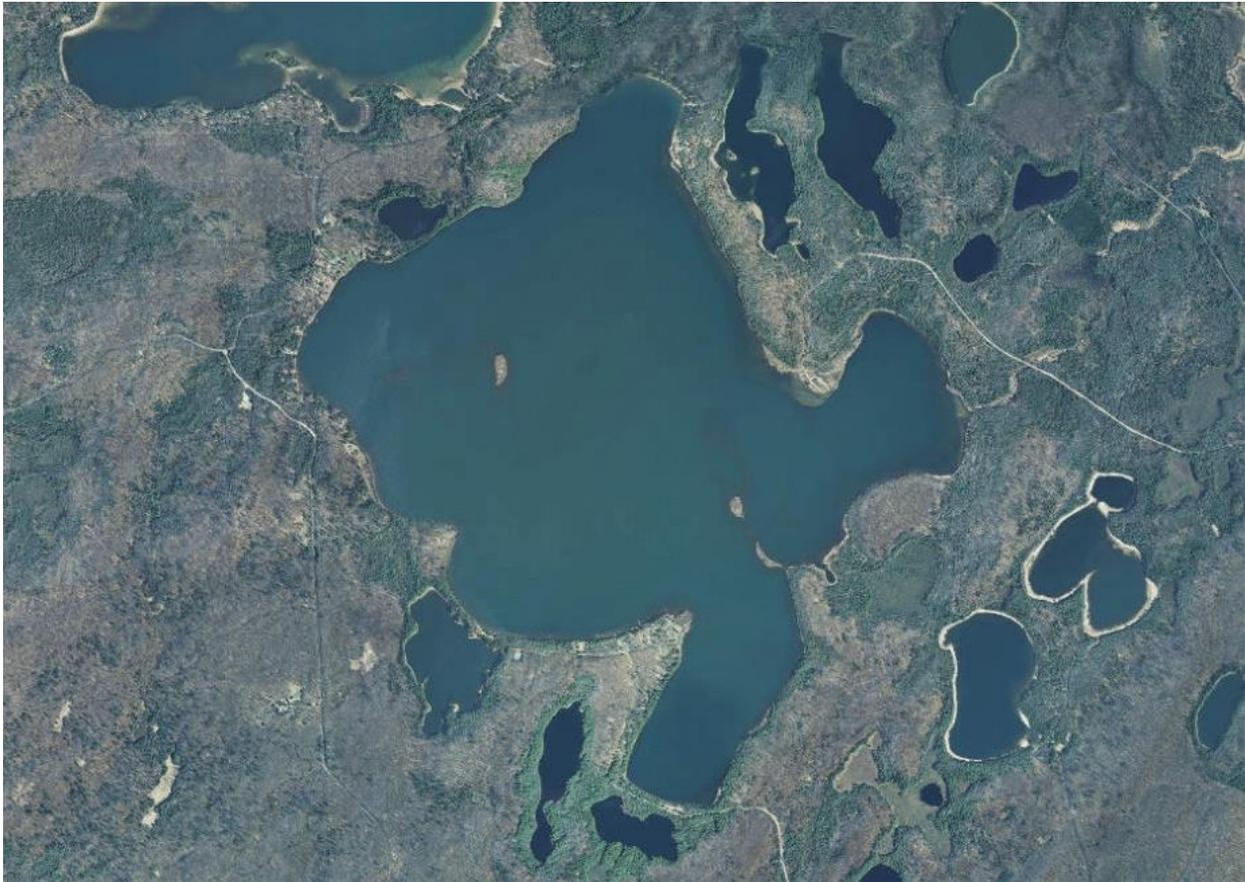


# **Comprehensive Fisheries Evaluation of Butternut Lake, Forest County, Wisconsin 2014**

Waterbody Identification Code 0692400



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Florence

January, 2015

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Lake and location:

Butternut Lake, Forest County, T.40N. R.12E. Sec. 27-28, 30 and 34

Located in north west Forest County, approximately 12 miles east of the town of Eagle River. Butternut Lake is part of the Menominee River watershed and is drained by the Pine River.

Physical/Chemical attributes:

<b>Morphometry:</b>	1,292 acres, maximum depth of 42 ft.
<b>Lake type:</b>	Spring fed, drained lake (ephemeral inlets and one outlet to the North Branch of the Pine River)
<b>Water clarity:</b>	Clear (2014 mean secchi depth – 18.5 ft.)
<b>Aquatic vegetation:</b>	Moderate to sparse.
<b>Shoreline character:</b>	Approximately 90% upland and 10% wetland
<b>Shoreline development:</b>	Low (private residences on approximately 15% of the lake)
<b>Winterkill:</b>	Unlikely
<b>Boat landing:</b>	Two public boat landings

Purpose of Survey: Comprehensive fisheries survey.

Dates of fieldwork:

Walleye/northern pike netting:	5/10-12/2014
Walleye electrofishing:	5/12/2014
Bass electrofishing:	6/3/2014
Fall electrofishing:	9/30/2014

**ACKNOWLEDGEMENTS**

Special thanks to the Woodruff fish hatchery crew for allowing us to collect data from fish caught in their nets and to the USFS for providing an employee during the spring bass assessment. Aaron Nelson, Brad Shucha, Joel Wils, Aaron Johnson, Jared Porter and Matt Ayvazzadeh, assisted in the field. Aaron Johnson assisted in age estimation of game and panfish from scales, spines and rays.

## I. EXECUTIVE SUMMARY

Butternut Lake was surveyed during 2014 with a variety of sampling gear to assess the status of the fishery. Sampling began just after ice out, with early spring fyke netting for walleye, northern pike and yellow perch followed by an early spring electrofishing survey to estimate the adult walleye population. Electrofishing continued to assess the smallmouth bass and summer spawning panfish populations. The 2014 survey was wrapped up with a fall electrofishing survey to assess gamefish recruitment.

Four gamefish species were captured during our survey of Butternut Lake. Smallmouth bass were found to be of high relative abundance and are the most abundant gamefish in Butternut Lake. The current walleye population is estimated at 2.7 adults/acre, which is below the long-term average for Butternut Lake but is still one of the higher density walleye lakes in Forest County. The northern pike population appears to be increasing, seemingly due to a large 2011 year class. Largemouth bass are present, but quite rare, in Butternut Lake.

Smallmouth bass size structure is at an all-time high in Butternut Lake. The current high size structure is likely due to the popularity of catch and release bass angling since nearly 60% of the smallmouth bass captured during this survey were  $\geq 8$  years of age. Growth rate of smallmouth bass is below the average for this region of Wisconsin, likely due to increasing abundance and intraspecific competition for resources.

Butternut Lake has been a high density, naturally reproducing walleye lake. The walleye population collapsed in the early 2000s, which resulted in the stocking of walleye fry by the WDNR from 2003-2007. These stocking events supplemented natural reproduction and by 2009 the adult walleye population increased to an all-time high at 6.6 adults/acre. Since 2009 the adult population has slowly declined to the current 2.7 adults/acre level. Natural reproduction in Butternut Lake is very good and will likely stop the declining trend in adult abundance. Size structure of the walleye population is quite good with over 90% of the fish sampled during the 2014 spring survey being  $\geq 15$  inches, however, no large fish were observed during the survey, which suggests little trophy potential in the current population.

The northern pike population in Butternut Lake has always maintained itself at a low density, which has allowed for fast growth and good trophy potential. However, northern pike abundance appears to be increasing. Continued expansion of this population could have negative impacts on the other species in Butternut Lake (including northern pike).

Five panfish species were captured during this survey of Butternut Lake. Yellow perch are the most abundant species, followed by bluegill and rock bass. These three species have growth rates at or above the average for Northern Wisconsin. Pumpkinseed and black crappie were also captured during the 2013 survey, but have what is considered low abundance.

Five non-game species were captured during our survey work. These species were bluntnose minnow, common shiner, golden shiner, mottled sculpin and white sucker.

## II. PAST MANAGEMENT AND SURVEYS

### **Butternut Lake Known Stocking History:**

Largemouth Bass	-fingerlings, 3 of 5 years 1943-47
Smallmouth Bass	-fingerlings, 9 of 12 years 1942-53
Walleye	-fry, annually 2003-07 -fingerlings, 1961 -lg. fingerlings, 1988 (Private)
Yellow Perch	-adults, 1989

### **Butternut Lake Past Management Activities:**

- 1943 (WDNR) – Growth analysis for walleye, black crappie and northern pike.
- 1961 (WDNR) – Fall recruitment survey – Documented solid natural reproduction. Walleye were considered “numerous”.
- 1967 (WDNR) – Fall recruitment survey – Age-0 walleye were considered “too numerous to collect”.
- 1973 (WDNR) – Management evaluation survey
- 1974 (WDNR) – Management evaluation survey
- 1978 (WDNR) – Management evaluation survey
- 1983 – Adult walleye population estimate
- 1984 – Adult walleye population estimate
- 1985 (WDNR) – Smallmouth bass electrofishing survey
- 1986-2014 (GLIFWC & WDNR) – Fall recruitment surveys conducted annually
- 1988-2014 (GLIFWC & WDNR) – Adult walleye population estimate annually (accept 2007)
- 1988-2004 (GLIFWC & WDNR) – Total walleye population estimate 5 of 17 years (1988, 1991, 1997, 1998 and 2004)
- 1990 – 150 half log structures placed to improve bass spawning habitat
- 1990 – 12-inch minimum size limit put in place for bass
- 1990 (WDNR) – November fyke net survey for whitefish – none captured, but a single fish was captured during the 1990 fall recruitment survey.
- 1990-92 (WDNR) – Seine survey to index smallmouth bass recruitment.
- 1991 – 50 half log structures placed to improve bass spawning habitat
- 1992 (WDNR) – Creel survey
- 1994 – Installation of public fishing pier at the north landing
- 1995 – Northern pike regulation changed to a 32-inch minimum size limit, 1 fish daily bag limit
- 1997 – Walleye regulation changed to no minimum length limit, 14-18” protected slot, with only 1 fish > 18”.
- 1997 (WDNR) – Northern pike regulation evaluation and mini-fyke net survey
- 1999 (GLIFWC) – 66 male walleye transferred from Butternut to Kentuck Lake
- 2000 (GLIFWC) – 94 male walleye transferred from Butternut to Kentuck Lake
- 2001 (GLIFWC) – 48 male walleye transferred from Butternut to Kentuck Lake
- 2001 (WDNR) – Spring fyke netting – northern pike regulation evaluation
- 2004 (WDNR) – Spring fyke netting – northern pike regulation evaluation

- 2005 – Restrictive northern pike regulation removed in favor of no minimum size limit, 5 fish daily bag limit
- 2007 (GLIFWC) – Walleye population estimate attempted –not completed due to time constraints
- 2014 – Spiny water flea discovered in Butternut Lake
- 2014 (Matzke) – Comprehensive fisheries survey

### III. METHODS

The survey began on 5/9/2014 when 6 standard fyke nets (3/4” stretch mesh) were set in Butternut Lake by WDNR hatchery staff to collect and fertilize eggs from walleye to rear Lake Michigan strain walleye at Art Oehmcke Hatchery. The following day 8 more standard fyke nets were set by WDNR fish management staff to sample walleye and northern pike. These 14 nets were fished for one night, then 3 nets were removed and the remaining 11 nets were fished another night and pulled from Butternut Lake on 5/12. After the nets were pulled from the lake a WDNR standard, alternating current, electrofishing boat was used to recapture walleyes and sample spring spawning panfish (yellow perch and black crappie) along the entire shoreline on the night of 5/12. Another electrofishing survey of the entire shoreline was conducted on 6/3 to assess the smallmouth bass population. During the 6/3 survey a 1.0 mile station was selected to sample yellow perch and two stations totaling 2.2 miles were chosen to sample centrarchid panfish. The survey culminated on 9/30 with an electrofishing survey to assess gamefish recruitment.

