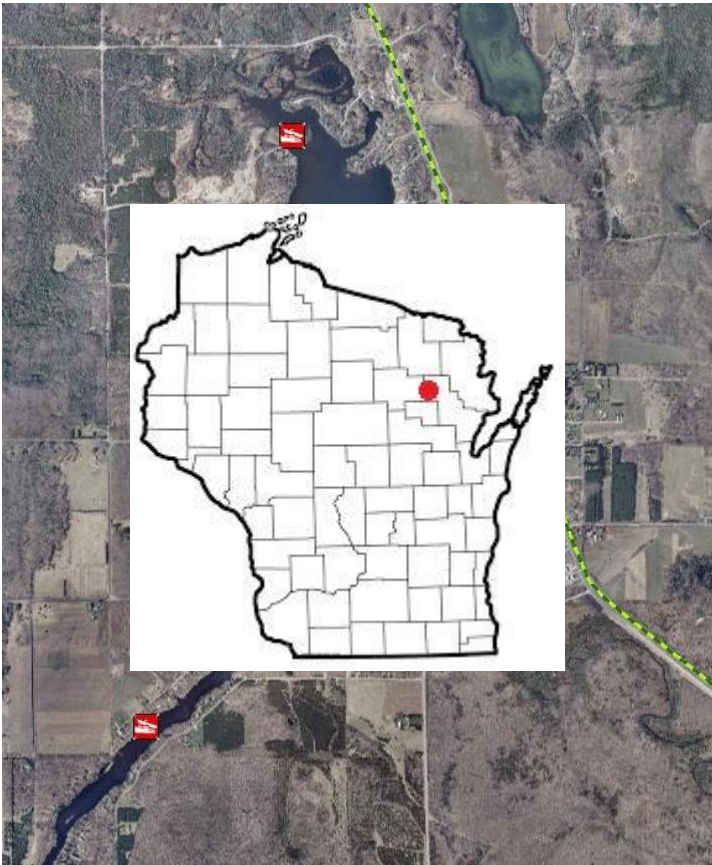


# Townsend Flowage

Oconto County  
2016 Fish Management Report

Cory Wienandt – Fisheries Technician  
Christopher C. Long – Fisheries Biologist



Wisconsin Department of Natural Resources  
101 N. Ogden Rd.  
Suite A  
Peshtigo, Wisconsin 54157



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2016 Fish Management Report



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Cory Wienandt, Fisheries Technician, Date

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Christopher C. Long, Fisheries Biologist, Date

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Michael Donofrio, Fisheries Supervisor, Date

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David Boyarski, East District Fisheries Supervisor, Date

## Summary

### Lake and location:

Townsend Flowage, Oconto County, T33N R15E Sec 15

### Physical / chemical attributes (Wisconsin DNR, 1977):

|                            |  |
|----------------------------|--|
| <b>Surface acres:</b>      | 476 acres  |
| <b>Maximum depth:</b>      | 30 feet  |
| <b>Average depth:</b>      | 9 feet   |
| <b>Shoreline length:</b>   | 10.49 miles  |
| <b>Lake type:</b>          | Drainage   |
| <b>Water chemistry:</b>    | Slightly alkaline, hard water having neutral, light brown water of moderate transparency, Secchi disk = 8 ft. (summer).  |
| <b>Littoral substrate:</b> | 71% muck, 20% sand, 8% gravel, and 1% rubble.  |
| <b>Aquatic vegetation:</b> | Moderate to dense.   |
| <b>Other features:</b>     | Townsend flowage is moderately developed. Shoreline area is primarily upland with vegetation consisting of mixed hardwoods and conifers. The remaining area is wetland composed of swamp conifers including cedar, black spruce along with other low land species. |

### Purpose of survey:

Determine the current status of fishery.

### Surveys:

|   |   |
|---|---|
| Spring fyke netting survey (SNI):         | April 19 <sup>th</sup> through April 23 <sup>rd</sup> |
| Electrofishing survey (SEI):              | May 9 <sup>th</sup>                                   |
| Electrofishing survey (SEII):             | May 24 <sup>th</sup>                                  |
| Electrofishing survey (fall recruitment): | September 6 <sup>th</sup>                             |

### Fishery:

The fishery of Townsend Flowage is comprised of panfish species (bluegill, black crappie, pumpkinseed, yellow perch, and rock bass) and gamefish species (walleye, largemouth bass, northern pike, and muskellunge).

## EXECUTIVE SUMMARY

- Townsend Flowage is located in northern Oconto County. The flowage is 476 acres and consists of 2 distinct basins. There are three public boat landings (Figure 11). All public landings are owned and maintained by the town of Townsend.
- A 6-foot drawdown was conducted over the winter of 2012-2013 with the objective of reducing the abundance of Eurasian water milfoil. The drawdown did not have any negative impacts to fish populations in the flowage.
- A total of 2,411 fish were collected (including recaptures) representing 12 species during the 2016 survey (Table 5). The five most abundant species collected by number were bluegill (33%), yellow bullhead (23%), yellow perch (13%), pumpkinseed (10%), and black crappie (6%).
- A total of 798 bluegill were collected (Table 5). The average length of bluegill was 5.3 inches with a range from 2.9 to 9.1 inches (Table 5). Bluegill were reaching 6 inches in 5 to 6 years (Figure 1).
- During the survey, 143 black crappie were collected (Table 5). The average length was 5.9 inches with ranges from 4.6 to 13.0 inches. Crappie are reaching 8 inches in 7 to 8 years (Figure 6).
- A total of 123 northern pike was collected during the 2016 survey. The average length was 21.6 inches long with a range from 14.2 to 30.2 inches (Table 5). The catch rate during spring fyke netting was 2.4 per net night (Table 8).
- A total of 120 largemouth bass was collected during spring fyke netting and electrofishing (Table 5). The average length was 12.9 inches with a range from 7.5 to 19.0 inches. Bass were reaching 14 inches in 6 to 7 years (Figure 4).
- Overall, 10 walleyes were collected during spring fyke netting and electrofishing (Table 5). The average length was 21.4 inches with a range from 9.0 to 24.6 inches (Table 5). During the fall recruitment survey, no young of the year (YOY) walleye were observed.
- A total of 6 muskellunge was collected during spring netting and fall surveys. The average length of fish captured was 21.0 inches with a range from 16.9 to 38.1 inches (Table 5).
- Largemouth bass abundance has remained relatively unchanged, but size structure is very good with 38% of sampled fish greater than the 14-inch minimum size limit (Table 5). At this time, no regulation changes are recommended for largemouth bass since size structure has improved and catch rates have increased.
- Walleye have been stocked into Townsend Flowage for 50 years with little measurable success. The stocking rate of 15 fish/acre in 2014 and 2016 produced only marginal returns to the fishery. Therefore, we recommended that walleye stocking be closely evaluated in future surveys and if measurable success cannot be achieved, walleye stocking may be discontinued by the WDNR on Townsend Flowage.

- Muskellunge stocking was resumed in 2009 by WDNR at the rate of 1 fish/acer (400 fish annually) (Table 2). Townsend Flowage provides abundant habitat and forage to sustain an increase in large predators. The stocking rate of muskellunge should be increased to 2 fish/acre to further develop this fishery. Fish should also be marked/fin clipped to monitor natural reproduction and emigration from the flowage.
- The next comprehensive survey for Townsend Flowage is scheduled for 2024 and will focus on the age, growth, abundance, and recruitment of the dominant gamefish and panfish.

## INTRODUCTION

Townsend Flowage is located in northern Oconto County. The flowage is 476 acres and consists of 2 distinct basins. Two streams were dammed to form the flowage; McCaslin Brook and Mosquito Creek. There are three public boat landings (Figure 11). All public landings are owned and maintained by the town of Townsend.

A 6-foot drawdown was conducted over the winter of 2012-2013 with the objective of reducing the abundance of Eurasian water milfoil. Problems with overabundant aquatic vegetation have been reported from homeowners and anglers since the 1960's. In 2002, the Townsend Lake Association began removing aquatic vegetation with a mechanical harvester whereas chemical treatments had been used annually since the 1970's. The most abundant aquatic plant is Bushy pondweed which inhabits approximately 62% of the flowage. Common waterweed was found to inhabit approximately 57% of the flowage (Roost 2006). The following is a current list of known aquatic invasive species in Townsend Flowage: Aquatic forget-me-not banded mystery snail, Chinese mystery snail, curly-leaf pondweed, and Eurasian water-milfoil (EWM).

Stocking of both walleye and muskellunge have occurred on a regular basis since the 1960's (Table 2). From 1998 to 2016 the Wisconsin Department of Natural Resources (WDNR) stocked approximately 80,000 small and large fingerling walleyes. From 2009 to 2016 over 2,600 large fingerling muskellunge have also been stocked by the WDNR.

Prior surveys on Townsend Flowage include electrofishing surveys in 1958, 1965, 1971, 1984, 2006, 2008, 2014, and 2015. Comprehensive surveys were completed in 1997 and 2016 (Table 3).

