Evaluating The Success of Walleye Recruitment

FEF Project 12 – 042

Swan Valley Sport Fishing Enhancement Inc.

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Acknowledgements

First of all, we would like to acknowledge the Manitoba Fisheries Enhancement Fund (FEF) for contributing funds to facilitate this important work; not only for this particular project, but for the various other projects that SVSFE has conducted over the years. The stamp is always a reminder a portion of angling license fees goes towards protecting fisheries for future generations.

Secondly, we would like to thank our directors, for their infinite determination and drive to enhance and sustain our local fisheries. Without the group's conviction and support, these projects would not have been possible. A huge thanks to our mentor and Regional Fisheries Biologist, Ian Kitch, for your endless support, knowledge and confidence in us. Special thanks to Fisheries Branch personnel; Ken Kansas, Lloyd Rowe and Jonathan Stephens for helping out with these projects along with your endless direction and support. An extra "gracias" to Kansas, as you were our leader and captain through this project. Without your dedication and willing to go the extra mile (literally) this project wouldn't be complete. Your firm guidance and training will never been forgotten.....and we always remember to never look at the captain with a headlamp on again.

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And last but not least, our local and non-resident anglers who have shared copious amounts of knowledge with us over the years. We hope to return the favour. Thanks.

Summary

SVSFE strongly supports walleye management with the objective of creating self-sustaining fisheries. When a fishery becomes a sustainable entity, stocking efforts can be concentrated elsewhere and stock can be reallocated to lakes which require stocking. Each spring walleye fry is limited for each Manitoban region, meaning proper allocation of these fry is of top priority. In order to understand which lakes require supplemental stocking and which do not, it becomes important to understand natural recruitment success. In order to determine walleye recruitment success on five targeted lakes, SVSFE used two different methods; evaluating success based on young of the year (0+) catches through seining and Oxytetracycline (OTC) markings from catches through electro-fishing. Recruitment assessments were evaluated during 2013 for; Beaver Lake, Marge Lake, and Line Lake, located in the Duck Mountains and Bell and North Steeprock Lake located in the Porcupine Mountains.

Success based on seining results was evaluated for all 5 lakes. Three of these lakes (Beaver Lake, Marge Lake, and Line Lake) were historically important walleye fisheries, but because of limited success, lake management had converted these lakes to different fisheries for various reasons. Recently, it was decided to re-establish these walleye populations by stocking adult fish and monitoring the success. Adult walleye were first stocked into Marge and Line Lake in 2010, and into Beaver Lake in 2011, with hopes of establishing self-sustaining walleye populations.

In 2013, each of these lakes were seined along various shoreline habitats believed to be utilized by young-of-the-year walleye. Because the three lakes were not stocked with walleye fry, any 0+ walleye captured via seining would be considered naturally reproduced fish. In Beaver and Marge Lake, evidence of natural recruitment was determined, with each lake yielding one young-of-the-year walleye each. On the contrary, Line Lake yielded no positive results, as no young-of-the-year were captured. SVSFE has recently acquired funding to repeat this study in both Beaver and Marge Lake in the summer of 2014. SVSFE is eager to determine more significant results.

Bell Lake and North Steeprock Lake seining results produced diverse findings between the two fisheries. Efforts in seining shorelines at Bell Lake proved to be difficult due to high water levels. No walleye were captured during seining though one should not draw to many conclusions from results. On the contrary, North Steeprock Lake results indicated recruitment success as walleye were found in several locations throughout the lake.

North Steeprock and Bell Lake were also in part of the Multi-Year OTC Study (FEF Project 10-004) conducted by Fisheries Branch – Eastern Region. The study was in addition to seining efforts in order to compare stocked walleye recruitment success versus the recruitment of naturally reproduced walleye in these two waterbodies. OTC is a chemical compound used to mark walleye fry before they leave their respectable hatcheries and are stocked into allocated waterbodies. Using an electo-shocking boat as the capture method, a sample size of 142 and 52 walleye were collected from North Steeprock Lake and Bell Lake respectively. Otoliths were extracted from each of these fish and sent away for OTC and aging analysis. SVSFE is eagerly awaiting results, as with this relevant information, lake managers will be able to determine the success of stocking and natural recruitment for the 2013 season. This study will be replicated in the fall of 2014 to expand results and further develop stocking/management plans for both Bell and North Steeprock Lake.

Each step taken in understanding each of these individual lakes provides scientifically based decisions and moves each fishery forward in enhancement and sustainability.

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2.0 Study Rationale

SVSFE strongly supports walleye management with the objective of creating self-sustaining fisheries. When a fishery becomes a sustainable entity, stocking efforts can be concentrated elsewhere in lakes that require it. Each spring walleye fry is limited for each Manitoban region, meaning proper allocation of these fry is of top priority. In order to understand which lakes require supplemental stocking and which do not, it becomes important to understand natural recruitment success.

In the summer of 2013 SVSFE technicians conducted a study regarding natural recruitment success of walleye in five local fisheries. These lakes included Beaver Lake, Marge Lake, and Line Lake in the Duck Mountains, along with North Steeprock Lake and Bell Lake in the Porcupine Hills. Using various methods, this study had three objectives:

1. To assess the success of spawning in lakes recently re-introduced with adult walleye. These lakes include Beaver Lake, Marge Lake, and Line Lake. These lakes have all been stocked with adult walleye in previous years in correlation Beautiful Lake Adult Walleye Transfer. Determining recruitment success of walleye sets precedence in lake management plans, as it would suggest if these fish are successfully reproducing within their new habitat. Secondly, to determine the success of naturally reproduced walleye compared to success of stocked walleye survival at both Bell and North Steeprock Lakes. It is beneficial to further understand if these waterbodies require supplemental stocking.

2. To assess the preferred young of the year habitat in each of these lakes. Also and equally important, relative abundance and composition of forage species can also be determined while assessing these habitats through the same methods.

3. To identify the presence of suitable walleye spawning habitat in each of these lakes and to observe and document these areas. Results will indicate whether rehabilitation or enhancement of these areas are necessary.

With this relevant information, corresponding with relevant ongoing studies, technicians and lake managers can determine proactive management techniques, including potential mitigation, changes in regulation, and habitat enhancement if required.

3.0 Background Information

Each lake has unique histories and therefore each requires special attention. Relevant managerial history and assessments pertaining to each lake are as follows:

3.1 Beaver Lake

Historically, Beaver Lake had been solely a northern pike fishery. In September of 1975, assessments were conducted and species composition consisted of northern pike, yellow perch, johnny darter, emerald shiner, spottail shiner, brook stickleback, and creek chub. In 1982, a decision was made to stock 200,000 walleye fry. By 1987, because of limited walleye success, the Beaver Lake Reclamations Project was initiated (Figure 1). Chemical reclamation removed all rough fish and in 1988, 16,000 brook & rainbow trout were introduced. Throughout the 1990s, fingerling-plus size rainbow trout continued to be stocked and in the 2000s splake were introduced. From 2000-2010 fingerling-plus size and adult rainbow trout and splake were stocked.

Following the 2010 & 2011 Stocked Trout Assessments (FEF Projects 10-011, 10-030 & 10-039) conducted by SVSFE, review of results with stocking committee and fisheries management initiated the decision to reintroduce walleye. In correspondence to the Beautiful Lake Walleye Transfer (FEF Project 10-039), 548 adult walleye were stocked into Beaver Lake in September 2011 with the intention of establishing a self-sustaining walleye fishery. In 2012, during SVSFE's Integrated Fisheries Assessment #2 (Mission Walleye) (Prj. 11-035), technicians assessed Beaver Lake with the objectives to; assess the walleye survival and to determine if walleye were successfully reproducing in their new location. Results indicated a good survival rate with high recapture numbers but no evidence of natural recruitment resulting in need for further assessments (Urban & Badger, 2013). In 2012 & 2013, 90 and 882 adult walleye respectively, were stocked in Beaver Lake during the Beautiful Lake Walleye Transfers (FEF projects 11-035 & 12-041). A total of 1,520 adult walleye have been stocked into Beaver Lake since 2011 (see appendix Table 3). Through angler reports and tagged fish submissions, Beaver Lake has appeared to become a very popular walleye fishery over the past few years.

Figure 1: Beaver Lake Reclamation Project Signage (left), Walleye Recaptures during IFA#2 (right)

3.0 Background Information

3.2 Marge Lake

Historically, Marge Lake has been a northern pike fishery. In the early 1970s splake were introduced into Marge Lake followed by walleye fry introduced in the mid 1970's. Test netting was done in 1978 to determine if splake and walleye stocking were a success, no splake or walleye were caught. No work on Marge Lake was conducted for some time until 1992; Fisheries Branch evaluated the lake to see if smallmouth bass stocking was a viable option. Results determined that the lake would without a doubt sustain a bass population, however downstream migration into the Shell River system would be a serious concern (Kansas, 1992). Bass stocking was rejected by the stocking committee, due to connectivity and potential invasion into the Shell River system. No stocking occurred until 1998 when 200,000 walleye fry were re-introduced. Assessments in 2000 indicated no walleye with a species composition of northern pike, white sucker, and yellow perch. This was followed by 400,000 walleye fry stocked in 2000. In the late 2000's further consideration of making Marge Lake a walleye fishery were explored. Morphology, habitat, dissolved oxygen results, good forage base, few predators all indicated this was a walleye lake (Rowe, 2013). Due to unsuccessful stocking in the past, in correspondence to the Beautiful Lake Walleye Transfer, 399 adult walleye were stocked into Marge Lake in October 2010 with the intention of establishing a self-sustaining walleye fishery. To ensure that the walleye had the opportunity to reproduce, a zero limit for walleye was implemented in 2010 for Marge Lake. In 2011, 585 adult walleye were stocked into Marge Lake corresponding with the Beautiful Lake Walleye Transfer (FEF project 10-039). In 2012, during SVSFEs Integrated Fisheries Assessment #2 (Mission Walleye)(FEF Project 11-035), technicians assessed Marge Lake with the objectives to; assess the walleye survival and to determine if walleye were successfully reproducing in their new location. Results indicated a good survival rate with high recapture numbers but again no evidence of natural recruitment resulting in need for further assessments (Figure 2). In the fall of 2012, an additional 125 walleye were stocked into Marge Lake via the Beautiful Lake Transfer (FEF project 11-035). A total of 1,109 adult walleye have been stocked into Marge Lake since 2010.

Figure 2: Recaptured Beautiful Lake Walleye (2012 Marge Lake Trap-Netting)

3.0 Background Information

3.3 Line Lake

Historically, Line Lake has been a northern pike and yellow perch fishery. Walleye fry were first stocked into Line Lake in 1974, and muskellunge fry were first introduced in 1980; both these species were stocked intermittently thereafter. It is interesting to state between the 1970s to early 1990s resident anglers have suggested that no northern pike existed in Line Lake over this duration; suggesting the walleye and musky were dominate enough to impact the pike population. During this time, muskellunge fishing in Line Lake provided one of the best opportunities available to fish trophy sized musky in Manitoba, and had gained provincial recognition in this regard (Wright, 1994). With response to this, along high quality walleye fishing in Line Lake, SVSFE decided to take action. Line Lake is a small shallow waterbody with poorly defined and irregular inflows, and as a result winterkill has always been a source of concern in managing the fishery. The lake was tested annually, and although angling success had not been a problem, oxygen levels in the "high risk" range have been recorded (Wright, 1994). In order to alleviate this concern, SVSFE acquired approval to construct a rock weir in the main outflow of Line Lake. The purpose of the weir was to maintain Line Lake at a constant level, thus keeping dissolved oxygen at tolerable levels. In the early 1990s, the construction of the weir was granted, but only an existing beaver dam was enhanced using sandbags. Even today there is concern of the dam blowing and compromising lake levels. The last muskellunge stocking occurring in 1997. In 2006, index netting occurred in Line Lake to assess walleye stocks. At this time it was believed Line Lake no longer had a resident musky population. Netting had concluded that partial winterkills over the past 5 years returned the lake to exclusively a northern pike fishery, however anglers have suggested to still be catching walleye in 2006.

Since walleye had historically done well in the past, in correspondence to the Beautiful Lake Walleye Transfer, 539 adult walleye were backpacked into Line Lake in October 2010 with the intention of re-establishing a walleye fishery (Figure 3). To ensure that the walleye had the opportunity to reproduce, a zero limit for walleye was implemented in 2010 for Line Lake. In 2011 and 2012, 54 and 89 adult walleye were stocked into Line Lake respectively, corresponding with the Beautiful Lake Walleye Transfer (FEF Project 10-039 & 11-035). In 2012/13, during SVSFEs Integrated Fisheries Assessment #2 (FEF Project 11-035), technicians assessed Line Lake with the objectives to; assess the walleye survival and to determine if walleye were successfully reproducing in their new location. Efforts produced no walleye, however anglers have suggested to catch the odd one. A total of 682 adult walleye have been stocked into Line Lake since 2010.

Figure 3: Beautiful Lake Walleye Transfer into Line Lake

3.0 Background Information

3.4 Bell Lake

Bell Lake has been intermittently stocked with walleye since 1959 (Table 1). Over the years, multiple studies have been conducted on Bell Lake, but the extent of natural reproduction remains unknown. A Bell Lake survey was conducted in 1992 suggested that Bell Lake is a "reasonably good walleye fishery that has been maintained mostly by natural recruitment" (Yakes, 1992). The study also suggested that "recruitment does not appear to be a problem", "observed numerous rocky shoals in the lake that appeared to be adequate for walleye spawning" (Yakes, 1992).

2012 & 2013 Trap Netting (FEF Projects 11-035 & 12-024) carried out by SVSFE technicians indicated "walleye populations are characterized to have a fair density (3.9 walleye/hectare) with frequencies of mature fish increasing" (Urban 2013). Pending age results will help further understand the walleye population dynamics. Seining results during this time found low densities and diversity of forage fish with no signs of walleye recruitment. It was also stated that water levels of the lake and later spawning periods of walleye may be influencing the success of spawning/recruitment.

Table 1: Bell Lake Stocking Records

Year	Number	Age
1959	500,000	Eyed Eggs
1976	500,000	Fry
1987	200,000	Fry
1990	300,000	Fry
1992	300,000	Fry
1994	300,000	Fry
1995	300,000	Fry
1996	300,000	Fry
1997	200,000	Fry
1997	16,036	Fingerlings
2000	200,000	Fry
2001	200,000	Fry
2002	200,000	Fry
2003	300,000	Fry
2004	300,000	Fry
2005	300,000	Fry
2006	300,000	Fry
2007	300,000	Fry
2008	300,000	Fry
2008	650	Fingerlings
2009	100,000	Fry
2010	100,000	Fry
2011	200,000	Fry
2012	300,000	Fry
2013	200,000	Fry
Total	**6,216,686**	

3.0 Background Information

3.5 North Steeprock Lake

North Steeprock Lake has been intermittently stocked with walleye since 1959 (Table 2). Over the years, multiple studies have been conducted on North Steeprock Lake, but the extent of natural reproduction is unknown. A survey was conducted in 1992 that suggested recruitment of walleye as a problem which may be due to; poor spawning habitat and/poor fry survival after spawning (Yake, 1992). A telemetry study was conducted in 1998 to identify potential walleye spawning habitat. It was determined the majority of fish (5/8) visited the inflowing river inlet during critical periods suggesting spawning may be occurring here. In 2009, SVSFE technicians observed a 100% visual on walleye spawning in this inlet significantly upstream (Urban 2009). Further studies, including walleye tagging in 2009 and trap netting in 2012 & 2013, found walleye populations were fair to moderate (3.7 walleye/hectare) with large walleye being the average sized fish. "Lower numbers of smaller walleye could indicate recent challenges with recruitment success " (Urban ,2013). It was apparent through seining results, forage was highly available with high densities of spottail shiners. These studies have concluded recent walleye recruitment was occurring as YOY walleye were found in seine catches during both years of the trap netting program.

