2016 Still-Water Trout Assessments and Non-Salmonid Removals

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November 2016

Submitted to:
Manitoba Sustainable Development
FLIPPR

Executive Summary

Executive Summary: In the spring of 2016, SVSFE technicians along with provincial fisheries staff set out to (1) quantify non-salmonid invasions, and (2) remove as many non-salmonid individuals as possible in five aerated still-water trout waterbodies including, Pybus, East Goose, West Goose, Patterson, and Tokaryk Lake(s). Following assessments/removals it was determined the program did not truly quantify the lake community/composition, as efforts were specifically targeting non-salmonid species, and not necessarily trout in multiple cases. For this reason, the demand to develop a scientific protocol that truly exhibits the fish community in stocked trout lakes is essential. At current, SVSFE is working towards creating a standard non-lethal fish inventory program which will be agreed upon by the scientific community, and will be used to fully understand non-salmonid invasion and trout stocking success. SVSFE plans to utilize this protocol on a few Duck Mountain trout lakes currently facing yellow perch invasions. This protocol will be public domain, and encouraged to be used to assess stocked trout waters throughout Manitoba in the future. In summary, although 2016 efforts did not paint a true picture of current fish community in the lakes assessed, it is believed that a fair representation of these five aerated waterbodies was determined. Summaries are as follows.

Pybus Lake: Very little evidence of trout stocking success was determined in Pybus Lake. A strong composition of both yellow perch and northern pike was found. It was determined that poor stocking success was directly related to interspecific competition and predation from yellow perch and pike. At current, FLIPPR and the RM of Harrison Park have decided to reclaim the lake by ceasing aeration and anticipating a full-winterkill. At this point, suggestions are to monitor winter oxygen levels and fish community response prior to trout stocking. Also, further investigation of the culvert connecting Pybus Lake and the unnamed waterbody to the north-west be priority to further limit non-salmonid invasion during high water periods, if, in fact, this is the true route of invasion.

East Goose Lake: East Goose Lake assessments found limited trout stocking success; as trout captured were almost exclusively large brown trout, with the exception of two 2015 stocked browns. When referencing stocking records one could assume there is a high rate of predation and competition from walleye and yellow perch resulting in low survival stocked trout. Also, it could be assumed that the large brown trout caught could be a result of the 2015 brood stocking. There are a lot of assumptions here, however there is confidence that the high level of non-salmonid presence is an issue that requires attention. Suggestion is to develop a cost-effective yet efficient manual rehabilitation program for the years to come. This is under the assumption that chemical rehabilitation and/or drawdown and ceasing aeration is out of the question. Regardless, when initiating a manual removal program there is a lot to consider; and it is advised that all considerations (see page 17) be further discussed before initiating a manual removal program on East Goose Lake.

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West Goose Lake: West Goose Lake effort was minimal in comparison to the other lakes assessed and was largely due to limited available shoreline for trap-netting, along with increasing water temperatures and risk of potential trout mortalities. Results found a very strong population of rainbow trout of multiple ages classes along with a very low brown trout catch. Low efforts may not represent a true species composition, as conversations with anglers, stocking records, the master angler database, and literature review suggested a much stronger presence of brown trout than results advocated. Along with the high trout catch, two "larger" yellow perch were captured and removed. Upon further investigation it was found that the first confirmed instance of perch in the waterbody was over 10 years ago. At this point it appears the yellow perch population is not compromising trout stocking currently, however the fact that perch exist is not something that should be over-looked. Perhaps yellow perch have not exploded and dominated the waterbody because of some habitat limitation, or the presence of larger piscivorous trout are keeping perch number down through predation of younger individuals. Final recommendations are to continue stocking practices, further quantify the true fish community and develop a proactive approach in managing the perch populations.

Patterson Lake: Results determined a very large population of both rainbow and brown trout at multiple length frequencies and ages classes, as expected. Due to the fact that Patterson Lake is arguably one of the best trophy trout lakes in the province, one could suggest that current management (i.e. stocking rates and lake regulations) are working. What was found, however was a very high composition of white suckers. Upon literature review, it was determined that historically (2000-2001) Patterson Lake was void of any large bodied fish community (i.e. suckers). The fact this species is new to this system is not a phenomena that should be discounted. Further literature review found multiple cases where white-suckers directly impact rainbow trout stocking success and growth through interspecific competition, as forage was found to overlap significantly between the two species. On the other hand, an extensive study initiated in Missouri found the opposite, noting the declining trout stocking success was not a result of competition between rainbows and suckers for forage but related to lake regulations. In summary for Patterson Lake, it is suggested to monitor the sucker populations through replicating the 2016 electrofishing program once every two years (or on a rotation decided on among stakeholders pending funding opportunities). It would be beneficial to develop a comprehensive program to battle white suckers before invasions prove to be detrimental (response plan). In addition, possible sources of invasions, particularly the connectivity to surrounding waterbodies, should be investigated. Creating a proactive plan is essential to maintaining this high class fishery.

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Tokaryk Lake: Tokaryk Lake results determined a strong presence of non-salmonids including yellow perch, white suckers, along with a lower presence of northern pike. In terms of trout, reasonable stocking success was determined as multiple age classes and length frequencies were found. Growth rates of stocked fish was lower when compared to the lake's neighbor, Patterson Lake. This was thought to be directly related to competition with the non-salmonid population in Tokaryk Lake. There is no concrete evidence indicating the time period of non-salmonid invasions but it is encouraged that managers and locals look over the data in hopes to pinpoint the source of these recent influxes. Therefore proactive management decisions can lead to a plan that will limit further invasions. It is evident non-salmonid presence is an issue and will require attention to maintain Tokaryk Lake as a trout fishery. The suggestion is to develop a cost-effective yet efficient manual rehabilitation program for the years to come. This is under the assumption that chemical rehabilitation and/or drawdown and ceasing aeration is out of the question. Regardless, when initiating a manual removal program there is a lot to consider; and it is advised that all considerations (see page 37) be further discussed when integrating manual removals into management plans.

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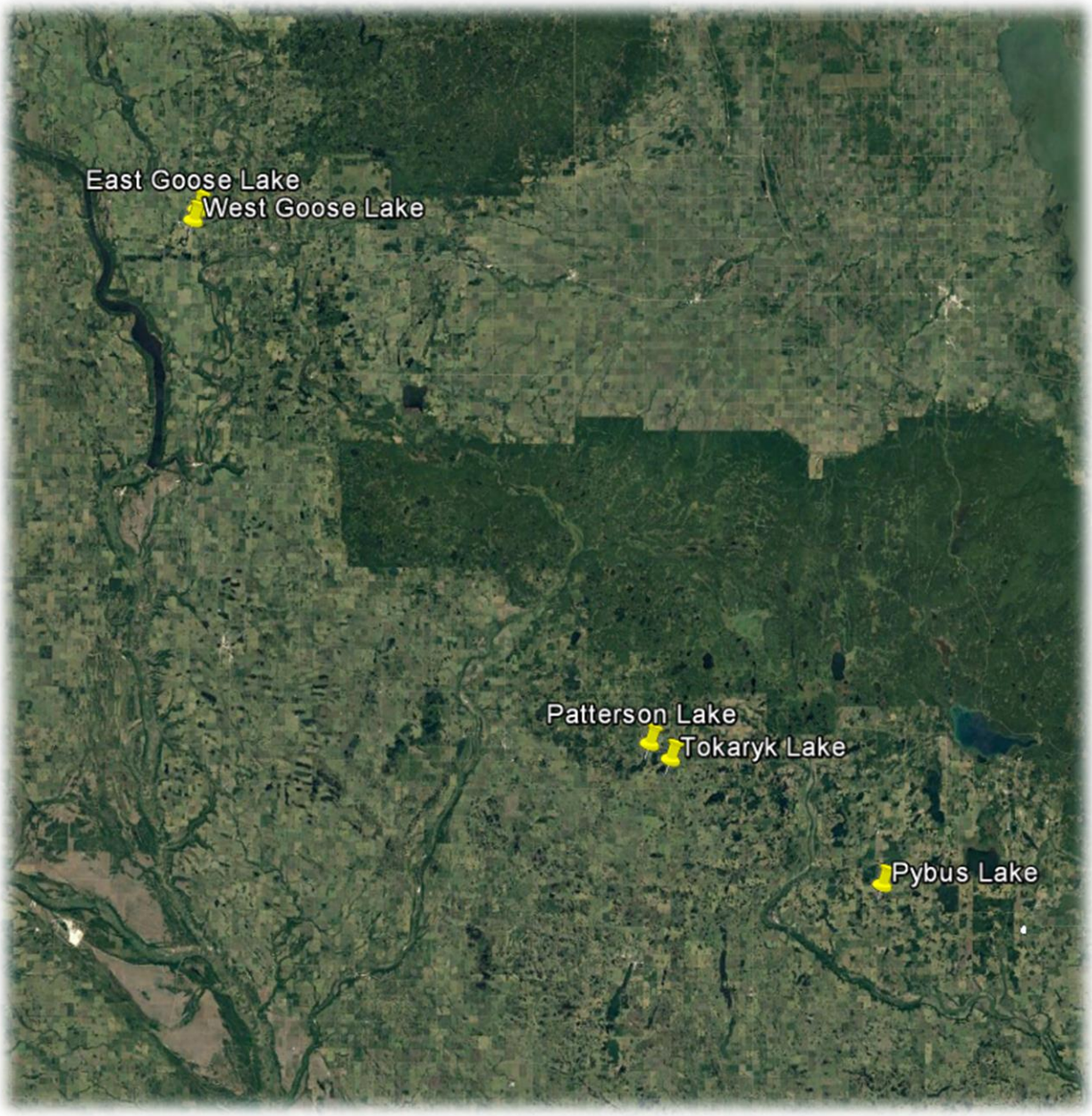
1.0 Study Area

Location: The study area included five aerated stocked trout waterbodies in the Parkland Region, Manitoba; including Pybus, East Goose, West Goose, Patterson, and Tokaryk Lake(s).

Lake Location Map



2.0 Study Rationale

The objective was to assess trout populations and management required to reduce invasion of non-salmonid species and implement the same; while at the same time determining a replicable protocol for further management objectives. Waterbodies sampled include; Pybus, East & West Goose, Patterson, and Tokaryk Lake(s).

Throughout the spring of 2016, FLIPPR, Sustainable Development - Fisheries Branch and SVSFE partnered to assess the current state of these five trout fisheries and remove non-salmonid species from these waters. SVSFE technicians were contracted through FLIPPR under a Fisheries and Wildlife Enhancement Fund (FWEF) grant to conduct field activities and assess trout populations while removing non-trout species at the same time. Angler's dollars are invested (through the FWEF) in producing the sought after trout species found throughout the Parkland and Manitoba. In addition, FLIPPR volunteers have dedicated their time and resources to developing renowned world class trout fisheries attracting anglers near and far. These "highly-productive aerated lakes" benefit local and provincial economies tenfold, therefore proactive management of these waterbodies is essential.

3.0 Methodology

Methods used were discussed heavily amongst Branch Staff, SVSFE technicians and FLIPPR representatives prior to conducting assessments. The primary objectives were to gather a sufficient understanding of the state of the fishery(s) while removing all non-salmonid catch in the short time provided. Two primary fish capture methods were utilized; both trap-netting and electro-fishing.

Two styles of trap nets used in the assessments; (1) custom small mesh trap nets commonly used for forage assessments and capable of capturing small-bodied fish (>40mm); and (2) larger mesh standard End of Spring Trap Netting (ESTN) Lake Superior Trap Nets, which are most effective in catchment of large-bodied fish. Trap netting is an efficient method for quantifying near-shore fish communities. The total effort time, and type of trap net varied from lake to lake, and was usually determined by the effectiveness of the method and target species. Net locations were chosen in habitats where target species should be most prevalent, and again, varied from lake to lake.

Electrofishing was conducted using a Smith-Root electrofishing boat. Again, effort time, transect distance, and habitat type varied from lake to lake depending on target species and assessment objectives. Usually, electrofishing occurred late evening or early morning during low light conditions. Once proper settings were dialed in, the crew would shock a transect distance, stop to sample the capture, continue to the next transect, and start over. In most cases, a target transect number was predetermined based on lake size and designed to get a full lake representation. For example, on Patterson Lake, a total of thirty 100m transects were distributed along the shoreline of the lake thus determining a representative sample of all habitats.

In terms of fish sampling, data collected varied from lake to lake and was largely dependent on efficiency and avoiding salmonid stress and mortality. In terms of trout capture, all fish were measured and released with a subsample being fully sampled; meaning length, weight, floy tag, and age structure were recorded and collected prior to release. In terms of walleye and northern pike, all fish were fully sampled prior to being removed. With regards to white suckers and yellow perch, all fish were counted prior to being removed, with sub-samples of representative length frequencies being collected.