## METHODS

### Data collection:

Ten standard fyke nets (3x6 ft. frames, 3 ft. hoop, ¾ inch bar, 1.5-inch stretch) were set shortly after ice out on 04/18/2016 (Figure 11). Nets were lifted daily from April 19<sup>th</sup> to April 23<sup>rd</sup>, 2016 for a total effort of 50 net nights. All fish collected were measured to the nearest 0.1 inch. A representative sample of panfish were measured and the remainder counted to reduce stress and handling mortality. All gamefish were given a fin clip per treaty fishery sampling guidelines. Aging structures were collected from 5 fish per 0.5-inch group for gamefish species (walleye, largemouth bass, and muskellunge). Aging structures were collected from 5 panfish per 0.5-inch group per species (bluegill and black crappie).

A standard WDNR electrofishing boat was used to sample 6.0 miles on May 5<sup>th</sup>, 2016. All walleye collected were examined for clips and measured to the nearest 0.1 inch. On May 24<sup>th</sup>, 4.0 miles of shoreline were sampled. All panfish and gamefish were collected for two staggered 0.5 mile transects, and only gamefish were collected for the remaining shoreline per protocol (Spring

Electrofishing II). On September 6<sup>th</sup>, 6.0 miles of shoreline were sampled targeting young of the year (YOY) walleye and muskellunge. Fish collected were identified and measured to the nearest 0.1 inch. Sampling gear, effort, date, and target species for each survey are listed in Table 3.

#### Data analysis:

Relative abundance, total catch, and catch per gear type were calculated for all species (Table 5, 6, 7, 8). Ages were assigned to each fish using standard WDNR procedures. Age and length frequency distributions and mean length at age analysis were performed for gamefish and panfish where ageing structures were collected. Proportional stock density (PSD) and relative stock density of preferred length fish (RSD<sub>p</sub>) were calculated (Anderson and Neumann 1996; Bister et al. 2000). PSD is the ratio of 'quality-length' fish to 'stock-length' fish multiplied by 100. RSD<sub>p</sub> is the ratio of 'preferred-length' fish to 'stock-length' fish multiplied by 100. Both PSD and RSD are commonly used as a measure of population size structure (Table 4). The Schumacher and/or modified Schnabel formulas were used to produce population estimates for largemouth bass, northern pike, and walleye. Age-frequency distribution was calculated after ages were distributed to all fish in the sample. Mean length at age for fish collected in 1997, 2008, and 2016 was plotted against northern Wisconsin averages for species where aging data was available.

## RESULTS

Water temperatures for the spring netting survey ranged from 50-55 and 59-68 degrees Fahrenheit during the spring electrofishing survey. A total of 2,411 fish were collected (including recaptures) representing 12 species during the 2016 survey (Table 5). The five most abundant species collected by number were bluegill (33%), yellow bullhead (23%), yellow perch (13%), pumpkinseed (10%), and black crappie (6%). Other species captured included northern pike, largemouth bass, rock bass, walleye, muskellunge, black bullhead, and white sucker.

#### Bluegill

A total of 798 bluegill were collected (Table 5). The catch rate was 9.1 per net night for spring fyke netting and 345.0 per mile for electrofishing (Table 8). The average length of bluegill was 5.3 inches with a range from 2.9 to 9.1 inches (Table 5). Bluegill PSD was 25 and falls in the acceptable range (20-60%) for a balanced population. Bluegill RSD<sub>p</sub> was less than 1 and below the desired range (5-20%) (Table 4). A subsample of 41 bluegill was aged from 3 to 12 years old. Growth was similar to other bluegill populations in northern Wisconsin. Bluegill were reaching 6 inches in 5 to 6 years (Figure 1). Natural reproduction and recruitment are evident with multiply year classes present.

#### Yellow Perch

A total of 306 yellow perch were collected (Table 5). The catch rate was 5.9 per net night during spring fyke netting (Table 8). The average length was 5.8 inches with a range from 3.3 to 9.8 inches. Yellow Perch PSD was 2 and RSD<sub>p</sub> was 0. Both PSD and RSD<sub>p</sub> are well below the acceptable range for balanced fish populations (Table 4). The catch rate was 5.9 per net night and 10.0 per mile for spring netting and electrofishing respectively. Yellow perch were not aged, but size structure is comparable to past surveys (Figure 8).

#### Black Crappie

During the survey, 143 black crappie were collected (Table 5). The catch rate for spring netting was 2.8 per net night. During spring electrofishing the catch rate was 4.0 per mile (Table 8). The average length was 5.9 inches with ranges from 4.6 to 13.0 inches. Black crappie PSD was 36 and RSD<sup>p</sup> was 11 (Table 5). A subsample of 61 black crappie was aged from 3 to 13 years old. Growth rates were below average when compared to northern Wisconsin with most reaching 8 inches in 7 to 8 years (Figure 6). Successful reproduction and recruitment are evident with multiple year classes present.

### Pumpkinseed

A total of 237 pumpkinseed sunfish were collected during spring netting and electrofishing surveys (Table 5). Catch rates were 2.3 per net night and 128.0 per mile of electrofishing, respectively (Table 8). The average length of pumpkinseed was 5.5 inches with a range from 3.4 to 7.9 inches. Pumpkinseeds were not aged, but length frequency suggests a balanced population based on size structure of our sample (Figure 9).

### Rock Bass

A total of 120 rock bass were collected during both spring netting and electrofishing surveys. The average length was 7.1 inches with a length range from 3.5 to 9.6 inches (Table 5). The catch rate was 1.8 per net night for spring fyke netting and 32.0 per mile for spring electrofishing (Table 8).

### Northern Pike

A total of 123 northern pike was collected during the 2016 survey. The average length was 21.6 inches long with a range from 14.2 to 30.2 inches (Table 5). The catch rate during spring fyke netting was 2.4 per net night (Table 8). PSD was 55 which is well within the acceptable range (Table 4). Recaptures were limited therefore, it was not possible to generate a population estimate. Aging samples were not taken for northern pike.

### Largemouth Bass

A total of 120 largemouth bass was collected during spring fyke netting and electrofishing (Table 5). The catch rate for Largemouth Bass was 24.8 per mile during spring electrofishing and 0.4 per net night for fyke netting (Table 8). The average length during spring electrofishing was 12.9 inches with a range from 7.5 to 19.0 inches. Largemouth bass PSD for spring electrofishing was 66 and RSD<sup>p</sup> was 23 (Table 5). Both PSD and RSD<sup>p</sup> are within the acceptable range for balance fish populations (Table 4). A subsample of 77 bass was aged from 3 to 14 years old. Growth rates for largemouth bass are comparable to northern Wisconsin averages with most bass reaching 14 inches (minimum length limit) in 6 to 7 years (Figure 4). Natural reproduction and recruitment are apparent with multiple year classes present. Recaptures were limited therefore, it was not possible to generate a population estimate.

### Walleye

Overall, 10 walleyes were collected during spring fyke netting and electrofishing (SE I and SE II) (Table 5). The catch rate was 0.2 per net night (Table 8). No walleyes were captured during SE I surveys and only one walleye was captured during spring electrofishing (SE II). The average length was 21.4 inches with a range from 9.0 to 24.6 inches (Table 5). A subsample of 6 walleye were

aged and ranged from 7 to 14 years old. During the fall recruitment survey, no young of the year (YOY) walleye were observed. Recaptures were limited therefore, it was not possible to generate a population estimate.

### Muskellunge

A total of 6 muskellunge was collected during spring netting and fall surveys. The catch rates were 0.1 per net night for fykenetting and 0.3 per mile for spring and fall electrofishing (Table 8). The average length of fish captured was 21.0 inches with a range from 16.9 to 38.1 inches (Table 5). Fifty percent of muskellunge captured were over 35 inches and all fish sampled were below the 40-inch minimum length limit. A subsample of 3 fish was aged from 9 to 12 years old.

### Yellow Bullhead

Yellow bullhead was the second most abundant fish sampled. A total of 547 yellow bullheads were collected during spring netting and electrofishing surveys. The average length of yellow bullheads was 9.9 inches with a length range from 7.2 to 12.7 inches (Table 5). The catch rate for yellow bullheads was 10.4 per net night and 26.0 per mile for spring netting and electrofishing, respectively (Table 8).

### Other Species

Other species present included black bullhead (2), white sucker (1), and golden shiners were observed.

## DISCUSSION

Multiple fisheries surveys have been conducted on Townsend Flowage over the years (Table 3). However, sampling protocols, equipment, and techniques have changed over time. Therefore, comparisons between previous survey data and the 2016 data were somewhat limited.

Townsend flowage supports a diverse panfish fishery. Catch rates for all panfish in 2016 have increased from the comprehensive survey in 1997 (Table 6 and 8). Although abundance has improved, the size structure diminished between 1997 and 2016 for bluegill and yellow perch (Figures 2, and 8). Bluegill PSD has decreased from 45 in 1997 to 25 in 2016. The PSD's for yellow perch and rock bass have all decreased as well. Along with decreased PSD's the average length has proportionally decreased as well (Table 5). The increases in abundance and decreases in PSD were observed in both spring netting and electrofishing samples and are likely not a result of changes in sampling protocols (Tables 6 and 8). Bluegill growth for both 1997 and 2016 is considered average, or slightly below average, compared to other lakes in northern Wisconsin (Figure 1).