Table 2: North Steeprock Lake Stocking Records

Year	Species	Number	Age
1959	Walleye	500,000	Eyed Eggs
1986	Splake	50,000	Fingerlings
1986	Lake Trout	30,000	Fingerlings
1990	Walleye	500,000	Fry
1994	Walleye	12,000	Fingerlings
1995	Walleye	200,000	Fry
1995	Walleye	24,166	Fingerlings
1996	Walleye	62,967	Fingerlings
1997	Walleye	24,844	Fingerlings
1999	Walleye	150,000	Fry
2002	Walleye	400,000	Fry
2003	Walleye	300,000	Fry
2004	Walleye	200,000	Fry
2013	Walleye	400,000	Fry
•Total Walleye Fingerlings		**123,977**	
•Total Walleye Fry & Eggs		**2,650,000**	

4.0 Methods

4.1 Study Area

The study area included a total of 5 lakes; Beaver Lake, Marge Lake, and Line Lake located in the Duck Mountain Provincial Park. The remaining lakes, Bell Lake and North Steeprock Lake are located in the Porcupine Provincial Forest. From the Town of Swan River; Beaver Lake is located 59.7 kilometers southeast, Marge Lake is 79 kilometers southeast, Line Lake is located 55.5 kilometers, Bell Lake is 60.4 kilometers north and North Steeprock Lake 71.6 kilometers north (Figure 4).

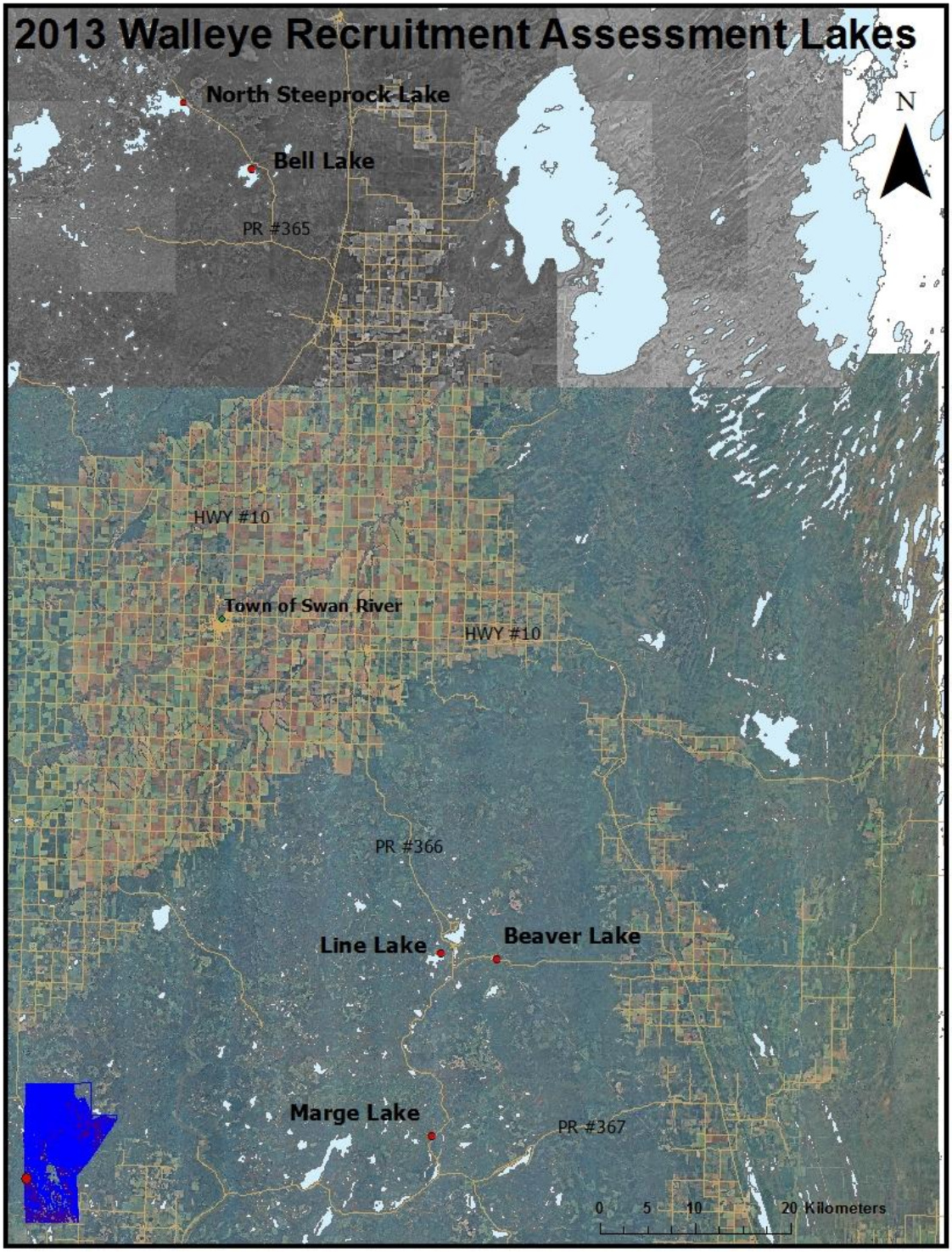

Figure 4: Walleye Recruitment Study Area

4.0 Methods

4.2 Study Period

This study occurred over the summer and fall of 2013. Lake specific study periods are summarized as follows:

Beaver Lake

Seining on Beaver Lake began on August 12th, 2013 with the first day-seine along with scouting for viable sample areas. Seining continued the following night on August 13th and 14th when six areas of the lake were sampled from 10:30pm until 2:00am. The last samples occurred in the morning of August 29th, 2013 when the east shore (the most productive site) of Beaver Lake was sampled to compare to previously acquired night-seine data.

Marge Lake

Seining on Marge Lake occurred over two-specific dates. A total of six areas were sampled on August 12th 2013 between the times of 9:50am and 3:00pm. Night seining on Marge Lake occurred on the night of August 14th and 15th. A total of five seines occurred on August 14th and 15th between 10:30pm and 2:00am.

Line Lake

Seining on Line Lake first occurred on August 26th, 2013 with the first seine. Because Line Lake's access if far from optimal, SVSFE hauled gear into the lake on August 26th which was followed by scouting the lake for viable sampling areas. One seine occurred at the end of the day on August 26th at the boat launch. Day seining on Line Lake occurred on August 27th, 2013 with eight areas sampled. Night seining occurred on the dates of August 28th, and 29th between 10:00pm and 2:00am.

Bell Lake

Seining on Bell Lake was done not only to assess young-of-year survival rates, but also to determine viable sites for electro-shocking. Lake levels on Bell Lake during the summer of 2013 were much higher than average. For this reason, seining proved to be very difficult. Regardless, SVSFE technicians were able to sample four different locations on August 8th, 2013, with obstacles encountered at each location. For this reason, only one night seine occurred on Bell Lake during this study. The night seine occurred near the boat launch at 2:30am on August 8th following North Steeprock Lake night seining. Electro-fishing occurred on Bell Lake on the night of September 10th and 11th 2013. A total of ten areas were sampled during the night of September 10th and 11th, 2013 between 8:30pm and 2:00am.

North Steeprock Lake

Seining on North Steeprock Lake was done not only to assess young-of-year survival rates, but also to determine viable sites for electro-shocking. Seining on North Steeprock Lake first occurred on August 6th, 2013 when fifteen areas were sampled during the day. Night seining occurred on August 7th and 8th 2013 between 11:00pm and 2:00pm, where three areas were sampled. Electro-fishing occurred on September 9th and 10th 2013, when fourteen areas were sampled between 3:00pm and 2:00am.

4.0 Methods

4.3 Data Gathering

Two different methodologies were utilized to understand recruitment success over the course of this study. Methods are summarized as follows:

Seining

The nylon beach seines used in this study were a total of 28ft long and made with 1/4 inch mesh. A 4ft wide and 6ft deep pocket (bag) was incorporated in the bunt (middle) of the net which is designed to keep more fish and prevent fish from escaping (Figure 5). The seine net had an attached weight line on the bottom and a float line on the top to keep the net vertical in the water while entrapping fish. Areas sampled were essentially any viable areas, with as little debris as possible (i.e. Boulders, snags, woody debris) that could complicate movement and therefore sampling. Sandy, hard packed and clean areas were selected as often as possible representing walleye young-of-the-year habitat (Kerr, 1997). During the sampling period, seining took place during both high and low light conditions (day & night). Night seining was necessary since characteristic habitat of young-of-the-year walleye often include; sandy, hard-packed areas during the night (Stevens, 1990). Technicians in chest-waders, attached the weighted line around their ankle and with float line in hand, ran the seine parallel to shore. Technicians would designate one person to deep water(max 1.3 m) and one to shallow water(min 0.2 m), running the seine as fast as possible along the shoreline to alleviate the possibility of fish from out-swimming the net. Sample distances varied significantly from site to site, as "seinable substrate" isn't usually constant. Once the designated distance was reached, technicians would assemble at the shoreline by the "deep water sampler" circling towards the "shallow water sampler". Once both samplers were within close proximity to each other near the shoreline, they would pull the net in while keeping the weight line on the bottom of the lake to prevent fish escapement. The catch was then designated to sample tubs in a swift motion, disallowing smaller forage species to sneak through the 1/4 inch mesh. Once fish were in the sampling tubs, forage species and young-of-the year were counted. Young-of-the-year were often sampled first thus avoiding mortality and measured for fork length. Forage species were counted quickly, and released. Level of abundance was then measured in catch-per-unit effort (CPUE); in this case, catch per meter of shoreline sampled.

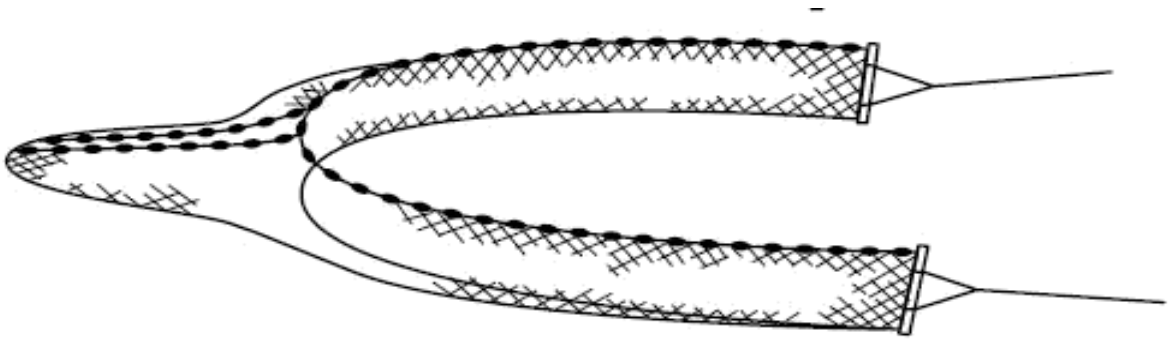

Figure 5: Beach Seine

4.0 Methods

4.3 Data Gathering

OTC Analysis & Electro-fishing

On May 30th, 2013 Bell Lake was stocked with 200,000 walleye fry and North Steeprock Lake stocked with 400,000 walleye fry supplied by the Whiteshell hatchery. Fry were released in various areas of each lake to ensure dispersal throughout the lakes. Since 2003, the Whiteshell and Swan Creek hatcheries (the two major walleye hatcheries in Manitoba) have been marking walleye using Oxytetracycline (OTC). OTC is a non-lethal, non-toxic internal dying agent that imprints a mark on boney structures of fish (i.e. Otoliths). Prior to stocking, recently hatched walleye fry are immersed in an OTC solution for 6-7 hours, dying their bony structures Efficacy trials (for the Whiteshell Hatchery) at this time have reached the 95+% mark (Kansas, 2013). .

Prior to electro-fishing, sample transects were predetermined and chosen based on a variety of substrates where young of the year were expected to be (cobble, boulder, gravel, sand/fine) but included various habitat compositions and fish cover. All sites were GPS'd and a route was created to simplify navigation during the night. This was a necessity for navigating especially on North Steeprock Lake due to its size and hazards (reefs).

Electro-fishing is a essentially a catchment method that has to ability to electrify the water and temporarily stun fish within the immediate area (Figure 6). More specifically this fishing method is also known as "Boom" shocking. It is called boom shocking because the specialized boat has two booms that are rigged off the front of the boat and suspended over the water. Hanging from these booms are multiple electrodes which are lowered accordingly until they are partially submerged in the water prior to "shocking". These are the positive electrodes (anodes); the negative electrodes (cathodes) are located alongside the boat and are also suspended in the water. Once current is initiated, DC current flows between electrodes while stunning fish in the immediate area. Working output is usually 4-10 amperes, but should be adjusted to water conductivity, size of fish targeting, and fish recovery time to avoid injury to the spine or gills (Schneider, 2000).

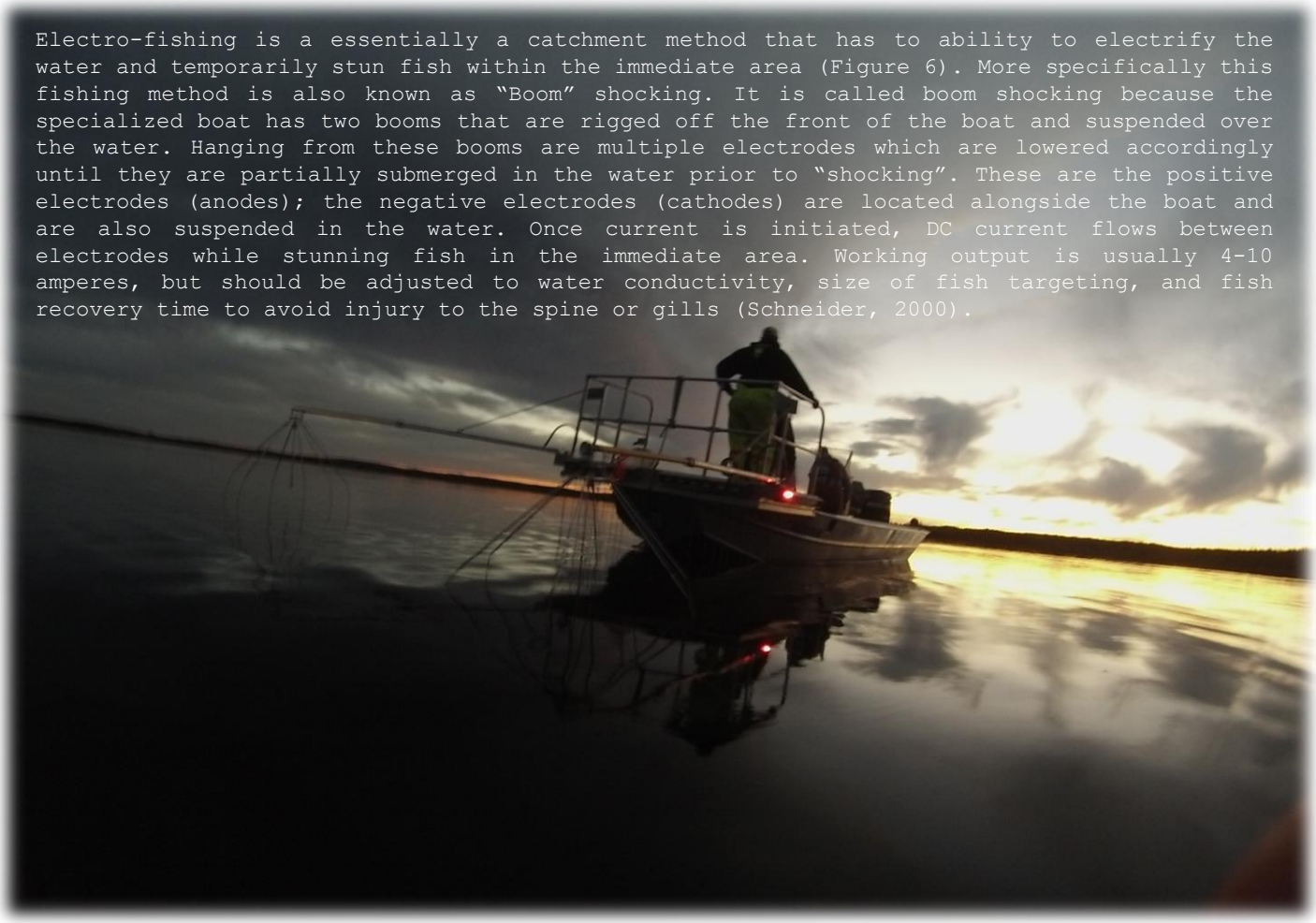

Figure 6: Fisheries Enhancement Fund Electro-Fishing Boat

4.0 Methods

Conductivity at North Steeprock during the time of sampling was 160$_u$s and all transects used 60 pulse/sec, 500 volts at 60 – 70% power. Amperes ranged from 6.8 – 8 during shocking. Conductivity at Bell Lake was found to be 140$_u$s and transects were shocked with 60 pulses/sec, 500 volts at 75% power. Amperes ranged from 7.0 – 7.5.