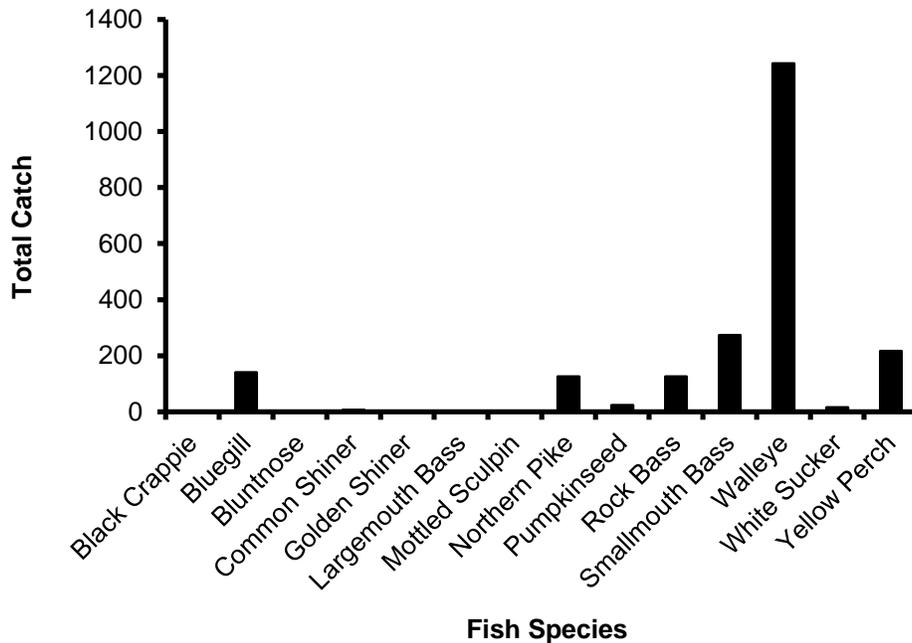
During the survey, length or length category (nearest half-inch), was recorded for all gamefish and panfish. Adult gamefish were given right pelvic fin clips while juvenile gamefish were given a top caudal fin clip for use in mark-recapture population estimates. Aging structures were removed and weight (gamefish only) was measured from five gamefish and three panfish for each species, sex and half-inch group.

Different aging structures were used for different species and length groups of fish. Dorsal spines were used to age walleye  $\geq 12.0$  inches as well as smallmouth bass  $\geq 8.0$  inches. Anal rays were used for northern pike  $\geq 18.0$  inches and yellow perch  $\geq 5.0$  inches in length. Anal spines were removed from black crappie  $\geq 7.0$  inches and all other panfish species  $\geq 6.0$  inches. Cross sections of these structures were blind read by two different readers; any discrepancies were then read by a third blind reader to remove as much error as possible from the aging process. Fish below the length cutoff for spine/ray removal had scales removed, which were blindly read by a single reader.

### IV. RESULTS AND DISCUSSION

#### **Catch Summary**

Four gamefish, 5 panfish and 5 non-game fish species were captured during the 2014 survey of Butternut Lake (Figure 1). There is more detailed information at the back of this report (Table 4, Appendix C).



**Figure 1.** Fish species and number captured during fyke netting and electrofishing surveys of Butternut Lake, Forest County, 2014.

**Gamefish:**

**Northern Pike**

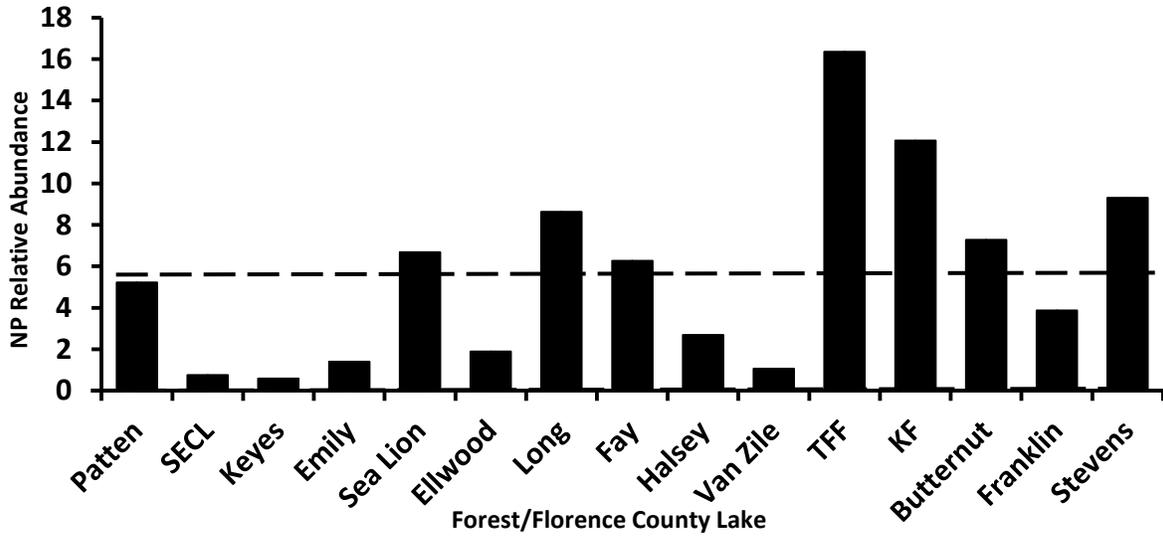
**Abundance**

We did not capture enough adult northern pike during our spring fyke net survey to perform a population estimate during 2014. Northern pike were the 2<sup>nd</sup> most encountered gamefish during spring netting with a catch rate of approximately 7.3 fish per net-night (Table 1). This catch rate is slightly above average for this region of Wisconsin, and puts the Butternut Lake population into the “moderate density” category (Figure 2). Relative abundance of northern pike has been increasing since the early 1980’s, with the highest relative abundance being measured in 2001; however, this survey directly targeted northern pike spawning areas which allows for a falsely high catch rate when compared to other spring surveys of Butternut Lake which have targeted walleye spawning areas. The current northern pike population has seemingly grown 10-fold since 1983 and I would consider it the highest documented northern pike population in Butternut Lake.

**Table 1.** Northern pike relative abundance, indexed using the catch rate during spring fyke net surveys, in Butternut Lake, Forest County, 1983-2014.

	2014	*2001	1997	1984	1983
<b>Catch/Net-night</b>	7.3	7.9	3.8	0.6	0.7

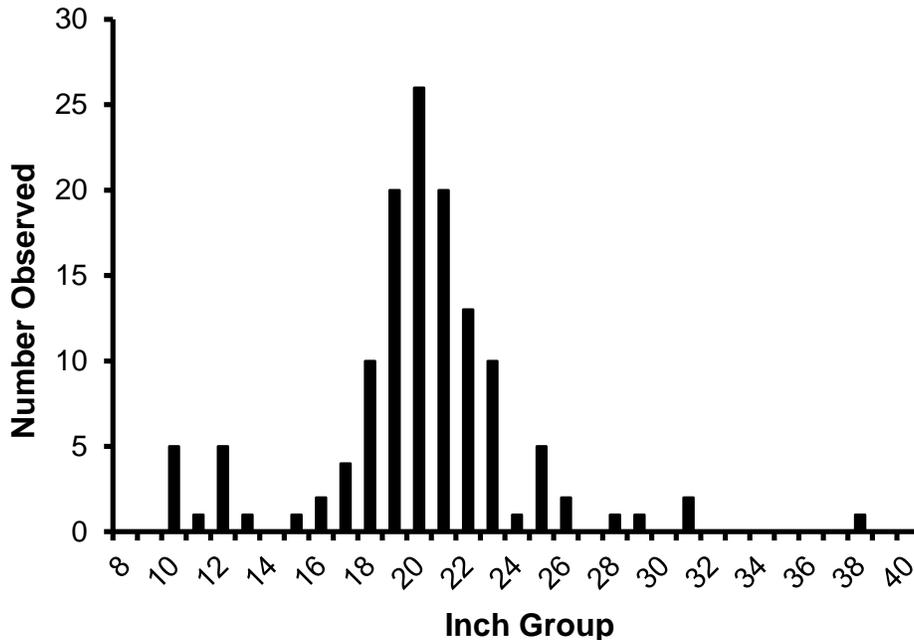
*\*Net locations set to specifically target northern pike*



**Figure 2.** Abundance of northern pike, indexed using catch per net-night during spring fyke net surveys, for all waters sampled in Forest and Florence Counties 2011-2014 (Mean = 5.6).

### Size Structure

A total of 128 different northern pike ranging from 10.0 to 38.5 inches were measured to assess size structure during the spring fyke net survey (Figure 3). Size structure of northern pike in Butternut Lake is quite average for this region of Wisconsin with 47.1% of the fish captured being  $\geq 21$  inches and approximately 4.2%  $\geq 28$  inches in length (Table 2). The size structure of the Butternut Lake population from 1973-2001 was very high with an average of 69.7% and 21.6% of the fish captured being  $\geq 21$  and 28 inches respectively over this time period.



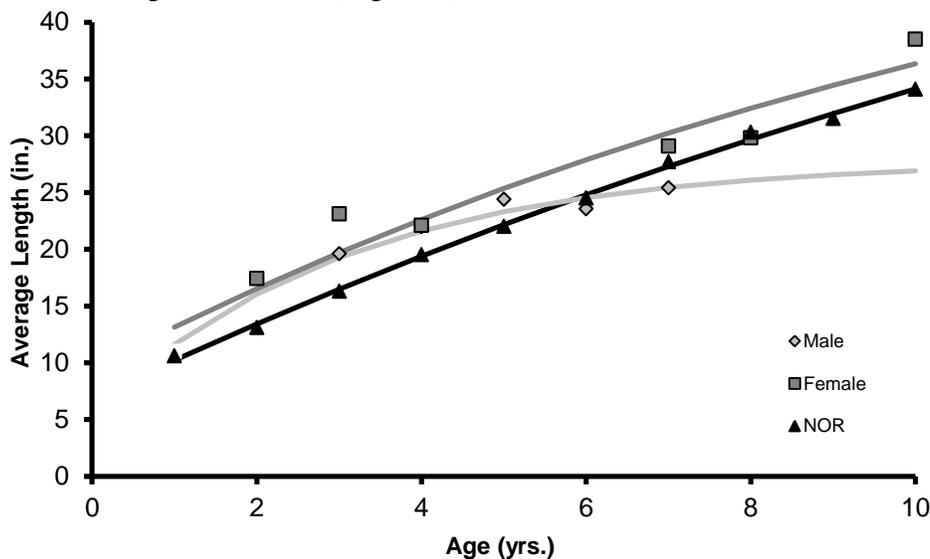
**Figure 3.** Length frequency of northern pike captured during spring surveys of Butternut Lake, Forest County, 2014 (N=131).

**Table 2.** Size structure, indexed using relative stock density, for northern pike captured during spring surveys of Butternut Lake, Forest County (2014: N=131).