Black Crappie size structure and abundance increased between 1997 and 2016 (Tables 6 and 8). Crappie PSD increased from 22 to 36 between the 1997 and 2016 surveys. Growth for black crappie from 1997 to 2016 has not changed and is considered below average compared to other lakes in northern Wisconsin (Figure 6). Crappie are cyclic spawners meaning that successful reproduction and recruitment can be highly variable and unpredictable from year to year. The 1997 survey revealed a strong year class of crappie around 4 inches (Figure 5). The recent survey suggests that crappie reproduction and recruitment has been relatively stable (Figure 5). As a result, crappie fishing should be good for the next several years.



Largemouth bass catch rates increased in 2016 (Table 5). Spring and fall electrofishing results from 1997, 2008, and 2016 increased from 10.6 per mile (1997) to 17.8 per mile (2008) to 24.8 per mile (2016) (Table 6, 7, and 8). However, the relative abundance of largemouth bass remains was relatively the same in 1997 and 2016 (Table 5). The relative abundance of bass was 19% in 2008 because no spring fyke netting was conducted and the overall catch of other species during the survey was greatly reduced thus inflating the relative abundance of bass. Largemouth bass PSD's have increased from 65.6 (1997) to 87.3 (2008) and then decreased to 66.1 (2016) (Table 5). Growth rates for 1997, 2008, and 2016 are almost identical and are considered below average compared to other lakes in northern Wisconsin (Figure 4).

The relative abundance of northern pike has declined in Townsend Flowage since 1997 (Table 5). Catch rates during spring netting in 1997 were 4.7 per net and decreased to 2.4 per net in 2016 (Table 6 and 8). The reduced catch may be attributed to the ice out condition in 2016. There was a lot of open water in 2016 prior to the ice leaving the boat launches. This coupled with the fact that nets were placed several days after ice out may account for the reduced catch since northern pike prefer to spawn at temperatures of 34 to 40 degrees F. Temperatures on the first day of netting were close to 50 degrees F. Therefore, many northern pike may have already spawned and were less susceptible to capture during the survey. Northern pike PSD and average size increased from 1997 to 2016. More than 55 percent of northern pike captured during spring netting in 2016 were greater than 21 inches (Table 5). In 1997 approximately 18 percent of fish captured during netting were greater than 21 inches.

Walleye have been consistently stocked into Townsend Flowage since the 1960's with more than 200,000 walleyes being planted (Table 2). Survey results through the years (1965, 1971, 1984, 1997, 2006, 2008, 2014, 2015, and 2016) have produced a total of 25 walleyes captured, with 10 of those caught during the 2016 survey (Table 5).

Much like walleye, muskellunge have been stocked regularly since 1960 (Table 2). More than 17,000 muskellunge have been stocked into Townsend Flowage. Muskellunge have not been collected during any fisheries survey prior to 2016 (Table 5 and 8), although the occasional fish is caught by anglers. Six fish were captured in 2016 (Table 5). All but one fish was an adult.

Other species captured of noticeable interest were yellow and black bullheads. Abundance of bullheads increased from 0.5 fish per net in 1997 to 10.4 fish per net in 2016. Bullheads were second only to bluegills in total catch (Table 5).

## CONCLUSIONS AND RECOMMENDATIONS

Abundance increased for most panfish species since the last survey but size structure was generally poor. This is likely a result of the dense aquatic vegetation which inhibits predator species such as bass and pike to effectively capture prey (i.e. panfish). The lake district maintains and operates a mechanical weed harvester and annually harvests approximately 30 acres of aquatic vegetation. Continued annual harvest is recommended with the possibility of expanding the current 30 acres however, flooded timber makes harvesting vegetation impossible in certain areas of the flowage. Natural reproduction and recruitment for all panfish species was good and their populations are healthy and self-sustaining. No changes to panfish regulations are recommended (Table 1).

Largemouth bass abundance has remained relatively unchanged but size structure is very good with 38% of sampled fish greater than the 14-inch minimum size limit (Table 5). Catch rates have

steadily increased from 1997 to 2016. At this time, no regulation changes are recommended for largemouth bass since size structure has improved and catch rates have increased.

Beginning in 2014 Townsend Flowage has been stocked with large fingerling walleye at an experimental rate of 15 fish/acre (Table 2). Large fingerlings were again stocked at the same rate in 2016. The normal, accepted stocking rate for large fingerling walleye is 5 fish/acre. Prior to 2014, most walleye stocking consisted of small fingerlings. The change in stocking strategy was a result of the Wisconsin legislature approving funds to begin the Wisconsin Walleye Initiative. Under the initiative, WDNR increased production and distribution of large fingerling walleyes throughout the state.

Walleye have been stocked into Townsend Flowage on and off for 50 years with little measurable success. The stocking rate of 15 fish/acre in 2014 and 2016 produced only marginal returns to the fishery. In October 2017, 11 walleyes between 8.5 and 12.3 inches were collected and likely from these 2 stocking events. Even though these fish were not aged at the time of this report, due to their size, the age/growth history from other local waters, and the lack of natural reproduction due to limited spawning habitat, it's safe to assume these are from the 2014 and 2016 stocking events. It is recommended that the department closely monitor and evaluate the walleye stocking success in future surveys. If measurable success (catch per mile, survival, and growth) are not achieved, it is recommended that walleye stocking be discontinued by the department. Townsend flowage is scheduled to be stocked with extended growth walleyes again in 2018.

Muskellunge have been stocked periodically since the 1960's in hopes of establishing a musky fishery. No muskellunge were stocked between 1977 and 2008. Muskellunge stocking was resumed in 2009 by WDNR at the rate of 1 fish/acer (400 fish annually) (Table 2). Prior to 2016, only 1 muskellunge has ever been captured in WDNR surveys. In 2016, six muskellunge were captured. A subsample of 3 fish were aged from 9 to 12 years old suggesting natural reproduction occurred since stocking resumed in 2009. Townsend Flowage provides abundant habitat and forage to sustain an increase in large predators. The stocking rate of muskellunge should be increased to 2 fish/acre to further develop this fishery. Fish should also be marked/fin clipped to monitor natural reproduction and emigration from the flowage. The current stocking guidance would allow this to occur for 4 consecutive years before returning to a "maintenance" stocking of 1 fish/acre.

The drawdown that occurred in 2012-2013 did not have any negative impacts to fish populations in the flowage. Anecdotal angler reports suggest fishing was excellent for several years following the drawdown. The drawdown appears to have been effective at reducing the amount of EWM however, several areas of EWM were observed during the 2016 survey.

The next comprehensive survey for Townsend Flowage is scheduled for 2024 and will focus on the age, growth, abundance, and recruitment of the dominant gamefish and panfish. Additional effort should focus on evaluating the muskellunge stocking program, specifically the change in stocking rate if approved.

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## TABLES AND FIGURES

Table 1. Current (2016-2017) fishing regulations for Townsend Flowage.

| Species  | Fishing Season       | Daily Limit         | Minimum Length |
|--|----------------------|---------------------|----------------|
| Largemouth Bass  | May 7 - March 5      | 5                   | 14 inches      |
| Smallmouth Bass  | May 7 - June 19      | Catch and release   |                |
|  | May 7 - March 5      | 5 in total with LMB | 14 inches      |
| Northern Pike  | May 7 - March 5      | 5                   | None           |
| Walleye  | May 7 - March 5      | 3                   | 18 inches      |
| Muskellunge  | May 28 - November 30 | 1                   | 40 inches      |
| Panfish (bluegill, pumpkinseed, crappie, and yellow perch) | Open all year        | 25 in total         | None           |
| Rock Bass  | Open all year        | None                | None           |
| Bullheads  | Open all year        | None                | None           |

Table 2. Stocking history of Townsend Flowage from 1973 to 2016.

| Year | Species     | Age Class        | Number Stocked | Avg Fish Length (in) | Source Type      |
|------|-------------|------------------|----------------|----------------------|------------------|
| 1972 | WALLEYE     | FINGERLING       | 14080          | 3                    | DNR COOP PONDS   |
| 1973 | MUSKELLUNGE | FINGERLING       | 1800           | 11                   | DNR HATCHERY     |
| 1974 | WALLEYE     | FINGERLING       | 18000          | 3.67                 | DNR COOP PONDS   |
| 1975 | MUSKELLUNGE | FINGERLING       | 640            | 11                   | DNR COOP PONDS   |
| 1976 | WALLEYE     | FINGERLING       | 34000          | 3                    | DNR COOP PONDS   |
| 1977 | MUSKELLUNGE | FINGERLING       | 1200           | 9                    | DNR COOP PONDS   |
| 1994 | WALLEYE     | FINGERLING       | 450            | 6                    | PRIVATE HATCHERY |
| 1998 | WALLEYE     | SMALL FINGERLING | 10000          | 1.2                  | DNR HATCHERY     |
| 2000 | WALLEYE     | SMALL FINGERLING | 10000          | 1.7                  | DNR HATCHERY     |
| 2003 | WALLEYE     | LARGE FINGERLING | 1250           | 8.5                  | PRIVATE HATCHERY |
| 2003 | WALLEYE     | SMALL FINGERLING | 10000          | 2.1                  | DNR PONDS        |
| 2005 | WALLEYE     | LARGE FINGERLING | 4760           | 7.4                  | DNR HATCHERY     |
| 2008 | WALLEYE     | SMALL FINGERLING | 10044          | 1.4                  | DNR HATCHERY     |
| 2009 | MUSKELLUNGE | LARGE FINGERLING | 200            | 10.5                 | DNR HATCHERY     |
| 2010 | WALLEYE     | SMALL FINGERLING | 10000          | 1.4                  | DNR HATCHERY     |
| 2011 | MUSKELLUNGE | LARGE FINGERLING | 400            | 9.3                  | DNR HATCHERY     |
| 2012 | MUSKELLUNGE | LARGE FINGERLING | 400            | 10.2                 | DNR HATCHERY     |
| 2012 | WALLEYE     | SMALL FINGERLING | 10000          | 1.5                  | DNR HATCHERY     |
| 2013 | MUSKELLUNGE | LARGE FINGERLING | 476            | 9.7                  | DNR HATCHERY     |
| 2014 | WALLEYE     | LARGE FINGERLING | 6667           | 6.8                  | DNR HATCHERY     |
| 2014 | MUSKELLUNGE | LARGE FINGERLING | 400            | 9.8                  | DNR HATCHERY     |
| 2015 | MUSKELLUNGE | LARGE FINGERLING | 400            | 11.4                 | DNR HATCHERY     |
| 2016 | WALLEYE     | LARGE FINGERLING | 6704           | 7.6                  | DNR HATCHERY     |
| 2016 | MUSKELLUNGE | LARGE FINGERLING | 399            | 10.88                | DNR HATCHERY     |

