

GERRISH TOWNSHIP HIGGINS LAKE SWIMMER'S ITCH PROJECT ANNUAL REPORT 2016



*“Working Together for a Better
Higgins Lake!”*

Gerrish Township
2997 E Higgins Lake Dr.
Roscommon, Mi.
989-821-9313

Northpoint Fisheries Management LLC.
930 S. Au Sable Tr.
Grayling, Mi.
989-348-5533

Report by

Steven P. Sendek

Steven S.J. Sendek

Dr. Mark Luttenton

Northpoint Fisheries Management, LLC

For several years both Gerrish and Lyon Townships have been concerned over the swimmer's itch problem that has been present on Higgins Lake. The two townships have researched different action plans available to try and develop a plan that will address the problem. They found that there are no known programs which will ultimately rid the lake of the SI parasite. The parasite needs two hosts to complete its life cycle so one or both hosts would need to be eliminated to break the cycle. The Department of Environmental Quality (DEQ) offered one management action which involves the application of the chemical copper sulfate to kill the snail host. A decision by both Boards to not utilize this method on Higgins Lake was made as the efficacy of copper sulfate and the long term effects of the chemical on the lake eco-system are an unknown and not an acceptable risk to other aquatic and human life.

A management action developed by SICON, proposed to trap and trans-locate Common merganser (*C. merganser*, *Mergus merganser*) hens and ducklings to Lake Huron. The proposal authors indicated that the hens and ducklings would not return to the lake of origin and the trans-location would not influence swimmer's itch in Lake Huron due to the absence of the appropriate snail host. In addition, SICON proposed to locate and seal nest cavities used by hens during that given year. This effort would be conducted over a two-month period between early June and the end of July. Higgins Lake Swimmer's Itch Organization chose to hire SICON. Subsequently, it has become clear to others that the SICON proposal lacks scientific basis given that literature from the early 1900's reported the presence of the appropriate snail host in the Great Lakes and other reports from the 1930s indicate that swimmer's itch was a widespread issue in the Great Lakes. Furthermore, sealing *C. merganser* nest cavities to reduce swimmer's itch has never been attempted in the past.

Gerrish Township officials ruled out the use of copper sulfate and questioned the high cost (\$245,000.00 per summer) to conduct a duckling trans-location program. Gerrish Township elected to conduct their own SI management program through the use of harassment, limited lethal take and nest destruction to limit *C. merganser* hours on the lake as a way of reducing the infection of snails, and breaking the parasite's life cycle. Fewer *C. merganser* hours on the lake will result in reduced amounts of infected feces deposited in the lake. This will result in fewer snails becoming infected with SI, resulting in fewer human cases of SI.

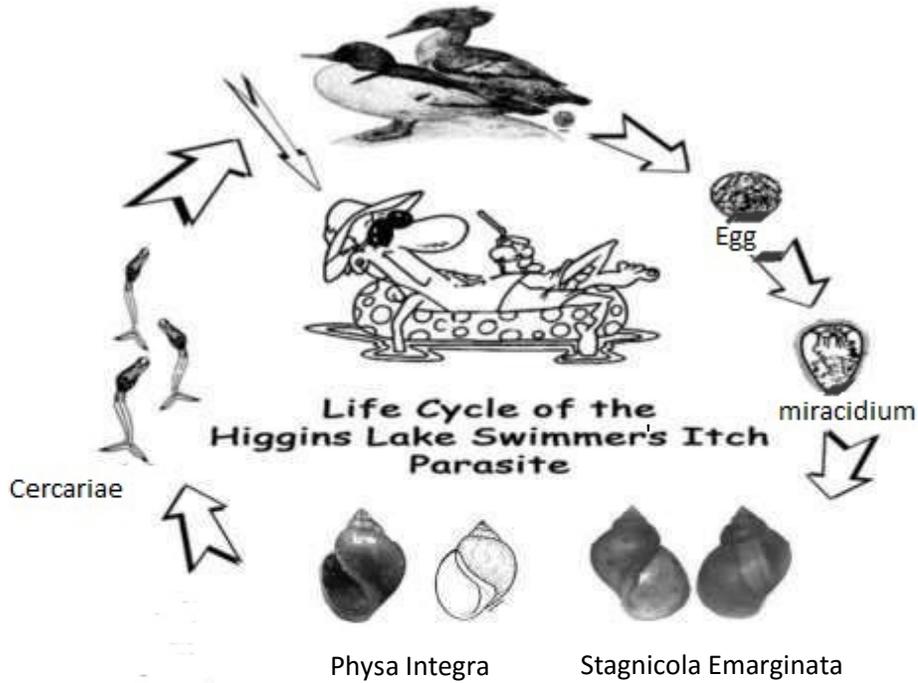
The primary goal of the Gerrish/Northpoint SI control program is to limit or prevent the host snails from becoming infected with the SI parasite early in the year. This will be accomplished by limiting the time *C. merganser* spend on the lake shedding SI eggs into the water through feces. Based on necropsies of *C. mergansers* taken by Northpoint from Higgins Lake in 2015, SICON determined that approximately 40 percent of the mergansers taken from the lake were infected and preliminary results from 2016 indicate that approximately 60 percent of the *C. mergansers* taken were infected with the SI parasite. Thus it is imperative to have the spring harassment/limited lethal take in the spring as studies have shown that host snails start to become infected at a water temperature of 39.2 degrees F. which occurs shortly after ice-out (J. Murray, 2002). Higgins Lake reached and exceeded this temperature threshold by April 13, 2016.

Summary of the swimmer's itch cycle on Higgins Lake:

The life-cycle of the swimmer's itch parasite is seen below (diagram 1). The *C. merganser* is the definitive host that carries the parasite which expels its eggs through the feces of the *C. merganser*. As the birds spend hours on the lake loafing, foraging, and breeding the *C. merganser* will excrete the SI eggs into the water which hatch and become miracidium. The miracidium penetrates the intermediate host, a specific species of snail, and resides in its digestive system where it matures. After a short developmental period, the parasites are released into the water and are called cercariae. The cercariae seek out the *C. merganser* host and may accidentally penetrate a human causing the swimmer's itch rash.

Diagram 1 Swimmer's Itch Cycle.

Generated by Steven S.J. Sendek



Summary of Gerrish Townships choices of actions and why and how harassment/limited lethal take was chosen as a tool for limiting bird hours on the lake:

There are no known procedures for eliminating the parasite which causes swimmer's itch. We can however in the short term limit either the definitive or intermediate host to break the cycle of swimmer's itch. Unfortunately, this is only a "Band-Aid" treatment to the problem. Ultimately addressing the core root of the problem is the only long term solution to the swimmer's itch dilemma.

Northpoint Summary of Program Events

Northpoint Fisheries Management LLC was contacted by Gerrish Township Supervisor Frank Homola in December of 2014 to propose a three-year program through the use of wildlife management, harassment, lethal take and nutrient management to reduce the bird hours of the Common merganser and snail population in order to reduce the swimmer's itch parasite on Higgins Lake. Supervisor Homola secured a limited lethal take/harassment permit through the Michigan Department of Natural Resources (MDNR) and the U.S. Fish and Wildlife Service (USFWS), Special Purpose Permit MB56627B-O.

Concepts of Harassment/Limited Lethal Take and Nest Box Management

The Gerrish/Northpoint program applies harassment, limited lethal take and nest box management techniques to reduce merganser days on the lake. These management actions are effective on adult, sub-adult and nesting hens. Together the actions create an environment on the lake that is undesirable for the ducks to spend time loafing, feeding, defecating and reproducing. But there are some C. mergansers that are more tolerant of hazing actions and determined to take residence on the lake. Limited lethal take is then used to eliminate these individuals from the lake population. Finally, nest boxes are used as an efficient and cost effective method to reduce duckling production on the lake, as ducklings have been identified as a significant vector for the spread of SI. Other benefits of nest boxes are that they are in pre-planned locations, close to the lake shore, easily reached and serviceable, as opposed to natural nests which can be up to 100 feet above the ground and a mile or more from the lake shore.