	2014	2001	1997	1984	1983	1973
<b>RSD21</b>	47.06	78.87	88.76	53.33	77.78	50.00
<b>RSD24</b>	10.92	39.62	56.80	33.33	44.44	33.33
<b>RSD28</b>	4.20	7.55	13.61	20.00	33.33	33.33
<b>RSD32</b>	0.84	1.51	1.78	13.33	0.00	0.00
<b>RSD40</b>	0.00	0.00	0.59	0.00	0.00	0.00

## Growth

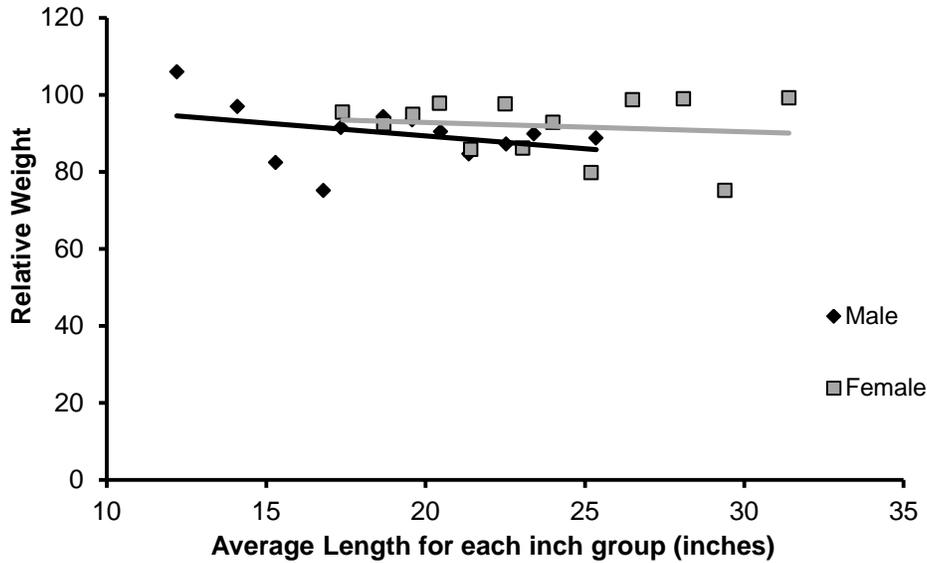
Age was estimated by examining scale samples and cross sections of anal rays, which were removed from a subsample of 103 northern pike captured during the spring fyke net survey (Table 1, Appendix B). Northern pike exhibit sexually dimorphic growth with female fish growing faster and achieving a larger size than male pike. Female pike in Butternut Lake have above average growth when compared to the Northern Region of Wisconsin (NOR) average for combined sex fish, while male pike display growth rates above the combined sex average early in life and below average later in life (Figure 3).



**Figure 3.** Average length at age for northern pike captured from Butternut Lake during a 2014 spring fyke net survey, fit with von Bertalanffy growth curves and compared to the average length at age for both sexes combined in the Northern Region of WI (Male: N=48, Female: N=48).

## Body Condition

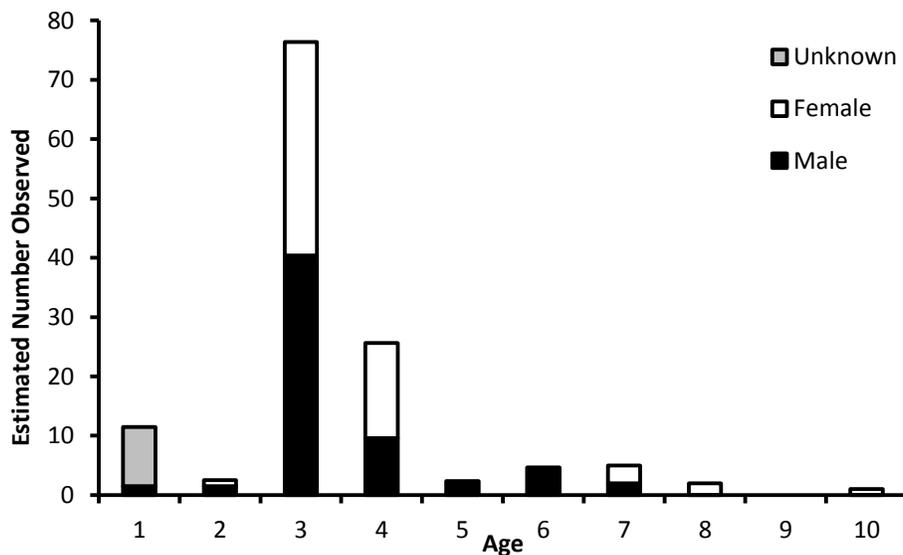
A subsample of 48 male and 46 female northern pike captured during our spring net survey were weighed to assess body condition of northern pike in Butternut Lake. Body condition was indexed using relative weight ( $W_r$ ).  $W_r$  of male northern pike ranged from 75.1 and 105.9 for individual length groups with an average of 90.1 (Figure 4). Female body condition was slightly higher, ranging from 75.1 to 99.2 with an average of 93.1. Male and female northern pike showed no relationship between  $W_r$  and total length. While the overall  $W_r$  of northern pike in Butternut Lake is below the benchmark of 100; having average  $W_r \geq 90$  is acceptable body condition for Northern Wisconsin.



**Figure 4.** Average relative weight at length, measured from all sexually mature northern pike captured during a spring fyke net survey of Butternut Lake, Forest County, 2014 (Male: N=48, Female: N=46).

### Recruitment

Gamefish recruitment was assessed via an electrofishing survey on 9/30/2014. No age-0 northern pike were captured or observed. However, there was a moderate number (11) of age-1 northern pike captured during our spring fyke netting survey. The presence of these juvenile pike, representation of all year classes 1-8 in the population and a growing northern pike population suggests that natural recruitment of northern pike is strong in Butternut Lake. In fact, three year old northern pike accounted for an estimated 58.3% of our spring fyke net catch in 2014 (Figure 5). This extremely large year class may be a sign that natural reproduction is increasing in Butternut Lake.



**Figure 5.** Age structure of the Butternut Lake northern pike population, indexed using the estimated age frequency of all northern pike captured during a spring fyke net survey of Butternut Lake, Forest County, 2014 (N=131).

## Walleye

### Abundance

A mark-recapture survey, consisting of 3 days of fyke netting and a single night of electrofishing, was conducted to estimate abundance of the adult walleye population. After analyzing the results of the spring survey I estimate there to be approximately 3,505 adult walleyes (2.71/acre) in Butternut Lake. This year's estimate continues a declining trend in the adult walleye population since the adult population rebounded in 2009 (Table 3).

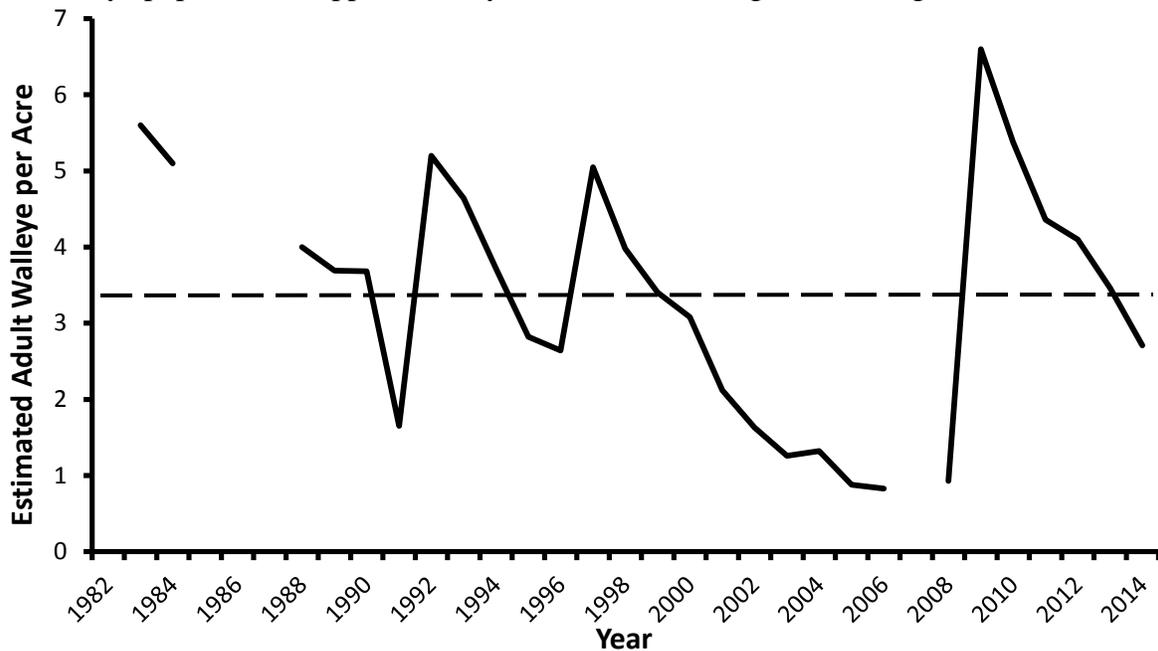
**Table 3.** Abundance of adult walleye, indexed using population estimation and catch rate during spring recapture surveys, in Butternut Lake, Forest County, 1983-2014.

	<b>2014</b>	<b>2013</b>	<b>2012</b>	<b>2011</b>	<b>*2010</b>	<b>*2009</b>	<b>2008</b>	<b>2006</b>	<b>2005</b>	<b>2004</b>
<b>Adults/Acre</b>	2.71	3.46	4.10	4.36	5.38	6.60	0.93	0.83	0.88	1.32
<b>Adults/mi.</b>	33.25	42.38	24.38	59.00	57.82	70.64	13.63	9.38	8.75	11.75
	<b>2003</b>	<b>*2002</b>	<b>2001</b>	<b>2000</b>	<b>1999</b>	<b>1998</b>	<b>1997</b>	<b>1996</b>	<b>1995</b>	<b>1994</b>
<b>Adults/Acre</b>	1.26	1.63	2.12	3.08	3.40	3.98	5.05	2.64	2.82	3.72
<b>Adults/mi.</b>	29.63	30.38	31.75	45.50	62.25	66.63	48.25	29.13	47.13	54.75
	<b>1993</b>	<b>1992</b>	<b>1991</b>	<b>1990</b>	<b>1989</b>	<b>1988</b>	<b>*1984</b>	<b>1983</b>	<b>Mean</b>	
<b>Adults/Acre</b>	4.64	5.20	1.65	3.68	3.69	4.00	5.10	5.60	3.35	
<b>Adults/mi.</b>	95.88	48.25	30.63	---	---	31.25	4.10	84.80	41.20	

\*Island/reefs not surveyed during recap run

Note: 8.0 miles used for surveys which sampled the islands/reefs (7.8 miles when islands/reefs were not)

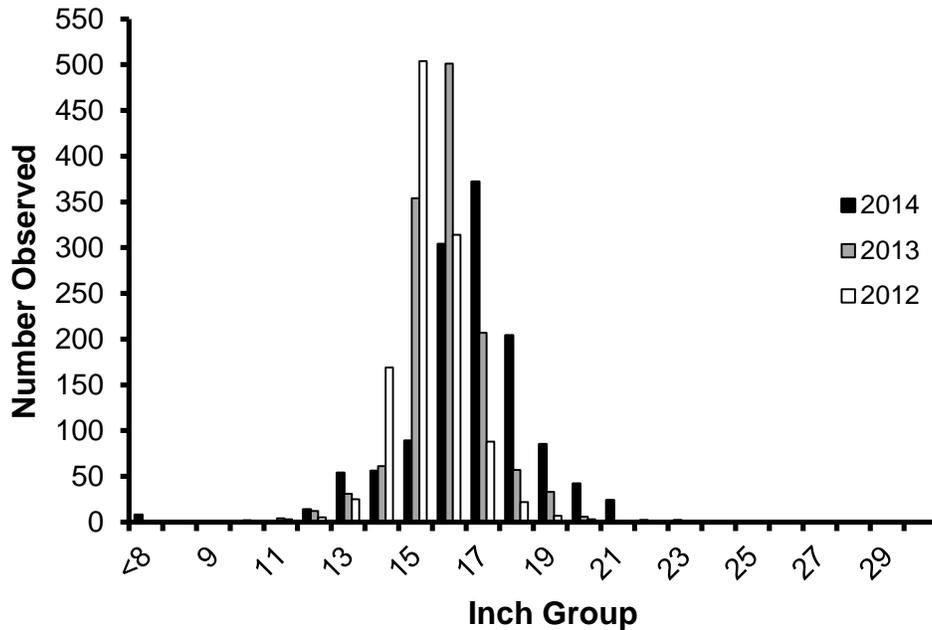
The abundance of adult walleye in Butternut Lake has been studied extensively since 1983. This dataset shows a highly variable adult walleye population in Butternut Lake with the highest density recorded in 2009 (6.60 adults/acre) and the lowest in 2006 (0.83 adults/acre) with a mean density of 3.35 adults/acre during this timeframe (Figure 6). This data suggests that the current adult walleye population is approximately 19% below the long-term average.