Table 3. WDNR fisheries surveys completed on Townsend Flowage from 1958 to 2016.

| Date                 | Survey type    | Target species          | Effort  | Survey purpose                    |
|----------------------|----------------|-------------------------|---------|-----------------------------------|
| September 8-12, 1958 | Netting        | All fish                | 35 NN   | Gamefish/panfish assesment        |
| July 16, 1965        | Electrofishing | All fish                | 7.0 mi. | Gamefish/panfish assesment        |
| August, 1971         | Electrofishing | All fish                | NA      | Gamefish/panfish assesment        |
| September 13, 1984   | Electrofishing | All fish                | 4.8 mi. | Gamefish/panfish assesment        |
| April 29-May 2, 1997 | Netting        | All fish                | 60 NN   | Gamefish/panfish assesment        |
| June 18, 1997        | Netting        | All fish                | 4 NN    | Gamefish/panfish assesment        |
| October 15, 1997     | Electrofishing | All fish                | 3.5 mi. | Gamefish/panfish assesment        |
| May 31, 2006         | Electrofishing | Walleye and Muskellunge | 7.0 mi. | Juvenile assesment                |
| May 6, 2008          | Electrofishing | Walleye and Muskellunge | 5.5 mi. | Walleye (SEI)                     |
| June 3, 2008         | Electrofishing | All fish                | 4.0 mi. | Gamefish/panfish assesment (SEII) |
| October 15, 2008     | Electrofishing | Gamefish                | 5.1 mi. | Gamefish assesment                |
| September 8, 2014    | Electrofishing | Walleye and Muskellunge | 6.0 mi. | Juvenile assesment                |
| September 29, 2015   | Electrofishing | Walleye and Muskellunge | 6.0 mi. | Juvenile assesment                |
| April 19-23, 2016    | Netting        | All fish                | 50 NN   | Gamefish/panfish assesment (SNI)  |
| May 9, 2016          | Electrofishing | Walleye and Muskellunge | 6.0 mi. | Walleye recap (SEI)               |
| May 24, 2016         | Electrofishing | All fish                | 4.0 mi. | Gamefish/panfish assesment (SEII) |
| September 6, 2016    | Electrofishing | Walleye and Muskellunge | 6.0 mi. | Juvenile assesment                |

Table 4. Proposed length categories used to calculate Proportional stock density (PSD) and Relative stock density (RSD) for various fish species. Measurements are total lengths for each category in inches. Updated Anderson and Neumann (1996) and Bister et al. (2000).

| Species         | PSD     | RSD-P    | Stock | Quality | Preferred | Memorable | Trophy |
|-----------------|---------|----------|-------|---------|-----------|-----------|--------|
| Black crappie   |         |          | 5     | 8       | 10        | 12        | 15     |
| Bluegill        | 20 - 40 | 5 - 20*  | 3     | 6       | 8         | 10        | 12     |
| Brown bullhead  |         |          | 5     | 8       | 11        | 14        | 17     |
| Largemouth bass | 40 - 70 | 10 - 40* | 8     | 12      | 15        | 20        | 25     |
| Muskellunge     | 30 - 60 |          | 20    | 30      | 38        | 42        | 50     |
| Northern pike   | 30 - 60 |          | 14    | 21      | 28        | 34        | 44     |
| Pumpkinseed     | 20 - 40 |          | 3     | 6       | 8         | 10        | 12     |
| Rock Bass       | 20 - 40 |          | 4     | 7       | 9         | 11        | 13     |
| Smallmouth bass | 30 - 60 |          | 7     | 11      | 14        | 17        | 20     |
| Walleye         | 30 - 60 |          | 10    | 15      | 20        | 25        | 30     |
| Yellow perch    | 30 - 50 |          | 5     | 8       | 10        | 12        | 15     |
| Yellow bullhead |         |          | 4     | 7       | 9         | 11        | 14     |

\* Range based on management strategy fo balanced populations.

Table 5. Number, relative abundance (%), average length, PSD, RSDp, and length range of fish collected from all gears in 1997, 2008, and 2016 from Townsend Flowage.

| 1997                 |        |           |                |      |      |                       |
|----------------------|--------|-----------|----------------|------|------|-----------------------|
| *Common Name of Fish | Number | Percent % | Average Length | PSD  | RSDp | Length Range (inches) |
| Bluegill             | 327    | 27%       | 5.9            | 45.2 | 2.5  | 3.4 - 8.9             |
| Northern Pike        | 326    | 27%       | 17.5           | 19   | 3.9  | 5.7 - 33.2            |
| Black Crappie        | 173    | 14%       | 6.4            | 22.1 | 5.3  | 4.4 - 11.2            |
| Yellow Perch         | 126    | 10%       | 6.4            | 5.7  | 0    | 4.2 - 9.3             |
| Pumpkinseed          | 77     | 6%        | 5.4            | 25.8 | 1.5  | 3.5 - 9.0             |
| Rockbass             | 72     | 6%        | 7.8            |      |      | 4.8 - 10.0            |
| Largemouth Bass      | 65     | 5%        | 13.7           | 65.6 | 40.6 | 4.7 - 22.2            |
| Bullhead sp.         | 48     | 4%        | 9.7            |      |      | 5.0 - 12.2            |
| Walleye              | 4      | <1%       | 14.3           |      |      | 13.2 - 14.7           |
| White Sucker         | 1      | <1%       | 20.4           |      |      | 20.4                  |
| Muskellunge          | 0      | NA        | NA             |      |      | NA                    |
| Total                | 1219   | 100%      |                |      |      |                       |

| 2008                 |        |           |                |      |      |                       |
|----------------------|--------|-----------|----------------|------|------|-----------------------|
| *Common Name of Fish | Number | Percent % | Average Length | PSD  | RSDp | Length Range (inches) |
| Bluegill             | 331    | 49%       | 4.3            | 5.6  | 0    | 2.7 - 7.6             |
| Northern Pike        | 37     | 6%        | 20.9           | 47.1 | 0    | 16.5 - 25.7           |
| Black Crappie        | 8      | 1%        | 5.7            |      |      | 4.7 - 8.7             |
| Yellow Perch         | 9      | 1%        | 4.5            |      |      | 3.7 - 6.1             |
| Pumpkinseed          | 84     | 13%       | 5.7            |      |      | 3.2 - 7.7             |
| Rockbass             | 42     | 6%        | 6.6            |      |      | 2.9 - 9.3             |
| Largemouth Bass      | 127    | 19%       | 14.3           | 87.3 | 33.8 | 8.0 - 19.4            |
| Bullhead sp.         | 21     | 3%        | 9.2            |      |      | 7.6 - 11.1            |
| Walleye              | 10     | 1%        | 14.6           |      |      | 12.6 - 18.8           |
| White Sucker         | 1      | <1%       | NA             |      |      | NA                    |
| Muskellunge          | 1      | <1%       | 12.5           |      |      | 12.5                  |
| Total                | 671    | 100%      |                |      |      |                       |

| 2016                 |        |           |                |      |      |                       |
|----------------------|--------|-----------|----------------|------|------|-----------------------|
| *Common Name of Fish | Number | Percent % | Average Length | PSD  | RSDp | Length Range (inches) |
| Bluegill             | 798    | 33%       | 5.3            | 25.2 | 0.8  | 2.9 - 9.1             |
| Northern Pike        | 123    | 5%        | 21.6           | 55.3 | 3.3  | 14.2 - 30.2           |
| Black Crappie        | 143    | 6%        | 7.4            | 36.3 | 11.8 | 4.6 - 13.0            |
| Yellow Perch         | 306    | 13%       | 5.8            | 1.9  | 0    | 3.3 - 9.8             |
| Pumpkinseed          | 237    | 10%       | 5.5            | 35.2 | 0    | 3.4 - 7.9             |
| Rockbass             | 120    | 5%        | 7.1            |      |      | 3.5 - 9.6             |
| Largemouth Bass      | 120    | 5%        | 12.9           | 66.1 | 23.7 | 7.5 - 19.0            |
| Bullhead sp.         | 547    | 23%       | 10             |      |      | 7.2 - 12.7            |
| Walleye              | 10     | <1%       | 21.4           |      |      | 9.0 - 24.6            |
| White Sucker         | 1      | <1%       | NA             |      |      | NA                    |
| Muskellunge          | 6      | <1%       | 21             |      |      | 16.9 - 38.1           |
| Total                | 2,411  | 100%      |                |      |      |                       |

\* Common names of fishes recognized by the American Fisheries Society.