While fishing along transects, two dip netters were located on the fishing platform with one along the shore side of the boat. Netters would capture stunned walleye and place them in the live well located in the center of the boat (Figure 7). Following the completion of each transect all walleye were counted, recorded, bagged (labelled with transect number) and placed on ice for later sampling. Seconds and amp ranges were also recorded for each transect.

All walleye were later sampled for fork length(mm) and weight(to a tenth of a gram using a digital scale). Otoliths were placed in 1.5 ml micro-tubes to protect them from being damaged during shipping and the number of otoliths extracted were recorded. Otolith samples were sent with the Eastern Region Biologist, Ken Kansas as part of the Multi Year OTC Project (FEF Project 10-004), and further preparation and identification of OTC marks are to be conducted by a private agency - Dr. Daniel Isermann, assistant professor of fisheries and co-director of the Fisheries Analysis Center and the University of Wisconsin-Stevens Point. Dan has a long history in fisheries research, and has extensive experience in estimating the age of fish from calcified structures. His ability to detect OTC marks has been repeatedly verified through blind trials, and has done OTC work for more than a dozen state agencies and academic institutions (Kansas, 2013). OTC analysis from Dan and his assistants at The University of Wisconsin-Stevens Point are scheduled to arrive in March/April 2014.

Total recruitment of walleye during electro-fishing was assessed using catch-per-unit effort (CPUE), in this case, number of walleye caught per time (hours) electro-fishing.

Figure 7: Deck of the Electro-Fishing Boat

5.0 Results

5.1 Beaver Lake

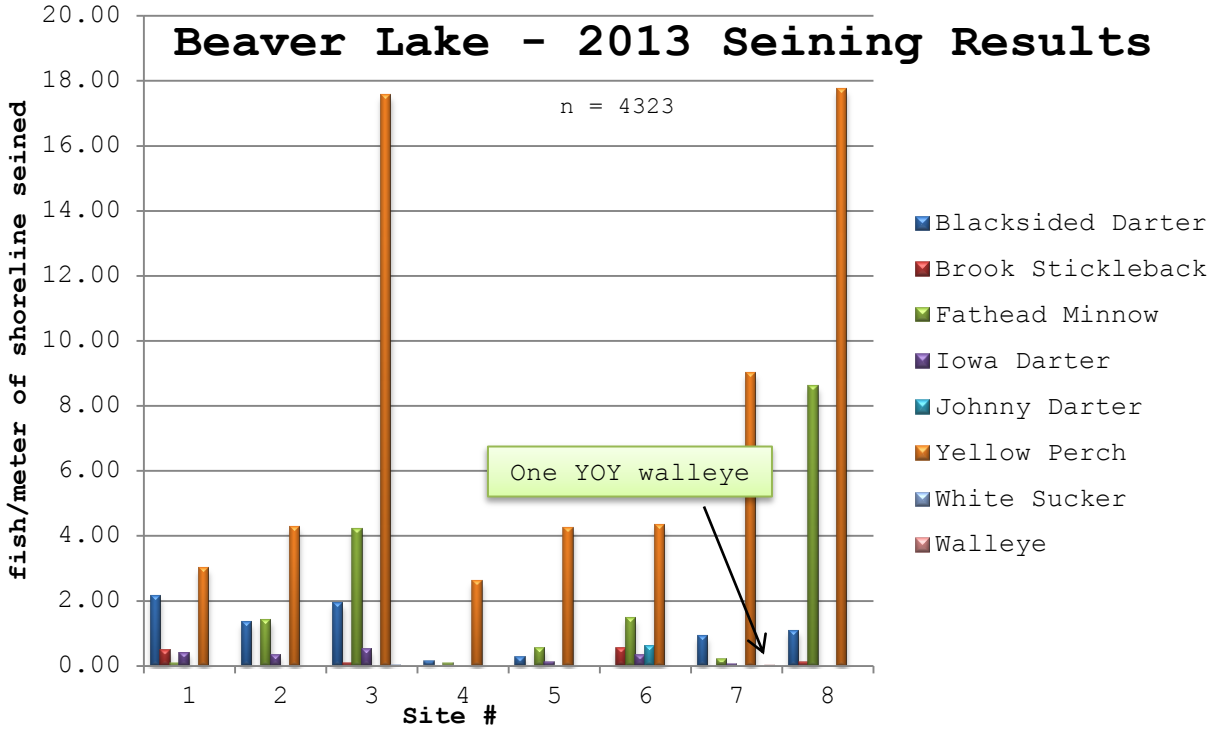

Figure 8: Beaver Lake – Seining Results - Species CPUE by site

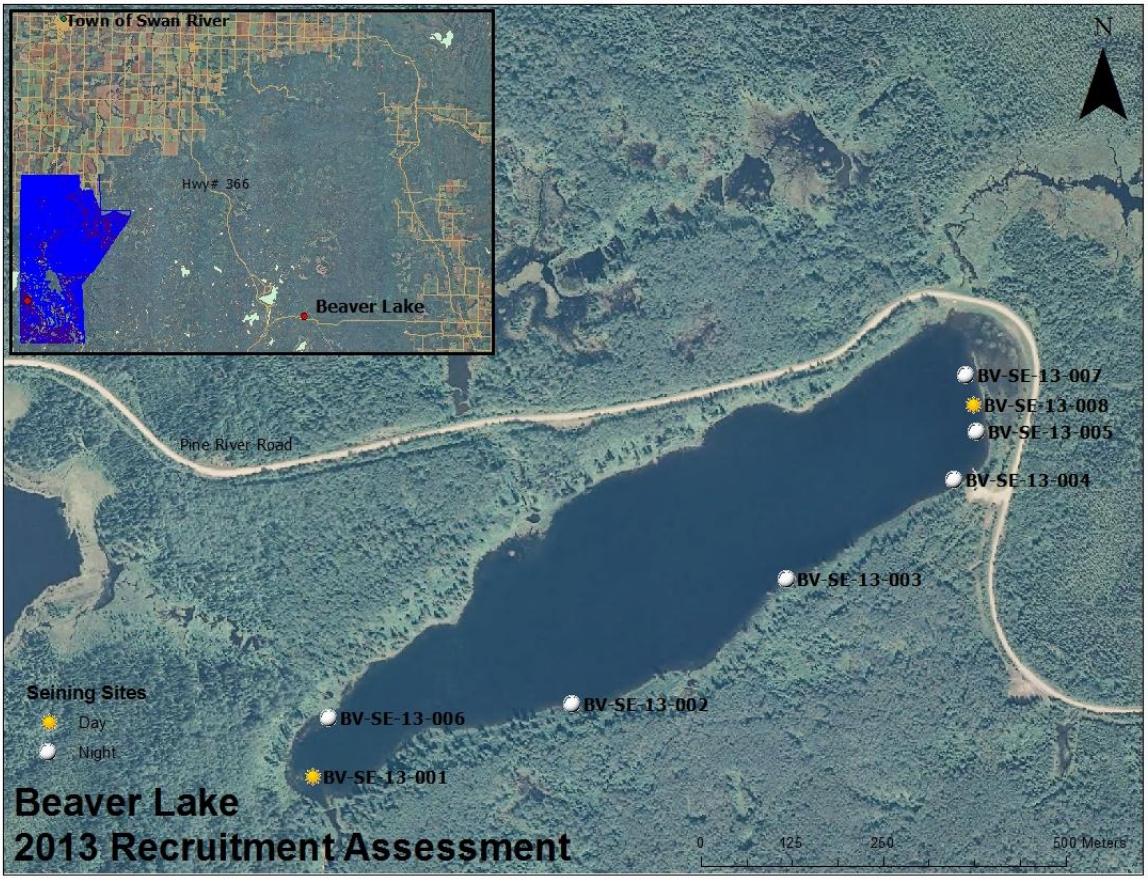

Figure 9: Beaver Lake Sample Sites

5.0 Results

5.1 Beaver Lake

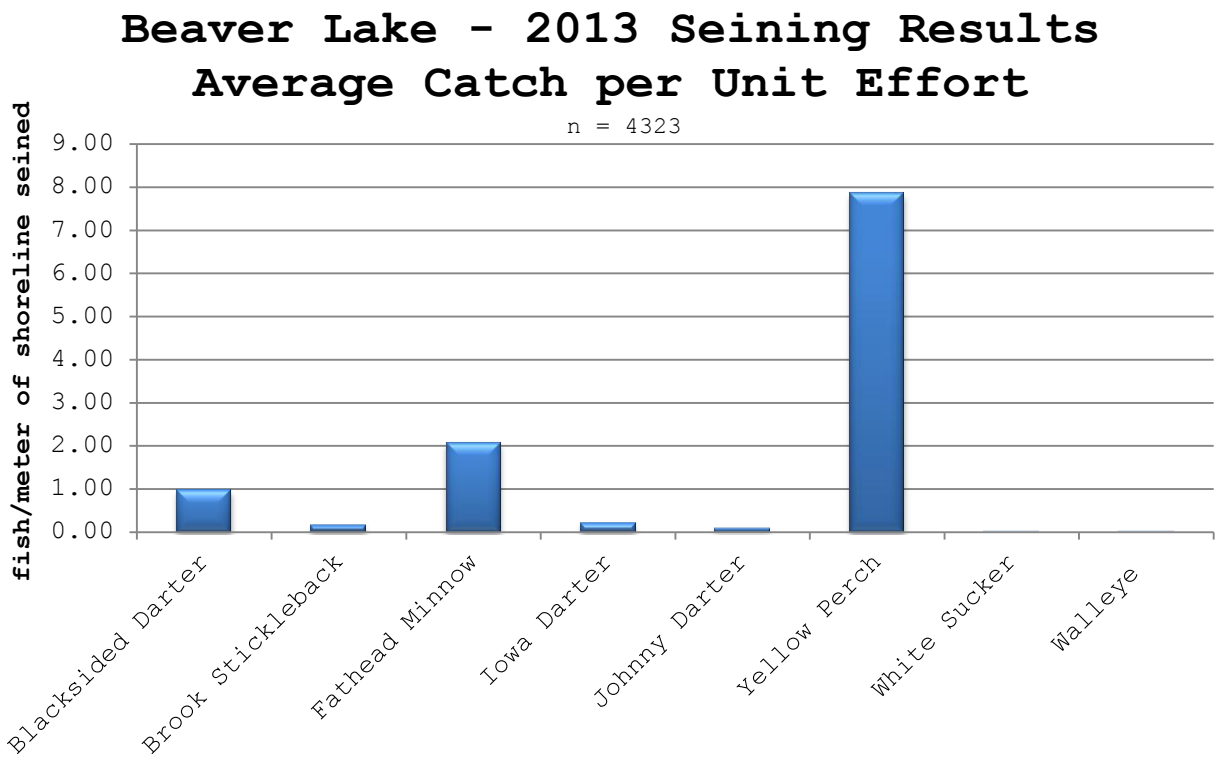

Figure 10: Beaver Lake Average CPUE by Species

Figure 11: Beaver Lake Young of Year Walleye 2013

5.0 Results

5.1 Beaver Lake

Summary:

A total of eight areas were seined within the study (2 day seines, and 6 night seines). Through these efforts, SVSFE is proud to announce that one young-of-the-year walleye (110mm) was captured; suggesting that natural recruitment is occurring in Beaver Lake. The walleye, which was caught during a night seine, was captured on the east (windswept) shoreline (Figure 12). On the east shoreline, the substrate is hard-packed sand, with interspersed cobble, gravel and boulders, and little available fish cover. Studies have attributed a strong association of young walleye with clean (i.e. sand) substrates to the relative ease in locating and capturing benthic prey such as chronomids (Venditti, 1994). It is important to state that the east shoreline habitat correlates with previous studies regarding juvenile walleye habitat. It has been hypothesised that spawning may be occurring at the east shore as well, as it appears to be the most suitable area of the lake at this time. Results determined that the average CPUE of all sites equated to 0.02 walleye per meter sampled. This measure may be considered unrepresentative, as many of the areas sampled had difficult terrain. It terms of forage, it has becomes apparent that forage availability and composition does not appear to be a problem in Beaver Lake. It is important to state yellow perch were the highest catch in all sites, an important adult walleye food source (Kerr, 2004). Also, correlation between species density, habitat type and day or night sampling in Beaver Lake can not be determined at this time. SVSFE is eager to begin constructing an artificial spawning shoal on the east shore of Beaver Lake in March 2014, in correspondence to federal monies acquired in late 2013. Once this shoal is constructed it will be interesting to see if natural recruitment success increases as a result of enhancing available spawning habitat. A follow up recruitment study has been approved and will transpire in the summer of 2014.

Figure 12: Beaver Lake Young of Year Walleye Locations - 2013

5.0 Results

5.2 Marge Lake

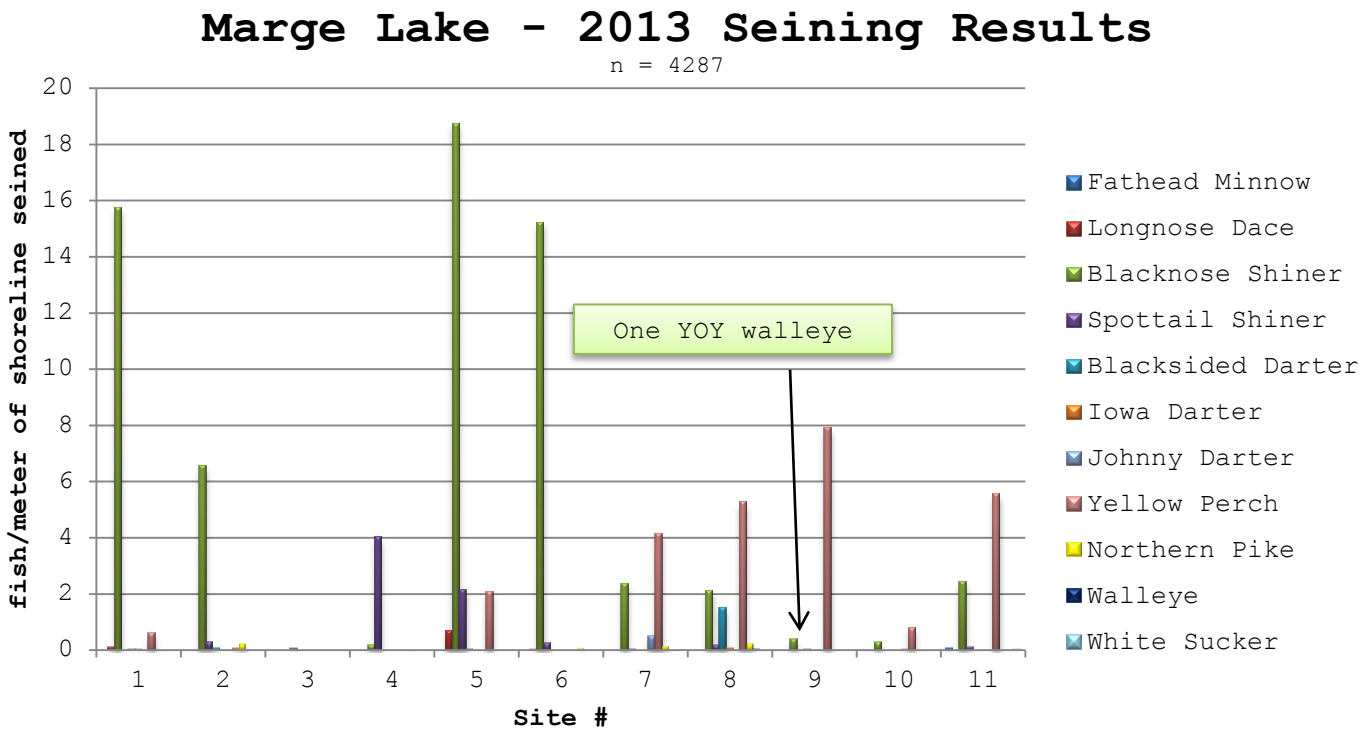

Figure 13: Marge Lake Seining Results Species CPUE by site

Figure 14: Technicians preparing to seine nearby shoreline

5.0 Results

5.2 Marge Lake

Figure 15: Marge Lake Sample Sites (2013)