**Figure 6.** Abundance of adult walleye, indexed using population estimation, in Butternut Lake, Forest County, 1983-2014 (Mean = 3.35).

## Size Structure

A total of 1,256 different walleye were captured and measured during our spring surveys in 2014, ranging in size from 5.5 to 23.4 inches in length (Figure 7). Male walleye ranged from 12.0 to 20.9 inches while female walleye were observed between 15.5 and 23.4 inches in length.



**Figure 7.** Length frequency of walleye captured during spring surveys of Butternut Lake, Forest County, during 2014 compared to two previous surveys (2014: N=1,256, 2013: N=1,271, 2012: N=1,141).

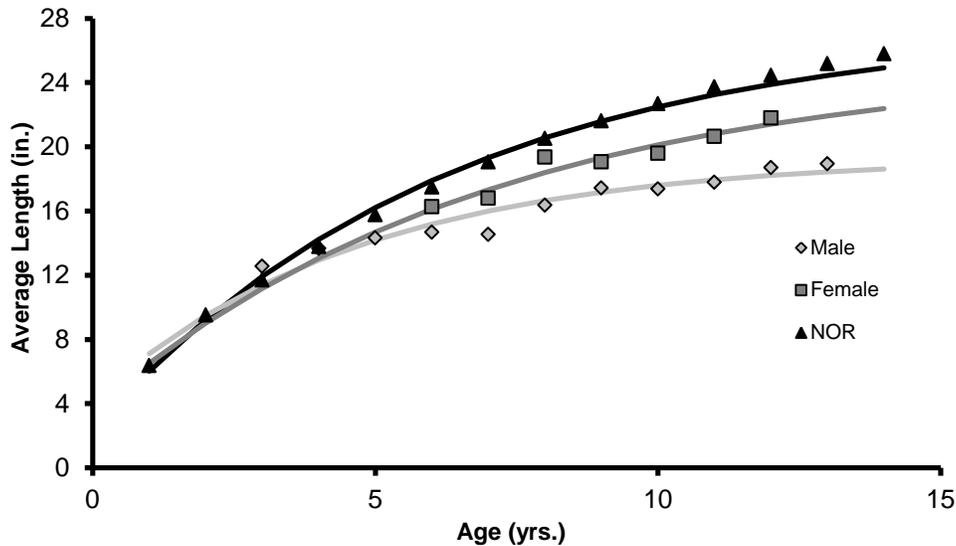
Size structure, indexed using relative stock density (RSD), of walleye in Butternut Lake has generally been low, except for the period from 2001-08 when walleye abundance was low (Table 4). During the 2014 spring survey approximately 90% of the fish were  $\geq 15$  inches and slightly less than 6% of the walleye captured were  $\geq 20$  inches, with no fish captured  $\geq 25.0$  inches.

**Table 4.** Size structure, indexed using relative stock density, for walleye captured during spring surveys of Butternut Lake, Forest County, 1973-2014.

	<b>2014</b>	<b>*2013</b>	<b>*2012</b>	<b>*2011</b>	<b>*2010</b>	<b>*2009</b>	<b>*2008</b>	<b>*2007</b>	<b>*2006</b>	<b>*2005</b>
<b>RSD15</b>	90.13	91.35	82.21	42.37	8.21	5.63	50.75	44.44	53.45	82.68
<b>RSD18</b>	28.79	7.79	2.80	1.34	1.42	0.90	22.37	25.00	41.19	46.41
<b>RSD20</b>	5.61	0.71	0.26	0.13	0.68	0.50	12.69	9.26	18.77	16.67
<b>RSD25</b>	0.00	0.08	0.00	0.00	0.26	0.10	4.09	0.00	1.15	0.33
<b>RSD28</b>	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>RSD30</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>% Legal</b>	<b>34.24</b>	<b>11.64</b>	<b>5.78</b>	<b>16.90</b>	<b>80.25</b>	<b>93.57</b>	<b>50.11</b>	<b>67.59</b>	<b>82.95</b>	<b>57.19</b>
	<b>*2004</b>	<b>*2003</b>	<b>*2002</b>	<b>*2001</b>	<b>*2000</b>	<b>*1999</b>	<b>*1998</b>	<b>1997</b>	<b>*1996</b>	<b>*1995</b>
<b>RSD15</b>	92.47	69.66	51.25	60.59	45.22	29.30	29.97	77.30	85.78	61.02
<b>RSD18</b>	58.97	25.09	17.89	21.62	12.09	10.58	7.44	49.64	10.35	2.01
<b>RSD20</b>	32.85	7.37	3.13	6.80	3.52	4.43	2.96	28.50	1.37	0.32
<b>RSD25</b>	1.12	0.00	0.36	0.17	0.16	0.14	0.00	0.07	0.00	0.00
<b>RSD28</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>RSD30</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>% Legal</b>	<b>64.10</b>	<b>41.45</b>	<b>53.76</b>	<b>50.48</b>	<b>45.27</b>	<b>69.84</b>	<b>74.37</b>	<b>69.02</b>	<b>18.89</b>	<b>9.99</b>
	<b>*1994</b>	<b>*1993</b>	<b>1992</b>	<b>*1991</b>	<b>*1990</b>	<b>*1988</b>	<b>1984</b>	<b>1983</b>	<b>1973</b>	<b>Mean</b>
<b>RSD15</b>	10.17	5.60	7.94	33.50	66.00	22.29	28.90	66.85	13.39	48.57
<b>RSD18</b>	0.56	1.21	3.06	10.51	---	6.03	16.44	46.52	8.23	17.37
<b>RSD20</b>	0.11	0.33	0.97	2.96	7.00	2.01	8.46	27.85	3.69	7.24
<b>RSD25</b>	0.00	0.00	0.16	0.66	---	0.17	2.38	4.18	0.61	0.58
<b>RSD28</b>	0.00	0.00	0.08	0.33	---	0.00	0.29	0.00	0.25	0.04
<b>RSD30</b>	0.00	0.00	0.00	0.00	---	0.00	0.00	0.00	0.00	0.00
<b>% Legal</b>	<b>60.03</b>	<b>79.56</b>	<b>85.41</b>	<b>70.44</b>	<b>---</b>	<b>67.83</b>	<b>80.61</b>	<b>89.93</b>	<b>86.96</b>	<b>57.79</b>
<i>*Electrofishing only survey</i>										
<i>Note: % Legal - includes all fish <math>\geq</math> 10.0 inches that are not within the 14-18 inch protected slot</i>										

## Growth

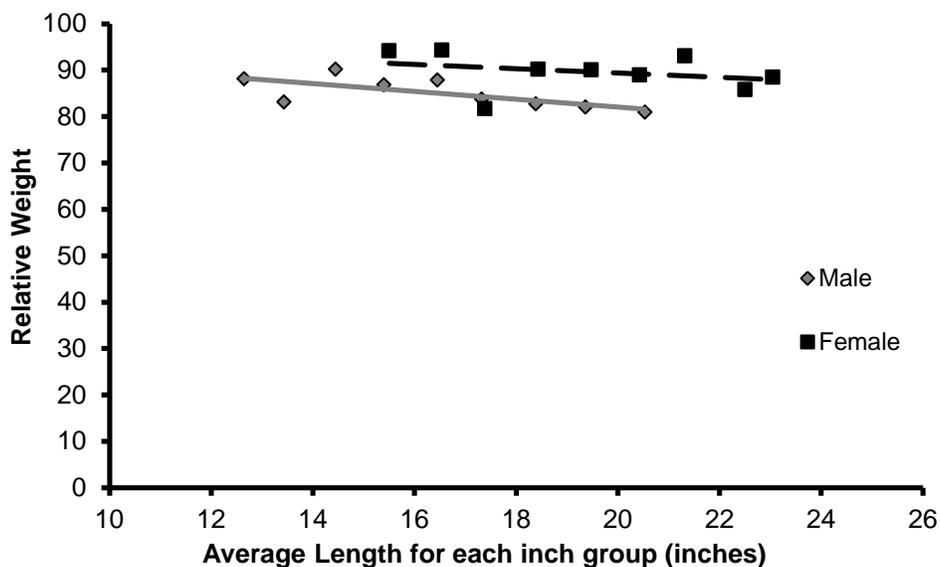
Age was estimated by examining scales and dorsal spines from a subsample of 118 walleye captured during the 2014 spring survey. Like northern pike, walleye exhibit sexually dimorphic growth with female fish growing faster and achieving larger overall size than males. However, growth of both sexes of walleye in Butternut Lake is considerably below the average for combined sex walleyes in the Northern Region of Wisconsin (NOR) (Figure 8). It takes approximately 5 years for a walleye to reach the start of the protective slot (14 inches), with the average male growing beyond the protective slot (18 inches) by age 11. Female walleye surpass the upper limit of the slot by age 8. The growth data obtained in 2014 (Table 2, Appendix B) suggests that the current regulation offers approximately 6 years of protection for males and 3 years of protection for female walleye.



**Figure 8.** Average length at age for walleye captured from Butternut Lake during 2014 spring surveys, fit with von Bertalanffy growth curves and compared to the average length at age for both sexes combined in the Northern Region of WI (Male: N=67, Female: N=49).

### Body Condition

A subsample of 115 sexually mature walleye were weighed to assess body condition of the Butternut Lake population via relative weight ( $W_r$ ) analysis.  $W_r$  for male walleye ranged between 81.0 and 90.2 for individual inch groups, with an average of 85.5 (Figure 9). Male  $W_r$  shows a statistically significant negative correlation with body length ( $P=0.03$ ). This suggests that conditions are worse for large male walleye in Butternut Lake, including the amount of metabolic energy needed to capture each unit of forage. Female body condition was better than that of the male population, ranging from 81.7 to 94.3 and averaging 89.5. Female  $W_r$  has no relationship to body length, suggesting that conditions are similar for all sizes of female walleye in Butternut Lake. In general, body condition is below the benchmark of 100 for both male and female walleye, however, this is not uncommon for naturally reproducing walleye populations in Northern Wisconsin and is considered acceptable for this region.



**Figure 9.** Average relative weight at length, measured from a sub sample of walleye captured during a spring survey of Butternut Lake, Forest County, 2014 (Male: N=67, Female: N=48).