Table 6. Summary for 1997 spring netting (60 net nights) and fall electrofishing on Townsend Flowage.

| Species         | 1997 Spring Netting |         | 1997 Fall Electrofishing |         |           |
|-----------------|---------------------|---------|--------------------------|---------|-----------|
|                 | Fish Count          | CPUE/NN | Fish Count               | CPUE/hr | CPUE/mile |
| Bluegill        | 182                 | 3.0     | 78                       | 43.3    | 22.9      |
| Northern Pike   | 282                 | 4.7     | 42                       | 23.3    | 12.4      |
| Black Crappie   | 95                  | 1.6     | 43                       | 23.9    | 12.6      |
| Yellow Perch    | 119                 | 2.0     | 6                        | 3.3     | 1.8       |
| Pumpkinseed     | 23                  | 0.4     |                          |         |           |
| Rockbass        | 48                  | 0.8     | 9                        | 5.0     | 2.6       |
| Largemouth Bass | 29                  | 0.5     | 36                       | 20.0    | 10.6      |
| Bullhead sp.    | 30                  | 0.5     | 1                        | 0.6     | 0.3       |
| Walleye         | 4                   | 0.1     |                          |         |           |
| White Sucker    | 1                   | 0.0     |                          |         |           |
| Muskellunge     | 0                   | 0       |                          |         |           |

Table 7. Electrofishing summary for 2008 at Townsend Flowage.

| Species         | 2008 Spring SEI |         |          | 2008 Spring SEII |         |          | 2008 Fall recruitment |         |          |
|-----------------|-----------------|---------|----------|------------------|---------|----------|-----------------------|---------|----------|
|                 | Fish Count      | CPUE/hr | CPUE/mi. | Fish Count       | CPUE/hr | CPUE/mi. | Fish Count            | CPUE/hr | CPUE/mi. |
| Bluegill        |                 |         |          | 331              | 584.1   | 331.0    |                       |         |          |
| Northern Pike   |                 |         |          | 3                | 1.3     | 0.8      | 34                    | 11.5    | 6.7      |
| Black Crappie   |                 |         |          | 8                | 14.1    | 8.0      |                       |         |          |
| Yellow Perch    |                 |         |          | 9                | 15.9    | 9.0      |                       |         |          |
| Pumpkinseed     |                 |         |          | 84               | 148.2   | 84.0     |                       |         |          |
| Rockbass        |                 |         |          | 42               | 74.1    | 42.0     |                       |         |          |
| Largemouth Bass |                 |         |          | 71               | 30.2    | 17.8     | 56                    | 19.0    | 11.0     |
| Bullhead sp.    |                 |         |          | 21               | 37.1    | 21.0     |                       |         |          |
| Walleye         | 5               | 1.8     | 0.9      | 4                | 1.7     | 1.0      | 1                     | 0.3     | 0.2      |
| White Sucker    |                 |         |          | 1                | 1.8     | 1.0      |                       |         |          |
| Muskellunge     |                 |         |          | 1                | 0.4     | 0.3      |                       |         |          |

Table 8. Summary of spring netting (50 net nights) and spring and fall electrofishing on Townsend Flowage.

| Species         | 2016 Spring Netting Fish |         | 2016 Spring SEII |         |          | 2016 Fall Recruitment Fish |         |          |
|-----------------|--------------------------|---------|------------------|---------|----------|----------------------------|---------|----------|
|                 | Count                    | CPUE/NN | Fish Count       | CPUE/hr | CPUE/mi. | Count                      | CPUE/hr | CPUE/mi. |
| Bluegill        | 453                      | 9.1     | 345              | 591.4   | 345.0    |                            |         |          |
| Northern Pike   | 120                      | 2.4     | 3                | 1.5     | 0.8      |                            |         |          |
| Black Crappie   | 139                      | 2.8     | 4                | 6.9     | 4.0      |                            |         |          |
| Yellow Perch    | 296                      | 5.9     | 10               | 17.1    | 10.0     |                            |         |          |
| Pumpkinseed     | 114                      | 2.3     | 128              | 219.4   | 128.0    |                            |         |          |
| Rockbass        | 88                       | 1.8     | 32               | 54.9    | 32.0     |                            |         |          |
| Largemouth Bass | 21                       | 0.4     | 99               | 48.7    | 24.8     |                            |         |          |
| Bullhead sp.    | 521                      | 10.4    | 26               | 44.6    | 26.0     |                            |         |          |
| Walleye         | 9                        | 0.2     | 1                | 0.5     | 0.3      |                            |         |          |
| White Sucker    | 1                        | 0.0     |                  |         |          |                            |         |          |
| Muskellunge     | 3                        | 0.1     | 1                | 0.5     | 0.3      | 2                          | 0.8     | 0.3      |

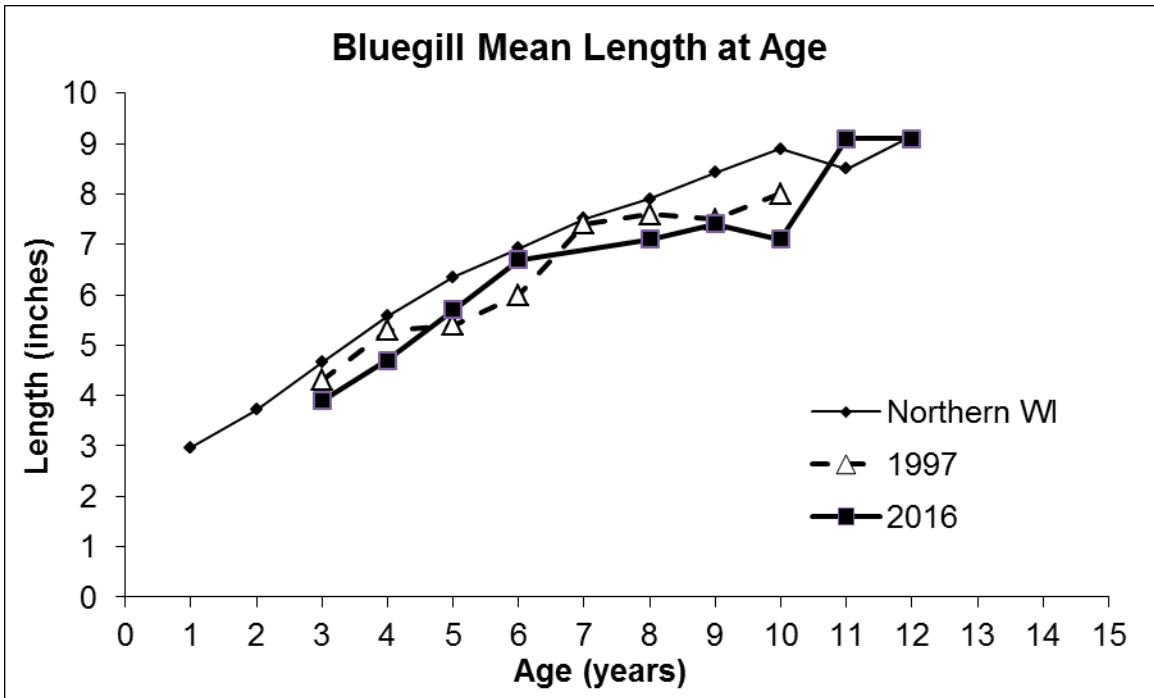


Figure 1. Bluegill mean length at age comparison between northern Wisconsin average, 1997 and 2016 from Townsend Flowage.