History-Year One:

Early in 2015, Northpoint presented a comprehensive SI control program to address swimmer's itch on Higgins Lake to the Gerrish Township Board of Directors. This comprehensive program consisted of:

Action 1. Reduce the adult and sub-adult Common merganser presence on Higgins Lake

Goal: Reduce the presence of adult and sub-adult C. mergansers (the definitive avian parasite host) on Higgins Lake through the use of hazing, harassment and the take of up to 25 individual C. mergansers. The U. S. Fish and Wildlife Service has issued Gerrish Township a Special Purpose – Miscellaneous permit (MB56627B-0) to haze, harass and take up to 25 C. mergansers on Higgins Lake in Roscommon County, Michigan. As stipulated in the permit these activities will be conducted from the time of ice out to when C. merganser broods are noted or May 22 at the latest. Activities will include the use of boats, pyrotechnics and non-toxic shot shells.

Action 2. Manage existing Common merganser nest boxes to reduce brood production and trap/remove other Common merganser broods produced on Higgins Lake.

Goal: Reduce C. merganser brood production on Higgins Lake. The U. S. Fish and Wildlife Service has issued Gerrish Township a Special Purpose – Miscellaneous permit (MB56627B-0) authorizes the destruction of up to 25 C. merganser nests and all eggs associated with those nest. Natural C. merganser nesting cavities are very difficult to locate let alone manage. Nesting boxes have been deployed to attract C. merganser nesting activity to defined locations that can be monitored and managed. Eggs deposited in these nesting boxes can be easily destroyed and nesting hens can be removed from the population. Other C. merganser broods that are produced will be trapped and removed from the lake. This specific action will require Gerrish Township to secure an amendment to the existing Miscellaneous permit (MB56627B-0) to allow trapping of C. merganser ducklings and the associated hen.

Action 3. Snail population assessment

Goal: Determine the distribution and abundance of host snail populations. Quantitative surveys of snail populations will be conducted twice during the summer (June and August) at 20 shallow locations around the Lake. Each survey location (100 m x 10 m) will be searched systematically for all snails which will be removed from the area. The area will be searched a second time for any remaining snails. The total density of snails can be estimated using the two values obtained during the first and second search period. These estimates will be compared to C. merganser population surveys which will allow us to evaluate the relationship between bird locations, snail population densities, and schistosomes.

Action 4. Assess snail infection rates

Goal: Determine the percentage of snails infected and the intensity of infection. A subsample of snails collected from the 20 survey locations will be retained from the June and August survey periods. Snails will be isolated and observed daily for signs of cercariae. We will also determine infection rates from dissected snails, and determine the intensity (total number of cercariae per snail) of infections by direct microscopic analysis. These estimates will be compared to

C. merganser population surveys and snail density estimates which will allow us to determine the relationship between these three factors.

Action 5. Assess the abundance of cercariae in Higgins Lake water

Goal: Track the abundance of cercariae in Higgins Lake during the summer. Every two weeks, we will sample Higgins Lake for cercariae. Cercariae will be collected from 10 locations around the Lake using fine mesh plankton nets following the recommendations of Muzzall et al. (2003). After collection, samples will be transported to Grand Valley State University and analyzed microscopically.

Action 6. Assess merganser infections

Goal: Determine the occurrence of SI eggs in C. merganser fecal samples. Merganser fecal samples will be collected from as many individuals as possible. Samples will be examined for SI eggs to determine the level of schistosome infections in mergansers from the area. We will plot the infection intensity of populations around the lake and use this information to focus C. merganser management.

Action 7. Develop rapid assessment tools

Goal 1. Continue to develop methods that employ automated tools to rapidly estimate the abundance of cercariae in lake water. We have begun developing automated assessment tools during the current field season. Our initial results look very promising. We will continue working to develop a procedure for estimating concentrations of cercariae using a flow cytometer. A flow cytometer can recognize and count specific particles within a sample at a very high rate. Developing this method will provide an automated process that will allow us to quickly analyze both: 1) samples from Action 4, and 2) water samples from the lake to determine current schistosome densities. We will also work to develop a method to estimate the abundance of schistosomes in snails. This procedure will include disrupting the snail's tissues to release the schistosomes, then using the flow cytometer to determine the number present. Developing this technology will allow us to survey the snail infection rates during late fall or early spring. These data may be developed into a predictor of schistosome abundance for the following summer.

Goal 2. Develop methods to track host snail population genetics. Based on research of human schistosomes, it appears that not all individuals of the intermediate host (snails) are equally susceptible to being infected with the schistosome. We will analyze the genetics of the snails retained for Action 4. Using these snails will allow us to compare a snail's genotype with its level of infection.

Action 8. Assist with development and implementation of plans for long-term reduction in snail populations through nutrient control

Goal: Reduce nutrient loading to the near shore area to limit algal growth and decrease snail populations. Nutrient concentrations in shallow near-shore areas foster the growth of algae, the primary food resource for snails. Reducing nutrients will minimize algal growth and limit snail reproduction and growth.

Action 9. Assist Gerrish Township Supervisor, Frank Homola, with an efficacy research area for his snail raking mechanism.

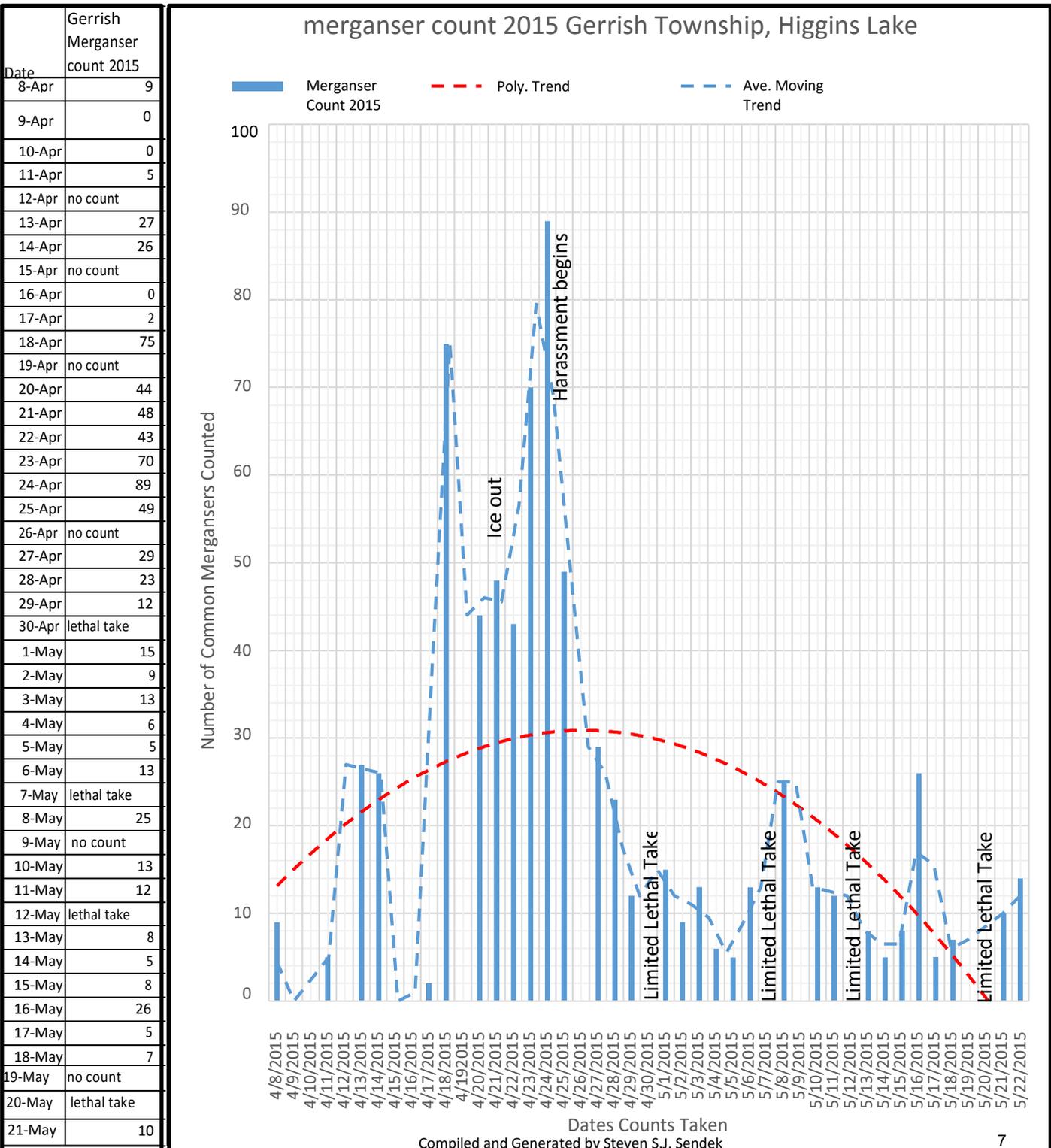
Goal: Test the theory and efficacy of dragging or raking snail hot spots where known SI cases have been reported to determine if raking snails is a cost effective tool to reduce the SI parasite on Higgins Lake.