5.0 Results

5.2 Marge Lake

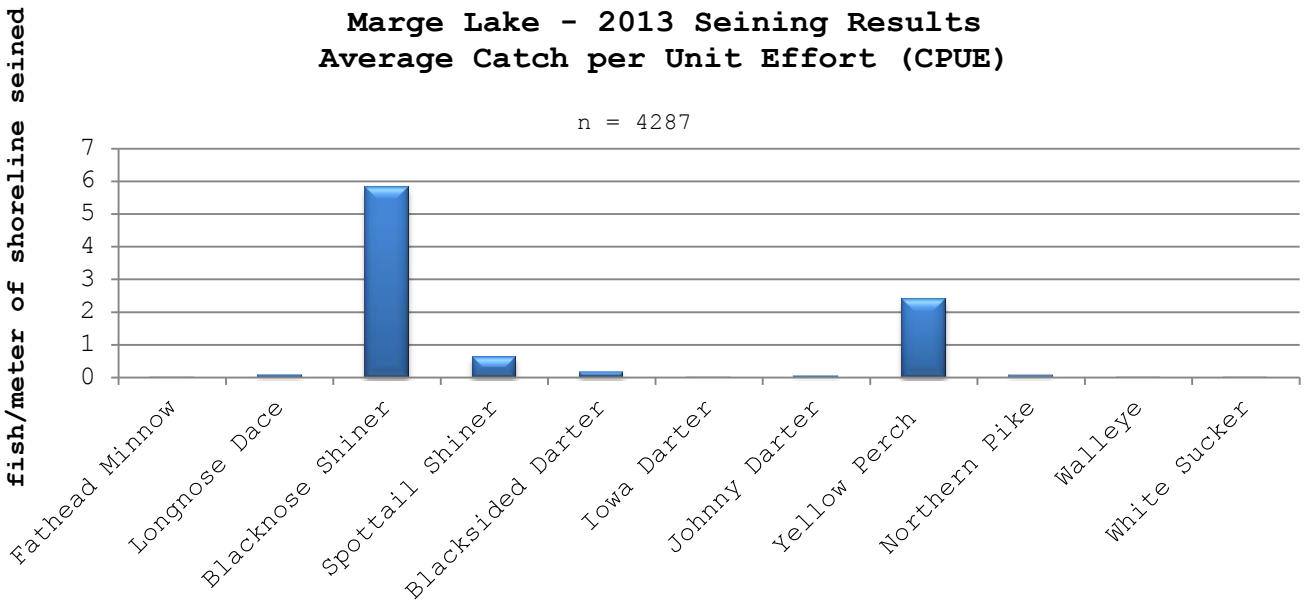

Figure 16: Marge Lake Average CPUE by Species

Figure 17: Marge Lake Young-of-Year Walleye

5.0 Results

5.2 Marge Lake

Summary:

A total of eleven areas were seined during the study (6 day seines, and 5 night seines)(Figure 15). SVSFE is proud to announce that one young-of-the-year walleye (102mm) was captured, suggesting that natural recruitment is occurring in Marge Lake. The walleye was captured on the south shore during a night seine, where substrate was a firm silt substrate with medium fish cover in the form of woody debris and macrophytes (Figure 18). Young-of-the-year walleye have been captured in a diversity of habitat types; muddy substrates, vegetated areas, sandy shoals, and gravel shorelines (Savoie, 1983). It is important to state that of total areas seined, the CPUE equated to 0.03 walleye per meter sampled. The fact that natural recruitment is occurring at Marge Lake is seriously progressive, especially when comparing to historical lake assessments. With regards to forage, it appears that forage availability and composition does not appear to be an issue in Marge Lake. A noteworthy point is crayfish (of all sizes) catches were exceptionally high at Marge Lake. A total of eighteen northern pike were caught in 6/11 sample sites; all in relative fish cover. Also, while seining, SVSFE technicians observed thousands of forage species in deeper "un-seinable" water. Blacknose shiners and yellow perch appeared to be the most prolific forage species; important food sources of adult walleye. A follow up recruitment study has been approved and will transpire in the summer of 2014. SVSFE is eager to determine follow-up recruitment success rates, and also determine if potential spawning habitat, (identified as Marge Creek) could be a viable area to enhance.

Figure 18: Marge Lake Young-of-Year Walleye Location

5.0 Results

5.3 Line Lake

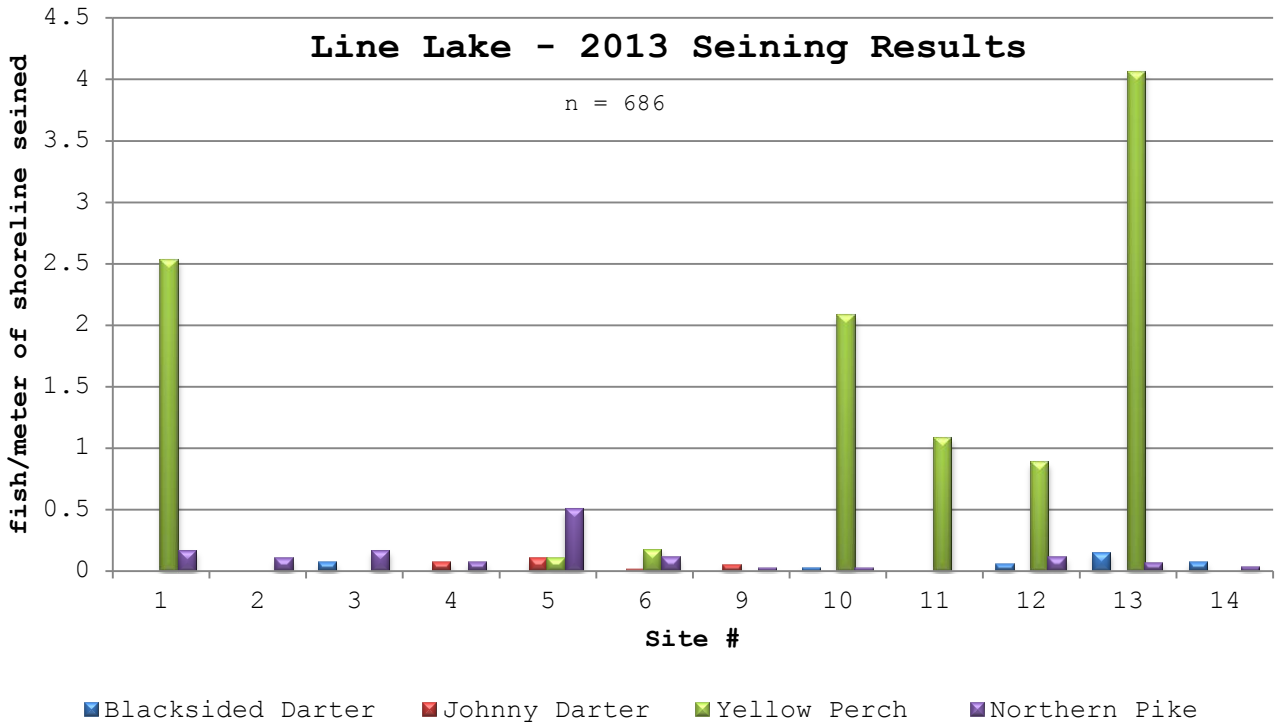

Figure 19: Line Lake Species CPUE per site

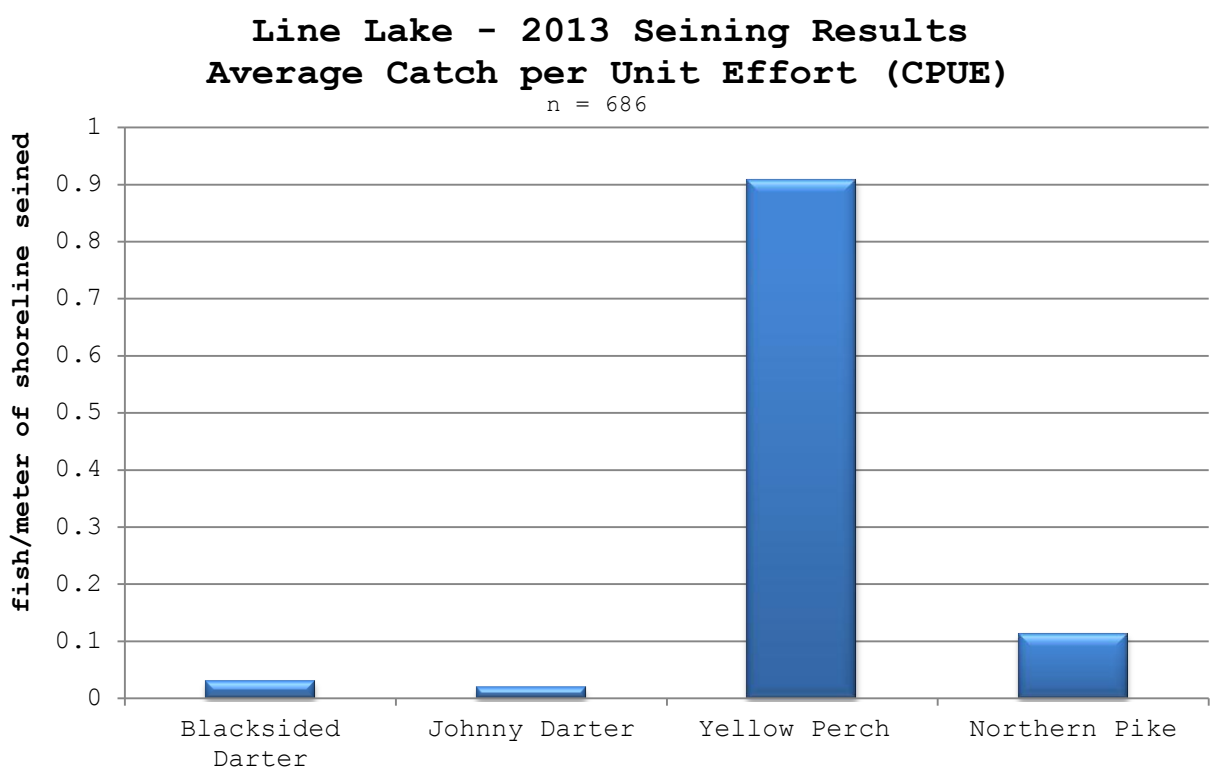

Figure 20: Line Lake Average CPUE per species

5.0 Results

5.3 Line Lake

Summary:

A total of fourteen areas were seined during the study (9 day seines, and 5 night seines)(Figure 21). Unfortunately no young-of-the-year walleye were caught over the course of this study. It has been hypothesised that walleye are not naturally reproducing in Line Lake, at least there is no evidence thus far. At the current time, no follow-up walleye recruitment studies are scheduled for Line Lake as adult walleye survival rates are unknown. Also in some waterbodies it may take several years for recruitment success to become evident. It is important to state that SVSFE has not given up on Line Lake as a potentially walleye fishery. At this time, any evidence of natural recruitment or walleye stocking success will have to come through angler submissions. Since walleye stocking at Line Lake is temporarily "on hold", it will be interesting to correlate angler catches to the size of walleye caught (if any) in the years to come. In terms of forage, abundance and composition does not appear to be a problem at Line Lake. Yellow perch, which were deemed the most prolific forage species were captured in 7/12 areas seined, six of which had relative fish cover. Age 0+ northern pike were captured in 11/12 areas seined, eight of which had sufficient fish cover. Line Lake has become a very popular northern pike fishery, and it would not be a surprise if lake managers and stocking committee members decided to leave it as this for the time being. The dominant composition of northern pike versus the past muskellunge/walleye composition may contribute to potential failure of adult walleye stocking. Some lake shores were identified as potential walleye spawning habitat, although further investigations are required to understand whether walleye can actually be a self-sustained fishery in Line Lake.