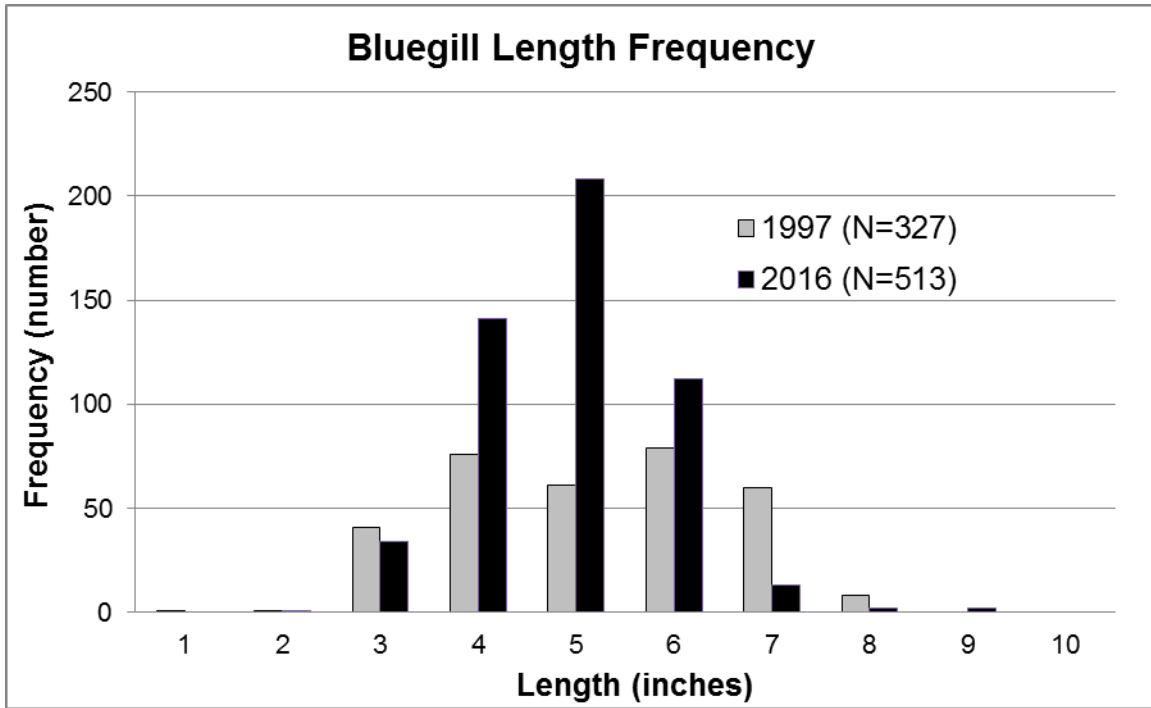


Figure 2. Bluegill length frequency comparison between 1997 and 2016 from Townsend Flowage.

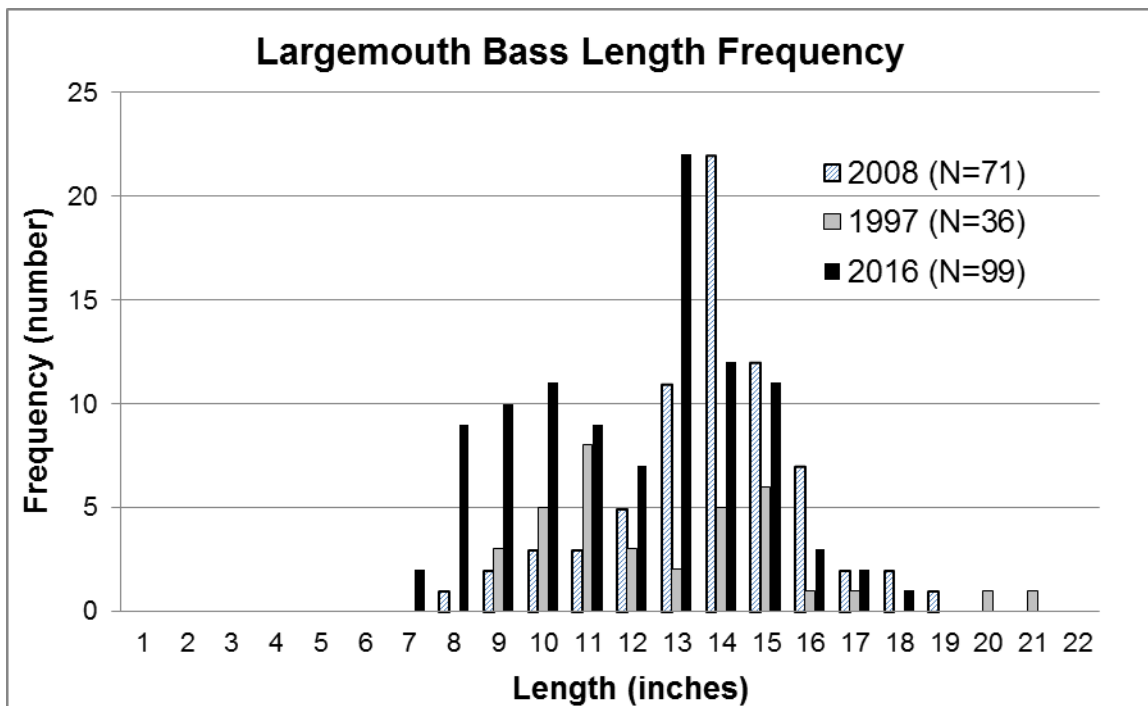


Figure 3. Largemouth bass length frequency comparison between 1997, 2008, and 2016 from Townsend Flowage.

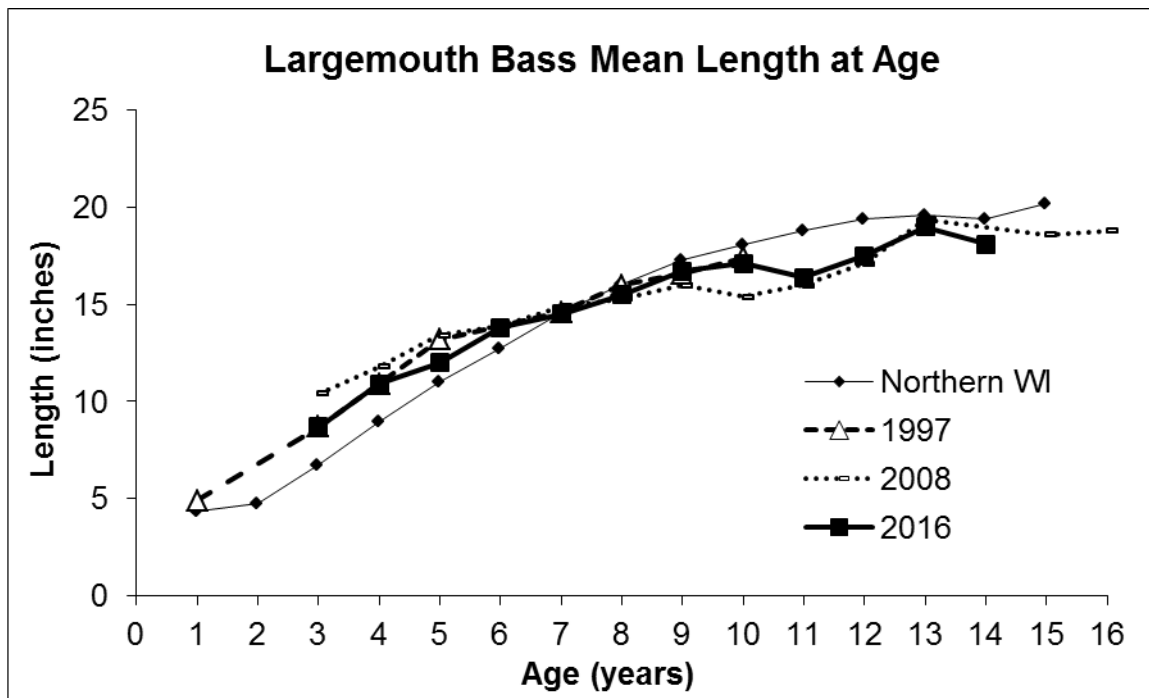


Figure 4. Largemouth bass mean length at age comparison between northern Wisconsin averages, 1997, 2008, and 2016 from Townsend Flowage

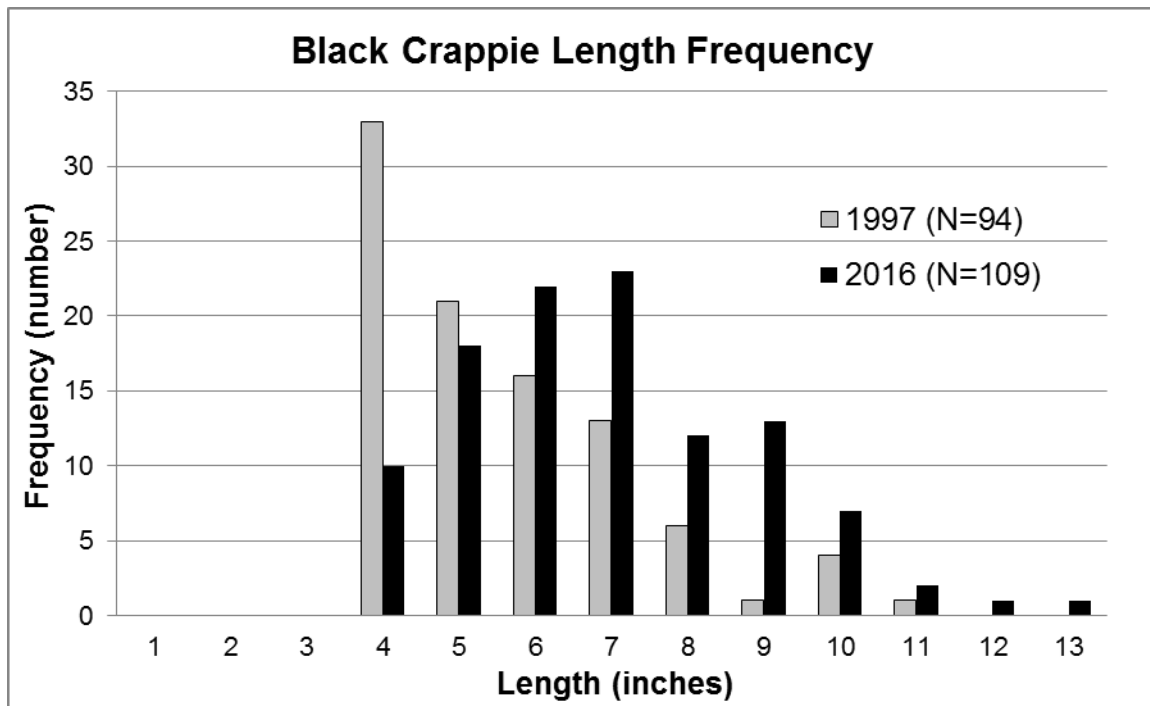


Figure 5. Black Crappie length frequency comparison between 1997 and 2016 from Townsend Flowage.