4.0 Catch Results

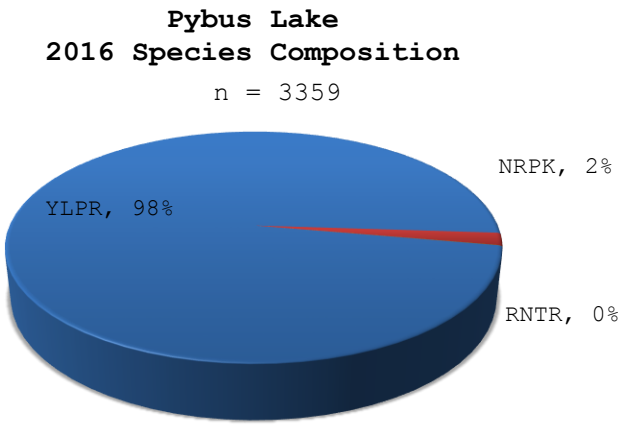
2016 Effort and Capture Summary

Lake	Date	Species	Electrofishing	Trap Netting	Total Removed	Fork Length (mm) min	max	average
Pybus Lake	May 2 - 5, 2016	Northern Pike	6	52	58	472	812	602
		Yellow Perch	1116	2181	3297	NA	NA	140
		Rainbow Trout	0	1	0	NA	NA	520
East Goose Lake	May 16 - 20, 2016 May 25 - 26, 2016	Yellow Perch	NA	192	192	NA	NA	NA
		Walleye	NA	199	199	173	763	426
		Brown Trout	NA	23	0	140	605	516
West Goose Lake	May 24 - 25, 2016	Yellow Perch	NA	2	2	NA	NA	252
		Brown Trout	NA	1	0	NA	NA	525
		Rainbow Trout	NA	62	0	167	604	505
Patterson Lake	June 13 - 14, 2016	White Sucker	449	14	463	198	460	303
		Rainbow Trout	16	75	0	284	550	464
		Brown Trout	21	29	0	357	567	509
Tokaryk Lake	June 14 - 17, 2016	White Sucker	433	777	1210	NA	NA	306
		Yellow Perch	3584	334	3918	NA	NA	240
		Northern Pike	0	5	5	480	607	552
		Rainbow Trout	2	21	0	215	519	420
		Brown Trout	9	54	0	175	525	433

5.0 Pybus Lake

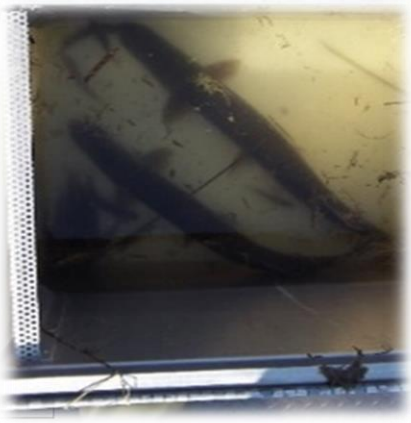
5.1 Results: Activities commenced May 2nd – 5th, 2016. Fish were collected via trap netting (effort = 100 hours) and electrofishing (effort = 17,356 secs). All northern pike and yellow perch were removed and transferred to Sandy Lake. The one trout caught was sampled (measuring 520mm in length and weighing 2366g), tagged and released (photo). Results are as follows;

Pybus Lake - Total Catches 2016				
Species	**Electrofishing**	**Trap Netting**	**Total**	**%**
Yellow perch	1118	2181	3299	98%
Northern Pike	6	52	58	2%
Rainbow Trout	0	1	1	0%
		Total	3358	100%

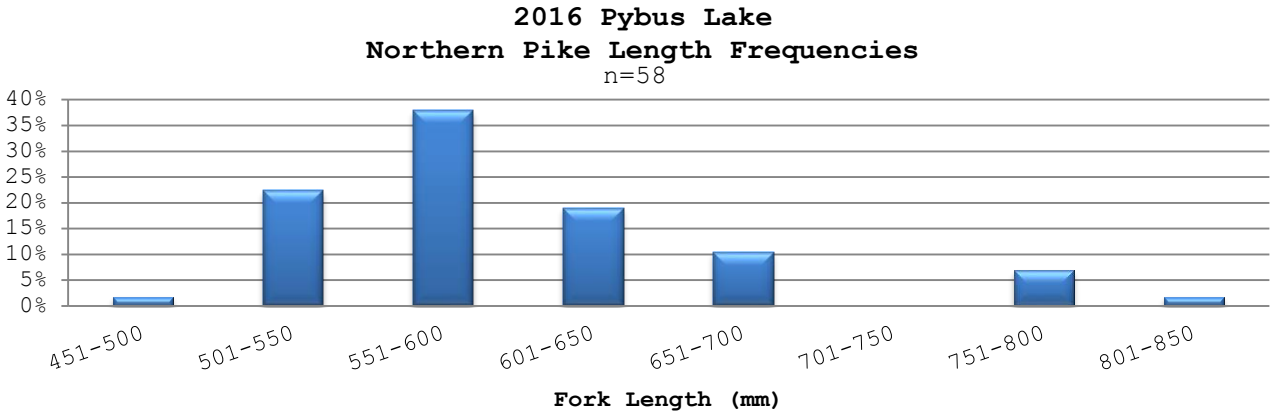


Northern Pike Age Sample (n=4)

SPECIES	FORK LENGTH	WEIGHT	SEX	AGE
NRPK	544	1225	MM	3
NRPK	645	2087	MM	4
NRPK	540	1089	MM	2
NRPK	760	3357	MF	4



5.0 Pybus Lake



Following spring assessments; results indicated a very high rate of invasion of northern pike and yellow perch, along with low trout capture. For this reason, SVSFE technicians were hired to return to Pybus Lake in October to initiate a trout-salvage program. From October 4th-6th, 2016 technicians initiated a trap-netting effort using all six trap nets (large and small mesh) along with standard gang gill nets in order to capture and salvage as many rainbow trout as possible which were to be destined for Corstophine Lake. Following 203 hours of netting efforts over two days, zero trout were captured. Following these low catches parties involved decided to cease the program due to little success.

5.2 Discussion/Recommendations: Following total efforts in 2016, it was concluded that Pybus Lake exhibits a very strong invasion of non-salmonids (pike and perch) along with very little evidence of trout survival, which is likely a result of interspecific competition and predation of non-salmonids. At current, FLIPPR and RM of Harrison Park have decided to cease aeration for the 2016/2017 winter. It is recommended that late winter DO testing be conducted on Pybus Lake during this time. If habitable oxygen levels exist, it may require multiple years with no aeration in order to fully reclaim the lake prior to trout stocking. There have been cases in Saskatchewan where the approach to reclaim aerated waterbodies from non-salmonid invasions by turning off aerators. This has had mixed results as some lakes have experienced full winterkills, whereas in others it resulted in large bodied fish dying off (trout and pike), but some perch surviving (Prestie, 2016). Also, one lake in Saskatchewan (Nesland Lake) took 4 or 5 years without aeration before the pike fully winterkilled but it did eventually happen (Prestie, 2016). It becomes important to keep a close eye on the status of reclamation at this point. Monitoring winter dissolved oxygen, along with test netting to ensure dye-off prior to trout stocking should be imperative. Perhaps if issues continue to exist while trying to reclaim the lake that a lake drawdown before freeze-up be discussed if applicable. Also, it becomes important to identify the source of invasions to prevent further contamination. At this point, invasions may have been (1) introduced illegally, or (2) entered the waterbody during high water conditions. Further investigating potential sources (i.e. culvert from northwest unnamed waterbody) will lead to proactive solutions to limit further invasions.

6.0 East Goose Lake

6.1 History: East Goose has a long management history going back to the 1920's. With reference to the Western Region Stocking Database, the lake has been stocked with walleye, yellow perch, northern pike, smallmouth bass, brown trout and rainbow trout over the years; with no available historical records of stocking success other than evidence that the lake periodically winterkilled. In 1985, East Goose aeration unit was installed, and has been stocked annually or semi-annually with either rainbow trout, brown trout, or both since. According to the Master Angler Awards Database, East Goose was producing trophy trout since the mid-1990s. With regards to past Fisheries Branch journal knowledge; perch and walleye were illegally introduced into the waterbody in the mid-late 1990's (Kansas, 2016). Following these introductions, a study was conducted on both East and West Goose Lakes in 1999/2000 by Dave Milani. At current, SVSFE is anticipating access to these documents. Also, according to East Goose records, past perch removal programs occurred in 2003, 2004, 2014, and 2015. In May of 2003, 4000 yellow perch were removed and from May 12th-28th, 2004 a total of 74,000 yellow perch were removed from East Goose, using trap/hoop nets. As a result of 2003/04 removals, no quantitative data in terms of positive trout response is known, however angling quality increased via "less wading of perch" between trout catches.

In 2014, fisheries branch utilized a customized electrofishing jon boat for removals. During the brief assessment, two hours of effort caught 360 yellow perch and five walleye. No trout were documented during the survey. In early June of both 2015 and 2016, 378 yellow perch and one walleye were removed during Family Fishing Weekend, respectively. Also, it is important to state that East Goose Lake is managed as a put-and-take fishery, as this is what current lake regulations suggest (general limits and no tackle restrictions).

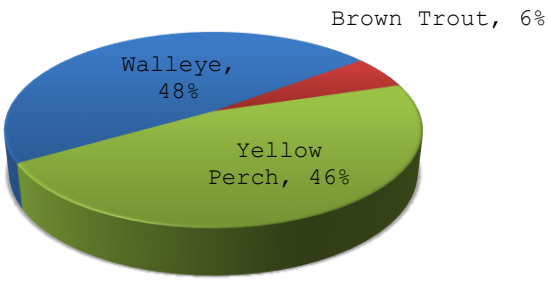
East Goose Effort Map

6.1 Results: Activities commenced May 16th – 20th and May 25th - 26th, 2016. Fish inventory, assessment and collection methods were exclusively trap netting (effort = 219.1 hours). The nets utilized in this assessment were fine mesh, and capable of capturing small bodied fish >5cm in length. Net locations were determined based on available shoreline and ideal depths for efficient trapping efforts (gap depth 2m). The highest CPUE of walleye and brown trout was in the northwest bay (Trap 1), and the highest CPUE of perch was along the north shore (Trap 2). It is important to state that electrofishing was originally scheduled as an assessment method, however due to mechanical issues with the boat and available time, no electrofishing was conducted in 2016. All walleye were sampled, tagged and transferred to Lake of the Prairies. Yellow perch catches consisted of smaller fish (~50g) and were also removed. Trout species caught were limited to brown trout. Results are as follows;

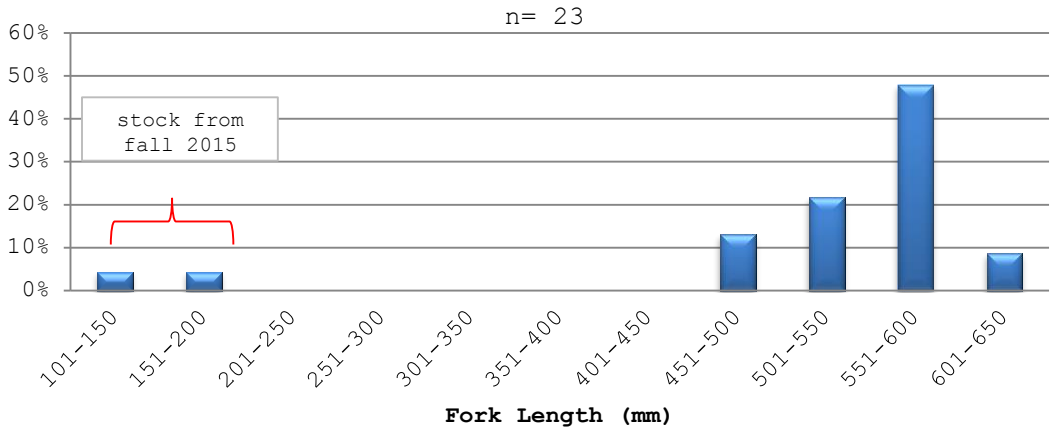
6.0 East Goose Lake

East Goose Lake – Total Catches 2016		
Species	No. of Fish	%
Walleye	199	48%
Brown Trout	23	6%
Yellow Perch	192	46%
Total	414	100%

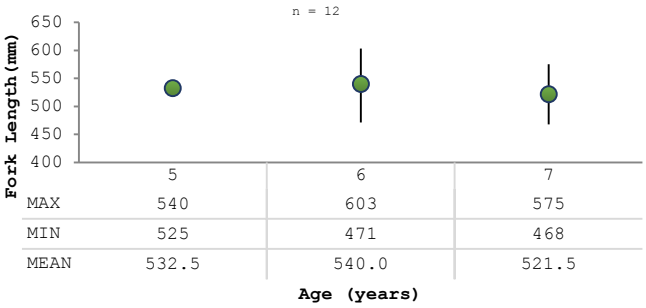
2016 East Goose Lake
Species Composition
n= 416



2016 East Goose Lake
Brown Trout Length Frequencies
n= 23

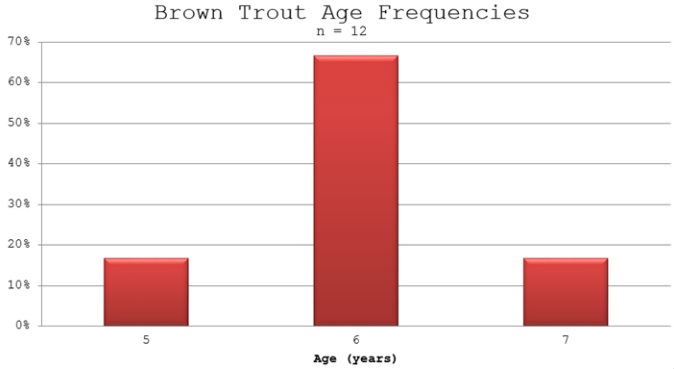


2016 EAST GOOSE LAKE
Min, Max, Mean Fork Length of
Brown Trout Ages 5 - 7

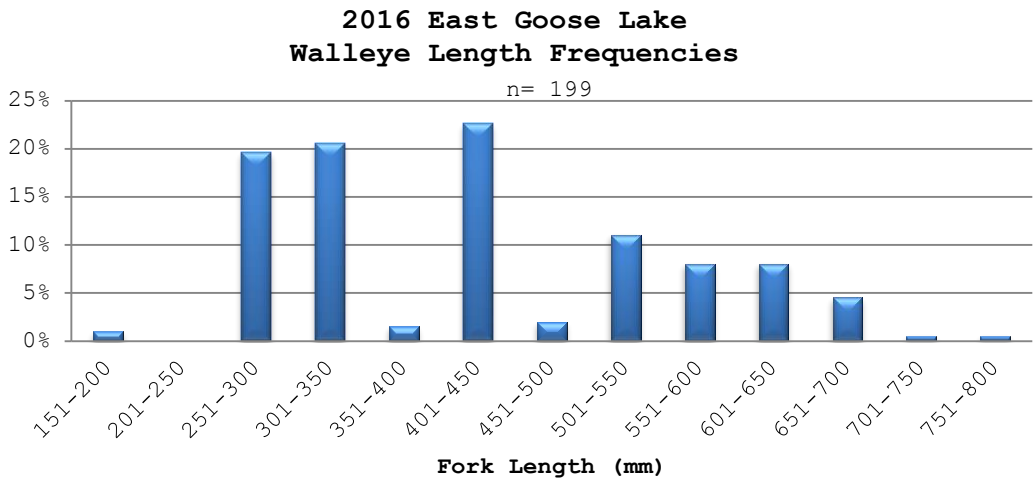


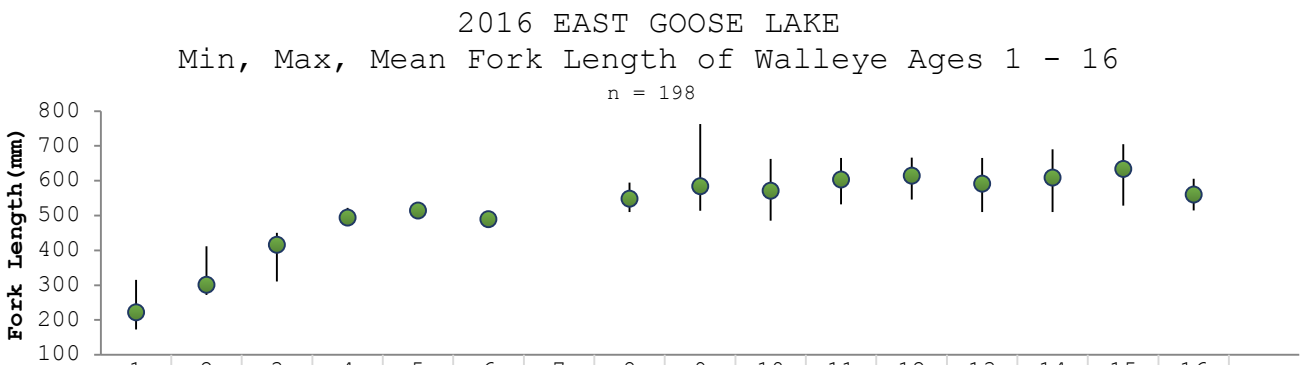
	5	6	7
MAX	540	603	575
MIN	525	471	468
MEAN	532.5	540.0	521.5

