609	-	-	6,000	-
1995	-	-	13,600	-	-	-	-
1996	-	-	10,000	-	-	50,000	32,500

Year	Lake trout	Splake	Rainbow Trout	Cutthroat	Brook Trout	Arctic Char	Sparr
1997	250	-	15,000	-	-	20,000	10,000
1998	10,000	-	6,564	-	-	21,000	-
1999	-	-	30,000	-	-	-	-
2000	25,000	-	11,870	-	-	-	-
2001	15,000	-	26,000	-	-	-	11,250
2002	-	-	14,200	-	-	-	-
2003	-	-	15,900	-	-	-	-
2004	30,000	-	15,000	-	-	2,800	-
2005	20,000	5,000	18,000	-	-	-	-
2007	-	-	10,200	-	-	-	-
2008	-	-	3,500	-	-	-	-
2009	40,000	-	20,500	-	-	-	-
2010	-	-	5,000	-	10,000	-	-
2011	16,000	-	-	-	2,500	-	-
2012	-	-	5,000	-	1,075	-	-
2013	22,600	-	1,500	-	-	-	-
2017	-	-	-	-	-	22,250	-
2020	-	-	-	-	-	25,550	-
2022						18,850	

Appendix 2: Arctic Char stocking history correlated with master angler records



Appendix 3: Rainbow trout stocking history correlated with master angler records



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