All nine goals would be conducted at the cost of \$88,000.00. Only the harassment/limited lethal take portions of the program were selected for 2015 at a cost of \$23,000.00. The nest boxes were built and put up as a cooperative voluntary effort of Gerrish Township and Northpoint Fisheries Management LLC. Snail counts were voluntarily taken and examined by Dr. Mark Luttenton and a GVSU student.

In an effort of cooperation, at the request of Lyon Township and SICON, Northpoint agreed not to harass/limited lethal take the Lyon Township portion of Higgins Lake. All C. mergansers taken were also turned in to SICON for necropsy. Ice out began April 5, 2015. Following are table 1 and chart 1 depicting Gerrish Township Common Merganser counts 2015. Chart 1 shows the trend of C. mergansers as declining on Higgins Lake throughout the harassment/limited lethal take program. We could not however provide the data that a complete lake wide harassment/limited lethal take program would show if the entire Higgins Lake area were covered. Due to Northpoint's cooperation with SICON and Lyon Township, the efficacy of the harassment/ limited lethal take for Higgins Lake was compromised.

Table 1

Chart 1.



As ice out occurs the number of *C. mergansers* increase significantly. After harassment starts the number of *C. merganser* declines. As *C. merganser* numbers start to rise lethal take is initiated and the numbers decline again. This is a definite pattern indicating that the limited lethal take used to reinforce harassment is effective.

Perceived program conflicts

A campaign was initiated by SICON and their supporters (Higgins Lake Property Owners Association and Higgins Lake Swimmer's Itch Organization) to have the Gerrish/Northpoint program eliminated or at the least modified to have it conducted after the duckling trap and trans-location project. After several contentious public meetings, both township boards requested a meeting between SICON and Northpoint to see if there was common ground that both programs could operate from. A meeting was held on Dec. 8, 2015 at Grand Valley State University. At the meeting SICON made it very clear that the only acceptable compromise would be that the spring harassment should be eliminated and replaced with a late summer/early fall harassment program after SICON had found and plugged nests and collected hens and broods on the lake. It was also demanded by SICON to have all nesting boxes removed under the assertion that nesting boxes were known to attract more *C. mergansers* to the lake increasing SI problems. Northpoint considered all of the pros and cons of changing their program, permit dates and nest box deployment but declined to forfeit their management actions proposed which address early SI infection of snails in place of SICON's theoretical and unproven research program to plug nest cavities.

The science supporting Northpoint's decision includes a study by J. Murray (2003), a student under the instruction of Dr. Harvey Blankespoore the founder of the SICON company. The study determined that 6% of snails become infected with the SI parasite at a temperature 39.2 degrees F, and then the infection rate rises from there until it peaks around the end of July at a temperature of approximately 82.4°F – 93.2°F. The SICON plan allows snails to become SI infected early and through the peak snail infection period with the hope of finding and plugging nest holes for a research project to determine if plugged nest holes will keep the hens from nesting on the lake.

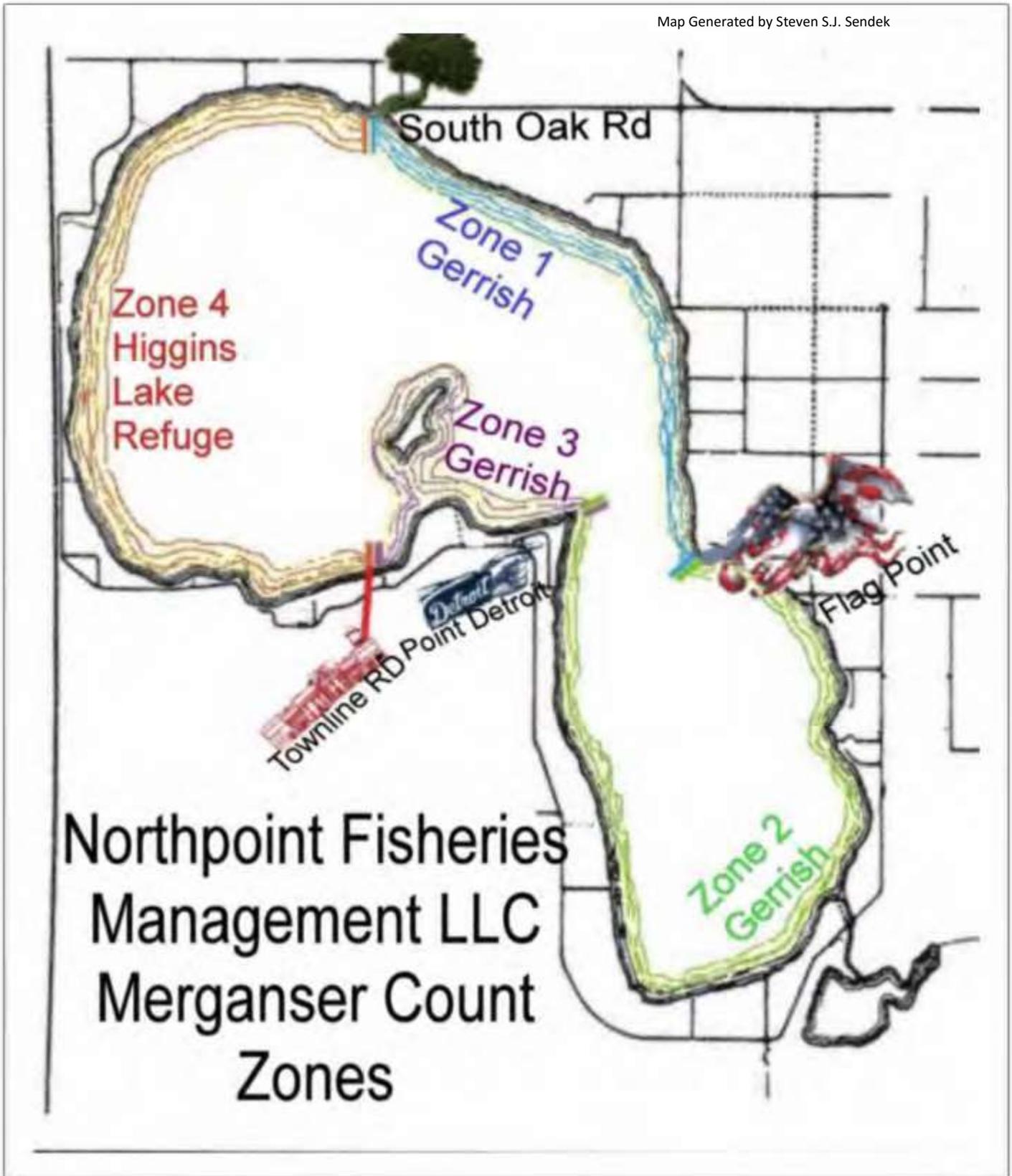
Nest plugging as a SI management tool is likely not to succeed as ornithologists have found that common mergansers not only nest in tree cavities, but also on the ground, in tree crotches, on rocks, in chimneys, and in nest boxes which refutes the theory of nest site fidelity. In addition, there is no scientific proof that nest boxes attract more *C. mergansers* to a lake as SICON had originally stated.

SICON, HLSIO and HLPOA also filed unsubstantiated complaints to the MDNR and USFWS of permit violations by Northpoint requesting that the Gerrish Township Special Purpose Permit MB56627B-O be revoked. The MDNR and USFWS investigated the allegations against Northpoint and found no violations. The two government entities in charge of issuing permits determined that the permits for both SICON and Gerrish Township would stand as issued with only slight modifications.