2016 EAST GOOSE LAKE
Brown Trout Age Frequencies



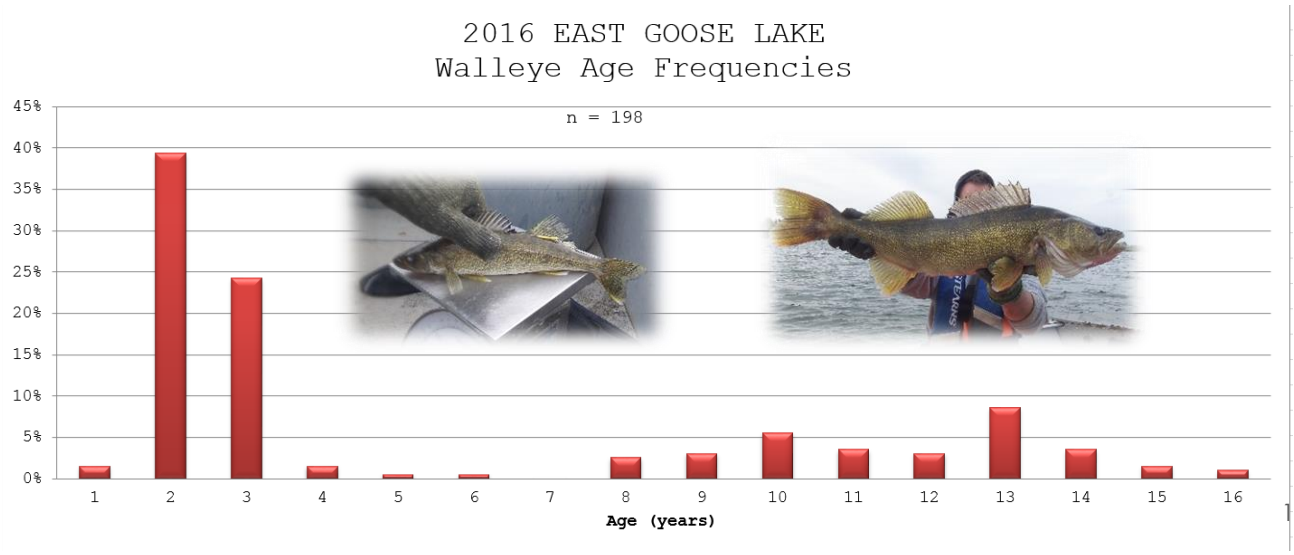
6.0 East Goose Lake





	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
MAX	315	412	450	522	515	490	0	595	763	663	665	666	665	690	705	606
MIN	173	272	311	480	515	490	0	510	514	485	532	546	510	510	528	515
MEAN	222.	301.	416.	494.	515	490	0	549	585	572	604	615	592	609	634	561

Age (years)



6.0 East Goose Lake

Brown Trout: East Goose efforts were exclusively trap-netting, and since this method is efficient in representing littoral (near shore) fish communities, a true representation of all fish may not have been achieved. In terms of trout, the catch was exclusively brown trout. With reference to the Western Region Stocking Records, it becomes notable that these browns (5,6,7 years) were a result of 2009, 2010, and 2011 spring stocking of 18+cm, OR the brood stocking of 2015. A wide range of growth amongst certain age classes was noted. For example, the 6+ age frequency of brown trout showed growth as low as 471mm and as high as 603mm. When referencing the stocking database, especially in recent years, rainbows and browns have been stocked at very similar densities, size, and times of year. From results, it can be hypothesised that rainbow trout survival is extremely low, while brown trout appear to be fairing better in this waterbody despite the presence of large predator fish (walleye).

Walleye: As a result of total trapping efforts, East Goose Lake exhibits a very strong population of walleye (48% species composition). Walleye (n=199) ages ranged from 0+ to 15 years old suggesting the walleye have indeed colonized the waterbody with evidence of successful natural recruitment. Generally, trout stocked in waters containing walleye suffer severe losses in the sub catchable stage (Wright & Sopuck, 1979). In addition, a litany of literature suggests very low growth and survival of trout in waters containing walleye, especially in the period three to four weeks after stocking (Swor & Bulow, 1975). Walleye are known as top predators and stocking trout on top of an established walleye population will result in immediate loss of stock through predation.

Yellow Perch: Total effort found 46% of the composition to be yellow perch. Ecologically, to deal with heavy natural predation and variable environmental conditions, perch have developed a reproductive strategy of producing many young so some survive to become adults. Trout, in general do not prey upon perch, so when introduced to stocked trout ponds, (perch) increase greatly in numbers (FMB Alberta, 2008). As perch populations expand rapidly, they compete with trout for forage, thus negatively affecting growth and survival. Yellow perch are strong competitors and larger perch will prey upon recently stocked trout. When perch exist in high numbers in stocked trout lakes, not only do they decrease stocking success but also angling quality.

6.3 Discussion/Recommendations: As stated above, walleye are top predators and yellow perch are strong competitors; which appear to be having a significant impact on stocked trout success and angling quality in East Goose Lake at the current time. At this point, please refer to a draft document entitled "SVSFE's Management for Unwanted Perch into Stocked Trout Lakes". This document is designed to provide a step by step approach to dealing non-salmonid (yellow perch) invasions in stocked trout waters (Appendix) but could be utilized for other percidae invasions.

Step 1: Quantify the problem - At current it appears the East Goose Lake exhibits a very strong rate of non-trout invasion. Again, 2016 methodology targeted non-trout species, and therefore may not be representative of true lake species composition. At this point in time, regardless of true scientific backing, one can assume that the issue in East Goose Lake is a serious one.

Step 2: Stakeholder Meetings: It becomes important for stakeholders to go over the data and discuss the options. In terms of stocking rates and frequency, one should determine if current stocking practices are efficient; correlate the current status of trout in lake with what seems to be working and what does not. Time of year and stocking size should be closely examined in this process. In terms of appropriate stocking densities, every managerial jurisdiction across the board has a different approach; where some densities work, some don't, and in many cases the success rates from jurisdiction to jurisdiction contradict each other. For this reason, it is suggested a stocking rate be further discussed and agreed upon amongst stakeholders. Efficient stocking rates are very lake specific, and more important in waterbodies containing a non-salmonid presence.

In terms of stocking size, a strong argument is that larger fish are quicker, can easily escape predation, as well as compete better. In 1959, Crossman, found that rainbows switched from a plankton to shiners at >250mm (Crossman et, el 1959). In Arizona, researchers found that rainbows <300mm fed predominantly on plankton before switching to a piscivorous diet (Otte, 1975). Beauchamp, 1990 found that rainbows switched from invertebrates to small bodied fish at a length of 250mm (Beauchamp, 1990). These cases arise because one could assume a perch population will always exist in East Goose; unless full lake reclamation is considered. In this case, stocking larger trout will improve chances of reaching length frequencies where they will switch to a piscivorous diet, compete less with perch for invertebrates and plankton, and potentially even feed on young yellow perch. In Lake Washington, WA, researchers found during the spring and summer yellow perch were an important forage base for rainbow trout >250mm (10") (Beauchamp, 1990). In general, the larger the trout at the time of stocking, the greater chance it will have to reach sizes attracted by anglers, especially in waterbodies where a strong non-salmonid presence exists. If shifting stocking practices (rates, stocking size, or species) becomes imperative, it is recommended to communicate decisions between stakeholders, provincial fisheries staff and Manitoba's fish stocking program. As we know, the province and local hatchery plan stocking years in advance, so if changing the stocking program becomes priority, it may take a few years to become implemented.

6.0 East Goose Lake

Step 3: Make a Decision - Based on current known management plans for East Goose Lake, one can assume that both changing the management plan to a walleye fishery or the concept of full lake reclamation are not options at this point, especially considering the local investments and the Annual Bug Chucker Cup. If these assumptions are correct, there are two potential options which could be attempted, or combined for effectiveness.

(1) Alter management plan – In this case, suggestions include adjusting trout stocking practices or lake regulations. This could refer to altering stocking size, frequency, and rate of desired species or attempt stocking different trout species that may compete better with perch populations. Saskatchewan found brook trout and rainbow trout do not compete well with perch, and after the establishment of perch, have seen success in lakes stocked with brown trout, tiger trout or splake (Prestie, 2016). If rainbow trout remains a preferred species for East Goose lake it is suggested to review opportunities for larger stock. Also, at this current time little is known regarding trout harvest. Current lake regulations suggest it is managed as a put-and-take fishery with general trout limits and no tackle restrictions. As this point, if managers prefer to attract trophy trout anglers, regulations should be put in place to protect the larger trout.

(2) Manual Rehabilitation - Evaluate the cost and benefits of initiating a manual non-salmonid removal program. Arguably, this is difficult to quantify, as manual removals can require significant effort, are expensive, and only temporary. For example, hiring outside technicians in 2016 stocked trout removals/assessments cost approximately $5,000 per week depending on distance travelled, accommodations and wages for three technicians. When comparing catches at East Goose Lake to this rate, this equates to $35 per walleye removed or $466 per hectare to conduct a 1.5 week project.

In Cow Lake, Alberta (~850ha) is was determined it would cost over $1,000,000 to remove perch to management levels with little confidence regarding success (FMB, Alberta, 2008). How Alberta reached this approximate value is not known, but is worth stating simply because costs associated with manual removal programs is highly unknown and variable. On the lighter side, according to a non-salmonid (northern pike) removal program in West Long Lake, Nebraska the researchers state that mechanical fish removal is only recommended on small bodies of water where sufficient effort can be put forth to remove enough fish to achieve management goals (Jolley et el, 2008). Also, Nebraska stated efforts are extremely unlikely to remove all individuals, and only temporary because the juveniles that remain will display compensatory increases in recruitment, survival and growth. Therefore, mechanical removal programs should be comprehensive and long term.

In summary, mechanical removals, if initiated must require comprehensive long term planning in order to be effective and must incorporate a response plan to most effectively target unwanted species and have a budget associated with it.

6.0 East Goose Lake

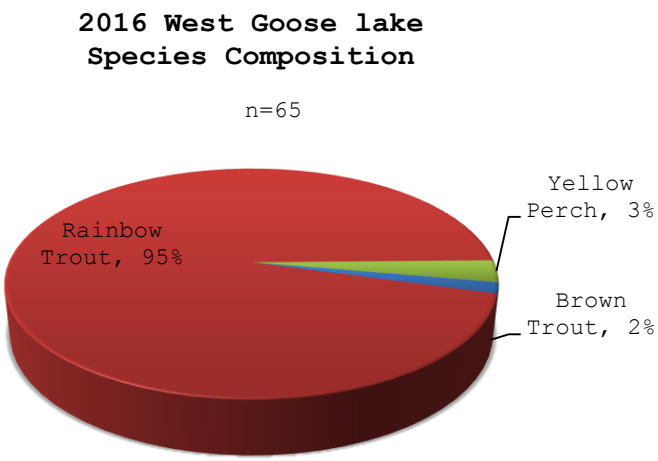
Because East Goose Lake is relatively small (~15ha), it becomes probable that a comprehensive manual removal program could be successful. If this initiative is agreed upon, it is recommended to conduct a full netting effort with complimentary electrofishing in the spring either before or during the spawning periods when yellow perch and walleye are in littoral areas. In accordance to "Fisheries Management Branch Response to Unwanted Occurrences of Perch in Stocked-Trout Lakes in Alberta", fishing or removal efforts continue until non-salmonid (yellow perch in this example) densities are less than 25% of total species composition, and therefore not considered to be affecting the trout stocking program. At this point, it is highly unknown how long it will take to achieve this management goal. Regardless, a solid week or two would likely reduce CPUE significantly. At this point, removing as many non-salmonids, especially walleye, would significantly increase trout stocking success in East Goose Lake. If manual rehabilitation becomes priority; below are considerations;

(1) Develop a program to efficiently conduct manual removal of non-salmonid species using the most effective methods possible (i.e. electrofishing, trap-netting, gill-netting, angling, etc.)
(2) Develop removal goals, budgets or both. Perhaps until walleye and perch consist of <25% of total species composition, or perch and walleye CPUE drops by more than 75%, or "one solid week allocation", or a dollar value.
(3) Develop a long term maintenance plan - How often do these programs need to be conducted in order to achieve trout stocking success, and retain species composition goals.
(4) Acquire necessary gear and train volunteers or seasonal workers to conduct removal programs on desired frequencies
(5) Keep an eye on perch and walleye populations – Once walleye numbers decrease, yellow perch survival and growth will likely increase and need to be managed
(6) Consider different trout species or stocking rates/stocking sizes that will compete better with perch populations
(7) Discuss current lake regulations – and determine if protecting larger trout is priority, or if lake should remain as a put-and-take
(8) Further investigate the culvert connecting East and West Goose, therefore evaluating the risk of escapement to other waters (i.e. West Goose)
(9) investigate/develop local educational programs or signage focusing on the serious ecological and economical implications of planting fish illegally

7.0 West Goose Lake

7.1 History: West Goose has a long management history going back to the 1920's. With reference to the Western Region Stocking Database, the lake has been stocked with walleye, yellow perch, northern pike, and rainbow and brown trout over the years; with no available records of stocking success other than evidence that the lake periodically winterkilled. According to the Master Angler Awards Database, West Goose was producing trophy trout since the late 1980's. The only assessment work known at this point was in 1999/2000 by Dave Milani. This assessment was likely to collect baseline information necessary to determine suitability for lake rehabilitation (aeration), however unknown. Again, SVSFE is anticipating access to these documents. In October of 2002, West Goose aeration unit was installed, and has been stocked annually with rainbow and brown trout since. According to fisheries records, the first official evidence of non-salmonid invasion (yellow perch) into West Goose Lake occurred in February of 2005 (Kansas, 2016). Also, it is important to state that West Goose Lake is managed as a trophy trout fishery, as this is what current lake regulations suggest (limit of one and tackle restrictions).