### Recruitment

Natural reproduction of walleye has always been strong in Butternut Lake (Table 5). There was a period of time (2003-07) where walleye fry hatched from Butternut Lake were stocked back into the lake because the adult population dropped to abnormally low levels. Since stocking has stopped, natural reproduction of walleye in Butternut Lake has averaged 44.5 age-0 fish/mile during fall recruitment surveys; this value is approximately double the average level of natural reproduction within the ceded territory of Northern Wisconsin for this time period (22.4 fish/mile) and shows that stocking of walleye is no longer needed to maintain the adult population in Butternut Lake.

**Table 5.** Recruitment of walleye, indexed by catch per mile of age-0 and age-1 walleyes during fall electrofishing surveys, in Butternut Lake, Forest County, 1978-2014.

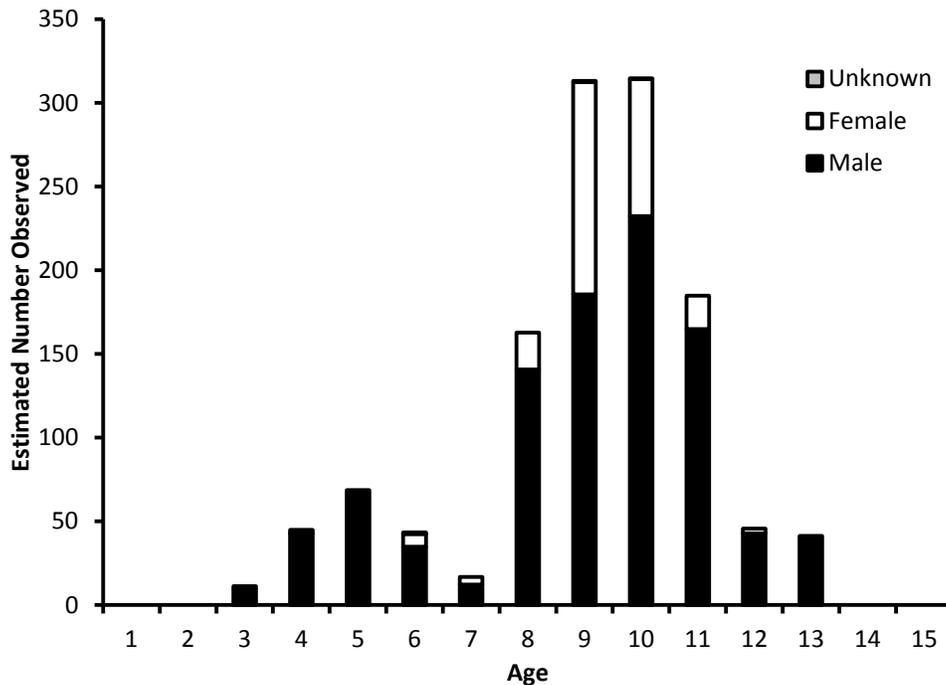
	<b>2014</b>	<b>2013</b>	<b>2012</b>	<b>2011</b>	<b>2010</b>	<b>2009</b>	<b>2008</b>	<b>2007</b>	<b>2006</b>	<b>2005</b>	<b>2004</b>
<b>Age 0/mi.</b>	26.0	86.6	3.4	73.0	12.9	74.5	35.1	9.3	95.1	21.1	1.6
<b>Age 1/mi.</b>	6.3	2.4	0.8	1.5	0.6	8.5	15.9	23.9	38.3	2.9	11.8
	<b>2003</b>	<b>2002</b>	<b>2001</b>	<b>2000</b>	<b>1999</b>	<b>1998</b>	<b>1997</b>	<b>1996</b>	<b>1995</b>	<b>1994</b>	<b>1993</b>
<b>Age 0/mi.</b>	192.0	192.2	5.3	13.6	47.6	34.2	33.1	34.1	19.6	165.0	3.0
<b>Age 1/mi.</b>	2.1	2.2	3.5	3.6	24.4	8.5	15.6	1.3	1.0	1.1	0.5
	<b>1992</b>	<b>1991</b>	<b>1990</b>	<b>*1989</b>	<b>1988</b>	<b>1987</b>	<b>1986</b>	<b>*1984</b>	<b>*1983</b>	<b>1978</b>	<b>Mean</b>
<b>Age 0/mi.</b>	0.6	135.5	0.0	205.3	118.9	8.0	4.4	19.3	7.3	16.0	52.9
<b>Age 1/mi.</b>	23.4	0.3	36.4	107.0	---	11.4	0.1	4.1	72.0	---	14.4

\*Only a portion of the shoreline surveyed

Note: 8.0 miles was used as the distance for all surveys that covered the entire shoreline

The data collected during 2014 shows that male walleye are sexually mature as early as age-3 (with the majority mature by age 4), while female walleye reach maturity by age-6. With this information we can assess recruitment to adulthood by looking at year-class strength of male fish  $\geq$  age 4 and females  $\geq$  age 6 (Figure 10). It is clear to see that 4 age groups currently dominate

the adult walleye population (age 8-11). These four year classes (2003-2006) were produced when the adult walleye population was at its lowest level, averaging 1.1 adults/acre. Having a lower adult density is typically beneficial to juvenile survival because predation decreases and a greater amount of resources are available due to a lower abundance of preceding cohorts of walleye (which led to the decrease in adult density). During this four year time period natural reproduction was also strongly augmented by an average of 3.7 million walleye fry stocked annually. The two previously explained reasons, along with a regulation that protects male walleye from ages 5-11 is likely what has shaped the current age structure of Butternut Lake walleye. Increase in year class strength since stocking events have ceased (shown as 5 and 6 year old walleye), along with above average age-0 walleye production since 2008, suggest that this population is no longer reliant on stocking to maintain a strong adult walleye population.



**Figure 10.** Age structure of the Butternut Lake walleye population, indexed using the estimated age frequency of all walleye captured during a spring fyke net survey of Butternut Lake, Forest County, 2014 (Male: N=978, Female: N=266, Unknown: N=4).

## Smallmouth Bass

### Abundance

Smallmouth bass were targeted and captured during a single night of electrofishing on June 3<sup>rd</sup> to evaluate adult abundance. During this survey we captured 248 different smallmouth bass (243 adults). Due to the size of Butternut Lake we were not able to conduct multiple surveys to estimate the population of adult smallmouth bass. However, smallmouth bass abundance can be indexed using the catch rate of adult fish during our electrofishing survey. During this survey we captured adult smallmouth bass at a rate of 31.15 fish per mile, suggesting a 74.8% increase in adult abundance since 1985 (Table 6). Based on the relationship between previous population estimates and the catch rate during those surveys the current population is likely  $\geq 5$  adults/acre. The Butternut Lake smallmouth bass population has the highest relative abundance of all

smallmouth bass populations assessed in Florence and Forest Counties since 2011, and is considered abundant (Table 7).

**Table 6.** Abundance of adult smallmouth bass, indexed using population estimation and catch per mile during late spring electrofishing surveys, in Butternut Lake, Forest County.

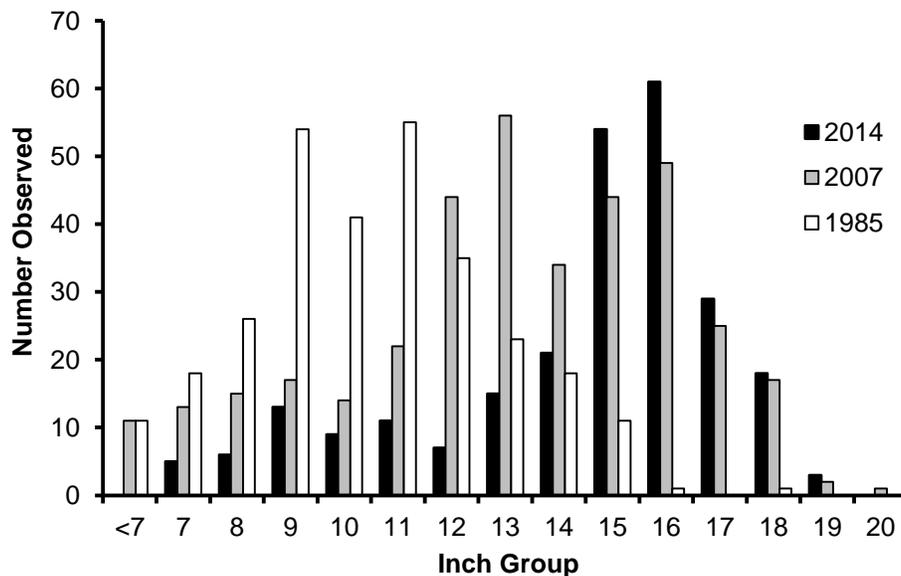
	2014	2004	1985
Adults/Acre	UNK	3.80	3.20
*Adults/mi.	31.15	21.15	17.82
<i>Note: Using 7.8 miles as distance</i>			

**Table 7.** Abundance of adult smallmouth bass, indexed using catch per mile during late spring electrofishing surveys, for all Forest and Florence County lakes containing a viable smallmouth population, 2011-2014.

	2011			2012		2013	2014			
	Patten	SECL	Silver	Ellwood	Keyes	Metonga	Kingsford	Butternut	Franklin	Mean
Adult SMB/mi.	6.02	2.04	2.24	18.78	3.92	9.12	8.85	25.05	16.34	10.26
<i>Note: All mileage is based on GPS mileage moved during the survey, not shoreline miles</i>										

### Size Structure

All smallmouth bass captured during spring surveys were measured to analyze size structure (Figure 11). The size structure of the smallmouth bass population in Butternut Lake is very good, with 73.8% and 19.8% of the fish sampled being  $\geq 14$  and 17 inches respectively (Table 8). This is the highest documented size structure for Butternut Lake for all length groups except RSD20, since there were no fish  $\geq 20$  inches captured during the 2014 survey. When compared to other smallmouth bass populations surveyed in Forest and Florence Counties in recent years, the Butternut Lake population ranks among the best for RSD11 and 14 and right at average for RSD17 (Table 9). This is quite impressive considering the high abundance of smallmouth bass in Butternut Lake and the negative relationship that is typically seen between size structure and abundance.



**Figure 11.** Length frequency of smallmouth bass captured during a 2014 spring survey compared to two previous surveys of Butternut Lake, Forest County (2014: N=252, 2007: N=364, 1985: N=294).

**Table 8.** Size structure, indexed using relative stock density, for smallmouth bass captured during spring surveys of Butternut Lake, Forest County 1978-2014 (2014: N=252).