Gerrish Township and Northpoint entered a second year contract (2016) to conduct a harassment/limited lethal take and nest box program for Higgins Lake. A restriction was added to the Gerrish Township Special Purpose Permit MB56627B-O at the request of SICON, Higgins Lake Swimmer's Itch Organization, Higgins Lake Property Owners Association, and Lyon Township Board to not conduct harassment/ lethal take activities in Lyon Township. In turn Northpoint requested that the bird specimens taken be given directly to the MDNR Biologist in Roscommon for proper identification to protect the chain of evidence and deter any unsubstantiated accusations by SICON, HLPOA and HLSIO of permit violation as had occurred the previous year. Both requests were granted. The following map (diagram 2) depicts the areas Northpoint conducted its harassment/limited lethal take activities. Counts were taken over the entire lake. Zone 1 is the northeast portion of Higgins Lake from Oak Rd. to Flag Point. Zone 2 is the entire south end of the lake from Flag Point to Detroit Point. Zone 3 is the area from Flag Point to Townline Road including the area surrounding Treasure Island. Zone 4, the Lyon Township/SICON *C. merganser* refuge, is from Townline Rd. west and north to Oak Rd including Beaver Creek Township in Crawford County.

Higgins Lake diagram 2.

Map Generated by Steven S.J. Sendek



2016 summary of Work Completed:

Harassment/Limited Lethal Take

The 2016 work season began with harassment efforts on March 24 with the majority of the lake ice free and many C. mergansers appearing on the lake and concluded May 21. During that 60-day period Northpoint staff actively worked 48 days on the lake with a total of 347 man hours (see appendix table 8). The Northpoint team was composed of 7 members along with Gerrish Township Supervisor, Frank Homola (Picture 1).

Picture 1.



Left to Right: Frank Homola, Steven P. Sendek, Dr. James Anderson, Mike McNamara, Nick Sendek, Cal Westover, Don Barnard, Steven S.J. Sendek

Project Staff:

Steven P. Sendek, Northpoint Fisheries Management, LLC owner and project manager. MDNR Fisheries Biologist (ret.) with 47 years' waterfowl hunting experience in Michigan and North Dakota.

Dr. Mark Luttenton, PhD. Associate Dean of Graduate Studies, Grand Valley State University with 45 years of waterfowl hunting experience in Michigan.

Dr. James Andersen, PhD & Brigadier General, Michigan National Guard (ret.) with 51 years of waterfowl hunting experience in Michigan, Arkansas and North Dakota.

Michael McNamara, MBA & Lt Colonel, Michigan National Guard (ret.) with 21 years of waterfowl hunting experience in Michigan, North Dakota and Ohio.

Don Barnard, MDNR Fisheries Technician (ret.) with 46 years of waterfowl hunting experience in Michigan and North Dakota.

Cal Westover, Sargeant First Class, Michigan National Guard (ret.) with 14 years of waterfowl hunting experience in Michigan, Missouri and Nebraska.

Steven S.J. Sendek, student Fisheries and Wildlife, Lake Superior State University with 17 years of waterfowl hunting experience in Michigan and North Dakota.

Nicholas J. Sendek, student Mechanical Engineering, Ferris State University with 14 years of waterfowl hunting experience.

Daily activities included harassment by boat (up to 5 boats), occasionally firing pyrotechnics to reduce C. merganser hours on the lake. Harassment efforts were reinforced with limited lethal harvest. Harassment/limited lethal take were concluded on May 21 when recreational lake activity increased significantly because of the Memorial Day weekend holiday, and as prescribed by the MDNR and USFWS permits.

Limited Lethal Take

Limited lethal take was developed, and allowed under USFWS and MDNR permits to reinforce the harassment effort. C. mergansers would periodically become desensitized to boat and pyrotechnic hazing. Lethal take of a few individual birds from groups was employed to further frighten them off the lake as permitted under USFWS and MDNR permits. Prior to initiation of lethal actions, Roscommon Central Dispatch and MDNR Law Enforcement Division in Roscommon were notified.

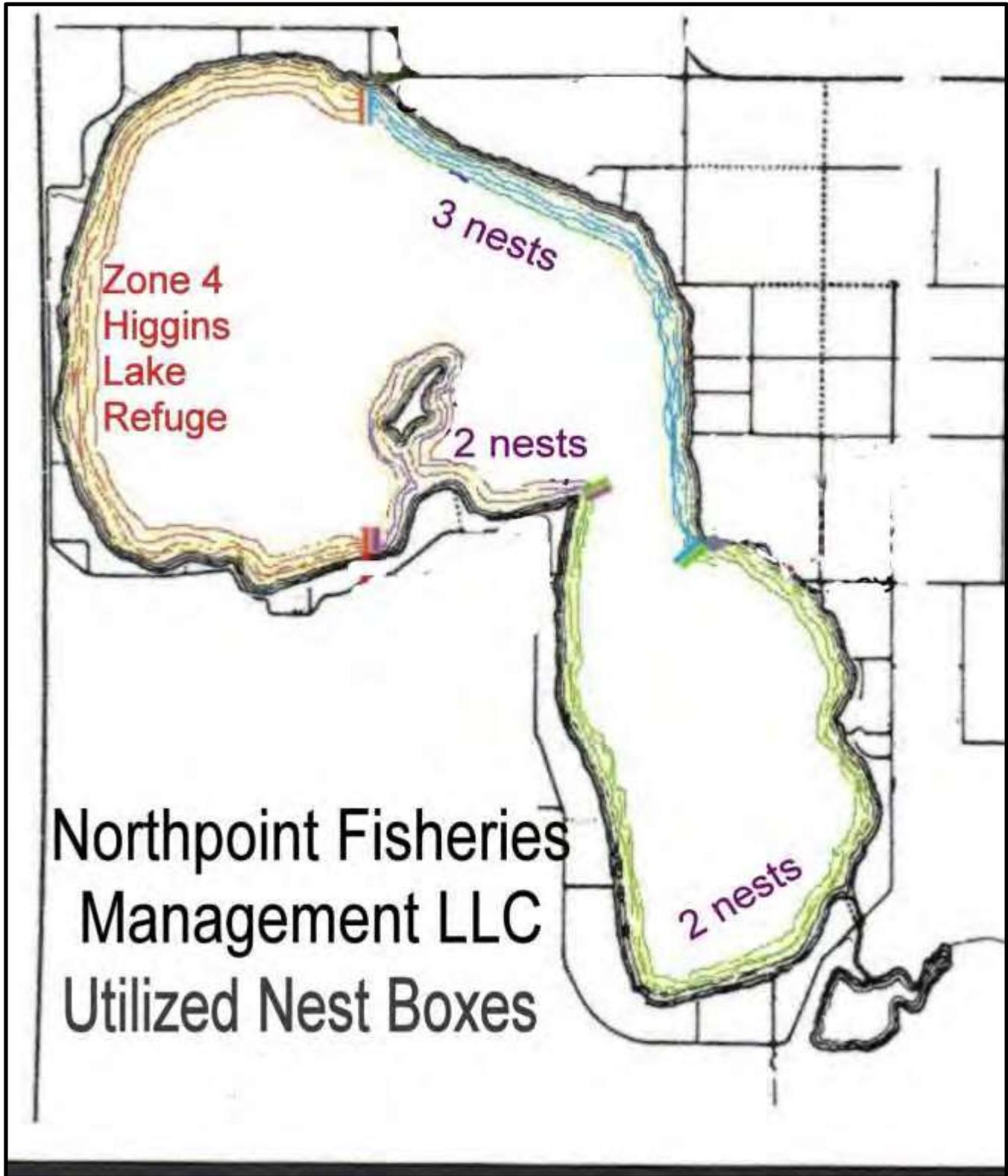
Lethal take was initiated on April 18, 2016 to support the harassment effort (Chart 2). A total of 23 C. mergansers were taken as part of the harassment/limited lethal take and nest box management efforts (17 C. mergansers during harassment/lethal take and 6 breeding hens from nest boxes). Included in this count is one hen that was not retrieved and one adult male that was crippled by some other event and retrieved. This crippled drake was referred to Northpoint staff by MDNR Wildlife Division staff on April 20, 2016. Northpoint staff later recovered and dispatched the bird.