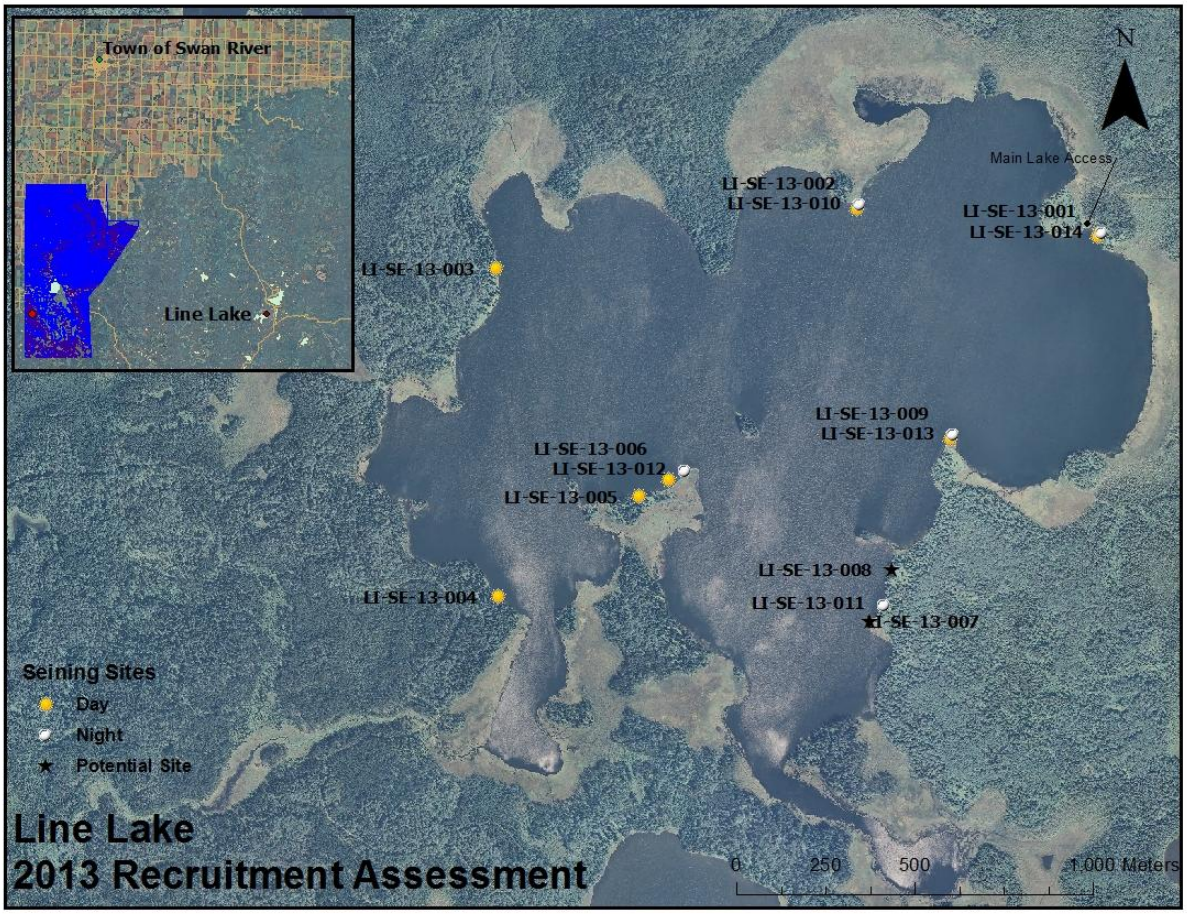

Figure 21: Line Lake Sample Sites 2013

5.0 Results

5.4 Bell Lake

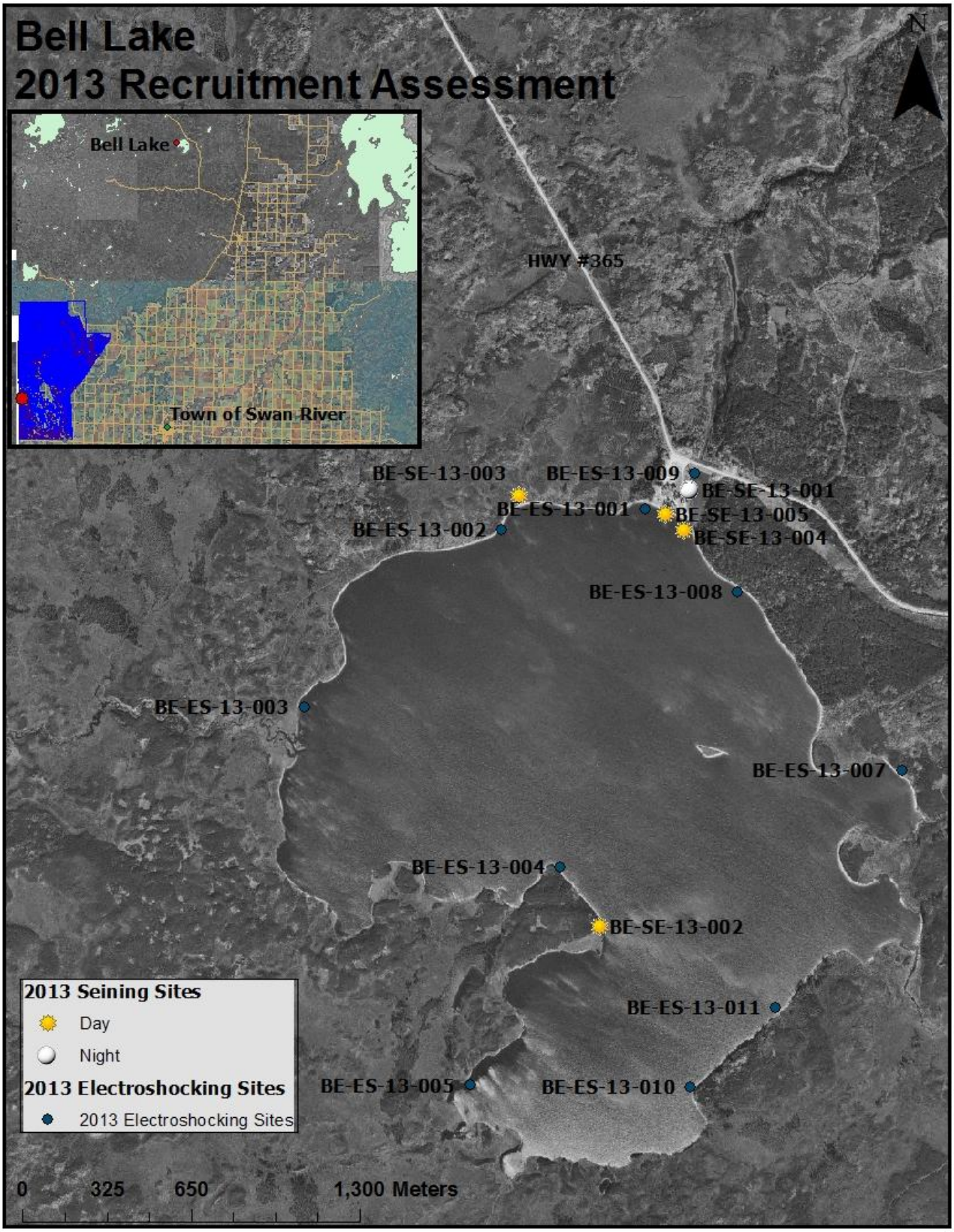

Figure 22: Bell Lake Sample Sites 2013

5.0 Results

5.4 Bell Lake

Seining Summary:

A total of five areas were seined over the course of the study (Figure 22). Unfortunately, seining results are not representative due to high water levels in 2013. No walleye were caught during these efforts. Johnny darters were the highest catch of forage species, although forage was considered very low (18 minnows caught). It has been suggested to not draw too many conclusions from the 2013 Bell Lake seining results due to conditions encountered.