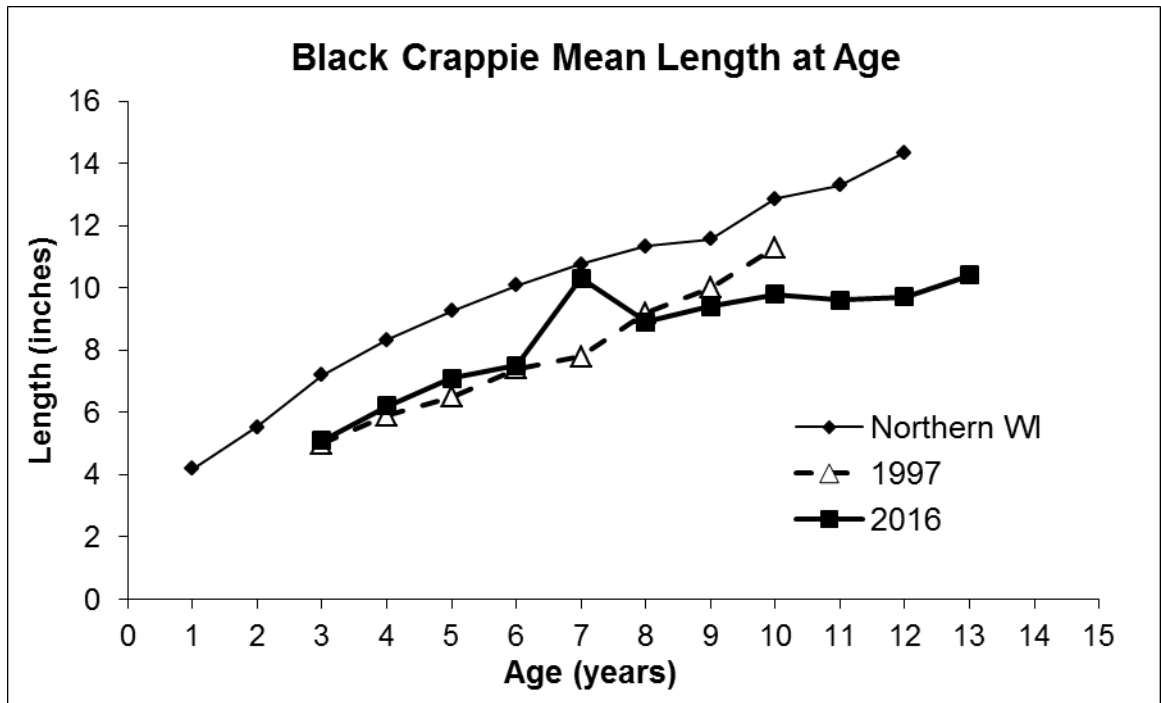


Figure 6. Black Crappie mean length at age comparison between northern Wisconsin averages, 1997, and 2016 from Townsend Flowage.

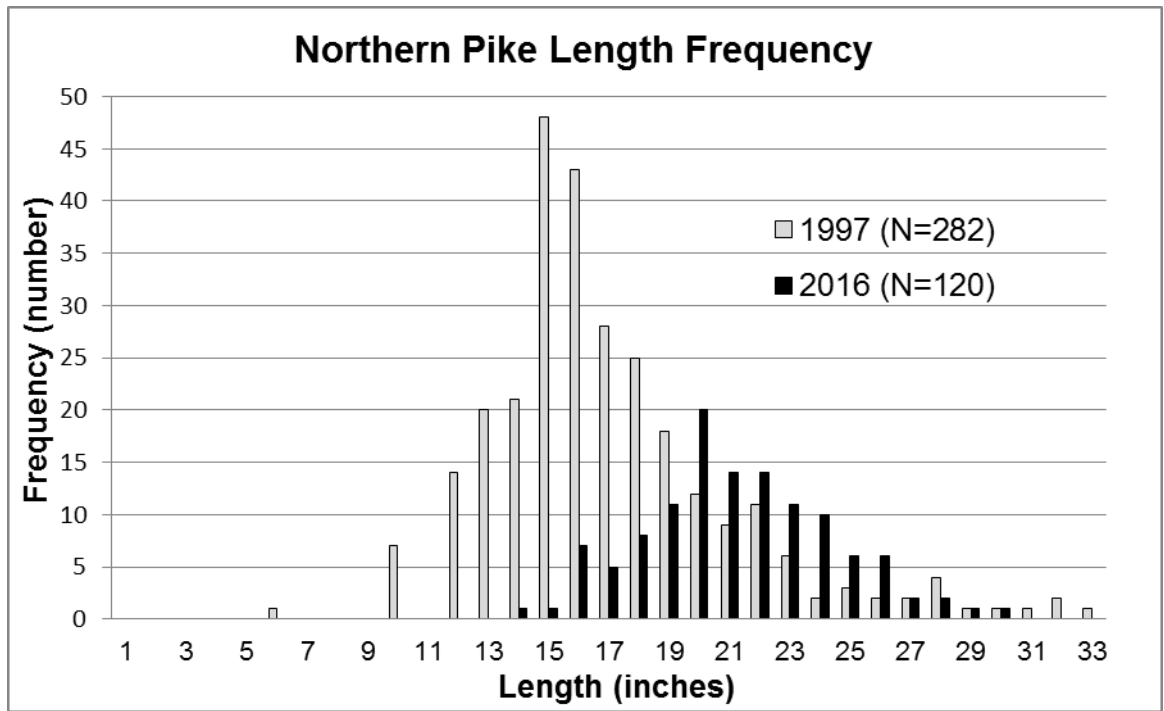


Figure 7. Northern pike length frequency comparison between 1997 and 2016 from Townsend Flowage.

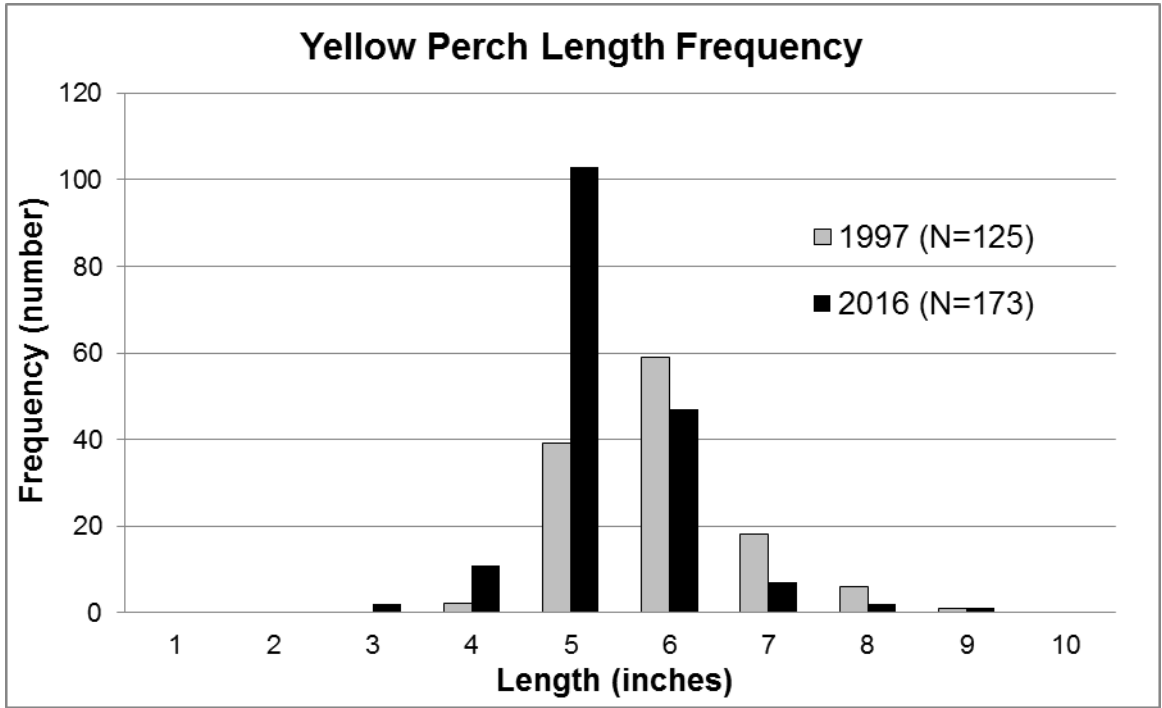


Figure 8. Yellow perch length frequency comparisons between 1997 and 2016 from Townsend Flowage.