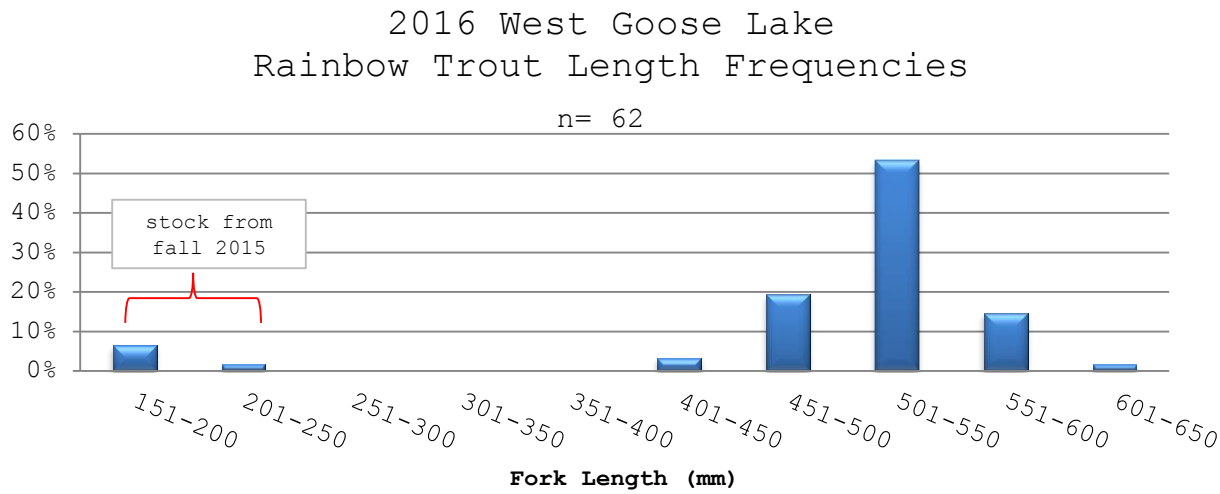
7.2 Results

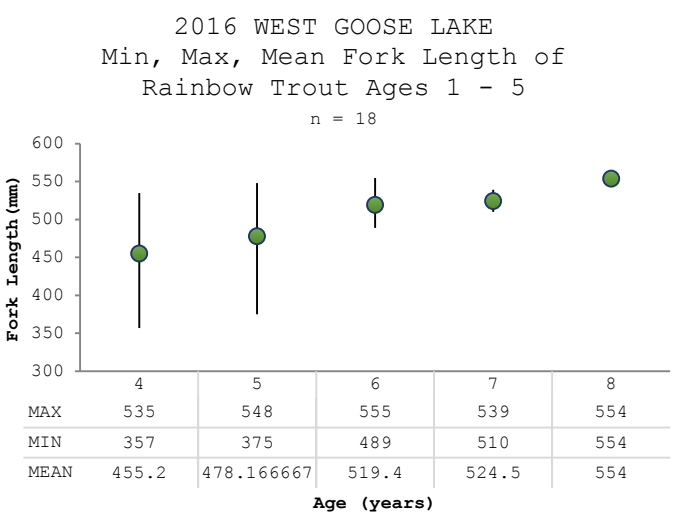


West Goose Lake Total Catches 2016		
Species	**No. of Fish**	**%**
Brown Trout	1	2%
Rainbow Trout	62	95%
Yellow Perch	2	3%
Total	65	100%

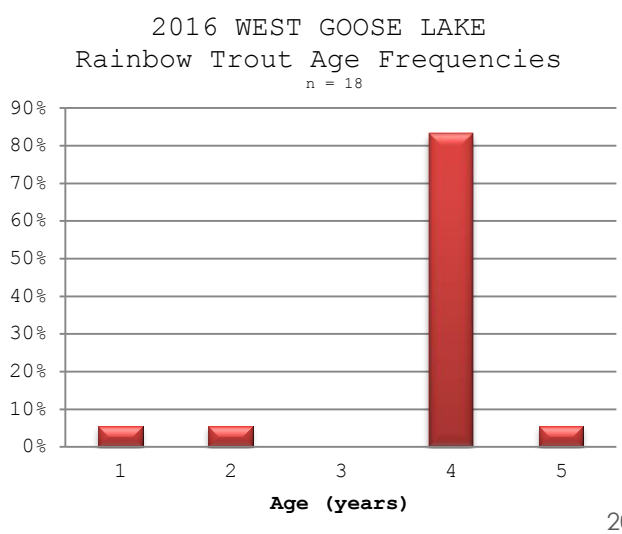
7.0 West Goose Lake

7.2 Results: Activities commenced May 24th - 25th, 2016. Fish inventory, assessment and collection methods were exclusively trap netting (effort = 47.3 hours). The nets utilized in this assessment were fine mesh and capable of capturing small bodied fish >5cm in length. Net locations were determined based on available shoreline and ideal depths for efficient trapping efforts (gap depth 2m). It is important to state that electrofishing was originally scheduled as an assessment method, however due to mechanical issues with the boat and available time, no electrofishing was conducted in 2016. Trap netting was concluded after one night of netting for two reasons; (1) limited shoreline suitable to relocate trap nets and(2) high concentration of trout catches. With water temperatures increasing and high concentration of fish in the nets, fish would become stressed if caught repeatedly. Rainbow and brown trout were sampled and released; yellow perch were removed.





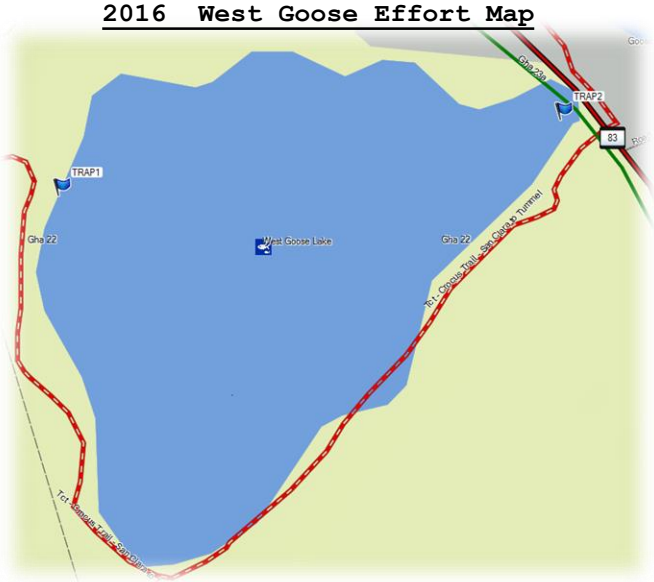
	4	5	6	7	8
MAX	535	548	555	539	554
MIN	357	375	489	510	554
MEAN	455.2	478.166667	519.4	524.5	554



7.0 West Goose Lake

Again, it is imperative to state that this particular assessment was very short and for this reason, suggests the stated species composition may not be ideally representative. For one, it is hard to believe brown trout consist of only 2% of the total composition, especially when reviewed through other available information (i.e The Manitoba Master Angler database, 2015 West Goose electro-fishing, stocking records, current conversations with anglers and lakes managers). In 2015, during electrofishing, twelve fish were caught, nine were browns (75%) three were rainbows (25%) and zero yellow perch. Also in terms of perch we are not confident that our efforts truly represent the current composition/population. "As far as Perch for West Goose I understand, is there are perch in West. Big ones, like close to master angler sizes can be caught. I've also caught a few smaller ones myself like in the 4-6 inch range and have seen smaller ones follow my lures casting off shore" (Brodeur, 2016). In summary, we believe that 2016 efforts are not truly representative of current species composition, as gear availability, lake morphometry, time, and increasing water temperatures restricted ideal data collection.

2016 West Goose Effort Map



Trout: Trout species caught were limited to rainbow trout (n=62 & mean 505mm) and one brown trout (425mm, age 3). Trout consisted of 95%, and 2% of total species compositions amongst rainbows and browns, respectively. A sub-sample of rainbows were fully sampled as an effort to minimize fish stress, the remaining were quickly measured and released. From the sub-sample (n=18), a strong composition (~80%) of rainbows were aged at 4+. This strong age class would either be fall 2012 (0+) stocking or spring 2013 stocking (1+). Since West Goose is managed as a trophy trout fishery, the sample size suggests that rainbows are capable of reaching master angler size by age 4+ and on average rainbows reach trophy size at age 5+, which could be of interest to managers. In summary, taking into account our data along with current known angling quality, it can be concluded that West Goose Lake provides a great trophy trout fishery with exceptional growth rates, condition factor, and angling quality.

Yellow Perch: Non-salmonid catch was exclusively yellow perch, with only two fish caught in total (200mm, 250mm) - removed. Based on available records, conclusions suggest that yellow perch have populated the lake for at least 10 years, and may have reached the lake through the culvert connecting it to East Goose on a high water year or by other means. Also, one could assume the perch population is not compromising the trout growth and survival. Fisheries staff in the province of Alberta, suggest that in the first few years after introduction to a waterbody perch sometimes produce attractive sized fish. As perch population expands rapidly they compete with the trout and each other of food, negatively affecting the trout growth (Alberta FMB, 2008). Considering the fact that perch have existed for over 10 years, and at this point do not appear to be compromising trout stocking/success, suggests some unknown habitat limitation or consistent predation from larger trout keeping perch at manageable levels. Although, this is a positive note, it might be a benefit to address the perch populations while it is at a manageable level.

7.3 Discussion/Recommendations: It is evident trout stocking does not appear to be compromised by yellow perch invasions in West Goose Lake. However, the fact is that yellow perch do exist in the waterbody is not something that should be overlooked. At this point please refer managers to a draft document entitled "SVSFE's Management for Unwanted Perch into Stocked Trout Lakes". This document is designed to provide a step by step approach to dealing non-salmonid (yellow perch) invasions in stocked trout waters (Appendix).

Step 1: Quantify the problem – As stated above, the methodology used was limited due to suitable shoreline for trap netting & lack of available equipment. In addition, effort was minimal due to increasing water temperatures, therefore species composition may not be representative. To further quantify the problem, an additional assessment agreed upon by stakeholders should be completed in 2017.

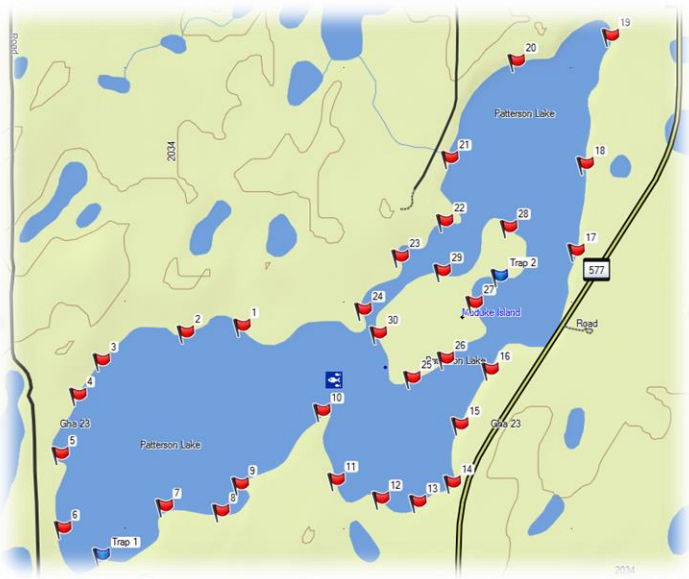
Step 2, 3: Stakeholder Meeting and Decision Making - In accordance to Fisheries Management Branch Response to Unwanted Occurrences of Perch in Stocked-Tout Lakes in Alberta; as long as perch density remains less that 25% of total composition or catch per unit effort, the perch are not considered to be negatively affecting trout stocking (Alberta FMB, 2008). In 2015 electrofishing effort and 2016 trap-netting effort, perch compositions consisted of 0%, and 3% respectively. In 2016, efforts showed CPUE and species composition are both far from reaching this non-ideal 25% threshold. At this point it is recommended to continue trout stocking program as necessary and to keep a close eye on perch populations. Best practices on how to monitor the populations stills needs to be discussed and decided among the scientific community. Essentially, yellow perch are present in the system and populations should be managed in a proactive manner versus the knee-jerk reaction. Lastly, "we understand both lakes (East and West Goose) fluctuate significantly" (Brodeur, 2016). Further investigations of the culvert connecting East and West Goose should be of utmost importance, therefore preventing the risk of possible invasions (yellow perch and walleye) from East Goose to West Goose during high water periods.

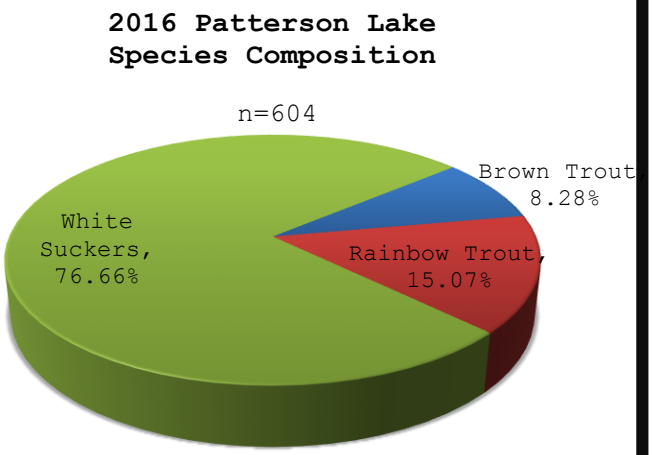
8.0 Patterson Lake

8.1 History: According to Western Region Stocking Database, Patterson Lake was first stocked with yellow perch in 1954 and 1955. Looking at the lake composition today, suggests that the lake historically winterkilled to anoxic levels that would kill-off perch populations. In terms of these records, stocking didn't occur from the 1950's up to trout introductions in 2000/2001. In July of 2000, two standard gangs were set in Patterson Lake to get an idea of fish community prior to introductions; two salamanders were caught (Kansas, 2016). In July of 2001 another standard gang was set overnight; no fish were caught (Kansas, 2016). It can be assumed that these fish community surveys were completed in association with "The Stillwater Lake Assessment Plan for Lake Development", (Kansas, unknown year) prior to lake rehabilitation/aeration. The first rainbow and brown trout stocking occurred in 2000/2001. In September of 2002 the aerator was installed; which was closely followed by the Patterson Lake Grand Opening later that month. Since then, rainbows and browns have been stocked annually at various rates and sizes. The lake has become an extremely popular trophy rainbow and brown trout destination, and arguably one of the best in the province. Also, it is important to state Patterson Lake is managed as a trophy trout fishery, as this is what current lake regulations suggest (limit of one <45cm and tackle restrictions).