Banded Common Mergansers

Northpoint staff harvested three banded C. mergansers from Higgins Lake in 2016 (two adult hens during the lethal operation and one adult hen from the nest box operation). The three hen C. mergansers harvested were banded the previous year by SICON. U.S. Geological Survey banding records show that SICON banded a total of 7 C. merganser hens from Higgins Lake in 2015 and trans-located them to Lake Huron. This harvest of banded C. mergansers represents a minimum yearly return rate of 43% of the previous years banded birds. U.S. Geological Survey banding records for 2015 show that SICON trapped, banded and trans-located a total of 7 C. merganser hens from Higgins Lake to Lake Huron at Tawas while they later reported trapping and removing 9 broods from Higgins lake.

All C. mergansers harvested were taken to the MDNR Roscommon Service Center and turned over to MDNR Wildlife Division staff for identification and subsequent release to SICON for necropsy (appendix Table 2). Three of the 23 birds (13%) collected by Northpoint and turned over to the MDNR for SICON to necropsy had to be discarded as SICON was not in the area to pick up the birds in a timely manner and were not included in the necropsy data collection.

Diagram 3. A map of nest box collections Generated by Steven S.J. Sendek



Nest Box Management

Nest box management was used as a cost effective method to reduce *C. merganser* brood productions on Higgins Lake. The objective was to monitor the boxes during the breeding and nesting season, capture the nesting hen at the onset of incubation and destroy the eggs. Nineteen nest boxes were deployed around Gerrish Township in the spring of 2015.

The first eggs were observed in a nest box on April 7, 2016. The first hen and clutch of 11 eggs was removed from that box on April 17, 2016. In total 7 clutches of eggs (63 eggs total) and 6 nesting hens (one hen was not captured) were removed during this management period (photograph 2).

Photograph 2. 63 Common Merganser eggs by Steven S.J. Sendek



One of the nesting hens removed from the nest boxes was a banded hen (Photograph 5). This bird was banded the previous year by SICON and trans-located with its brood to Lake Huron at Tawas City. Photograph 3 -6 below.

Photograph 3, 4, 5. Banded hens, last one from nest box.

Steven S.J. Sendek



Photograph 6. Common merganser hen using nest box taken from a trail cam by Steven S. J. Sendek.

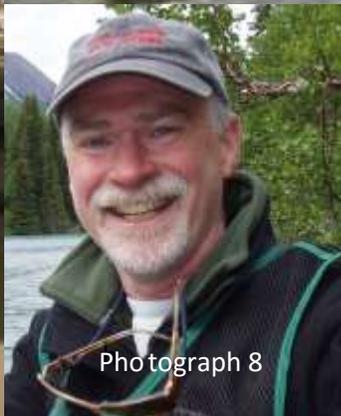


Gerrish Township Snail Raking Evaluation

Gerrish Township Supervisor, Frank Homola, is conducting a trial program to reduce snail populations by raking or disturbing the lake bottom sediments with a metal drag. This action was based on a research paper by Leighton et al. (1999) who conducted an experiment that mechanically disturbed the epilithic habitat of the snails using a boat mounted rototiller or a tractor and rake, eliminating almost all of the snails if the disturbance was done in areas of high snail concentration in shallow areas of the lake during the breeding and early development phase of the snail. They proposed that the incorporation of snail habitat disturbance into management programs is an effective way to control Schistosoma Dermatitidis. "New control strategies being tested by the SFU researchers look promising. One method, involving the physical disturbance of snail habitat in areas of high infection, appears to work as well or better than the use of chemicals, and with less impact on the lake. Chemicals are not approved for use in British Columbia because of their impact on fish and other wildlife (Meadahl, 1999).

Gerrish Township fabricated a rake system (photograph 9) to be pulled manually in shallow areas of the lake (photographs 8 and 9) to disturb the surface of the lake bottom, damaging snails and their eggs masses in the process. An experimental area for treatment was established at the Gerrish Township Park to evaluate the effectiveness of this technique to reduce snail densities. Raking took place on May 17, 2016 and the snail population assessment was conducted on May 21, 2016. Snail density estimates were determined by Dr. Mark Luttenton (photo 8), Grand Valley State University and graduate student Nate Akey (photo's 6 and 7). Snail density estimates were determined from 20 quadrants within the treatment area and 20 quadrants outside of the treatment area (control site). The snail density estimate for the treated area was 0.36 snails per square meter and 1.6 snails per square meter in the control area. A 77% decline in snail density was attributed to the bottom raking along with a notable decline in the number of snail egg masses; there were no egg masses within the treated area whereas numerous egg masses were observed within the control area. Bottom raking activity is considered a minor activity by Michigan Department of Environmental Quality (MDEQ) and is being monitored by staff from the MDEQ office in Gaylord.

Photographs of Dr. Mark Luttenton (8), Nate Akey collecting snails (6,7), Frank Homola's rake for Higgins Lake snails (9).



Photographs 10, and 11. Frank Homola's snail rake in action.



Photograph 10



Photograph 11

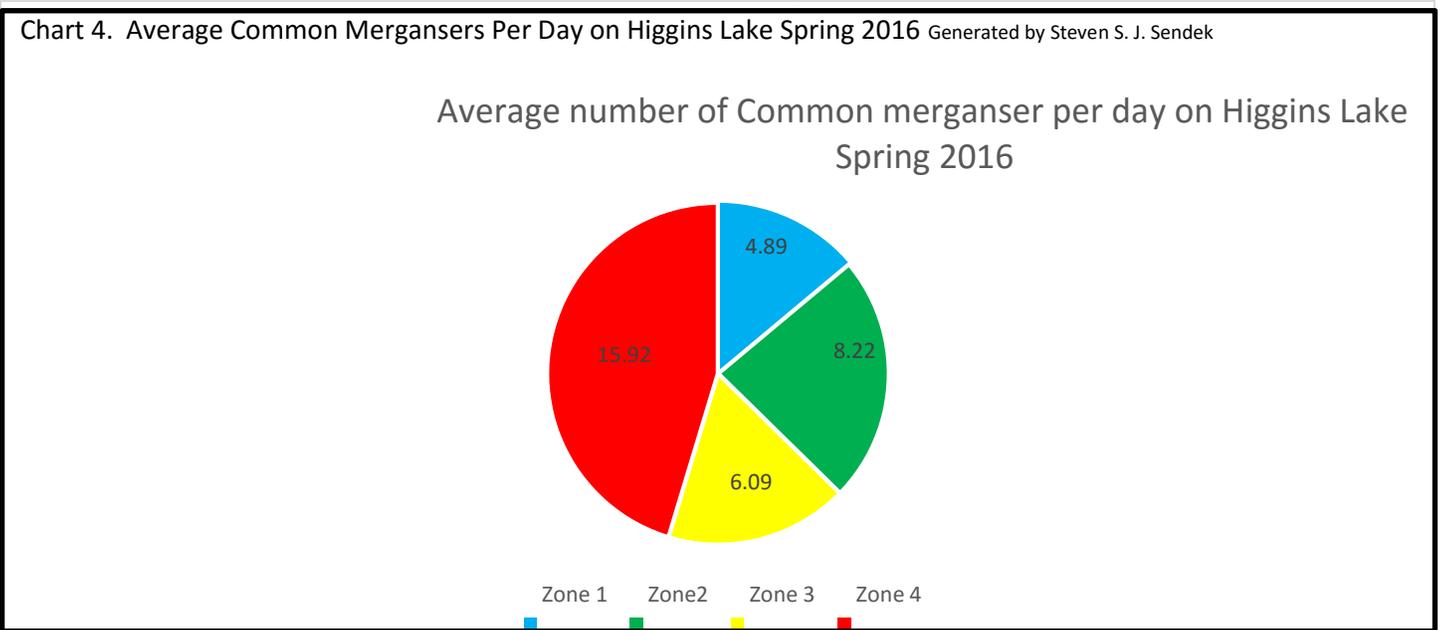
Common merganser (duck) days on the lake

Common merganser counts were conducted daily in conjunction with harassment activities as weather permitted. To better understand distribution of C. mergansers around the lake, it was divided into zones (see lake map diagram 1). Harassment activities were only conducted in Gerrish Township zone 1, 2, and 3. Zone 4 was the Lyon Township/SICON C. merganser refuge. Zone 1 is the northeast portion of Higgins Lake from Oak Rd. to Flag Point. Zone 2 is the entire south end of the lake from Flag Point to Detroit Point. Zone 3 is the area from Flag Point to Townline Rd in Gerrish Township, including the area surrounding Treasure Island. Zone 4, the Lyon Township/Sicon C. merganser refuge, was from Townline Rd. west and north to Oak Rd including Beaver Creek Township in Crawford County. C. To help quantify the number and time C. merganser spent on Higgins Lake, a standardized value defined as “C. merganser day” was calculated for the lake based on the daily counts made for each zone during the harassment period of March 24-May 21, 2016.