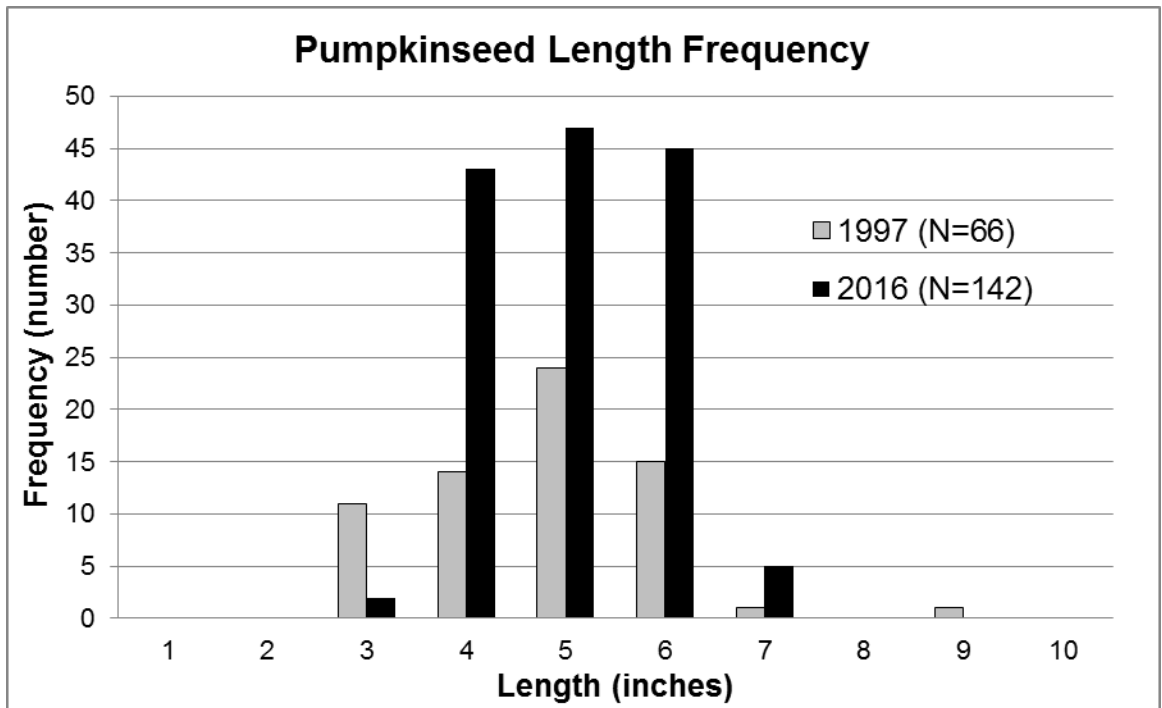


Figure 9. Pumpkinseed length frequency comparisons between 1997 and 2016 from Townsend Flowage

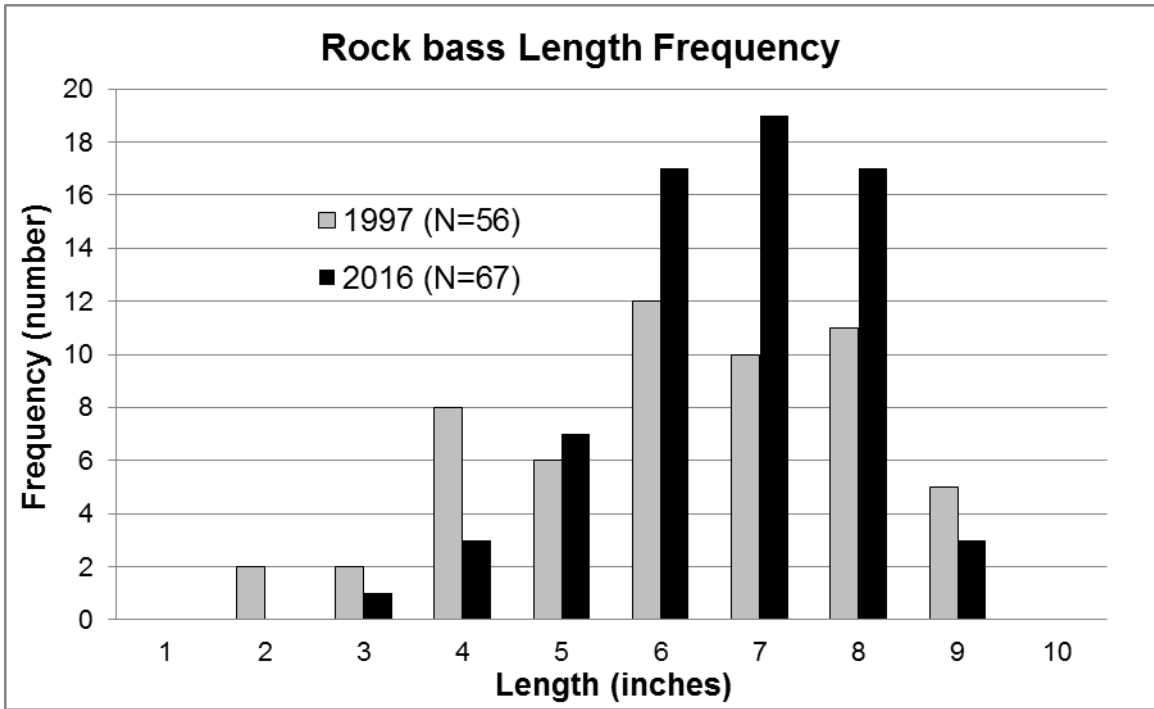


Figure 10. Rock bass length frequency comparisons between 1997 and 2016 from Townsend Flowage.

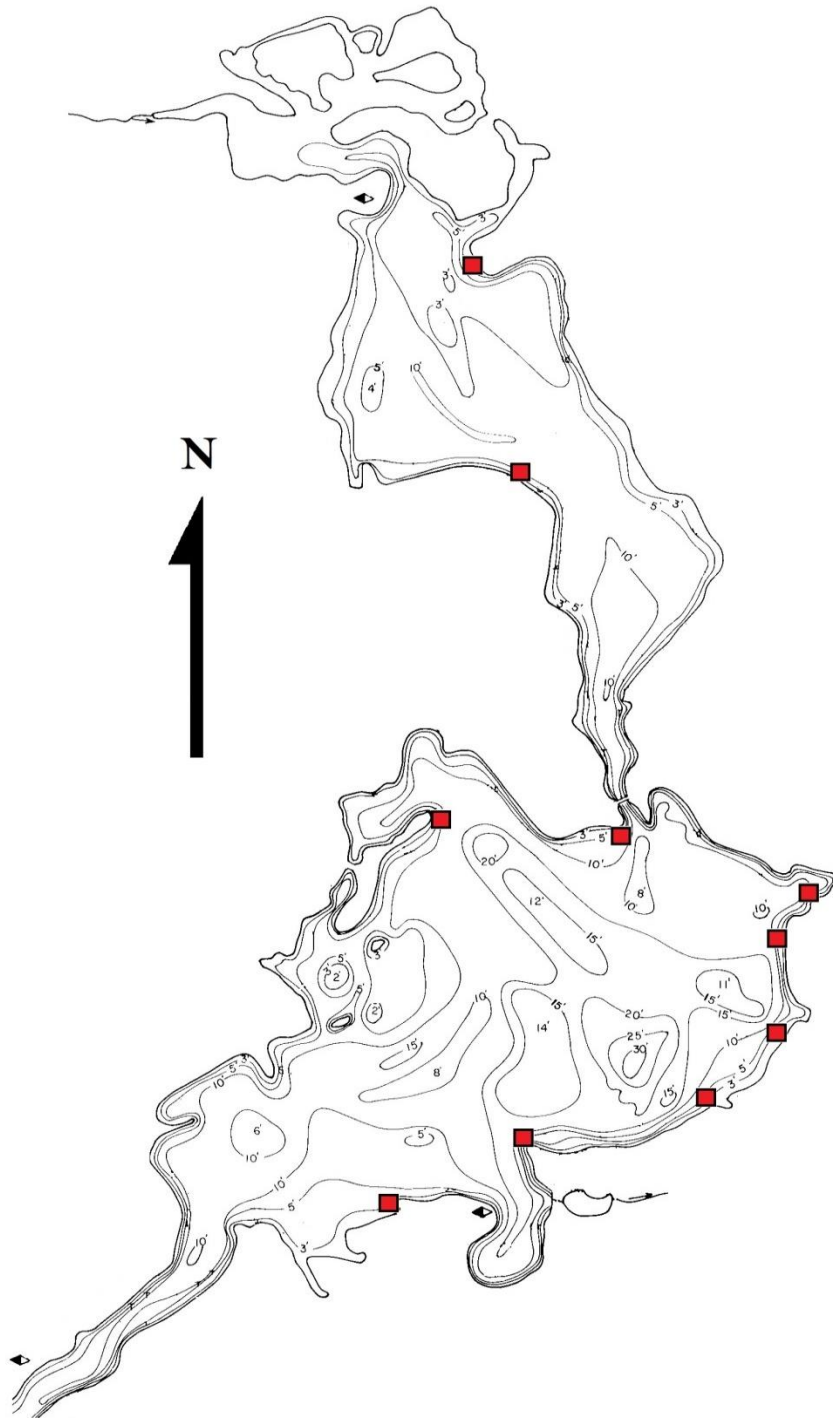


Figure 11. Fyke net locations and public boat launches during the 2016 comprehensive survey of Townsend Flowage.