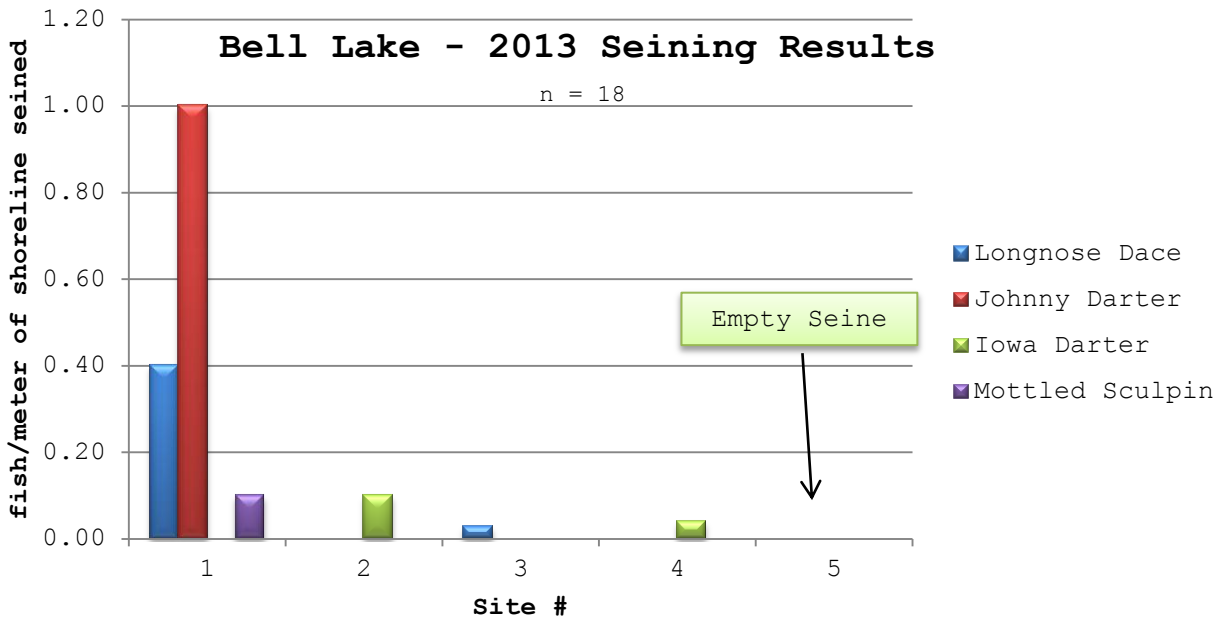

Figure 23: Bell Lake Species CPUE by site

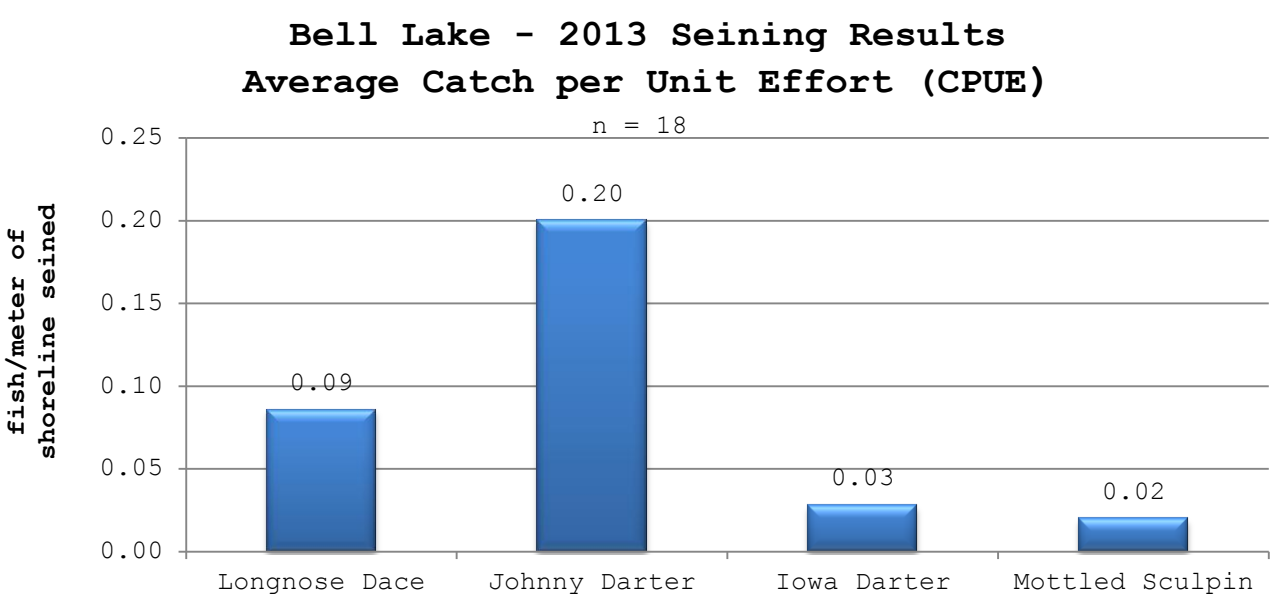

Figure 24: Bell Lake Average CPUE by Species

5.4 Bell Lake

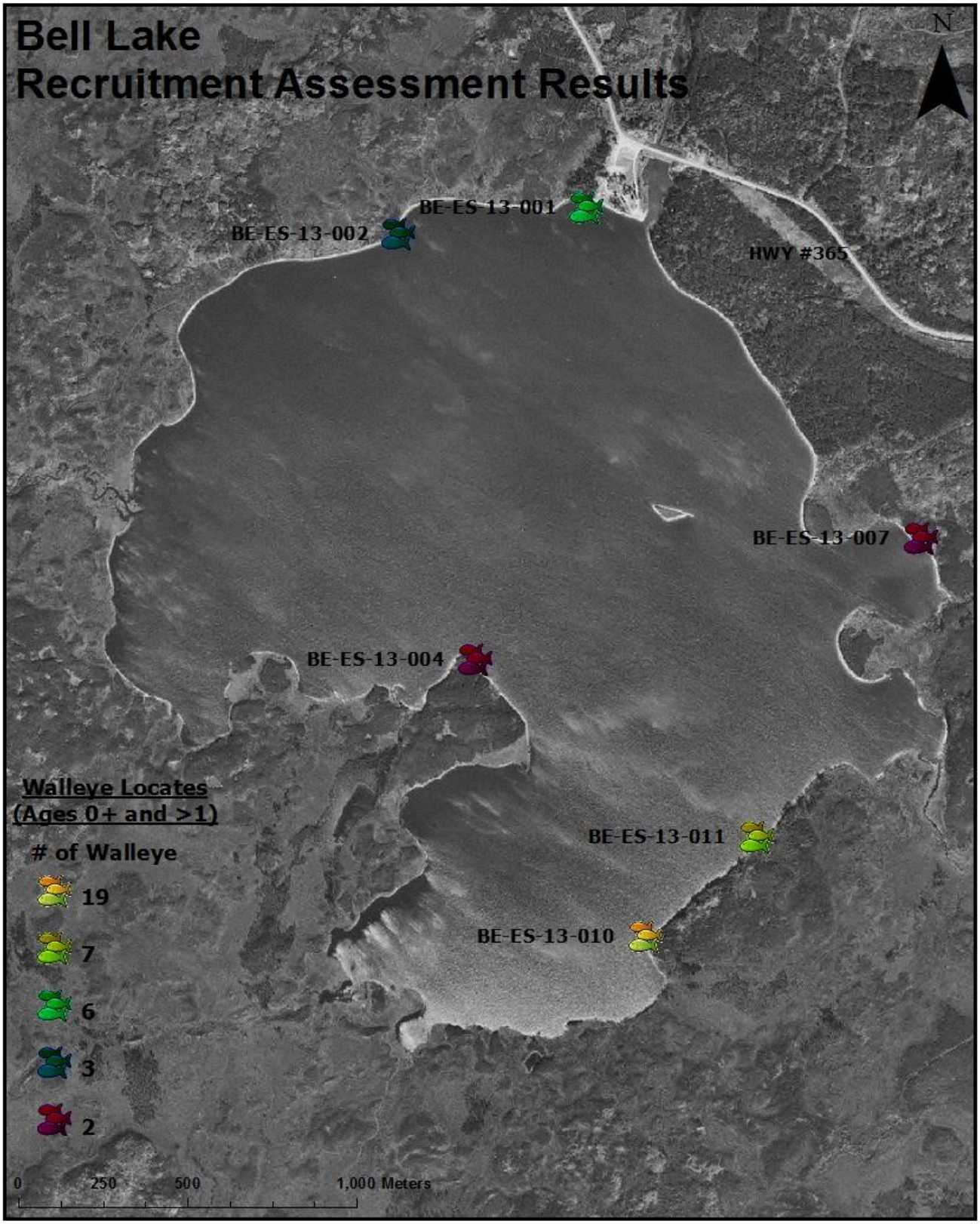

Figure 25: Bell Lake Electro-Shocking Site Success

5.0 Results

5.4 Bell Lake Electro-Shocking

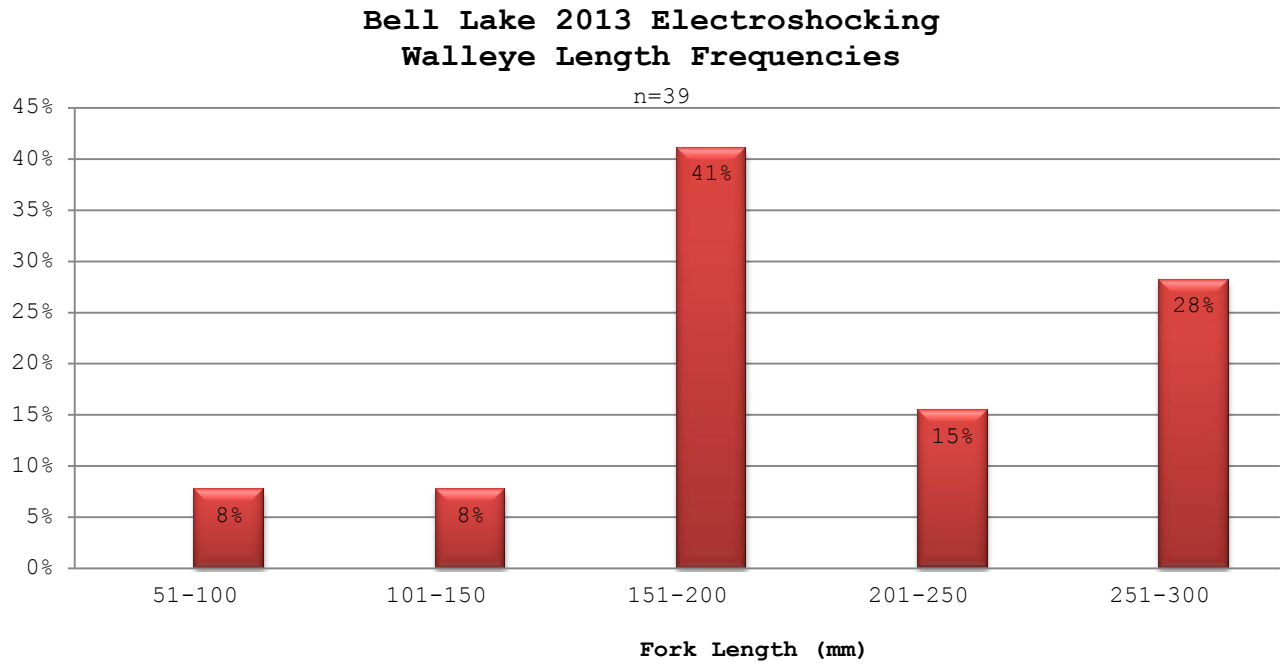

Figure 26: Bell Lake Walleye Length Frequencies

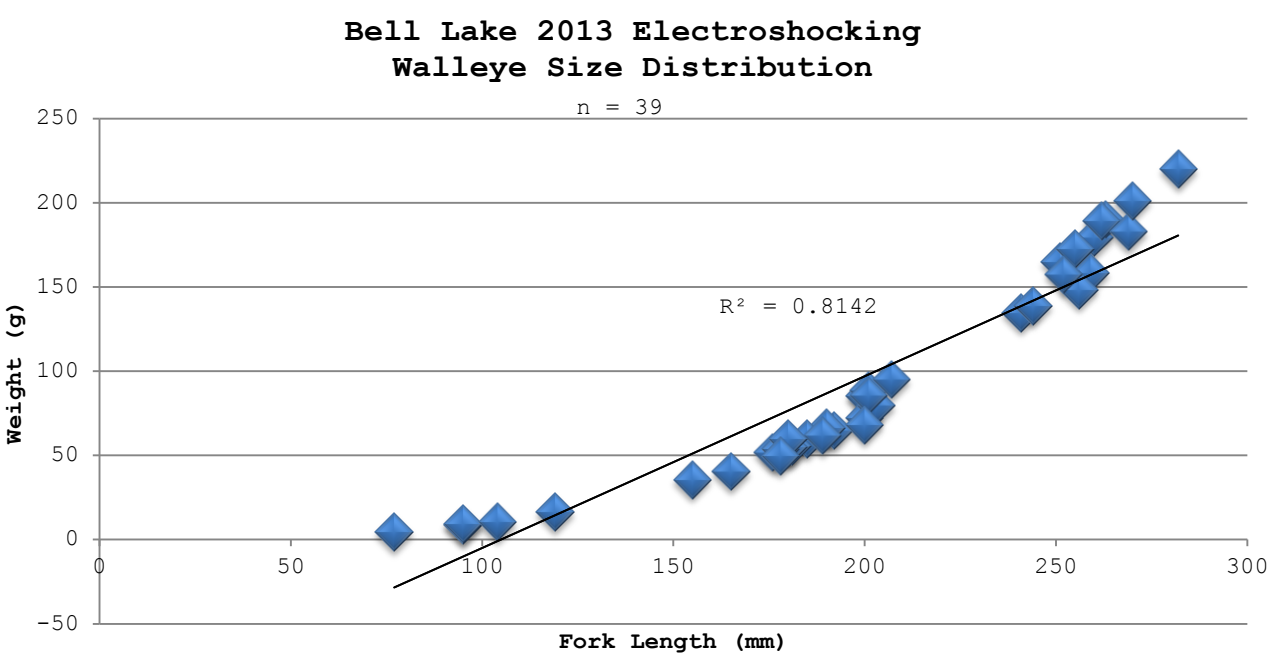

Figure 27: Bell Lake Walleye Size Distribution

5.4 Bell Lake

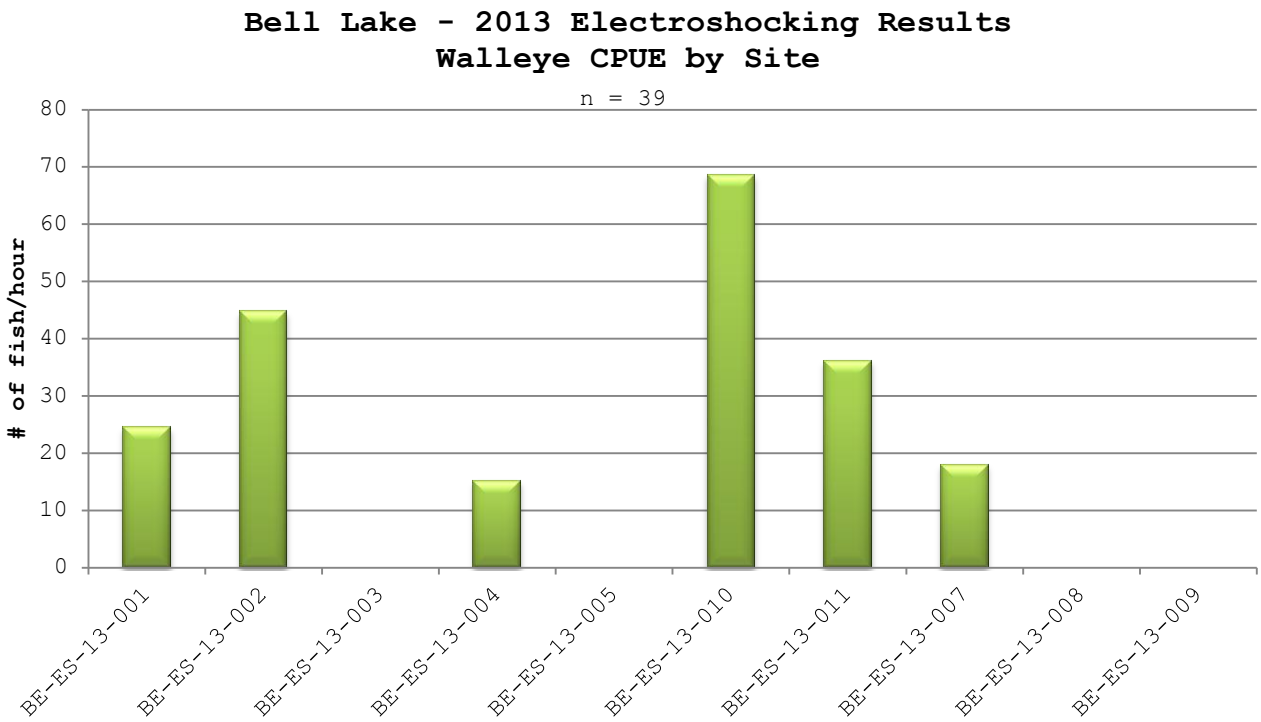

Figure 28: Bell Lake Walleye Catch by Site

Electro-fishing Summary:

A total of nine sites were sampled using the electro-fishing boat (Figure 22). Of these nine sites, six produced walleye (Figure 25). In total, 39 walleye were sampled and otoliths were removed and sent away for OTC analysis. It is interesting to state that lengths of the walleye varied significantly (77mm – 282mm)(Figure 26). It will be interesting to receive the aging analysis, as this will determine the range of growth referring to young-of-the-year walleye. The average CPUE for all sites was 20.7 fish per hour fishing (shocking)(Figure 28).

The majority of walleye (66%) were located on the southeast (windswept) shoreline, CPUE on the southeast shoreline was 52.3 fish per hour fishing (shocking). It is interesting to state that all six sites which produced walleye had similar substrates (sand with interspersed cobble, gravel and boulders). This important information will now be utilized in future Bell Lake walleye assessments. The sites which produced no walleye had similar substrates (soft/muddy substrate). Further OTC studies are scheduled to be repeated for the fall of 2014. At this current time, SVSFE is still waiting on results from OTC markings and aging analysis; results are expected by March/April, 2014.

Walleye spawning habitat at Bell Lake includes several potential spawning shoals throughout the lake. Fluctuating water levels can compromise this habitat year to year. Several tributaries are connected to Bell Lake and further investigations should be completed to understand their potential for walleye spawning habitat.