8.2 Results:

2016 Patterson Lake Effort Map

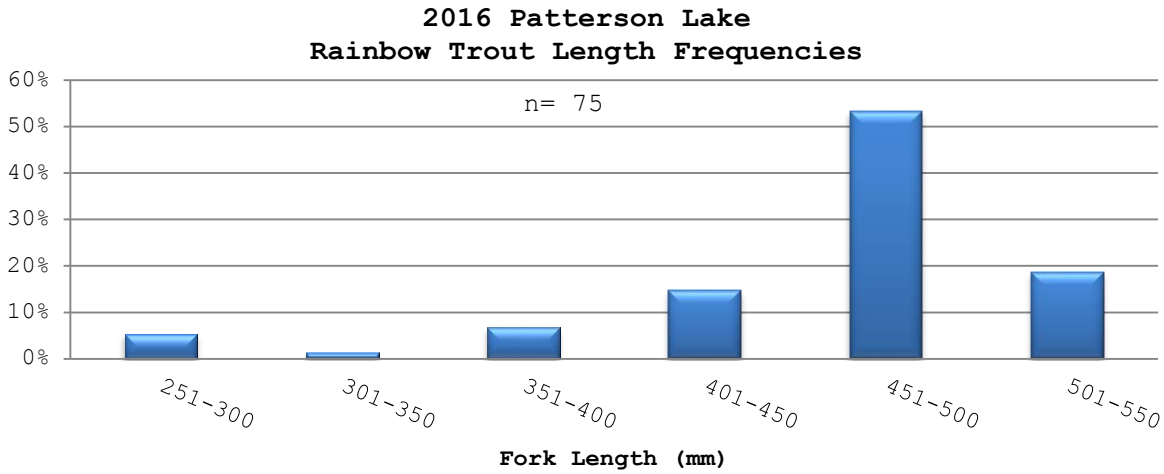


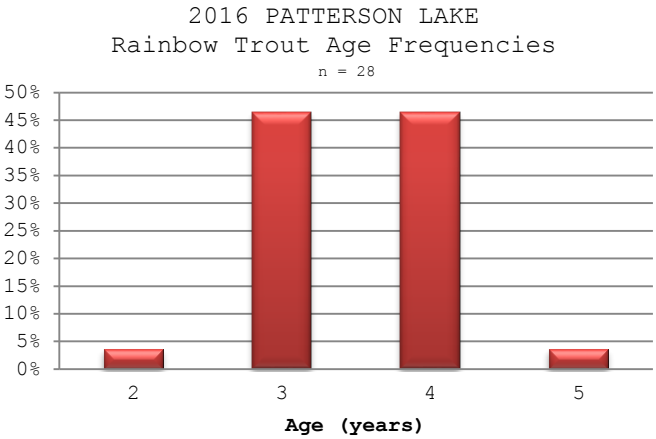


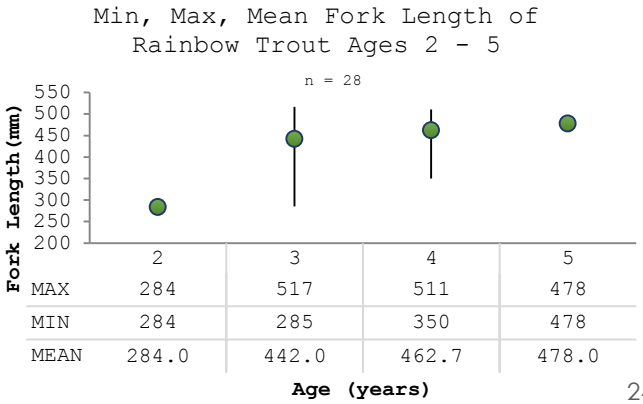
8.0 Patterson Lake

8.2 Results cont'd: Activities commenced June 13th – 14th, 2016. Fish were collected via trap netting (effort = 23 hours) and electrofishing (effort = 9066 secs). Trap netting was conducted during evening hours only and was concluded after one night of netting for two reasons; (1) increased water temperatures (2) high concentration of trout catches. For these reasons it was agreed that trap netting cease for the duration of the program to avoid fish stress and potential mortality. Electrofishing transects were fished over two evenings and was most effective in obtaining non-salmonid species present - white suckers. A total of 30 transects were completed at 100m each which was representative of the total shoreline habitat.

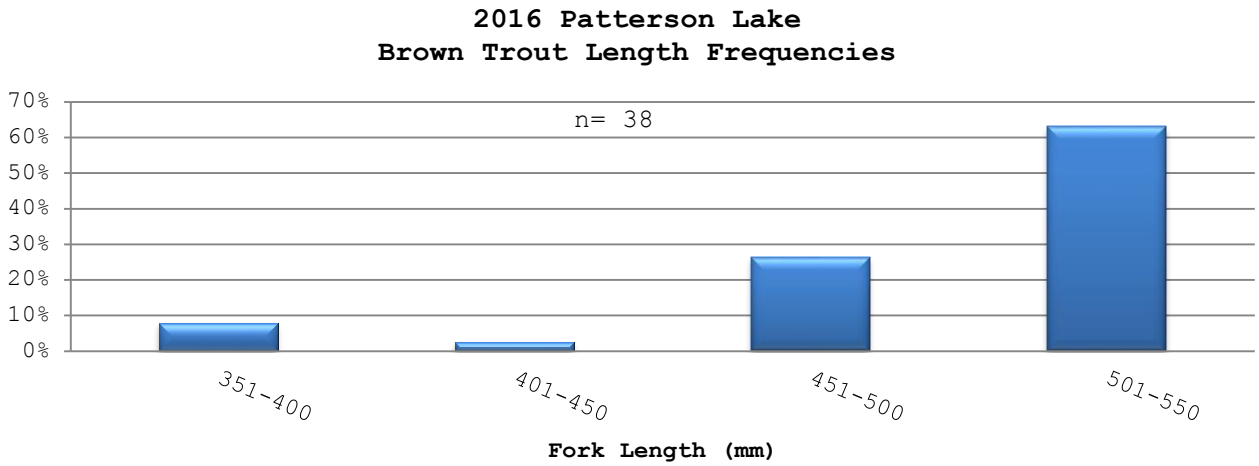
Patterson Lake - Total Catches 2016				
Species	Electrofishing	Trap Netting	Total	%
Brown Trout	21	29	50	8.28%
Rainbow Trout	16	75	91	15.07%
White Suckers	449	14	463	76.66%
		Total	604	100.00%

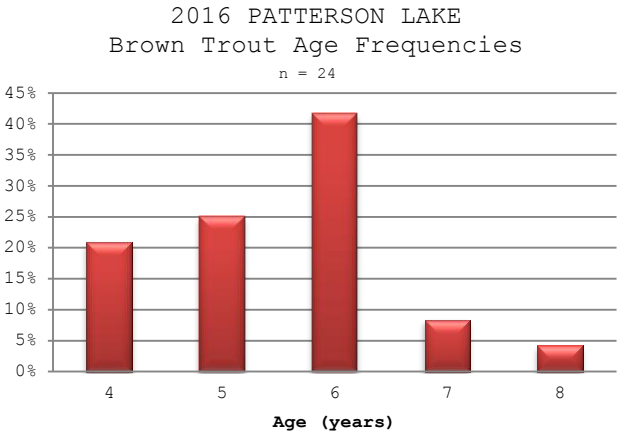


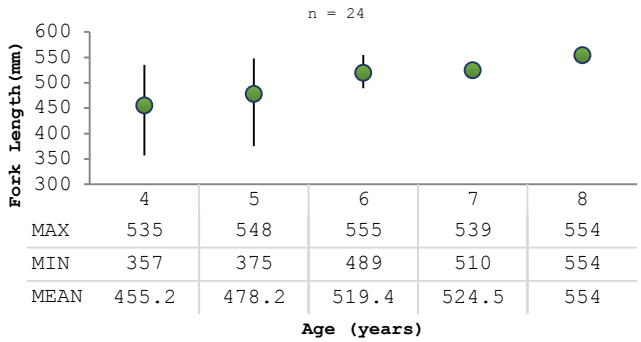




8.0 Patterson Lake







	4	5	6	7	8
MAX	535	548	555	539	554
MIN	357	375	489	510	554
MEAN	455.2	478.2	519.4	524.5	554

Once again, efforts were to gather a greater understanding of the state of the fishery with emphasis on removing as many non-salmonids as possible. For this reason, the species composition is likely not a true representation of the current lake status but is still defined for interpretation. The electrofishing program was designed to be replicable, and all relevant information was recorded, suggesting that this program can be used for trend analysis and comparison in the future.

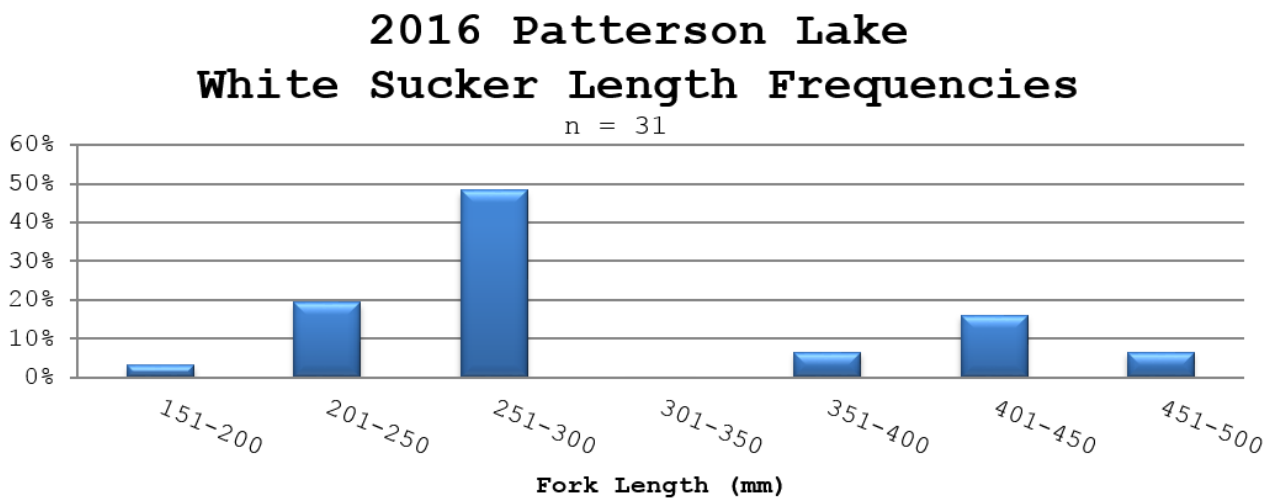
In terms of trout, there appears to be a wide spread of length frequencies suggesting that current stocking efforts are effective with many trophy fish present, along with lower ages classes for future years. As an effort to reduce trout stress with increasing water temperatures; 30 of each species were fully sampled (aged, length and floy tag). Note, in terms of age analysis, anticipated sample size was not achieved as some scales taken were regenerated, and therefore not admissible in the data set.

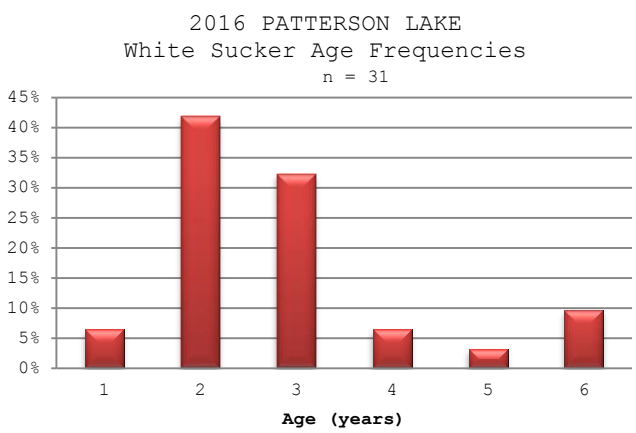
8.0 Patterson Lake

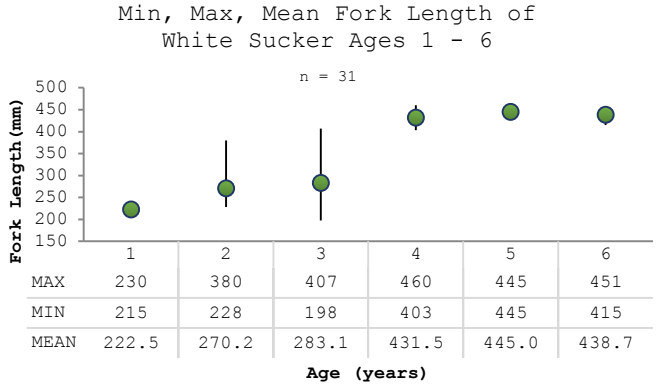
Rainbow Trout: Referring to the Master Angler Awards, the first "trophy" rainbow was submitted in October of 2004. Since then over 1,300 trophy rainbows have been registered. Interestingly, submission rates appear to "skyrocket" and stay high from 2010 onwards and is likely do to increasing popularity of the fishery. Trap-netting was more efficient in regards to trout capture than electrofishing, and together suggested a species composition of 15%. In terms of rainbows aged (n=28) results ranged from 2-5 years with a very high composition of 3 and 4 year olds (92% of sample). Correlating with stocking records these fish would have either been 2012, 2013 (0+) stocking. At this current time, no real conclusions can be drawn regarding reasoning behind these strong age classes as our sample size (n=30) was relatively low. In terms of growth, there was a very wide range of growth amongst all age classes. For example, in the 3 year class we saw a min-285mm and a max-517mm. Since Patterson is managed as a trophy trout fishery, the sample size suggests rainbows are capable of reaching master angler size by age 3+, which could be of interest to managers. At current, no recapture submissions have been obtained, suggesting no information has been determined from fish tagging at this time.

Brown Trout: Regarding the Master Angler Awards, the first "trophy" brown was submitted in May of 2004. Much like the rainbows, masters continued to be registered since, with a obviously spike in 2010. Species composition was found to be 8% of the population. Brown trout (n=24) ages ranged from 4-8 years old, with a high composition of 6 year olds (42% of sample), and again nothing seems to be correlating between this age class and stocking records. Interestingly, older fish were within the sample - up to 8+ yrs. Since Patterson is managed as a trophy trout fishery, the sample size suggests that browns are capable of reaching master angler size by age 4+ and on average reach trophy size at age 6+, which could be of interest to managers. At current, no recapture submissions have been obtained. Overall, there appears to be a moderate presence of older brown trout within the system.

8.0 Patterson Lake







	1	2	3	4	5	6
MAX	230	380	407	460	445	451
MIN	215	228	198	403	445	415
MEAN	222.5	270.2	283.1	431.5	445.0	438.7

White Sucker: Through total efforts, a total of 463 white suckers (76% of total spp. composition) were captured and removed during assessments. As noted in pre-aeration assessments, it was concluded that Patterson Lake was void of any large bodied fish. At this point in time, it is unknown when the first report of white sucker was confirmed in Patterson Lake. In June of 2015 a master angler white sucker was submitted to the award program. Discussions have suggested that they may have accessed Patterson through the culvert located at the south end of the lake (near the mass graves), but this only a theory at this time. This recent influx of white suckers should not be overlooked. Several studies have demonstrated a negative relationship between white suckers and rainbow trout (Kerr, 2000). The diet of rainbow trout, white-sucker and longnose sucker was found to overlap considerably in Paine Lake, Alberta (Barton and Bidgood, 1979). Bidgood and Barton (1982) noted that the presence of suckers resulted in decreased growth rate of stocked rainbow trout. Alexander, 1975 found survival of stocked rainbow trout was reduced after the introduction of white sucker in both East Fish Lake and Fuller Pond in Michigan. This was attributed to a reduction of benthos populations (Kerr, 2000).