C. merganser days on Higgins Lake were calculated by determining the average number of C. mergansers counted per day and multiplying by the number of days per harassment period (58). For the 2016 spring harassment period, there was an estimated total of 1,687 C. merganser days for the entire Lake (Table 3).

Table 3. Total Common Merganser Days on the Lake. Generated by Steven S.J. Sendek

	Zone 1	Zone2	Zone 3	Zone 4
Average # CM per day	4.89	8.22	6.09	15.92
Total CM days on Lake	284	477	353	573



Comparing the harassment efforts of 2015 and 2016 in Gerrish Township, there was a decrease in the daily average of C. mergansers from 21 C. mergansers/day in 2015 to 18 C. mergansers/day in 2016, a 13% decrease.

Table 4. Percentage of change between 2015 -2016

Generated by Steven S.J. Sendek

	2015	2016
Average # of CM Per Day	21	18
3/21 = 13% the same methods and efforts were used both years. See Table 6 in the appendix.		

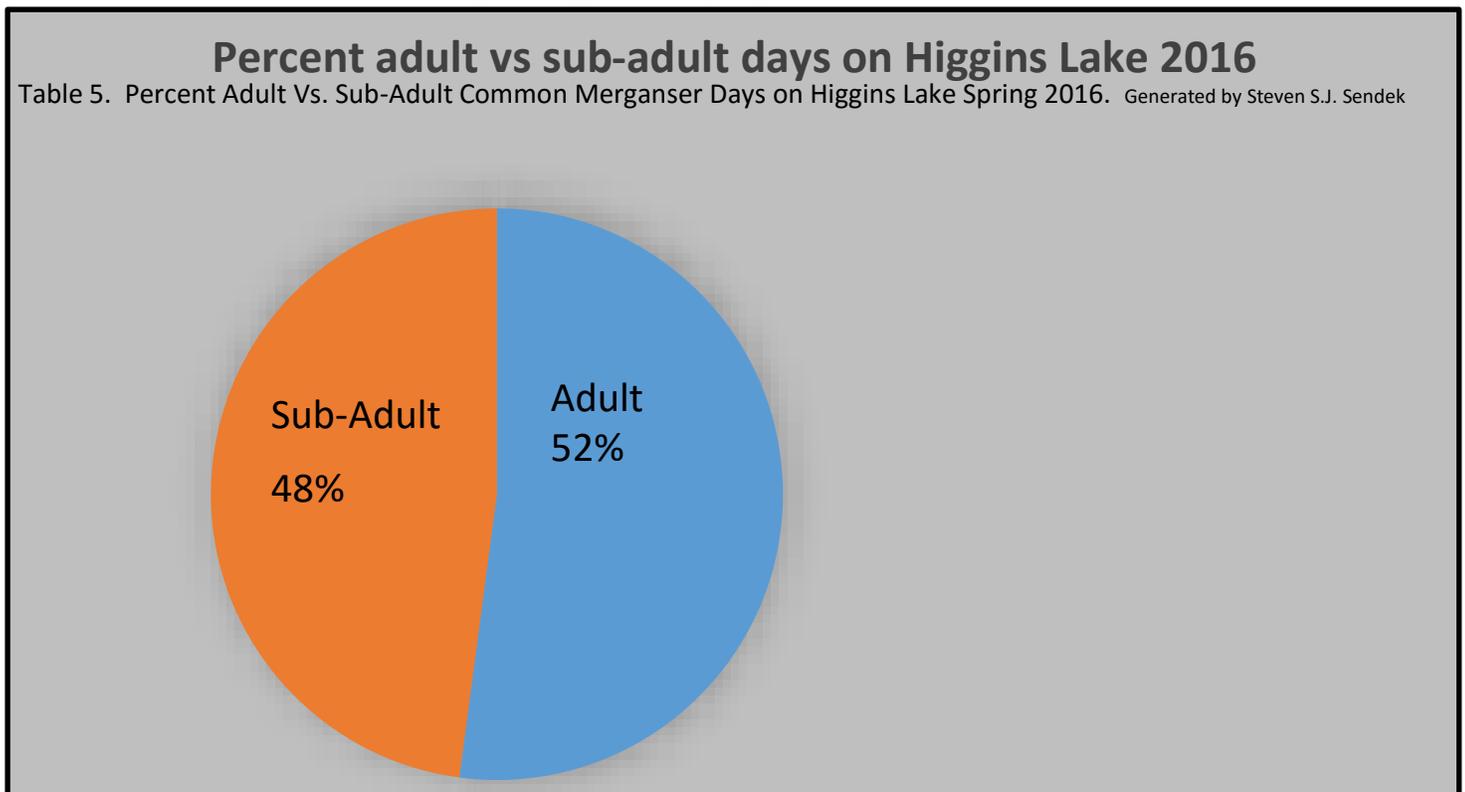
Sub-adult C. mergansers were observed using the lake the entire harassment period. Early on it was evident that many of these sub-adults were migrants along with the adults. As the migrants were moved on by the harassment activities, it was still common to see sub-adults on the lake. One method to identify migrant sub-adults from resident sub-adults would be from band retrieval but we do not have this information as no trans-located ducklings have been banded. Periodically small groups of sub-adults and adults were observed which appeared to be family units (groups that may have hatched together the previous year). It was estimated (based on counts made) there were 451.24 sub-adult days on Higgins Lake during the 2016 the Gerrish/Northpoint harassment period. An average of 7.78 sub-adults per day (210 sub-adults divided by 27 days when the count was taken over the whole lake) over the 58-day period of harassment/limited lethal take. This number substantiates that there was a significant number of sub-adult C. mergansers on Higgins Lake during the spring of 2016 (Table 5 and Chart 5).

Table 5. Adult and Sub-Adult days on Higgins Lake Spring 2016

Merganser days on the lake	Adult spring 2016	sub-Adult spring 2016
Merganser days on the lake	491	451

Chart 5. Percent Adult Vs Sub-Adult days on Higgins Lake Spring 2016

Generated by Steven S.J. Sendek



Conclusions and Recommendations

- Harassment/limited lethal take has reduced C. merganser hours on Higgins for both 2015 and 2016.
- Harassment/limited lethal take has reduced the numbers C. merganser (average number of ducks per day) from 2015 to 2016, note that the effort and methods were the same each year.
- Nearly ½ of the spring 2016 merganser population is made up of sub-adults, year old birds, even though SICON claims to have removed all ducklings in 2015 before they imprinted on Higgins Lake through trap and translocation.
- Nest boxes are an efficient and cost effective tool to reduce C. merganser brood production.
- Seven C. merganser broods (63 eggs) were eliminated from hatching on the lake through the use of nest boxes.
- Nest boxes did not attract additional breeding hens to Higgins Lake as the number of C. mergansers dropped between 2015 and 2016.
- One banded C. merganser hen (who nested in a natural nest last year on Higgins Lake) utilized one of the nest boxes this year, thus disproving the concept of nest fidelity and the effectiveness of any potential benefit from nest plugging.
- 43% (3 of 7) of last year's breeding C. merganser hens trapped on Higgins Lake and trans-located to Lake Huron by SICON returned to Higgins lake this spring and were eliminated by lethal take.
- Lake bottom "raking" holds great promise as a cost effective, efficient and environmentally friendly method to reduce snail populations

Gerrish Township/ Northpoint's harassment actions have been successful in reducing C. merganser hours on the lake for both adult and sub-adults. The limited lethal take has been successful in supporting the harassment effort along with eliminating bird hours (both adult and sub-adult) and brood production on the lake. The limited lethal take has removed permanently 3 of the 7 previously breeding hens from the lake preventing an expensive and continuous trap/transfer/return to Higgins Lake/ produce another brood/ and trap/ transfer again cycle. The nest box management has proven to be a very efficient and cost effective method to reduce brood production and to eliminate repetitive hen nesting.