	2014	2004	*1997	1985	1984	1983	1978	1974
<b>RSD11:</b>	86.90	83.29	6.20	50.88	88.24	33.72	15.00	11.69
<b>RSD14:</b>	73.81	48.73	3.10	10.95	32.35	6.98	0.00	0.00
<b>RSD17:</b>	19.84	12.75	0.78	0.35	14.71	1.16	0.00	0.00
<b>RSD20:</b>	0.00	0.28	0.00	0.00	0.00	0.00	0.00	0.00

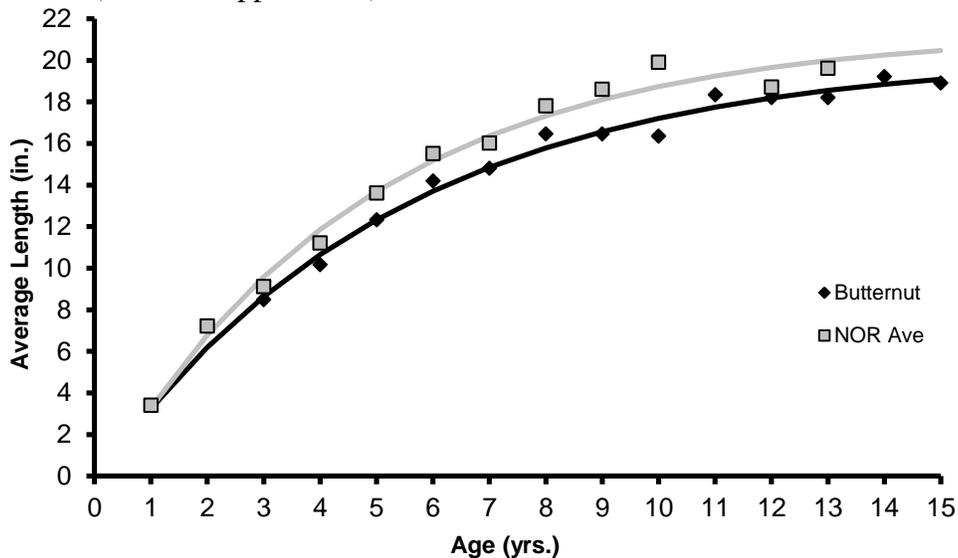
\*June Fyke Net Only

**Table 9.** Size structure, indexed using relative stock density, for all viable smallmouth bass populations surveyed in Forest and Florence Counties, 2011-2014.

	2011			2012		2013	2014			Mean
	Patten	SECL	Silver	Ellwood	Keyes	Metonga	Kingsford	Butternut	Franklin	
<b>RSD11</b>	76.04	69.35	83.33	50.19	58.21	85.03	72.34	86.90	85.63	74.11
<b>RSD14</b>	59.38	30.65	66.67	28.96	25.37	79.93	46.81	73.81	29.38	48.99
<b>RSD17</b>	29.17	6.45	36.67	1.93	11.94	50.17	12.77	19.84	12.50	20.16
<b>RSD20</b>	4.17	0.00	3.33	0.39	1.49	2.21	0.00	0.00	0.00	1.29

## Growth

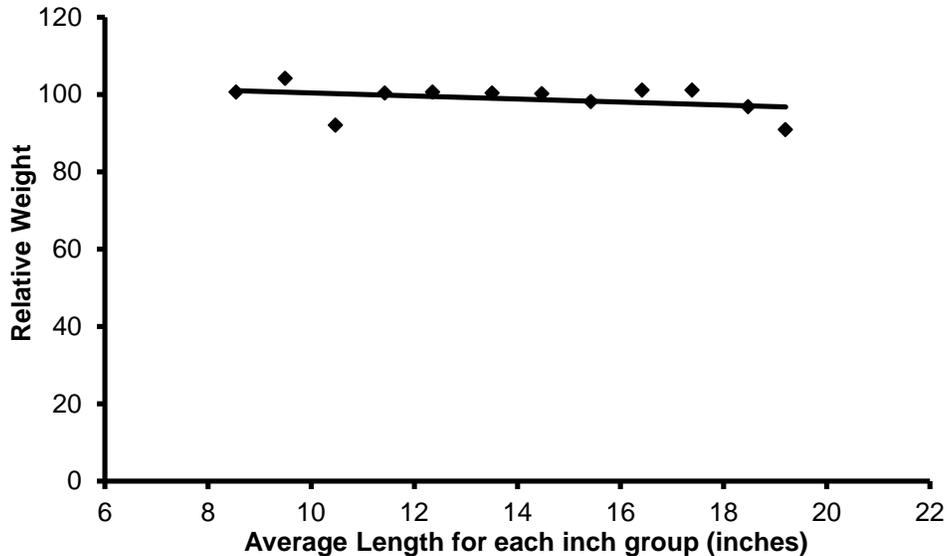
During the 2014 survey we were unable to visually determine the sex of smallmouth bass, so fish of both sexes were grouped into a single category of unknown sex smallmouth bass. Dorsal spine and scale samples were collected from a subsample of 91 smallmouth bass to estimate age. Growth was then inferred using average length at age and compared to the average for the Northern Region (NOR) of Wisconsin (Figure 12). This population of smallmouth bass exhibited below average growth when compared to other populations in the NOR of Wisconsin. On average it takes smallmouth bass in Butternut Lake just under 6 years to reach the minimum size limit of 14 inches (Table 3, Appendix B).



**Figure 12.** Average length at age for smallmouth bass captured during spring surveys of Butternut Lake in 2014, fit with a von Bertalanffy growth curve and compared to the average length at age for the Northern Region of WI (N=91).

## Body Condition

Randomly selected fish ( $\geq 8.0$  inches) were weighed during our spring survey to assess body condition of smallmouth bass via relative weight ( $W_r$ ) analysis.  $W_r$  values for both sexes combined ranged from 90.9 to 104.1 for individual length groups with an average value of 99.6 (Figure 13).  $W_r$  had no relationship to body length for this population, suggesting that conditions are similar for all sizes of smallmouth bass in Butternut Lake. With an average relative weight of 99.6 the body condition of this population is considered good.



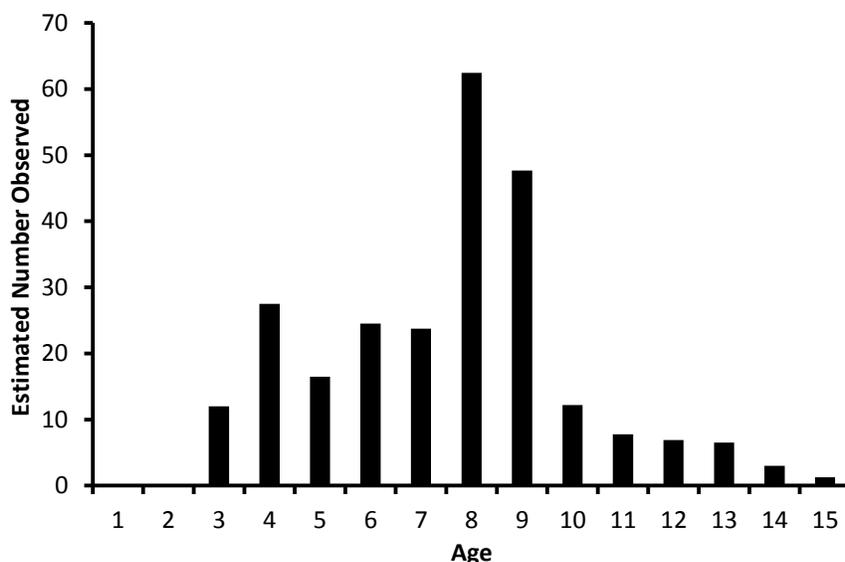
**Figure 13.** Average relative weight at length, measured from a sub sample of adult smallmouth bass ( $\geq 8.0$  in.) captured during spring surveys of Butternut Lake, Forest County, 2014 (N=90).

## Recruitment

During our fall electrofishing survey we attempted to index recruitment of all gamefish using average catch per mile of young-of-the-year (YOY) gamefish. A total of 3 YOY and 9 age-1 smallmouth bass were captured during this survey, catch rates of 0.38 and 1.13 fish per mile respectively (Table 10). This is not a high catch rate of juvenile smallmouth bass; however it is very similar to previous surveys conducted since 1984. A seemingly growing adult population along with all age classes 3 (the age at which smallmouth bass mature and are vulnerable to the gear used) through 15 represented during our spring survey suggest that natural recruitment is high enough to maintain or grow this population (Figure 14).

**Table 10.** Recruitment of smallmouth bass, indexed using catch per mile of age-0 and age-1 fish during fall electrofishing surveys, in Butternut Lake, Forest County, 1984-2014.

	2014	2013	*2004	2000	1996	1994	1993	1991	1990	1989	1988	1987	1984
<b>Age 0/mi.</b>	0.38	2.13	2.75	0.50	0.25	0.63	0.13	0.25	0.13	2.75	0.00	0.13	0.17
<b>Age 1/mi.</b>	1.13	7.63	---	0.25	0.50	0.50	0.00	0.00	0.13	11.25	1.38	0.13	0.68
<i>*Only surveyed 1/2 the lake</i>													
<i>Note: 8.0 miles was used as the entire shoreline mileage</i>													



**Figure 14.** Age structure of the Butternut Lake smallmouth bass population, indexed using the estimated age frequency of all smallmouth captured during a spring survey of Butternut Lake, Forest County, 2014 (N=252).

### Largemouth Bass

#### Abundance

Largemouth bass were targeted on June 3<sup>rd</sup> by electrofishing the entire shoreline of Butternut Lake. A total of two largemouth bass were captured during this survey. Largemouth bass have never been abundant in Butternut Lake, and should be considered a “background species” (Table 11).

**Table 11.** Relative abundance of largemouth bass, indexed using catch per mile during electrofishing surveys, in Butternut Lake, Forest County, during 1985 and 2014.

	2014	1985
<b>Adults/mi.</b>	0.26	0.19

### Panfish

#### Yellow Perch

#### Abundance

Yellow perch abundance was assessed using the relative abundance of fish captured during this year’s spring fyke net survey (Table 12). Abundance of the yellow perch in Butternut Lake is well below the average for yellow perch populations in this region (Table 13). During electrofishing surveys designed to target walleye and smallmouth bass we witnessed a much larger population of yellow perch than our fyke net catch suggests. One reason for a falsely low abundance of perch during spring netting is the difference in preferred spawning habitat for yellow perch and walleyes. The spring surveys of Butternut Lake are typically designed to assess walleye abundance; this is likely why past and present surveys have shown low abundance of yellow perch. Based on the observations made during electrofishing surveys it appears that yellow perch are of moderate abundance and are the dominant panfish species in Butternut Lake.

**Table 12.** Yellow perch relative abundance, indexed using catch per net-night, during spring fyke net surveys of Butternut Lake, Forest County.

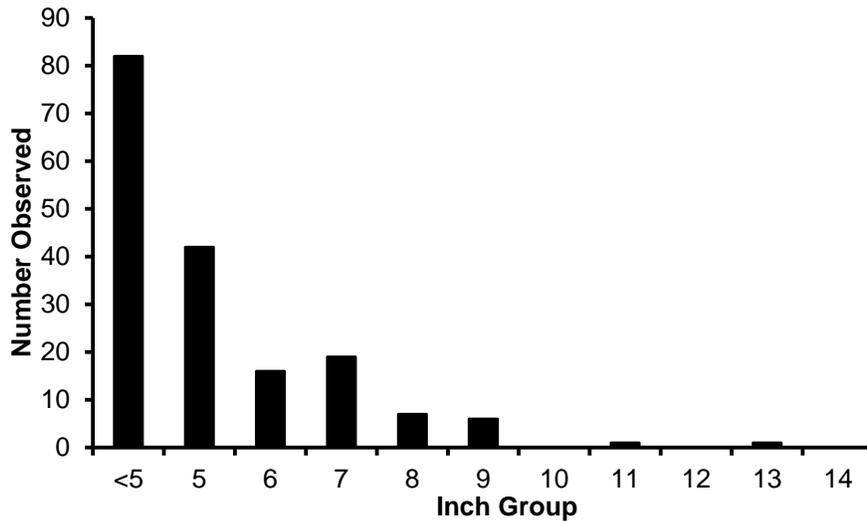
	2014	1997
YP/net-night	0.44	1.77

**Table 13.** Yellow perch relative abundance, indexed using catch per net-night, during spring fyke net surveys of lakes in Forest and Florence Counties with measurable yellow perch populations, 2011-2014.