8.0 Patterson Lake

On the other hand, Lake Taneycomo, Missouri suggested white suckers do not compete with trout for food. This lake has historically been the state's most popular fishery for rainbow and brown trout. Annual fish surveys (1972-2002) noticed a decline in the 1990's in the put-and-take rainbow fishery, which prompted numerous studies concluding rainbow trout experienced degrading foraging conditions and were heavily exploited by anglers (Kruise, 2003). Beginning in 1987 large numbers of white suckers began showing up which were believed to be detrimental to the invertebrate community and compromising rainbow trout growth. The declining of stocked trout success sparked a comprehensive multiyear study, which included; stocking changes, regulation changes, annual fish surveys, annual angler surveys, and annual invertebrate/benthic surveys. Following the study, Wieland & Hayward, 1997 concluded white-suckers consumed primarily algae and secondarily smaller stages of invertebrates, suggesting suckers do not present substantive interspecific competition with trout for food in this particular waterbody (Kruise, 2003). Angling quality improved over time and was determined to be largely a result of protection regulations initiated on the upper reaches of the waterbody (Kruise, 2003). These regulations implemented a slot suggesting all rainbow trout between 12 and 20 inches be released, as well as the tackle restriction of flies and hard tackle only. This regulation change produced unexpected results, as the upper reaches (regulation area) of the reservoir attracted primarily fly fishers, who released 98% of "legal size" rainbows, while the downstream "non-regulated" areas attracted mostly bait fishers, who harvested most of their catch. Conclusions suggest that current management program be maintained, and the periodic fish survey, angler survey, and invertebrate sampling be maintained.

In summary, this particular study indicated white-suckers were not detrimental in this system, and how important angling regulations and the fly fishing culture is on the health and long term management on trophy trout fisheries.

8.0 Patterson Lake

8.3 Discussion/Recommendations: At this current time, no evidence of perch invasion was noted in Patterson Lake. For this reason we will not refer to "Management Options for Un-wanted Perch Populations in Stocked Trout Lakes" though the thought process is relevant. Currently, what we do know is 1) the current trout stocking program is very successful and 2) white-suckers are present in the waterbody. Recommendations are as follows:

(1)Continue Current Management Objectives: Patterson Lake is arguably one of the best managed trophy rainbow and brown trout fisheries in the province, attracting avid fishers from far and wide. It becomes apparent that current lake regulations and stocking are largely responsible for this success.

(2)Quantify The Problem - As stated earlier, efforts used are likely not fully representative of fish community but it is believed there is an abundant presence of white suckers (76% of total species composition). The interspecific relationships between trout species and white suckers are unknown, but the condition of this trout fishery indicate minimal impacts at this time. Methodology from the 2016 assessment could be replicated at least once every two years to monitor effects of removal and abundance of white suckers. If lake managers require a full representation of the lake community, a more comprehensive fish inventory study agreed upon by the scientific community should be created. This is something SVSFE plans with partners to develop in order to create a standardized protocol for management of stocked trout lakes.

(3)Keep an Eye on the Suckers – As previously stated, the recent influx of white-suckers and their influence on trout is uncertain. Regardless, the presence of them should not be overlooked. If agreed upon, manual removals should be considered as chemical reclamation or ceasing aeration are not options and conducting removals while populations are manageable could prove to be more effective. Waiting for sucker populations to effect/threaten trout populations could be a recipe for disaster. An effective response plan should be developed to identify areas of spring sucker congregation (inflows, gravel substrates), efforts required and methods to use (at minimum spring electrofishing).

(4)Further Investigate Potential Inflowing Tributaries: It is unknown how white-suckers entered Patterson Lake. The Stillwater Assessment for Lake Development was conducted in 2000 and showed no evidence of suckers. Inflow/outflows are an integral part of this assessment, and didn't pose an issues back then. Perhaps in the past 16 years some water management decisions (ie. culverts/drainage) were implemented and have lead to sucker introductions. It is suggested these potential sources of invasion be re-evaluated to restrict future entries.

9.0 Tokaryk Lake

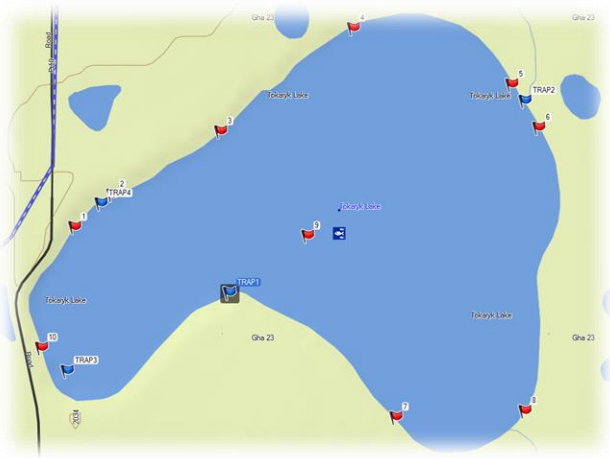
9.1 History: According to the Western Region Stocking Database, Tokaryk Lake was first stocked with walleye fry in 1970. Since then walleye were stocked at various sizes and rates intermittently through the 1970/80's. The initial stocking of rainbow and brown trout occurred in the late 80's and early 90's and have continued annually since. In accordance to the Manitoba Master Angler Database, the lake has produced hundreds of trophy rainbow and brown trout since 1992 (rainbows), and 1993 (browns), and has continued to do so until today. Equated from this, is the fact that historically Tokaryk Lake only partially winterkilled, with some winters leading to full die-offs. No records of fish inventories or fish studies on this particular waterbody were obtained at the point of summarizing the 2016 results. The aeration system was installed in 2010 and has been in operation ever since.

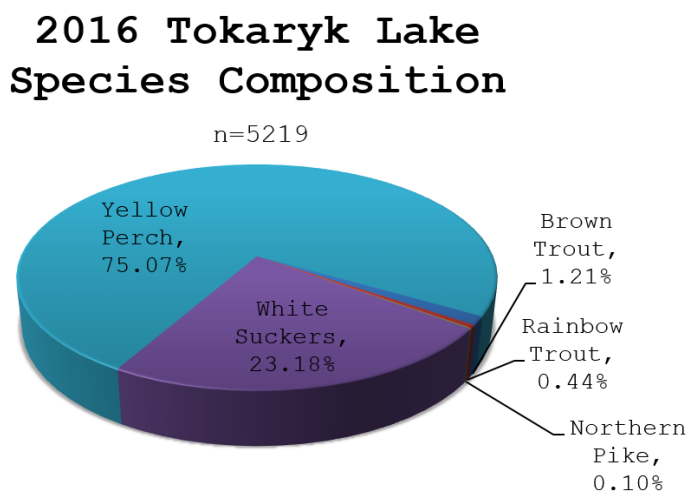
As a result of confirmed instances of yellow perch and northern pike (within past few years), removal programs conducted by provincial fisheries staff were initiated in 2015 (Bruederlin, 2016). From August 7th - October 1st, 2015 a total of 6,758 yellow perch, 117 white sucker, and one northern pike were removed from the waterbody via hoop nets and electrofishing (Bruederlin, 2016). Also, it is important to state that Tokaryk Lake is currently managed as a put-and-take fishery, as this is what current lake regulations suggest (general limits and no tackle restrictions).

9.2 Results:

Tokaryk Lake - Total Catches 2016				
Species	**Electrofishing**	**Trap Netting**	**Total**	**%**
Brown Trout	9	54	63	1.21%
Rainbow Trout	2	21	23	0.44%
Northern Pike	0	5	5	0.10%
White Suckers	433	777	1210	23.18%
Yellow Perch	3584	334	3918	75.07%
		Total	5219	100.00%

2016 Tokaryk Lake Effort Map

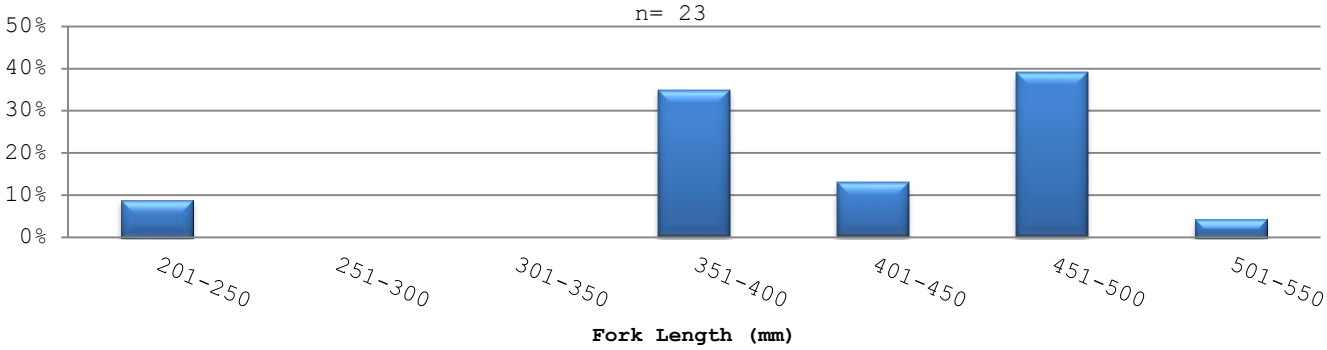




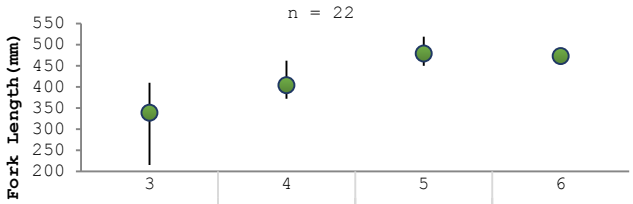
9.0 Tokaryk Lake

9.2 Results cont'd: Activities commenced June 14th – 17th, 2016. Fish were collected via trap netting (effort = 79 hours) and electrofishing (effort = 6210 secs). Trap netting was exclusive to evening hours to accommodate the increase in water temperatures. Electrofishing transects (10 at 100m) were fished one evening and intended to be simple and replicable in the future. On the evening of the 16th, electrofishing occurred in high catch percentage habitats with the intention of removing as many yellow perch as possible. E-fishing was the most effective in obtaining yellow perch while trap netting was effective in capturing trout, white suckers and pike. Results are as follows;

2016 Tokaryk Lake Rainbow Trout Length Frequencies



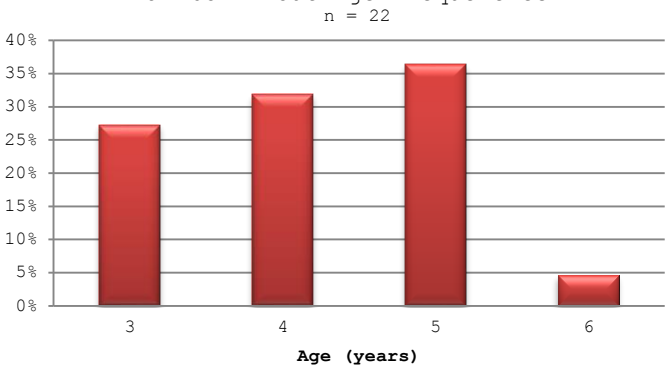
2016 TOKARYK LAKE
Min, Max, Mean Fork Length of
Rainbow Trout Ages 3 - 6



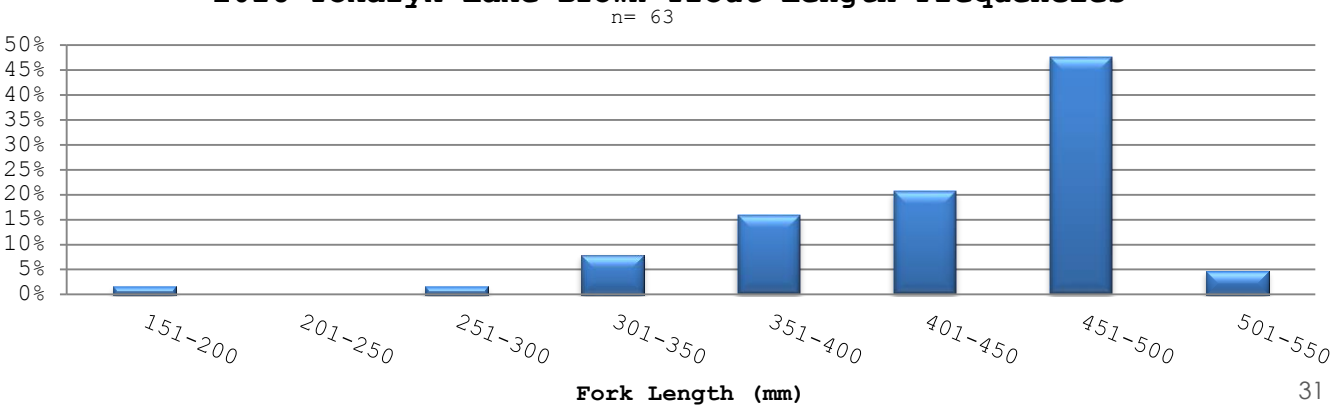
	3	4	5	6
MAX	410	462	519	473
MIN	215	372	450	473
MEAN	339.0	403.7	478.9	473.0

Age (years)

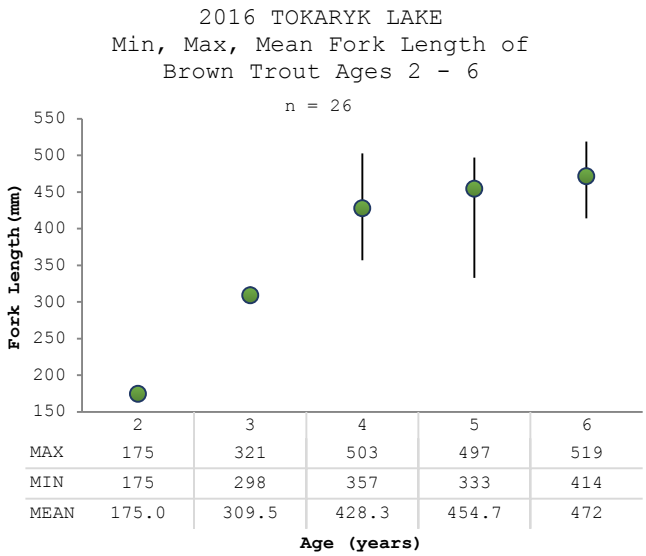
2016 TOKARYK LAKE
Rainbow Trout Age Frequencies



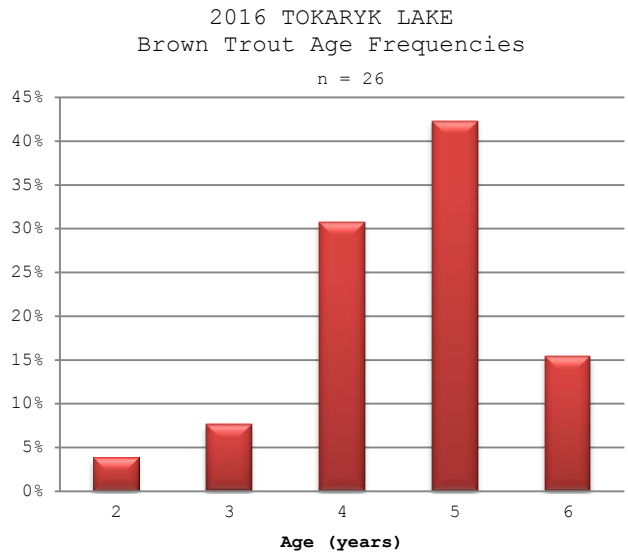
2016 Tokaryk Lake Brown Trout Length Frequencies