Lake bottom raking is showing great potential as a cost effective, efficient and environmentally friendly method to reduce snail densities in specific areas.

All of the actions are being conducted at a time when large numbers of infected C. mergansers are on the lake. They are also being conducted during a time when snails are becoming infected with the SI parasite thereby reducing the potential for snails to become infected and later infect human recreational lake users.

In addition, we have learned much during the past two seasons about common merganser behavior and biology, some of which scientifically challenges or refutes other proposed SI/merganser management actions which appear to be based on myth, half-truth, misinformation, not supported with any validated data and lacking adherence to scientific methods.

Some of the most common misinformation is:

1) “merganser hens might return to the lake where they nest after being trapped and transferred to a new location”.

Fact is they do return to the lake where they nested as proven by the banded hens Northpoint took during the spring of 2016. This raises another concern though, that in just this one year three of the seven hens were captured during the following spring. U.S.G.S. banding records show that dozens of C. mergansers have been banded the past 2 decades. Unfortunately, there has never been any reference to or data produced that has been published reporting the return rate on these other projects. It is difficult to believe with a return rate of 43% this year alone that there have not been any recaptures reported on other similar C. merganser trans-location projects.

2) “nest plugging is the long term solution to eliminating SI in a lake by eliminating nesting cavities and preventing hens from nesting and producing broods in the future”.

The common belief here revolves around the C. merganser and its nest site fidelity. The misconception here is that the common merganser hen selects one nest cavity her entire reproductive life. Gerrish/Northpoint's capture of a banded hen in a nesting box in the spring of 2016 refutes this myth. Northpoint nest box collections disproves this theory as one of the hens captured nesting in a box was banded by SICON on Higgins Lake in 2015. The significance of the recapture is that this hen nested on Higgins Lake in 2015 at an unidentified natural nesting site. She produced a brood, she and the brood were captured by SICON and trans-located to Lake Huron at Tawas City. This hen then returned to Higgins Lake in the spring of 2016 to re-nest but this time selected a Gerrish/Northpoint nest box to lay its clutch of eggs instead of its previous year's natural nest site. This finding clearly refutes nest site fidelity stated by SICON biologists along with their nest cavity plugging management action to reduce C. merganser reproduction.

3) “Maintenance of a C. merganser refuge on Higgins Lake to allow SICON (per their request) to find and plug natural nest sites is beneficial to reducing the SI problem.”

Maintenance of C. merganser refuge on Higgins lake is an impediment to a successful comprehensive swimmers itch program on Higgins lake. The refuge was created for SICON to have an undisturbed area for finding nesting cavities and plugging them. It is common belief by reputable ornithologists that C. mergansers may prefer nesting in cavities but will nest on the ground, in rocks, old chimneys, fallen trees, old stumps, and in the grass. Maintaining a refuge in Lyon Township to experiment with this myth of nest site fidelity only leads to a more drawn out swimmers itch program. The restrictions imposed by a Lyon Township refuge should be removed allowing for a full and complete harassment/limited lethal take program. Contrary to claims that C. mergansers won't use nest boxes, 7 of 18 artificial nest boxes were occupied in the spring of 2016 during the course of an ambitious harassment/lethal take program operated by Northpoint.

4) “Common merganser harassment should be conducted after July 31 when juvenile birds show up and not in the spring”.

This year's 2016 spring count data clearly shows that 48% of the total counts of C. Mergansers were sub-adults. This raises another concern, supported by Northpoint observation, of why there are so many sub-adults on Higgins Lake when there was great effort and expense to trap and trans-locate the ducklings from Higgins Lake in 2015. This will be addressed in the next misconception review.

5) "Duckling home site imprinting occurs at the location where ducklings obtain the ability to fly and not the hatching location".

Higgins Lake C. merganser count data indicates many juvenile or sub-adults (who were hatched in 2015) were observed on Higgins Lake this spring (2016). This is after SICON claims to have trapped and translocated 100% of the ducklings that hatched on Higgins Lake last year (2015). Higgins Lake count data for spring 2016 shows that 48% of the C. mergansers duck days on the lake are made up of sub-adults hatched in 2015 (see chart 5 above). If imprinting occurs at the time of developing flight, as SICON claims, there should not be any sub-adults on Higgins Lake as there were no C. merganser ducklings on Higgins Lake in 2015 that learned to fly. The question is "are these sub-adults ones that were trans-located from Higgins Lake and are now returning to Higgins Lake because imprinting occurred at hatching, or are these juvenile birds following the hen back during the spring migration as is common in many waterfowl species?" Or is it simply that juveniles just randomly fly around looking for future nesting territories"? This question can be easily answered, but only if SICON bands any and all ducklings captured this summer.

6) "Ducklings cannot be banded."

There is a type of band used for day old ducklings called an oval band (USGS uses the term plasticine). SICON needs to incorporate these bands into their trans-location program to determine imprinting patterns.



7) snail shedding rates are the best way to evaluate success for any SI management action”.

Other prominent parasitologists and scientists (Muzzall, et al) say shedding rates are too variable over time to be use as a metric to evaluate the results of a SI management action. Muzzall et al (2003) reported in a SI study conducted on Michigan lakes “treating mergansers with a drug that kills blood flukes has been reported to result in a 50 percent decrease in the percentage of snails shedding cercariae from one year to the next in some Michigan lakes (Reimlnk et al 1995). Natural variability in shedding rates is high, however, this reduction is well within the range of variability expected when comparing one year to the next without any treatment at all. The pattern of decreases involving treatment of waterfowl with a drug would have to be repeated for several experimental and reference lakes in the same year and/or for pairs of treated and reference (untreated) lakes over several years before the treatment could truly be judged effective. It might have been effective but this cannot be confirmed scientifically unless the pattern occurs across a large enough sample of lakes to be statistically significant”. A more accurate way is direct dissection of the snail’s digestive tract, liver and pancreas, Muzzall et al (2006). Sicon should discontinue the use of snail shedding rates and use another metric to evaluated the success or failure of any SI management action such as direct dissection to determine overall snail infection rates as recommended by Muzzall in his study. Furthermore, he states that the only way to determine true snail infection rates is, “The light box assay determines only the number of snails actively shedding cercariae, it does not yield data on the total number of infected snails in the population, which is best determined by direct dissection and microscopic examination of the snail’s liver and pancreas. A subsample of several hundred snails that did not shed cercariae in the light box were dissected to determine if any infected snails had not been detected by the light box assay. We found that several snails with infections of the liver or pancreas had not shed cercariae in the light box assay. Adding the total number of infected snails detected by dissection to the number that had shed cercariae in the light box increased percentages of infection for this sample of snails from 0.46 to 1.05 percent in 1999, from 0.95 to 1.61 percent in 2000. and from 1.37 to 1.61 percent in 2001. These results suggest that not all infected snails shed cercariae on any particular date,” (Muzzall et al, 2006).

8) Nest boxes will attract more merganser hens to Higgins Lake.

To date there is no data to support this, however Northpoint has collected data that supports a decrease in *C. merganser* numbers on Higgins Lake instead of an increase with the deployment of nest boxes. It is questionable that *C. mergansers* migrating north over the lake would know how many potential nesting sites are available on a given lake. (see merganser numbers and breeding hens chart).

9) Swimmer's itch infection is only of concern during warm summer water temperatures.

Murray (2002) determined that the schistosome eggs hatch and start to infect snails at 4°C or 39.2 °F.” Northpoint believes standard protocol dictates it is best to deal with an infection at the onset not after it is full blown.

Summary

We fully understand that there are two SI programs operating on Higgins lake which have polarized the community. It has been and continues to be our full intention to only conduct programs that will benefit the reduction of swimmer's itch. It is our belief the best actions will include spring harassment supported with limited lethal harvest, employing nest boxes to reduce brood production, hot spot snail lake raking, followed up with duckling trapping for the short term. The long term solution lies in reducing nutrient contributions to the lake which in turn will reduce the algal food source driving the snail population explosion.