	2011		2012				2013					2014					
	Patten	SECL	Ellwood	Emily	Keyes	Sea Lion	TFF	Fay	Halsey	Long	Van Zile	Metonga	Kingsford	Butternut	Franklin	Stevens	Mean
YP/net-night	3.38	1.31	0.00	0.00	0.02	0.44	1.21	8.58	235.31	23.58	59.41	3.68	0.31	0.44	8.00	87.20	27.05

### Size Structure

Every yellow perch captured during our spring fyke net survey, a random sample during the walleye recapture survey and every yellow perch captured during a 1.0 mile index station during the bass electrofishing survey was measured to assess the size structure of this population (Figure 15). While the bulk of the sample was < 5.0 inches, of those larger than 5.0 inches approximately 37% and 9% were  $\geq 7.0$  and 9.0 inches, with the largest fish captured being 13.7 inches in length. The size structure measured during 2014 is substantially worse than previous surveys of Butternut Lake (Table 14), however, when compared to other yellow perch populations in this region the current yellow perch size structure is very average (Table 15).



**Figure 15.** Length frequency of yellow perch captured during spring surveys of Butternut Lake, Forest County, during 2014 compared to two previous surveys (N=174).

**Table 14.** Size structure, indexed using relative stock density, for yellow perch captured during surveys of Butternut Lake, Forest County, 1983-2014.

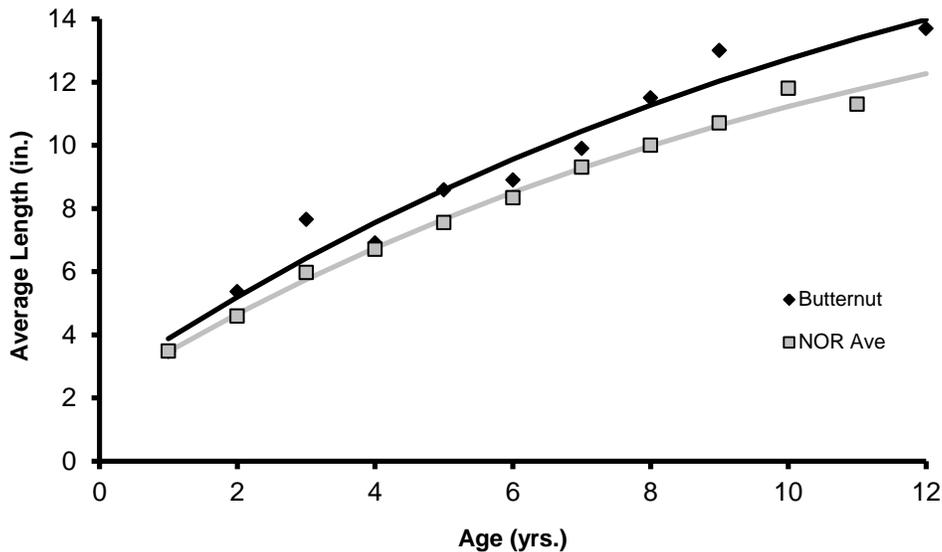
	2014	1997	1984	1983
RSD7	36.96	85.04	100.00	97.48
RSD8	16.30	33.58	100.00	80.5
RSD9	8.70	4.38	91.11	32.7
RSD10	2.14	0.73	42.22	7.55
RSD12	1.09	0.00	0.00	1.26

**Table 15.** Yellow perch size structure, indexed using relative stock density, for all lakes sampled in Forest and Florence Counties, 2011-2014, with a measurable yellow perch population.

	2011		2012		2013				2014				Mean
	Patten	SECL	Wabikon	Riley	Fay	Halsey	Long	Van Zile	Metonga	Butternut	Franklin	Stevens	
RSD7	31.17	36.21	66.00	75.41	11.92	42.91	4.58	5.79	92.65	36.96	21.33	17.48	36.87
RSD8	6.49	13.79	34.00	34.43	1.32	7.96	0.42	0.83	87.54	16.30	5.33	6.02	17.87
RSD9	2.60	5.17	10.00	11.48	0.00	0.00	0.42	0.00	69.97	8.70	1.33	2.04	9.31
RSD10	0.00	1.72	4.00	1.64	0.00	0.00	0.42	0.00	42.17	2.17	0.00	1.14	4.44
RSD12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.51	1.09	0.00	0.23	0.40

## Growth

A random sample of 58 yellow perch captured during the 2014 survey had structures removed to estimate age. Growth was then inferred using average length at age. The Butternut Lake population grows faster than the Northern Region (NOR) average (Figure 16). With these growth rates yellow perch achieve a length of 8 inches in less than 5 years, which is over one year faster than the average in this region of Wisconsin.



**Figure 16.** Average length at age for yellow perch captured from Butternut Lake during spring surveys in 2014, fit with a von Bertalanffy growth curve and compared to the average length at age for the Northern Region of WI (N=58).

## Bluegill

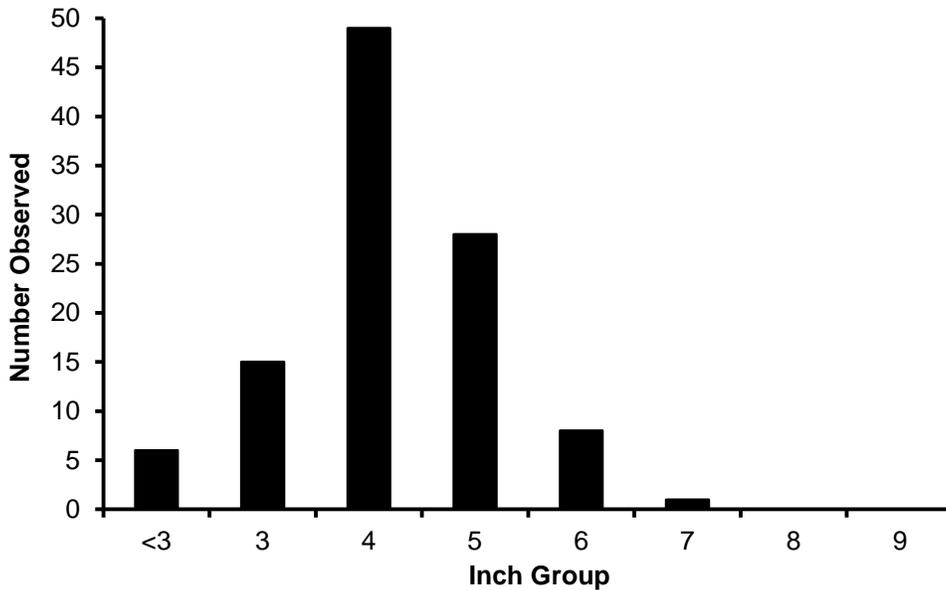
### Abundance

Only 29 bluegill were captured during our spring fyke net survey (1.6/net-night), indicating a low abundance of bluegill in Butternut Lake. After analyzing the available habitat during our spring electrofishing surveys we determined that there were very few areas where nets could be set to target spawning bluegill, so our typical June fyke net survey was cancelled. Instead, two stations (which contained the best spawning habitat for bluegill) were sampled during the electrofishing survey on June 3<sup>rd</sup> (Map 3, Appendix D). During this survey we captured 55 bluegill per mile from station #1 and 43.3 bluegill per mile within station #2 for an overall

relative abundance of 48.6 fish per mile. Based on this data bluegill in Butternut Lake are considered to be of low abundance.

### Size Structure

Every bluegill captured within the index stations sampled via electrofishing was measured to assess size structure (Figure 17). The size structure of the Butternut Lake population is poor with only 8.9% of the bluegill captured being  $\geq 6.0$  inches and just under 1% being  $\geq 7.0$  inches in length (Table 16).



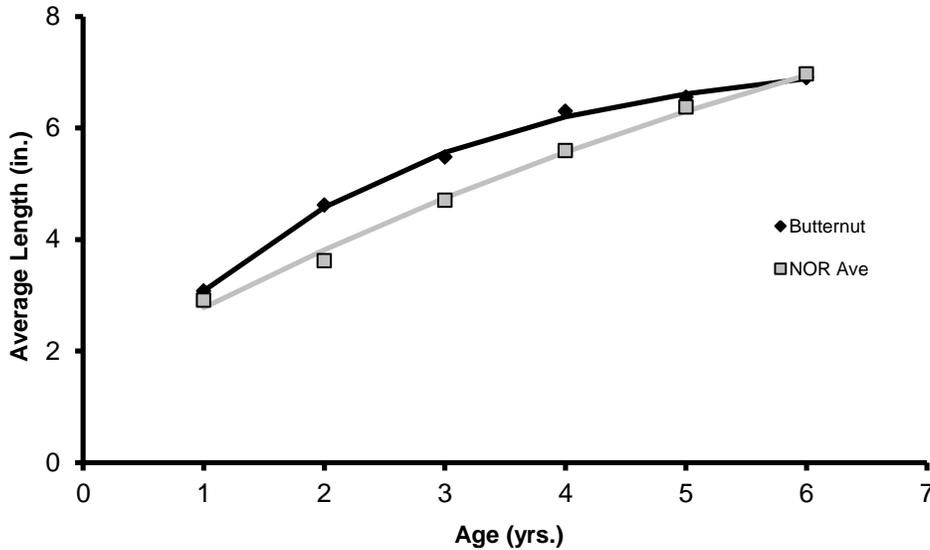
**Figure 17.** Length frequency of all bluegill captured during spring surveys of Butternut Lake, Forest County, 2014 (N=107).

**Table 16.** Size structure, indexed using relative stock density, of bluegill captured during spring surveys of Butternut Lake, Forest County, 2014.

	2014
RSD6	8.91
RSD7	0.99
RSD8	0.00
RSD9	0.00
RSD10	0.00

### Growth

Anal spines and scales were removed from a sample of 26 bluegill to estimate age. Growth was then inferred using average length at age. Bluegill in Butternut Lake display growth rates that are above average for the Northern Region (NOR) of Wisconsin (Figure 18). It takes a bluegill an average of 3.5 years to achieve 6 inches in length; one year faster than the average bluegill population in Northern Wisconsin.



**Figure 18.** Average length at age for bluegill captured from Butternut Lake during a 2014 spring survey, fit with a von Bertalanffy growth curve and compared to the average length at age for the Northern Region of WI (N=26).

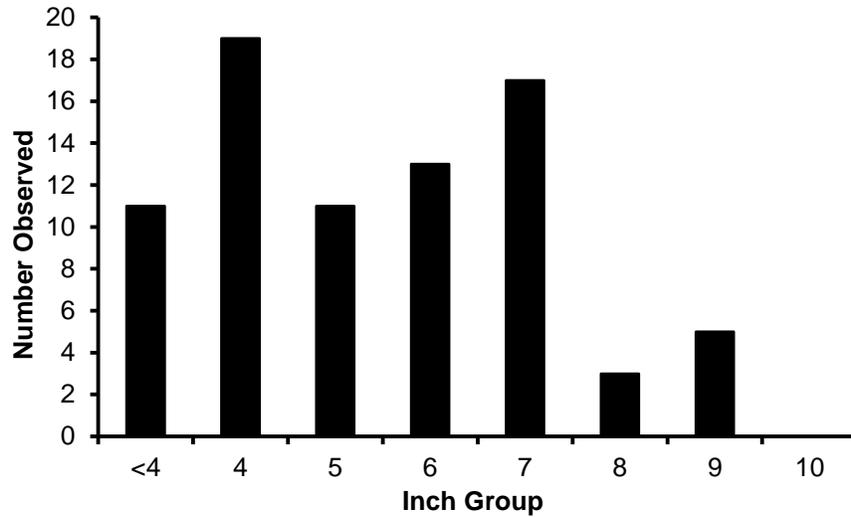
## Rock Bass

### Abundance

Like bluegill, rock bass abundance was assessed from index stations that were electrofished during the June 3<sup>rd</sup> survey. A total of 79 rock bass were captured (35.9 fish/mile) during this survey. Rock bass are the third most abundant panfish species in Butternut Lake (behind yellow perch and bluegill). While the abundance of rock bass is not high compared to other panfish populations in Butternut Lake, it is above average when compared to other rock bass populations in this region.