5.5 North Steeprock Lake

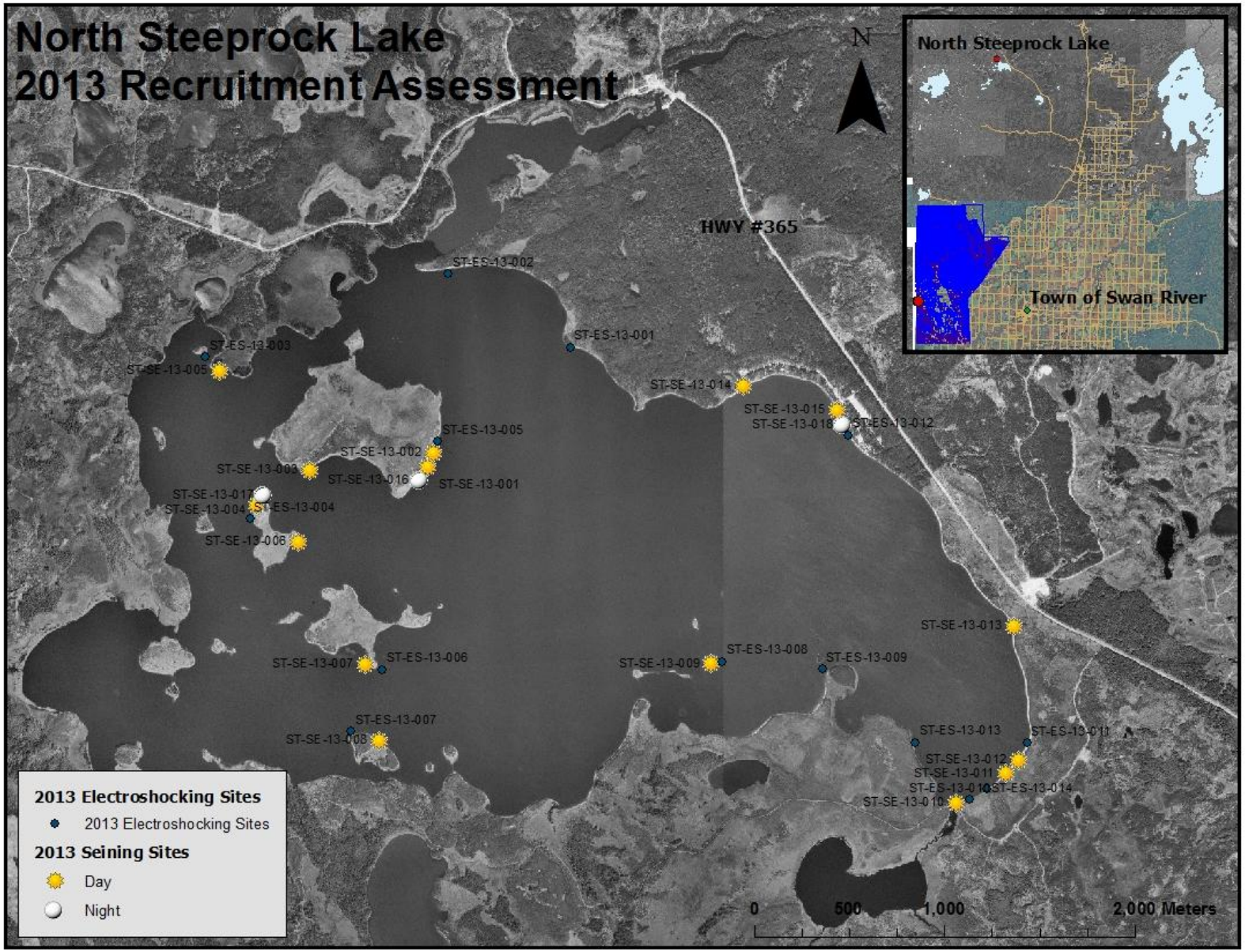

Figure 29: North Steeprock Lake Sample Sites

5.0 Results

5.5 North Steeprock Lake

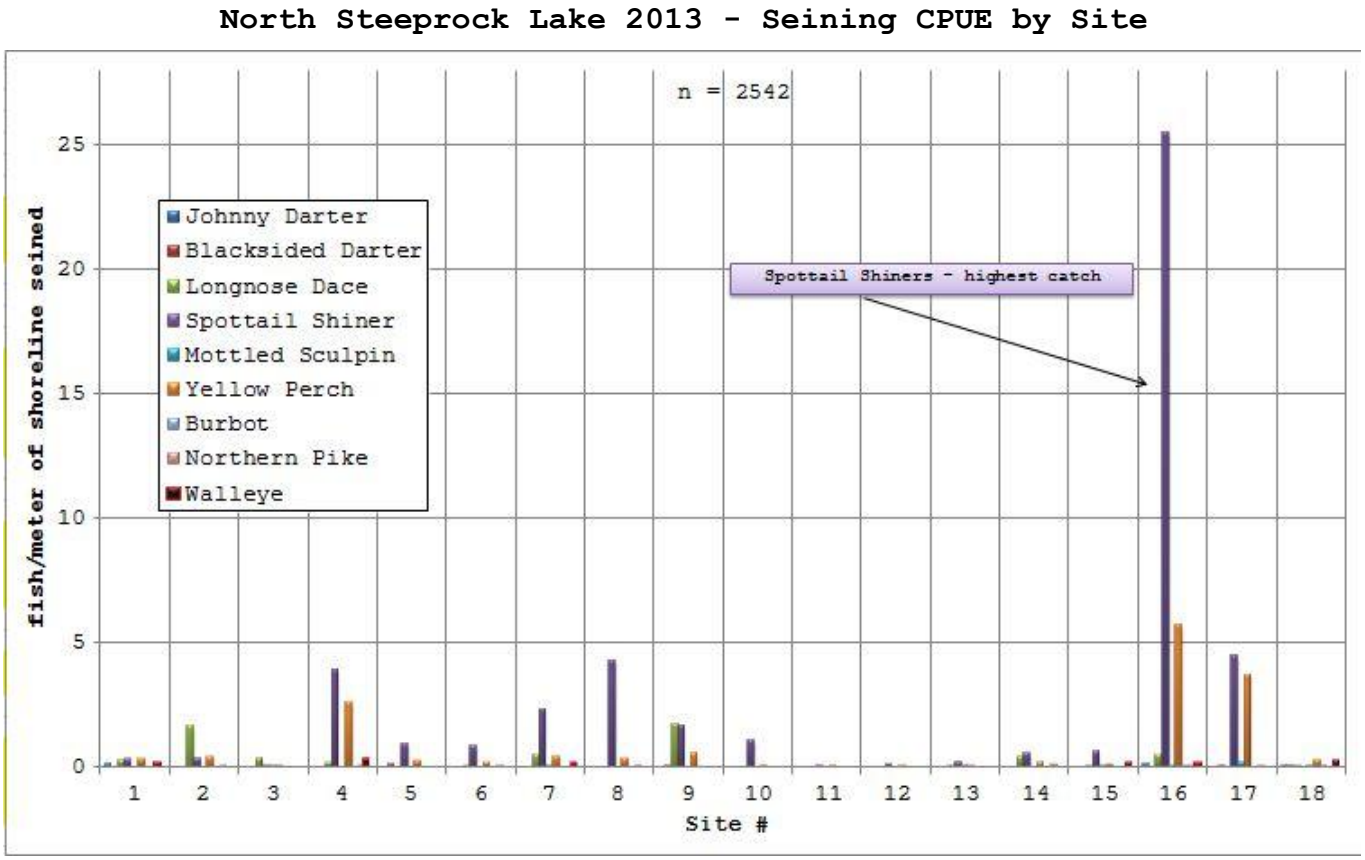

Figure 30: Steeprock Lake Species CPUE by Site

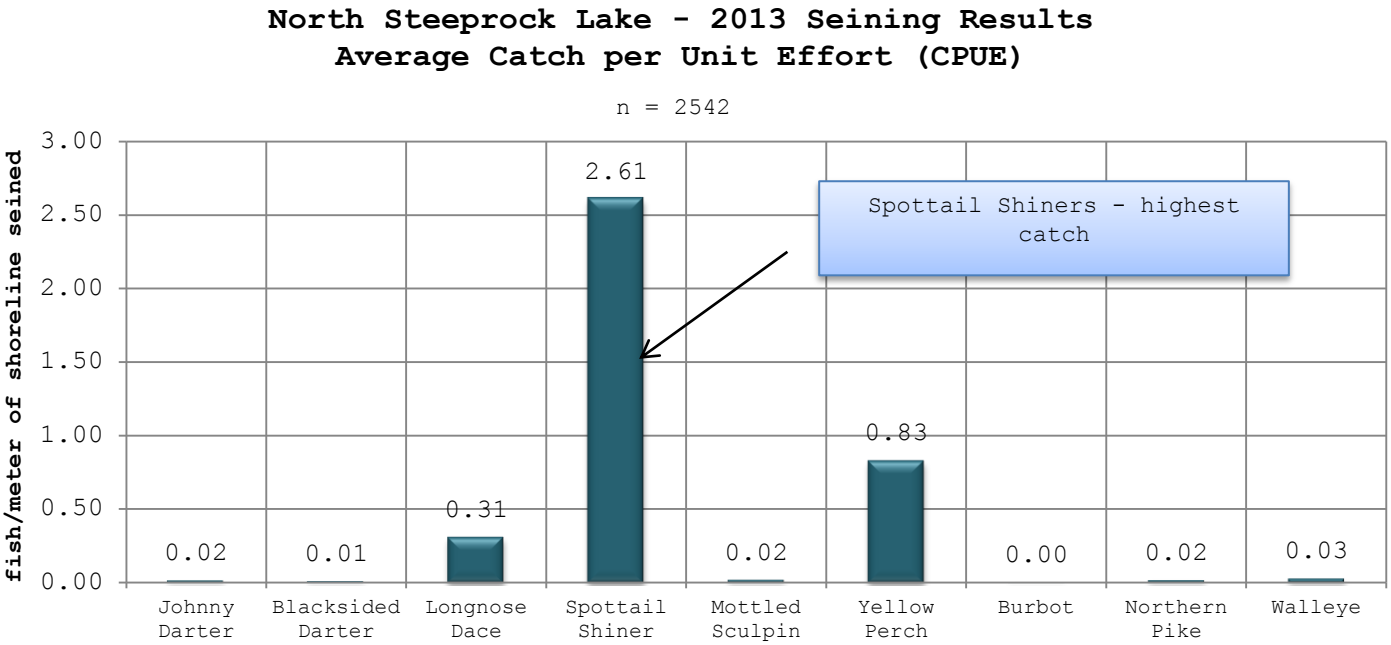

Figure 31: Steeprock Lake Average CPUE by Species

5.0 Results

5.5 North Steeprock Lake

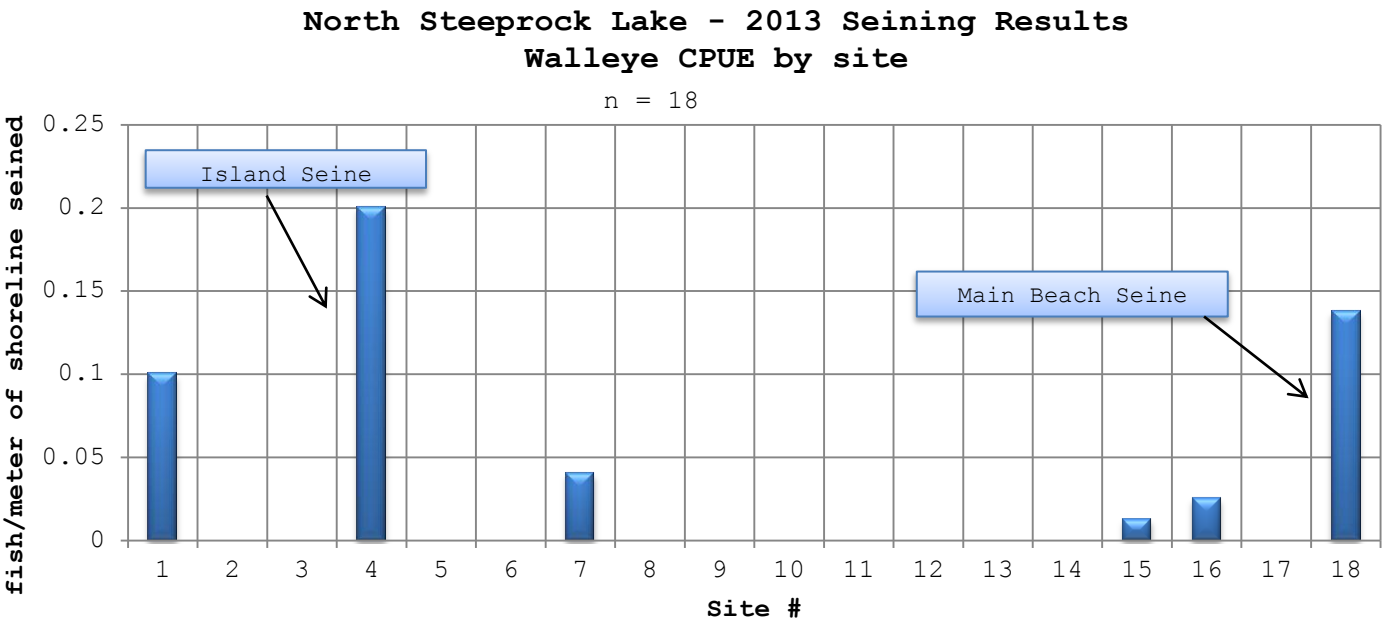

Figure 32: Steeprock Lake Walleye CPUE by Site

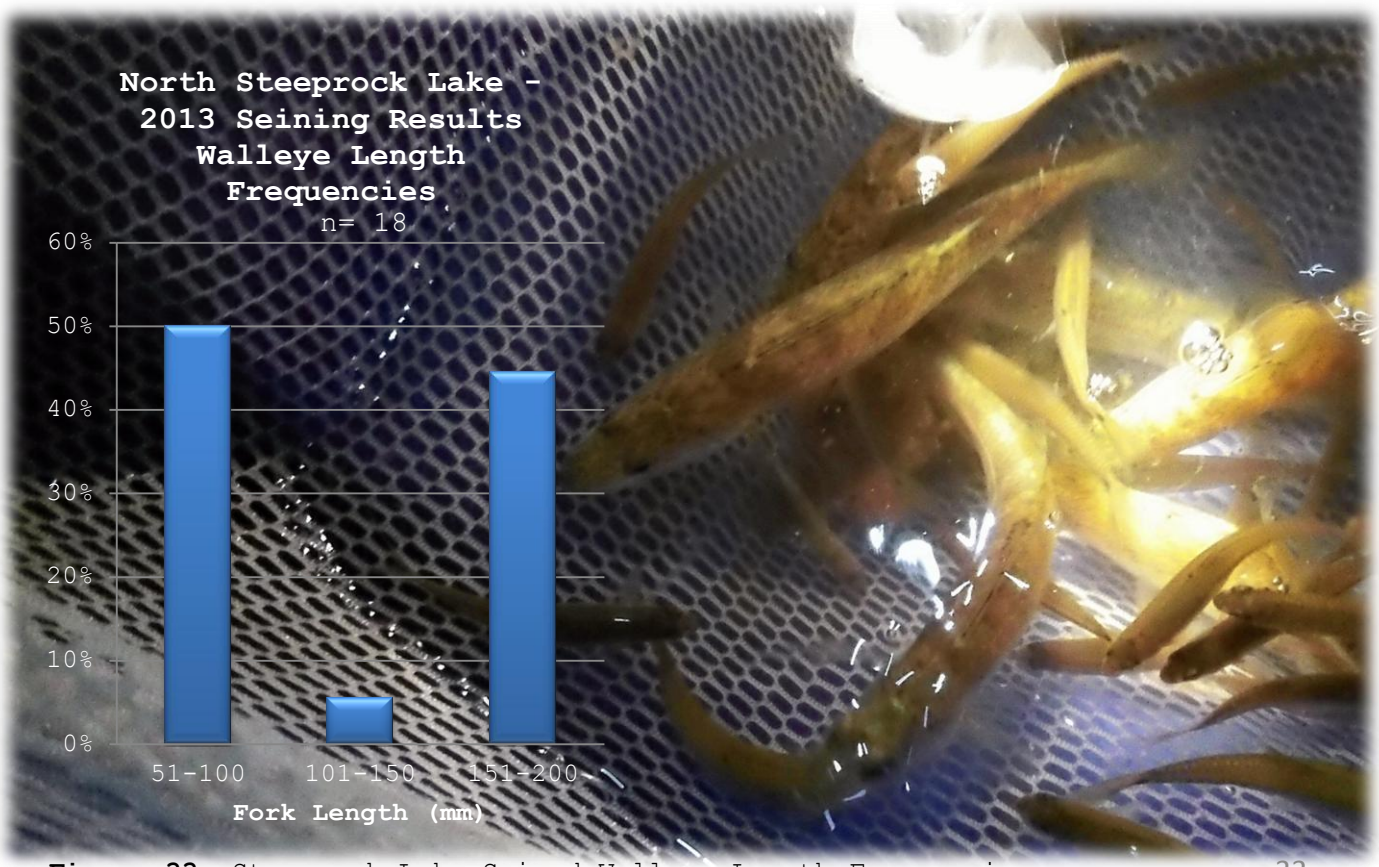

Figure 33: Steeprock Lake Seined Walleye Length Frequencies

5.0 Results

5.5 North Steeprock Lake

Seining Summary:

A total of eighteen seines occurred over the course of the study (15 during the day, and 3 during the night)(Figure 29). A total of twenty-two walleye were caught varying in length from 65-200mm, signifying different age classes (Figure 33). Of the twenty-two caught, ten were captured during the day, and twelve were captured at night. It is important to state that there was less effort during the night due to size of lake and travel time required in darkness. The three night seines occurred in areas that produced the most walleye during day seines. Regarding this phenomena, there seemed to be correlation regarding day versus night seines; however the correlation was opposite in different areas. For example, the Big Island seine produced four walleye during the day, and one at night, whereas the Main Beach seine produced zero walleye during the day, and eleven during the night. This may be because of sampling error, but it may be solely due to habitat type/fish cover present at these sites (Beach site possessed no fish cover). It will be interesting to compare results during walleye recruitment assessments scheduled for the summer of 2014. Walleye were generally caught in hard-packed sandy beach areas, whereas areas with boulders, cobble and larger rock produced less walleye. The average CPUE of all sites equated to 0.03 walleye per meter sampled, and the CPUE of the most productive site (Main Beach) equated to 0.14 walleye per meter sampled (Figure 32). Length frequencies are also interesting to mention as 50% of walleye caught seining were between 51-100mm in length, 5% were between 101-150mm in length, and 45% were between 151-200mm (Figure 33). This is most likely the difference between ages 0+ and 1+ walleye, but is still unknown until ages are received from a sub-sample of spines collected. These length frequencies may also be the difference between natural fish and stocked fish.

In terms of feed, forage availability and composition is abundant in North Steeprock Lake. Spottail shiners were by far the most prolific forage species (Figure 30 & 31). An intriguing finding was a total of 2,098 individual forage fish were captured though the seining portion of this study, while a total of 1,018 spottail shiners were captured during ONE 40 meter night seine on the east side of the Big Island. It is interesting to state that a trap net set off the east side of this island produced many large walleye during a fall trap-netting study in 2013. It has been hypothesised that this is a very popular feeding site for "larger walleye".

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Figure 34: Steeprock Lake Seined Young-of-Year Walleye

5.5 North Steeprock Lake

Figure 35: North Steeprock Lake Electro-Shocking Site Success

5.5 North Steeprock Lake

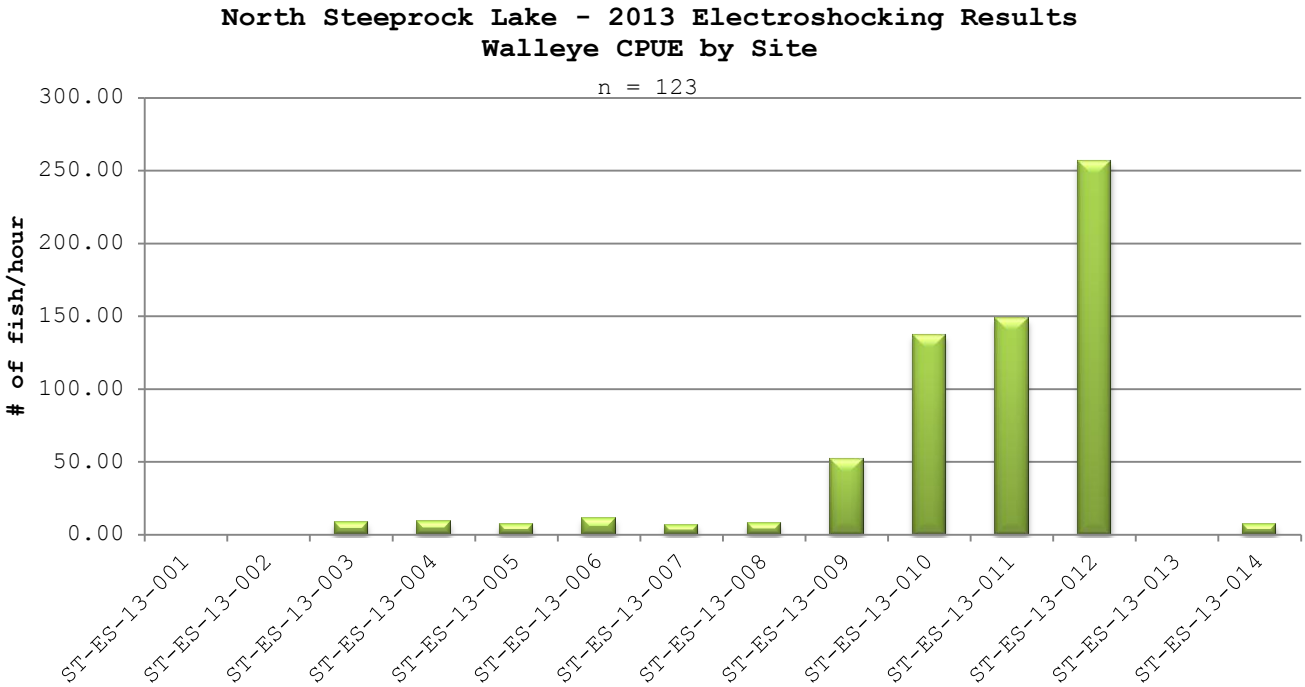

Figure 36: North Steeprock Lake Walleye CPUE by Site

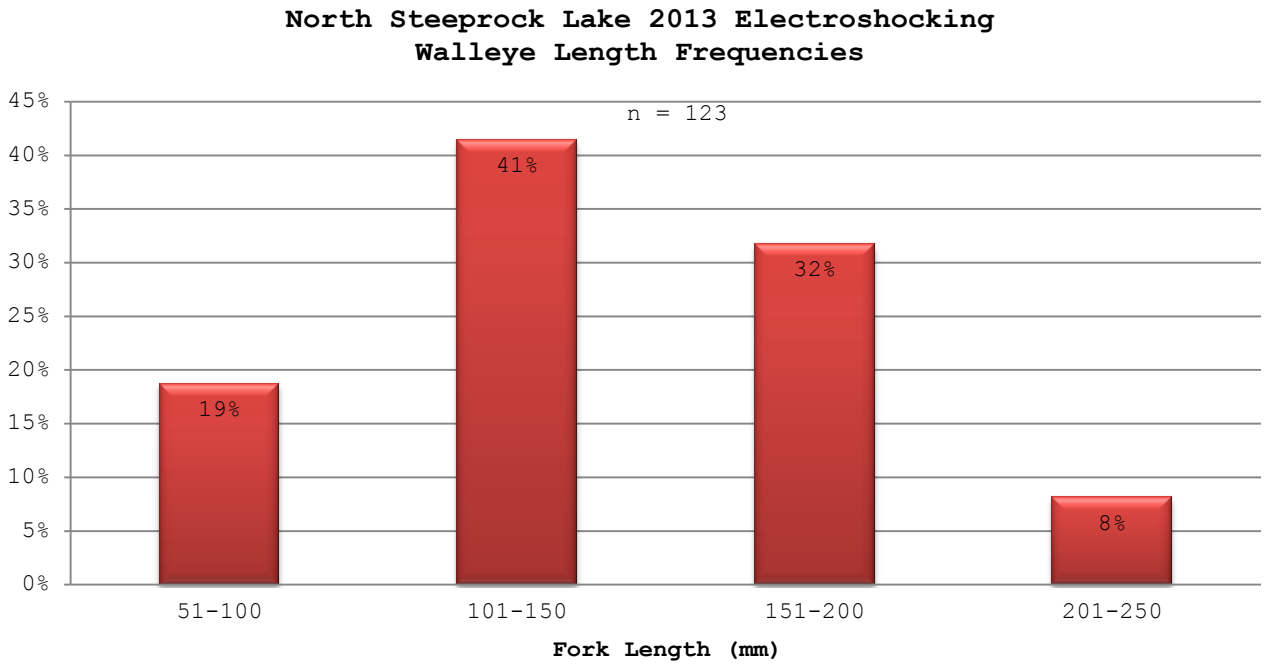

Figure 37: Steeprock Lake Electro-Shocking Walleye Length Frequencies

5.0 Results

5.5 North Steeprock Lake

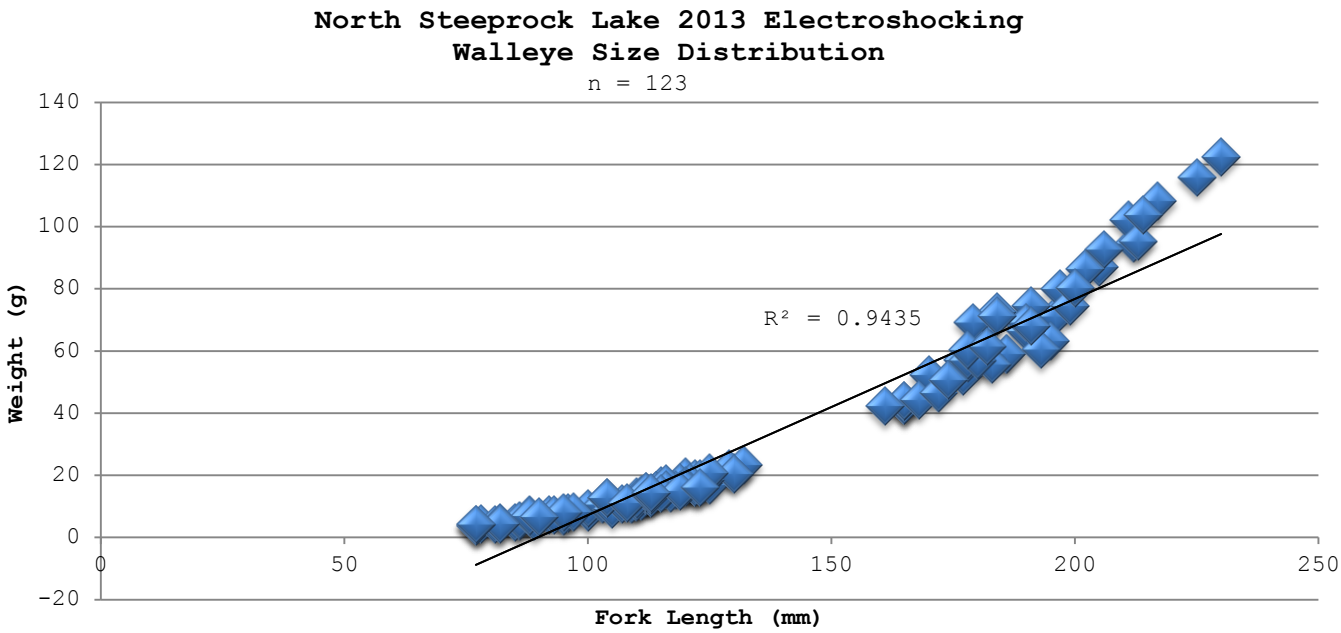

Figure 38: Steeprock Lake Electro-Shocking Walleye Size Distribution

Electro-fishing Summary:

A total of fourteen sites were sampled using the electro-fishing boat (Figure 29). Of these fourteen sites, eleven produced walleye (Figure 35). A total of 123 walleye were collected and otoliths were sent away for OTC analysis. The length of walleye collected varied significantly (77mm – 230mm) and size distribution displayed a significant gap (Figure 37 & 38). This is most likely the difference between 0+ and 1+ fish (or greater), but some differences may be contributed to stock (natural versus hatchery), however aging and OTC markings will determine this. At this current time, SVSFE is still waiting on results from OTC and aging analysis; results are expected by March/April, 2014.