9.0 Tokaryk Lake



	2	3	4	5	6
MAX	175	321	503	497	519
MIN	175	298	357	333	414
MEAN	175.0	309.5	428.3	454.7	472

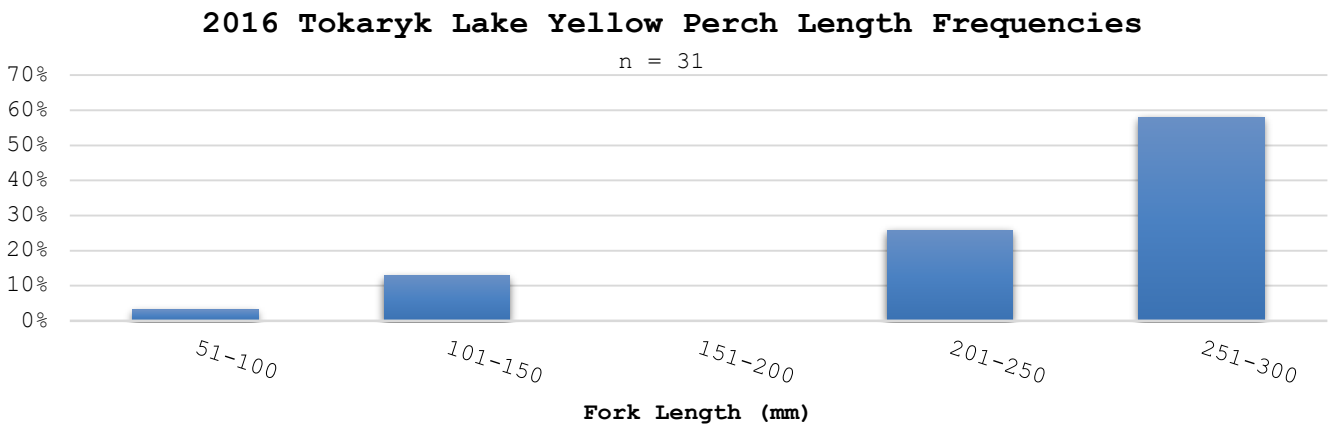


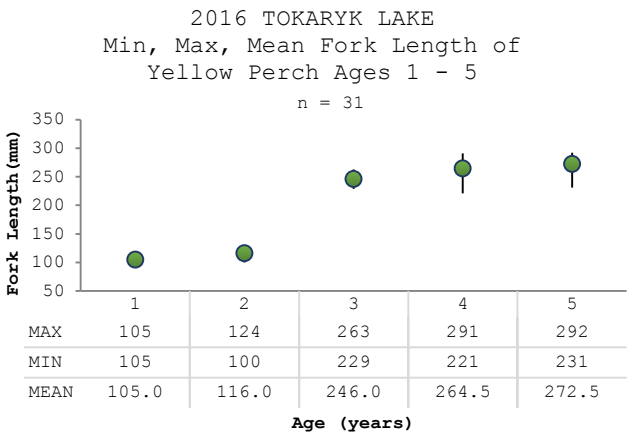
Trout: Trout consisted of 0.44% and 1.21% of total species composition of rainbow trout and brown trout respectively. Again, efforts included electrofishing and trap-netting as primary fish capture, and likely are not truly representative of true species composition. Trap-netting was a much more effective method for trout capture in comparison to electrofishing. As stated above, Tokaryk Lake has produced hundreds of registered "master angler" trout since 1992/1993 and continues to do so. Aside from this we know very little about current trout angling quality besides some qualitative information suggesting that "it is a reasonable put-and-take fishery", and "you need to wade through multiple perch before landing a trout" (Unknown Anglers, 2016).

When looking at trout length frequencies, there is a wide range which simply suggests the annual stocking program is showing some level of survival from each stocking. In efforts to limit stress on the trout, no fish were weighed which could provide us with condition factor; regardless technicians noted trout in general were healthy specimens. There was a considerable variance of growth within certain ages classes; for example in the 3+ year class of rainbows a minimum growth of 215mm and maximum growth of 410mm was found, and in brown trout another example is amongst the age 5+ class ranging from 333mm-497mm. Interestingly, when comparing rainbow growth to it's neighbour, Patterson Lake, the average growth of a 3 year old is 339mm in Tokaryk and 442mm in Patterson. Another example is amongst the 4+ rainbows, where average length is 403mm in Tokaryk and 462mm in Patterson. We notice the same amongst brown trout, however not as excessive. On average, both browns and rainbows were below master size at age six, though there were occurrences of master sized fish at ages 4, 5 & 6. As stated before you can not draw too many conclusions from a small sample size, however this is evidence that the prolific perch and white-sucker populations are likely affecting trout growth due to interspecific competition.

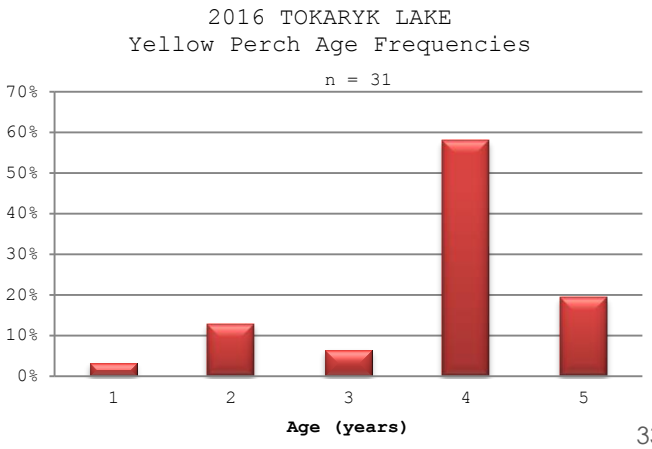
9.0 Tokaryk Lake

Yellow Perch: When focusing attention to yellow perch, 2016 efforts showed yellow perch consist of >75% of the total fish community. In total 3,918 yellow perch were captured and transferred to nearby Shoal Lake. In terms of methods, trap-netting was more effective in capturing larger, mature individual whereas electrofishing was more effective in capturing smaller immature individuals. When reviewing trap-netting, no specific location appeared to have higher catch rates than others, however when reviewing electrofishing sites, the north shore produced by far the best results and was likely do to strong south and south-east winds leading up to and during assessments/removals. In addition, catches were higher in habitat possessing greater amounts of woody debris (beaver lodges). From length frequencies, not too much can be concluded due to the fact that the random sub-sample of 30 fish was collected from the trap nets; made up of larger individuals and very few smaller, younger individuals. This suggests a misinterpretation of the perch community. Regardless, a very strong age class (>55%) of age 4+ yellow perch was noted. This could either be a result of an ideal spawning season in 2012, or could be the "bucket" of live 1+ perch dumped in the lake after an unsuccessful fishing day of some individual in the spring of 2013. An effort was made to age the largest individuals in the system; the largest was 292mm and was aged at 5 years old. At this point, the sources of invasion is highly unknown, and could be (1) illegal introductions, or (2) invasions via connectivity to another waterbody during high water periods.



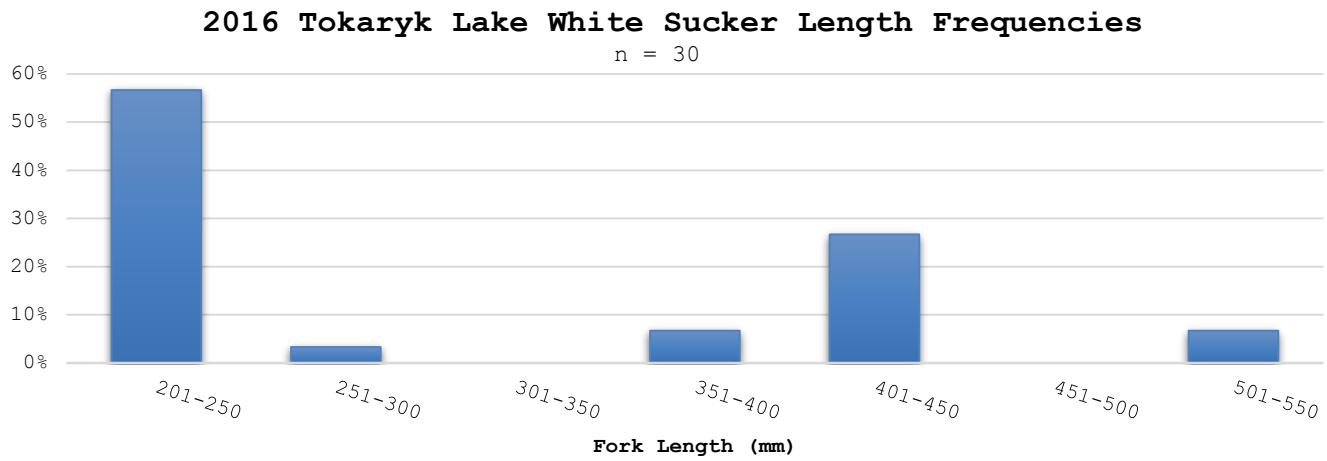


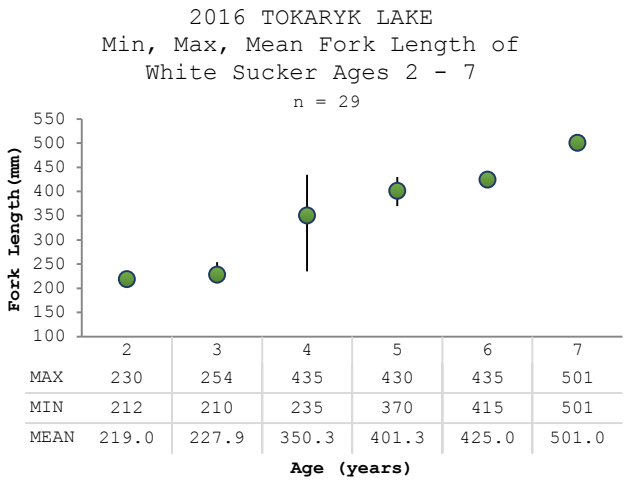
	1	2	3	4	5
MAX	105	124	263	291	292
MIN	105	100	229	221	231
MEAN	105.0	116.0	246.0	264.5	272.5



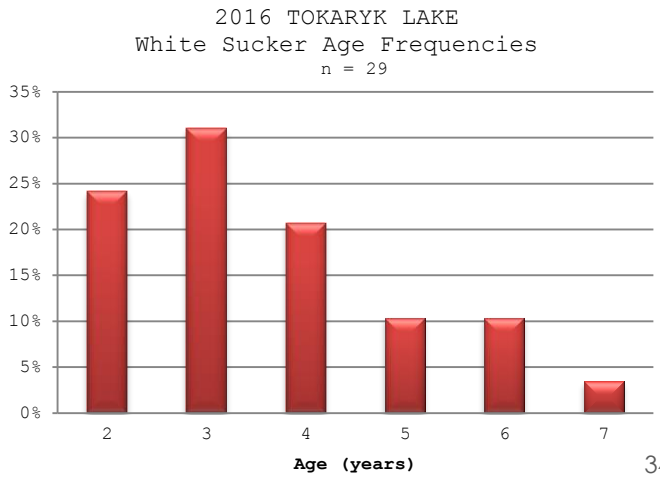
9.0 Tokaryk Lake

White Sucker: When looking at white suckers, the species made up of 23% the total species composition. Through full efforts a total of 1,210 individuals were removed and repurposed. It was determined that both electrofishing and trap-netting were effective methods of white-sucker capture, however CPUE of trap netting was higher and traps located in the south-east bay of the waterbody produced the most individuals (n=530). When referencing electrofishing, the east and north shores resulted in the highest CPUEs. In terms of length frequencies, (random subsample n=30) suggests the majority of the sample (>55%) were smaller; between 200-250mm. This length frequency correlated with 2+ and 3+ age classes and suggests that the lake provides suckers with ideal spawning habitat to successfully recruit. From the sample the oldest individual was 501mm and was age 7+. From this age analysis not too much can be concluded besides the idea that the species may have been in the system prior to aeration, or accessed the lake afterwards via tributaries. As for the potential sources of invasion there are three possibilities (1) illegal introductions (however, unlikely), (2) invasion from other waterbodies during high water periods (i.e. the inflowing tributary from Swystun Lake), or (3) suckers have historically existed in the waterbody, however at low populations limited by partial winterkills prior to aeration. Interestingly, in the 2005 a master angler sucker was registered on the Master Angler Awards in Tokaryk Lake but has not been verified at this time.



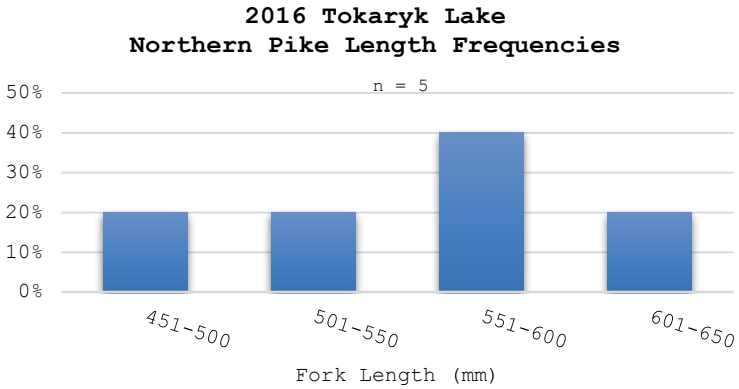


	2	3	4	5	6	7
MAX	230	254	435	430	435	501
MIN	212	210	235	370	415	501
MEAN	219.0	227.9	350.3	401.3	425.0	501.0



9.0 Tokaryk Lake

Northern Pike: With regards to northern pike, the species equated to a total of 0.1% (n=5) of total species composition. Trap-netting was the most effective method in capturing northern pike when compared to electrofishing. Also, no specific location showed higher CPUEs of pike; arguably if efforts were conducted earlier in the spring it may have shown different results. The five pike captured were repurposed. Pike length frequencies ranged from 518mm to 607mm. Because the pike were fully sampled we were able to determine that 4/5 were females, the other was an immature male. One pike contained yellow perch in it's stomach, while the other four had empty stomachs. Through age analysis it was determined that all five pike were aged at 3+ years, which is in the upper range of pike growth in this age class. At current the route of pike invasion is still highly unknown and could be two possible sources (1) introduced illegally or (2) reached the waterbody during high water periods. When referencing satellite imagery, it becomes apparent that Tokaryk Lake could be directly connected to Swystun Lake via the northern inflowing tributary during high water conditions. Interestingly, in the late 1980's four master angler northern pike were registered in Tokaryk Lake, which could indicate movement from connected waterbodies.



In summary, through age analysis SVSFE intended to pinpoint the time period of multiple non-salmonid invasions in Tokaryk Lake. Unfortunately, at this current time, lack the sufficient local information is known to accurately correlate these ages with any source of invasion. Interestingly, between all three non-salmonid species, high frequencies were apparent in 3 and 4 age classes. At this point, it is encouraged that lake mangers/locals reference this data in attempt to accurately pinpoint these routes of invasion. Understanding these sources will lead to timely proactive decisions that will limit further invasion in the future.