Literature Cited

Coady, N. R., P. M. Muzzall, T. M. Burton, R. J. Snider, J. Saxton, M. Sergeant, and A. Sommers. 2006. Ubiquitous variability in the prevalence of *Trichobilharzia stagnicola* (Schistosomatidae) infecting *Stagnicola emarginata* in three northern Michigan Lakes. *The Journal of Parasitology* 92:10-15.

Leighton, Bruce J. Sandra Zervos and John M. Webster. 2000. Ecological factors in schistosome transmission and an environmentally benign method for controlling snail in a recreational lake with a record of schistomes dermatitis. *Parasitology International*. 49 (2000) 9-17

Meadahl, Marianne. Researchers Have Solution to Swimmer's Itch Riddle. <http://www.sfu.ca/archive-sfunews/sfnews/1999/Oct21/webster.html>. SFU News, 21 Oct. 1999. Web. 26 May 2016. <<http://www.sfu.ca/archive-sfunews/sfnews/1999/Oct21/webster.html>>.

Murray, J. A., and H. Blankespoor, Dr. "Effect of Temperature on the Longevity and Infectivity of *Trichobilharzia Stagnicola* Miracidia in *Stagnicola Emarginata*." AGRIS: International Information System for the Agricultural Science and Technology. 2002. Accessed June 10, 2016. <http://agris.fao.org/agris-search/search.do?recordID=PH2003001072>.

Murray, Jody, "Effects of Temperature Change on the Swimmer's Itch Life Cycle." 7th International Congress on Medical and Applied Malacology in October 2002, in Los Banos, Philippines.

Muzzall, Patrick M., Dr, Thomas M. Burton, Dr, Richard J. Snyder, Dr, and Nathaniel R. Coady, Dr. "Occurrence, Distribution, and Control of Parasites That Cause Swimmers Itch in Michigan." Extension Bulletin WQ8 Michigan State University. June/July 2003. Accessed May 27, 2016. http://www.michigan.gov/documents/deg/wrd-sw-as-itcbrochure_445468_7.pdf

Appendix 1.

Table 2. Higgins Lake C. Merganser Count and Comments 2016. Generated by Steven S.J. Sendek

Date	Higgins Section 1	Higgins Section 2	Higgins Section 3	Higgins Refuge	comments
24-Mar	2	19	8	0	
25-Mar	8	60	15	12	
26-Mar	0	30	14	31	
27-Mar	3	27	17	44	
28-Mar	2	2	25	47	
29-Mar	4	7	11	19	
30-Mar	8	17	14	20	
31-Mar	none	none	none		
1-Apr	9	17	18	18	
2-Apr	none	none	none	none	
3-Apr	10	13	2	38	
4-Apr	none	none	none	none	
5-Apr	none	none	none	none	
6-Apr	none	none	none	none	
7-Apr	9	2	0	26	
8-Apr	3	7	5	18	
9-Apr	4	3	4	16	
10-Apr	none	none	none	0	
11-Apr	0	0	5	11	
12-Apr	0	7	4	6	
13-Apr	7	8	20	14	
14-Apr	2	14	6	10	
15-Apr	8	6	6	12	
16-Apr	2	9	8	10	

17-Apr					Duck box maintenance 1 hen 11 eggs
18-Apr	1	11	2	no count made	First lethal take 4 - 1 hen 3 drakes
19-Apr	2	7	2	9	
20-Apr					Duck box maintenance 1 hen 10 eggs
21-Apr	4	14	7	9	lethal take 3 drakes 4 others
22-Apr	4	16	6	34	
23-Apr	0	0	5	12	
24-Apr	0	4	0	7	
25-Apr	2	2	4	3	
26-Apr	21	5	2	8	
27-Apr	2	0	6	2	
28-Apr	11	5	2	No count	lethal 1 hen banded # 2107-00455
29-Apr	8	8	8	32	
30-Apr	5	2	1	0	
1-May	8	14	4	No count too rough	
2-May	4	12	3	No count too rough	Duck box maintenance 1 hen 10 eggs
3-May	0	0	0	12	
4-May	none				
5-May	none				lethal 1 immature drake
6-May	4	8	10	no count	lethal 1 immature drake
7-May	16	0	2	27	lethal 1 immature drake

8-May					
9-May	3	0	0	11	
10- May	19	13	7	No count taken	
11- May	1	0	0	10	
12- May	7	0	2	37	
13- May	12	0	4	No count taken	Lethal harvest 1 banded hen #: 2107-00454
14- May	2	3	0	No count taken	
15- May	0	0	0	4	
16-May	none				
17- May	0	0	7	2	
18- May	0	0	7	0	
19- May	none	0	0	0	Duck box maintenance 1 hen 10 eggs
20- May	3	0	1	2	Duck box maintenance 1 banded hen #2107-00451, 9 eggs
21- May					Duck box maintenance 2 boxes 1 hen 9 eggs and 3 eggs
Total Count	220	372	274	573	
Number of days counted/section	45	45	45	36	
Ave Duck/day	4.89	8.22	6.09	15.92	

Table 6. Comparative data for Gerrish Merganser Counts 2015-2016

Generated by Steven S.J. Sendek

Date	Gerrish Merganser count 2016	Gerrish Merganser count 2015		
24-Mar	29			
25-Mar	83			
26-Mar	44			
27-Mar	47			
28-Mar	29			
29-Mar	22			
30-Mar	39			
31-Mar			no count	
1-Apr	44			
2-Apr			no count	
3-Apr	25			
4-Apr			no count	
5-Apr			no count	
6-Apr			no count	
7-Apr	11			
8-Apr	15	9		
9-Apr	11	0		
10-Apr		0	no count	
11-Apr	5	5		
12-Apr	11			no count
13-Apr	35	27		
14-Apr	22	26		
15-Apr	20			no count
16-Apr	19	0		
17-Apr		2	no count	
18-Apr	14	75		
19-Apr	11			no count
20-Apr		44	no count	
21-Apr	25	48		
22-Apr	26	43		
23-Apr	5	70		
24-Apr	4	89		
25-Apr	8	49		
26-Apr	28			no count
27-Apr	8	29		
28-Apr	18	23		
29-Apr	24	12		
30-Apr	8			lethal take

1-May	15	15		
2-May	9	9		
3-May	13	13		
4-May	6	6		
5-May	5	5		
6-May	13	13		
7-May				lethal take
8-May	25	25		
9-May				no count
10-May	13	13		
11-May	12	12		
12-May				lethal take
13-May	8	8		
14-May	5	5		
15-May	8	8		
16-May	26	26		
17-May	5	5		
18-May	7	7		
19-May				no count
20-May				lethal take
21-May	10	10		
22-May	14	14		
total	884	745		
average	$886 \div 48 = 18$ (total days counted)	$745 \div 35 = 21$ (total days counted)		

Table 6. Total Average ducks per day on Gerrish Township, Higgins Lake only on the days when counts were taken both days both years 2015-2016

Dates	2015	2016
8-Apr	9	15
9-Apr	0	11
11-Apr	5	5
13-Apr	27	35
14-Apr	26	22
18-Apr	75	14
21-Apr	48	25
22-Apr	43	26
23-Apr	70	5
24-Apr	89	4
25-Apr	49	8
27-Apr	29	8
28-Apr	23	18

9-Apr	12	24
12-Apr	27	35
13-Apr	26	22
17-Apr	75	0
19-Apr	44	11
20-Apr	48	0
21-Apr	43	25
22-Apr	70	26
23-Apr	89	5
24-Apr	49	4
26-Apr	29	28
27-Apr	23	8
28-Apr	12	18
30-Apr	15	8
1-May	9	26
2-May	13	19
3-May	6	0
7-May	25	18
9-May	13	3
10-May	12	39
12-May	8	9
13-May	5	16
14-May	8	5
15-May	26	0
20-May	10	4
Total Lake Counts	1190	549
Averaged by 38 days' counts were taken on Gerrish both years both days for comparison did not use in paper as both ice outs aren't used due to dates that aren't the same. This gives an inflated range of change.	$1190 \div 38 = 31$	$549 \div 38 = 14$