The average CPUE for all sites was 46.5 fish per hour fishing (shocking). Majority of walleye (64%) were located on the east (windswept) shoreline (CPUE = 142.6 fish per hour)(Figure 36). The second most productive site, in terms of fish caught, was the Main Beach where 24% of total catch were caught (CPUE = 256.4 fish per hour). Arguably the most productive area is the main beach, however, electro-fishing was more difficult in this area because the presence of docks, therefore restricting sampling distance. The east shore on the other hand had no obstacles. Both the main beach and east shore have similar substrates(sand with interspersed gravel) and walleye were only caught during low light periods (night) during seining and electro-fishing (note east shore was not seined at night). This suggests young walleye may feed primary at night due to low fish cover and habitat types found at these sites. This also suggestions walleye within these habitats preferred depths too high to facilitate seining (approximately 1.5 meters) during the day due to light sensitivity. Light intensity is probably the most critical factor influencing walleye distribution and abundance. As walleye are extremely sensitive to light, cover is important from the perspective of providing shade (Kerr 1997). When this study is repeated during the fall of 2014, findings of these two areas will be interesting and overall will provide quality management information.

5.0 Results

5.5 North Steeprock Lake

In regards to available spawning habitat, past studies have identified areas frequented by walleye (main north inlet). In addition, North Steeprock Lake has several potential lake shoals, reefs and tributaries which may be utilized for spawning purposes. Information received from OTC markings will help determine success of spawning within North Steeprock.

Figure 39: North Steeprock Lake

5.6 Sources of Error

Sources of error include circumstances that may have influenced results. In terms of seining, many sources of error exist. Any object that snags a seine or causes it to lift off the bottom can allow fish to escape (Hahn, 2004). Aquatic vegetation, which provides cover for small fish, will often lift the seine net, also allowing fish to escape. In addition to substrate unevenness, snagging on logs, rocks, and other debris will slow down the seining and decrease seining efficiency by allowing fish to escape underneath the net or out swim the moving seine. With every snag increases the chance of holes becoming present in the net. For example, during a 200 meter haul on the southeast shore of Beaver Lake, a large hole became present in the seine, this sample was later nullified. Even clean soft substrates cause problems allowing the weight line to act like a dredge, slowing the speed of the seining process and therefore allowing fish to swim out of the seine. This dredging effect was present on the east shore of North Steeprock Lake, an area where no walleye were caught day seining, and many were caught electro-fishing. With regards to many sites, specifically multiple sites in Line Lake, woody debris from beavers and muskrats was often present in potential seining areas. In these situations, technicians would remove the debris and allow a 24 duration before seining the site. This may have effected results as fish cover and habitat was removed, this changing site dynamics. Water turbidity plays a role, the greater the turbidity of the water decreases chances of fish seeing the incoming net. Noise, vibrations and changes in water pressure which are induced by moving seines may deter fish (Hahn, 2004).

In terms of electro-fishing, many potential errors also exist. First of all technical error is always a potential. There is always the potential that voltage would be too low to stun targeted species, however unlikely. In some cases, target species would be stunned out of reach of the dip netters, influencing CPUE results. Human error is always present. A strong depth perception is required when dipping stunned fish, this may have resulted in missing target species. While shocking, three different safety panels (kick plates) must be initiated in order to facilitate current. On some occasions this safety precaution becomes uninitiated through human error, thus halting current. This could very well influence results. On occasions, semi-aquatic mammals (ie. Beavers) become present while shocking; at this point shocking is temporarily halted, thus influencing results.

Overall, there are potentially many different factors that could have influenced results, but SVSFE technicians and other individuals involved, being aware of this potential did their best to avoid them over the course of this study.

6.0 Discussion/Recommendations

With regards to the Mission Walleye Lakes, (Beaver, Marge, and Line Lake), some very significant results were determined. The fact that young of the year walleye were found in both Beaver and Marge lakes is truly encouraging. With the construction of a artificial spawning shoal at Beaver Lake scheduled for March, 2014, SVSFE is looking forward to further assessing the recruitment success. Walleye recruitment along with trap netting assessments are scheduled for the summer of 2014 for both Beaver and Marge Lake. This data will help to further understand the health of these fisheries, effects of management practices, along with understanding walleye recruitment. SVSFE is excited to complete these studies, and further determine if any additional management is required (ie. results may signify when the Marge Lake walleye fishery be re-opened and a walleye limit be established or to further close fishing at Beaver Lake).

With regards to Line Lake, it has been determined that walleye recapture has been less than optimal. Also, no evidence of walleye recruitment has been determined. It was stated further investigations are required to understand whether walleye can actually be a self-sustained fishery in Line Lake. At this point in time, no supplementary assessments are scheduled for Line Lake.

Figure 40: Analyzing Seine Net

With regards, to North Steeprock and Bell Lake, SVSFE is still waiting results on OTC analysis. This data, which is expected to be completed by March/April 2014, will provide exceptionally relevant information regarding natural recruitment versus stocked walleye success in these lakes. The OTC study is scheduled to be replicated in the fall of 2014. For this reason, results from the 2013 OTC study will not result in any management (ie. stocking) changes in these two lakes at this time. Although, results from 2013 OTC analysis are expected to provide imperative information, replication of the study is required as annual parameters could vary significantly regarding juvenile survival.

6.0 Discussion/Recommendations

Further understanding recruitment success will bring management closer to the objectives outline in the Mulit-Year OTC Project:

- to enhance the utilization/distribution of walleye fry stocking program
- to stock lakes with walleye fry that need supplemental assistance due to high harvest rates and/or low to nil natural reproduction. Lakes that exhibit a very low to nil presence of stocked walleye will have annual stocking levels reduced and more fry will be made available to lakes that need them.

In the end, walleye fry will be distributed more effectively based on proven science that leads to quality management decisions (Kansas 2013).

It is suggested that no management decisions can be conclude at this time as results are still pending. SVSFE is optimistic that results from past, current and future studies will provide essential information for management plans specific to each waterbody. Each step taken provides scientifically based decisions and moves each fishery forward in enhancement and sustainability.

Figure 41: Dip-netting Platform of Electro-fishing Boat 2013

7.0 Appendix

Table 3: Beautiful Lake Walleye Transfer – Walleye Stocking

Beautiful Lake Walleye Transfer						
	2009	**2010**	**2011**	**2012**	**2013**	**Total by Lake**
Wellman Lake	48	522	222	153	144	**1,089**
Spray Lake	0	50	41	75	0	**166**
Verrall Lake	0	74	57	132	0	**263**
Child's Lake	230	0	0	0	0	**230**
Singush Lake	650	0	0	77	200	**927**
Line Lake	0	539	54	89	0	**682**
Chain Lake	0	40	0	0	0	**40**
Marge Lake	0	399	585	125	0	**1,109**
Vermillion Reservoir	0	20	300	200	324	**844**
Swan River	0	395	54	0	0	**449**
Beaver Lake	0	0	548	90	882	**1,520**
West Blue Lake	0	50	0	0	0	**50**
Langan Lake	0	0	0	50	0	**50**
TOTALS:	**928**	**2,089**	**1,861**	**991**	**1,550**	**7,419**
Average size:	29cm	35cm	34.5cm	27.6cm	17.5cm	
TRAP METHOD	ES	TR	TR	TR	TR	

7.0 Appendix

Figure 42: Beautiful Lake Walleye Transfer – walleye stocked

7.0 Appendix

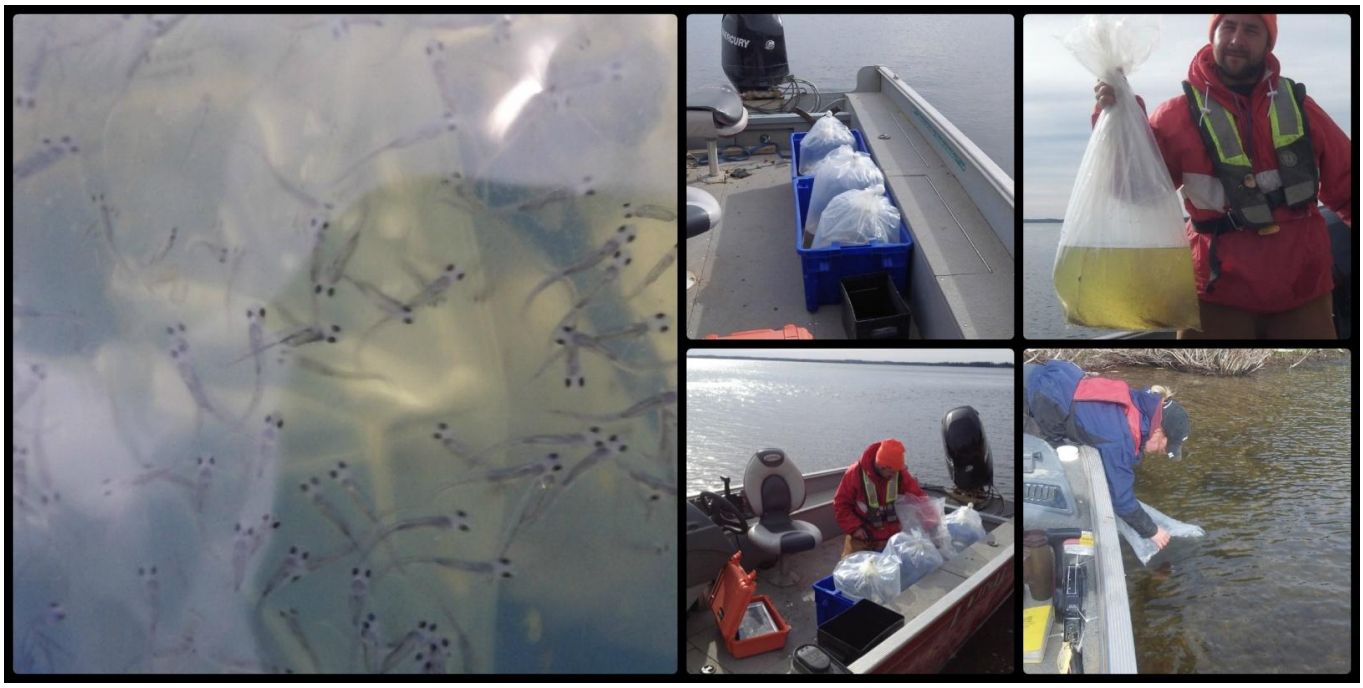

Figure 43: 2013 Walleye Fry Stocking

7.0 Appendix

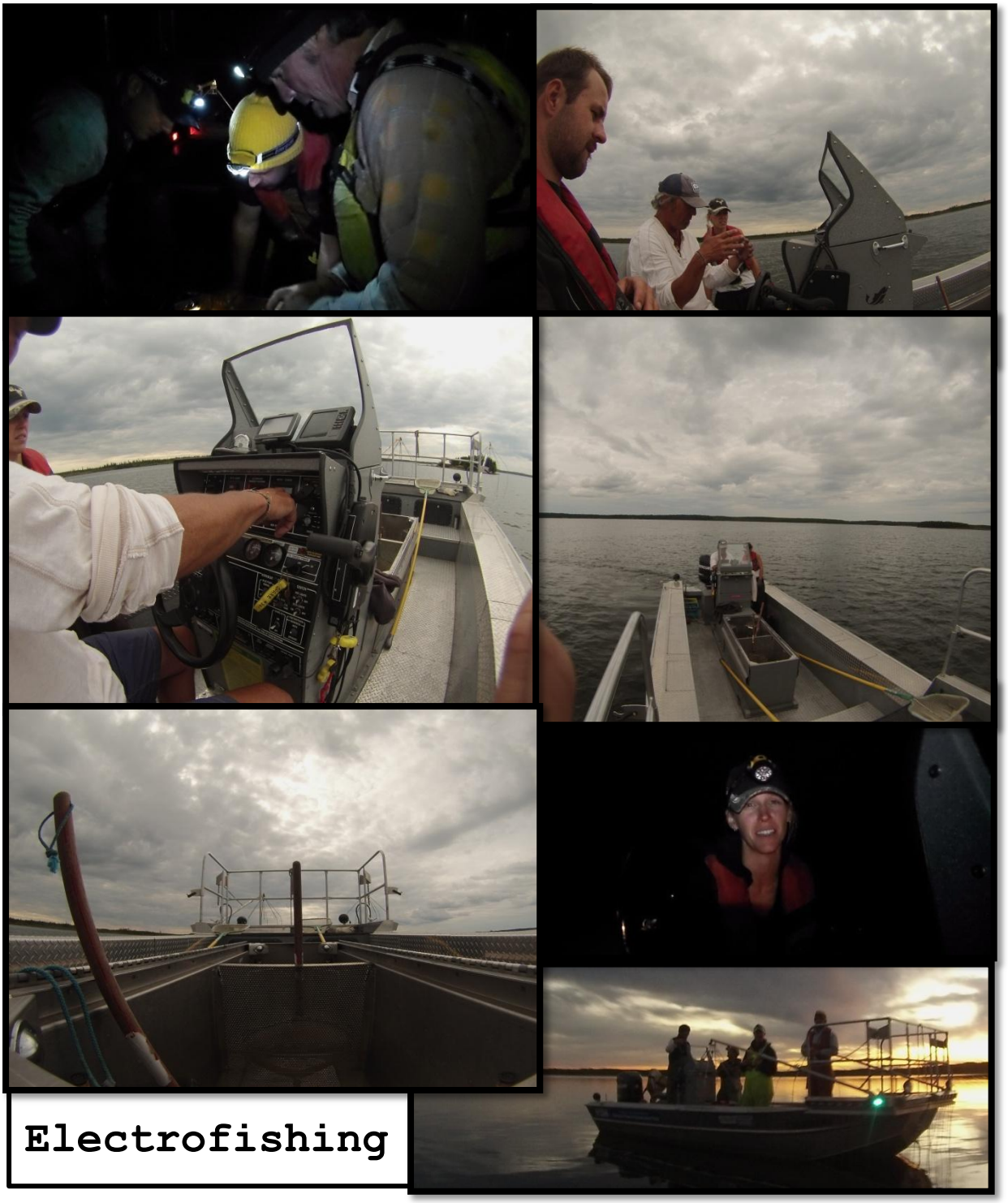

Figure 44: 2013 Electrofishing

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