9.0 Tokaryk Lake

9.3 Discussion/Recommendations: As we know, pike are top predators, yellow perch are strong competitors, and white-sucker feeding habits can overlap that of trout (specifically rainbow trout). From data acquired it can be assumed that some level of adversity exists between non-salmonid presence on the trout stocking program. Furthermore, it is understood through conversations that these invasions are impacting current angling quality. For ease of the thought process, please refer to a draft document entitled "SVSFE's Management for Unwanted Perch into Stocked Trout Lakes". This document is designed to provide a step by step approach to dealing with non-salmonid (specifically yellow perch) invasions in stocked trout waters (Appendix). Note: this approach is very similar to East Goose Lake suggestion.

Step 1: Quantify the problem - It appears Tokaryk Lake exhibits a very strong rate of non-trout invasion. However, it is important to state that methodology used was targeting non-trout species, and therefore may not be representative of trout species present in the community. At this point in time, regardless of true scientific backing, it can be assumed that the issue in Tokaryk Lake is a serious one to the trout fishery.

Step 2: Stakeholder Meetings: It becomes important for stakeholders to go over the data and discuss the options. In terms of stocking rates and frequency, one should determine if current stocking practices are efficient; how do trout ages and length frequencies correlate with current status of trout in lake and what seems to be working and what does not; time of year and stocking size should be closely examined in this process. In terms of appropriate stocking densities, it has been noticed that every managerial jurisdiction across the board has a different approach; where some densities work, some don't, and in many cases the success rates from jurisdiction to jurisdiction contradict each other. For this reason, we suggest that stocking rate be further discussed amongst stakeholders. Efficient stocking rates are very lake specific, and more important when stocked lake's possess non-salmonid predatory and competitive fish presence.

In terms of stocking size, a strong argument is that larger fish are quicker and can easily escape predation, as well as compete better. As stated in previous literature, it was found that rainbows switched from a plankton diet to a piscivorous diet around 250 to 300mm in size (Crossman et, el 1959, Otte, 1975Beauchamp, 1990). This evidence is relevant because it is assume perch populations will always exist in Tokaryk (unless full reclamation is decided). In this case, stocking larger trout will improve chances of reaching length frequencies where they will switch to a piscivorous diet, compete less with perch for invertebrates and plankton, and potentially even feed on young yellow perch. In general, the larger the trout is at the time of stocking, the greater chance it will have to reach sizes that will attract anglers in waterbodies containing a competitive/predatory non-salmonid presence.

If shifting stocking practices (rates, stocking size, or species) becomes imperative, it is recommended to communicate decisions between stakeholders, provincial fisheries staff and Manitoba's fish stocking program. As we know, the province and local hatchery plan stocking years in advance, so if changing the stocking program becomes priority, it may take a few years to become implemented.

9.0 Tokaryk Lake

Step 3: Make a Decision - Based on current known management plans for Tokaryk Lake, it can assumed that both changing the management plan to a pike and perch fishery or the concept of full lake reclamation are not options at this point, especially considering the annual trout investment in the waterbody. Regardless, if these assumptions are correct, there are two potential options which could be attempted, or combined for effectiveness.

(1) Alter management plan – In this case, reference is to altering trout stocking practices and/or lake regulations. This could refer to altering stocking size, frequency, and rate of desired species or attempt stocking different trout species that may compete better with perch populations. Other provinces, such as Saskatchewan, found brook trout and rainbow trout do not compete well with perch, and have seen success after the establishment of perch are lakes stocked with brown trout, tiger trout or splake (Prestie, 2016). Also, SVSFE has little knowledge regarding harvest. Lake regulations suggest a put-and-take fishery with general trout limits and no tackle restrictions. As this point, if managers prefer to attract trophy trout anglers, regulations should be put in place to protect larger trout.

(2) Manual Rehabilitation - Evaluate the cost and benefits of initiating a manual non-salmonid fish-out programs. This is difficult to quantify, as manual removals can require significant effort, are expensive, and only temporary. Comparative to other removals, costs for travel, accommodations, and three technician wages removals equated to an average of $5,000 per week depending on distance travelled. When comparing catches at Tokaryk and Patterson for one week of work with this rate, it equates to a dollar per fish removed but does not include expenses associated with two provincial fisheries staff and use of the electrofishing boat. A study in Alberta determined removal costs to be quite expensive (upwards to million dollars) and little confidence regarding long term success (FMB, Alberta, 2008). This displays how unknown and variable manual removal programs can be. Nebraska researchers state mechanical fish removals are only recommended on small bodies of water in order to achieve management goals (Jolley et el, 2008). These efforts are extremely unlikely to remove all individuals and are only temporary because the juveniles that remain will display compensatory increases in recruitment, survival and growth.

In summary, mechanical removals, if initiated must require comprehensive long term planning in order to be effective and must incorporate a response plan to most effectively target unwanted species and have a budget associated with it.

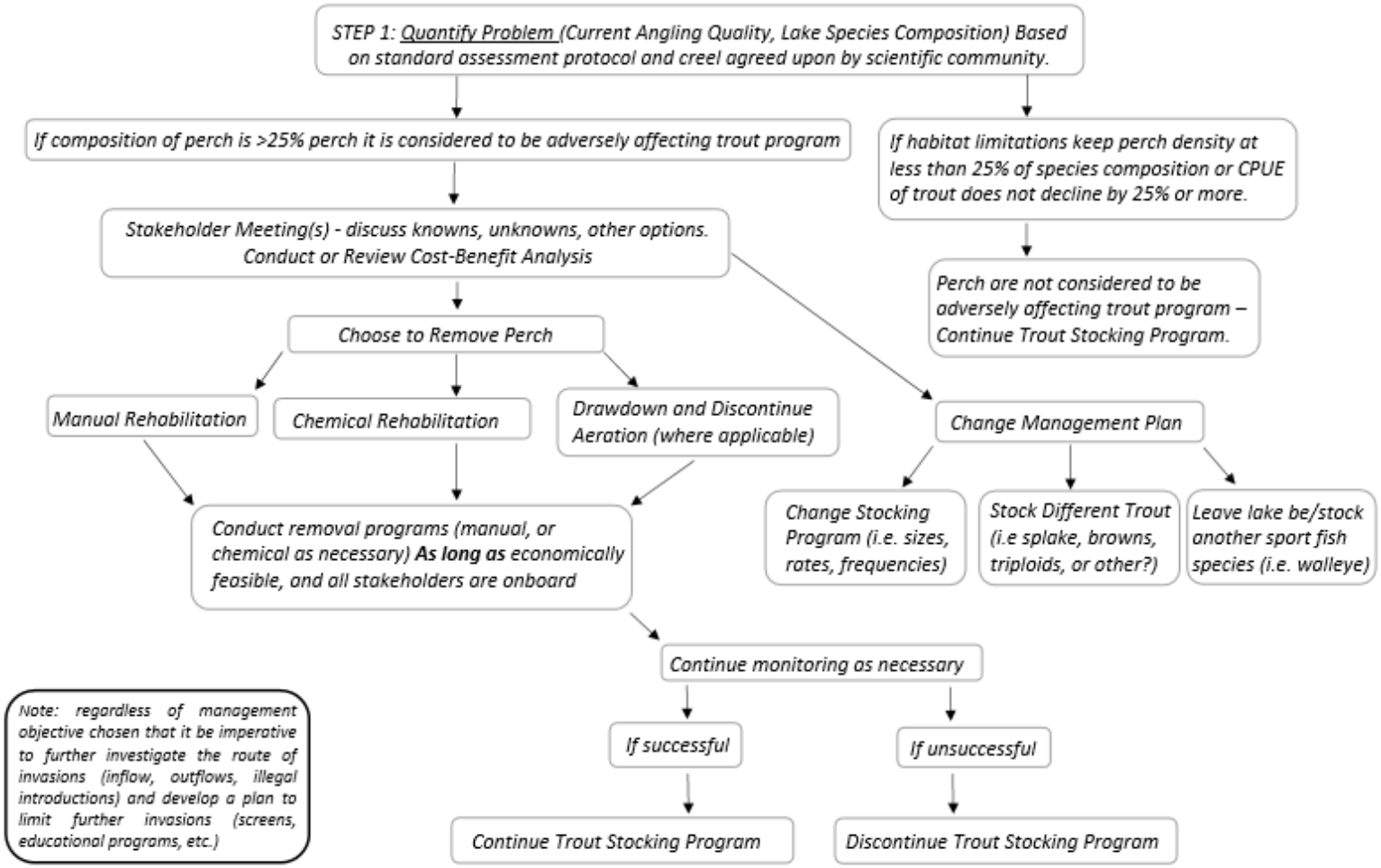
9.0 Tokaryk Lake

Because Tokaryk Lake is a fairly small sized lake (~82ha), it becomes likely that a comprehensive manual removal program could be successful if commitment is available. If this initiative is agreed upon, it is recommended to conduct a full netting effort with complimentary electrofishing be initiated in the spring either before or during the spawning periods of non-salmonids. In accordance to "Fisheries Management Branch Response to Unwanted Occurrences of Perch in Stocked-Trout Lakes in Alberta", states that fishing or removal efforts continue until non-salmonid (yellow perch in this example) continue until densities are less than 25% of total species composition, and therefore not considered to be affecting the trout stocking program. At this point, it is highly unknown how long and how expensive it will be to achieve this management goal, regardless a good two weeks – a month of removal should be considered and hopefully reduce CPUE of non-salmonids significantly. At this point, removing as many non-salmonids (especially northern pike) would significantly increase trout stocking success in Tokaryk Lake. If manual rehabilitation becomes priority; below are considerations;

(1) Develop a program to efficiently conduct manual removal of non-salmonid species using the most effective methods possible (i.e. electrofishing, trap-netting, gill-netting, angling, etc.)
(2) Develop removal goals, budgets or both. Perhaps until non-salmonid species consist of <25% of total species composition, or perch, pike and sucker CPUE drops by more that 75%, or set a number of weeks, or a dollar value.
(3) Develop a long term maintenance plan - How often do these programs need to be initiated in order to achieve trout stocking success, and retain species composition goals.
(4) Acquire necessary gear and train volunteers or seasonal workers to conduct removal programs on desired frequencies
(5) Keep an eye on non-salmonids – through replication of 2016 electrofishing efforts in order to identify trend-over-time
(6) Consider different trout species or stocking rates/stocking sizes that will compete better with perch populations
(7) Discuss current lake regulations – and determine if protecting larger trout is priority, or if lake should remain as a put-and-take
(8) Further investigate the connectivity between Tokaryk to Sywstum Lake, therefore evaluating the risk further non-salmonid invasions.
(9) investigate/develop local educational programs or signage focusing on the serious ecological and economical implications of planting fish illegally

10.0 Appendix

SVSFE Management Options for Unwanted Perch into Stocked Trout Lakes

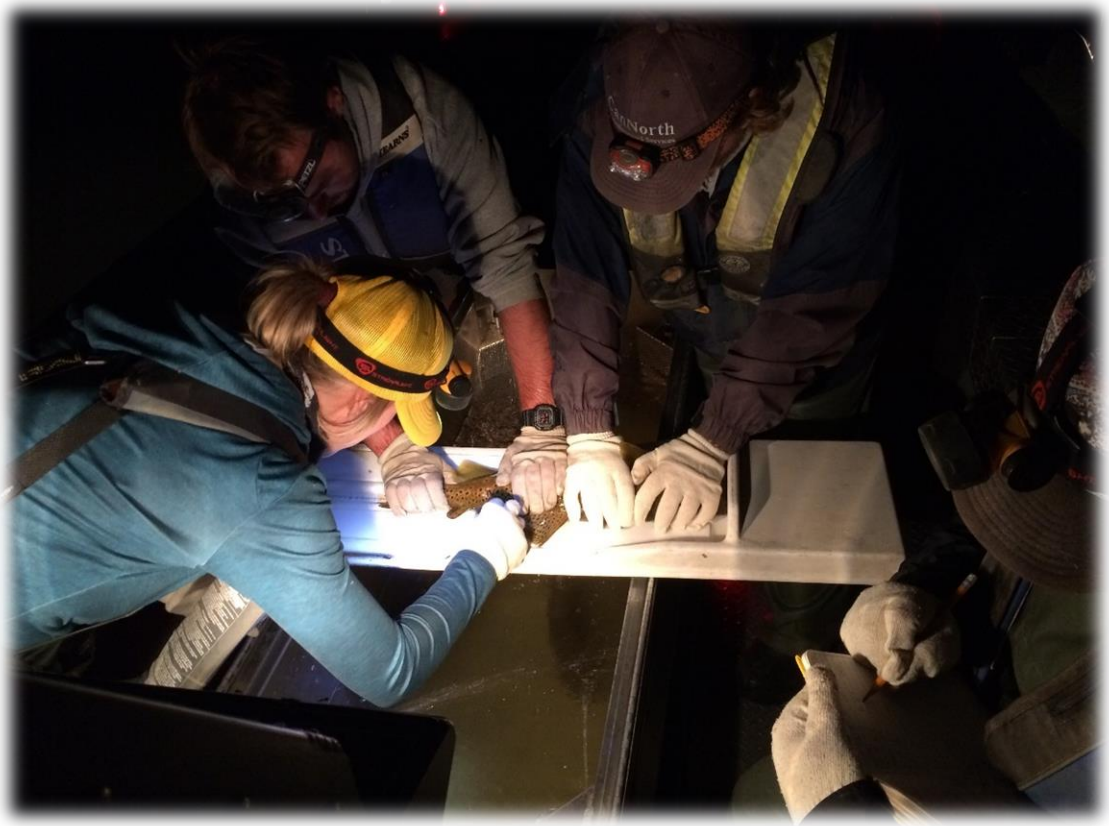


Literature Cited: Fisheries Management Branch Response to Unwanted Occurrences of Perch in Stocked-Trout Lakes in Alberta, 2008

Acknowledgements

SVSFE is excited to report the work and results from 2016, but our team does not do this alone. We rely on partnerships and support through several entities. First and foremost, recognition of the Fisheries and Wildlife Enhancement Fund (FWEF) is imperative. The fund supported FLIPPR and granted dollars to facilitate not only this particular project, but various other essential projects in the Parkland Area over the years. The stamp is a constant reminder that a portion of angling licenses goes towards creating, protecting, and enhancing fisheries for future generations. The work completed under the "FLIPPR Lakes – Trout Assessments & Lake Management" Project would not be possible without the initiatives of the fund.

We would also like to thank our directors for their understanding and lead on creating partnerships to enhance and sustain local fisheries. Without our group's conviction and support to break boundaries, this type of neighboring support would not be achievable. A huge thank you to Fisheries Branch Staff, for your endless support and guidance. And also, a huge thank you to the FLIPPR members, project partners, and volunteers (you know who you are). Goals are only achievable by working with individuals who are passionate about fishing and who have the drive to do meaningful work. These partnerships are truly the key to success. We, as SVSFE technicians are extremely grateful for the encouragement received from the organization and look forward to building this partnership in the years to come.



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