### Size Structure

All 79 rock bass captured during our electrofishing survey were measured to assess size structure (Figure 19). Rock bass size structure is quite good in Butternut Lake with 36.7% of the fish sampled being  $\geq 7.0$  inches in length (Table 17).



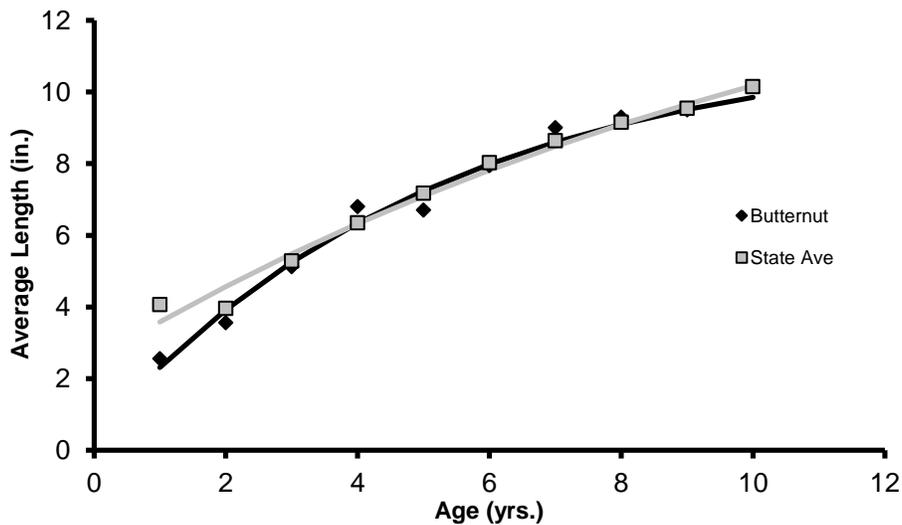
**Figure 19.** Length frequency for a sample of rock bass captured during a spring survey of Butternut Lake, Forest County, 2014 (N=79).

**Table 17.** Size structure, indexed using relative stock density, for rock bass captured during spring surveys of Butternut Lake, Florence County.

	2014	1997
RSD7	36.76	31.00
RSD8	11.76	7.00
RSD9	7.35	0.50
RSD10	0.00	0.00

## Growth

Anal spines and scales were removed from 24 rock bass to estimate age. Growth was then inferred using average length at age. Rock bass growth was very similar to the state of Wisconsin average (Figure 20).



**Figure 20.** Average length at age for rock bass captured from Butternut Lake during 2014 spring surveys, fit with a von Bertalanffy growth curve and compared to the average length at age for the state of WI (N=24).

## **Other Species**

Pumpkinseed and black crappie were captured in small numbers during the 2014 survey (Table 4, Appendix C), but make up a very small portion of the panfishery. Five non-game fish species were also captured during this survey; bluntnose minnow, common shiner, golden shiner, mottled sculpin and white sucker. All of these species are good prey items for the predatory fish in Butternut Lake. Past surveys of Butternut Lake have documented a small lake whitefish population. No lake whitefish were witnessed during this survey; however, no directed effort was spent trying to assess this population of fish.

## **V. MANAGEMENT RECOMMENDATIONS**

### **Northern Pike**

Northern pike abundance appears to be at an all-time high in Butternut Lake. The 2011 northern pike year class (3 year old fish) currently makes up an estimated 58% of the adult population. There are a few reasons that could explain why this single year class has such high relative abundance. In Northern Wisconsin age-3 is typically the first year that both sexes of northern pike are sexually mature. The gear used to sample northern pike during this survey is designed to take advantage of sexually mature fish, which are cruising shallow water searching for suitable spawning areas. Having a higher catch rate of young adults is not uncommon since they have been exposed to less mortality than older adult cohorts. Increased angling and natural mortality may reduce the abundance of these young adult northern pike through time, eventually making them no more abundant than previous year classes. The 2011 year class may also be nothing more than an anomaly that was created by optimal conditions for reproduction and survival. However, if this year class is a sign of increased northern pike recruitment, eventually leading to an increased adult abundance it could cause substantial changes to the fishery.

Increased northern pike abundance, on top of the already abundant smallmouth bass and walleye populations may create increased competition between these predatory species. This would not be beneficial to Butternut Lake which contains popular and important walleye and smallmouth bass fisheries. The historically low abundance of northern pike has also allowed for good growth, high size structure and a trophy fishing opportunity. I recommend paying closer attention to the northern pike population in Butternut Lake, if the population continues to grow and negative impacts to walleye, smallmouth bass or yellow perch are seen action should be taken to reduce northern pike abundance. For right now, the current no minimum length limit, 5 fish daily bag limit is the most appropriate regulation.

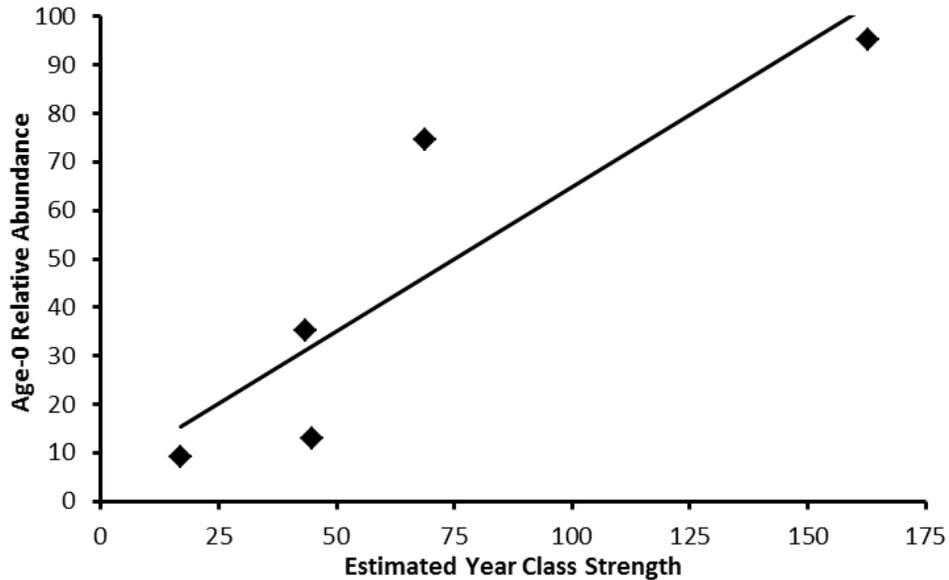
## Walleye

Butternut Lake has an extensive history of walleye population monitoring, with population estimates conducted in 26 of the last 27 years. Over this time period the walleye population has been highly variable (Figure 21). Fluctuations in walleye populations are quite common due to natural variations in walleye recruitment. However, walleye recruitment has been somewhat stable with approximately 87% higher age-0 relative abundance than the ceded territory average since 1986. Above average recruitment has been documented in 15 of 29 years over this time period.



**Figure 21.** Abundance of adult walleye, indexed using population estimation, in Butternut Lake, Forest County, 1983-2014 (Mean = 3.35).

Relatively stable walleye recruitment would be expected to result in a relatively stable adult population, given the relationship between recruitment and adult abundance in Butternut Lake (Figure 22). However, the adult population has been anything but stable; especially since the current walleye angling regulation was put in place in 1997. Under the current regulation the mean adult abundance has declined approximately 27.6% from the average population prior to the current regulation, with annual adult abundance exceeding the “pre slot limit” average abundance only 4 of 16 years (Table 18).



**Figure 22.** Relationship between walleye recruitment, indexed using age-0 relative abundance during fall surveys, and year class strength, indexed using estimated abundance of a given year class in the current (2014) adult population, for Butternut Lake, Forest County, 2006-2010 ( $P=0.047$ ,  $R^2=0.78$ ).

**Table 18.** Walleye abundance, indexed using estimated number of adult fish per acre, prior to the current walleye size regulation (1983-97) compared to mean abundance after the current regulation was put in place (1998-14).

	1983-1997	1998-2014
<b>Adult Density</b>	3.98	2.88

The current no minimum length limit, with fish between 14 and 18 inches protected from harvest and only 1 fish allowed > 18 inches does not appear to be the best walleye regulation for Butternut Lake. This regulation has been shown to protect male walleye for twice as long as female walleye, focusing the angler harvest on female and juvenile fish. While minimum size limits have also been shown to direct angler harvest toward the faster growing female fish it is my belief that a minimum size limit would increase the harvest opportunity on male walleye to an exploitation level closer to that of female fish, while stabilizing the adult population by protecting juvenile walleye.

I recommend changing the current regulation to the statewide 15-inch minimum size limit, with a daily bag limit of 5 fish (which would be reduced to a lower level after tribal declaration). Not only do I believe that this regulation is a better fit for long-term walleye management in Butternut Lake, but it will also remove a special regulation that has not managed this population optimally. If an option was available to insert a protective slot on a portion of the population that was primarily female (example: fish  $\geq 20$  inches) I would be in favor of placing that on top of a 15-inch minimum size limit.

### Smallmouth Bass

Smallmouth bass are the most abundant gamefish in Butternut Lake. This population has grown in size and is the highest density smallmouth bass population in Florence and Forest Counties (of those surveyed since 2011).

The size structure of this population is at an all-time high and body condition is quite good. Growth rates are below the regional average and the age structure of the population is abnormally high, suggesting that the high size structure is due to low angler harvest.

For right now the statewide 14-inch minimum size limit seems appropriate. However, emphasis should be placed on monitoring this population via spring electrofishing surveys. If abundance continues to increase density dependent variables such as growth, body condition and size structure may be negatively impacted. However, recruitment does not seem to be high and this population may be able to maintain its desirable state long-term.

## **Panfish**

Yellow perch are the most abundant panfish species in Butternut Lake. The current size structure is much lower than previous surveys. Growth rates are very good and recruitment appears to be high so I see no reason to change the current angling regulations for Butternut Lake. With the current growth rates I expect the size structure of this population to increase in the near future.

Bluegill abundance is fairly low in Butternut Lake. Maintaining a simple fish community dominated by three fish species (yellow perch, walleye and smallmouth bass) is likely beneficial to the fishery and is my management recommendation. Projects designed to increase centrarchid abundance should not be conducted on this lake.

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## Appendix A – Length Frequencies

**Table 1.** Length frequency of northern pike captured during a spring fyke net survey of Butternut Lake, Forest County, 2014 (Unmarked fish only).

Inch Group	Spring Net	Total
< 10		
10	3	3
11	1	1
12	4	4
13	1	1
14	0	0
15	1	1
16	2	2
17	4	4
18	10	10
19	20	20
20	26	26
21	20	20
22	13	13
23	10	10
24	1	1
25	5	5
26	2	2
27	0	0
28	1	1
29	1	1
30	0	0
31	2	2
32	0	0
33	0	0
34	0	0
35	0	0
36	0	0
37	0	0
38	1	1
39		
> 40		
<b>Totals</b>	128	128

**Table 2.** Length frequency of walleye captured during surveys of Butternut Lake, Forest County, 2014 (Unmarked fish only).

Inch Group	Spring Netting	5/12 Spring Electrofishing	Fall Shocking	Total
< 8.0	0	8	207	215
8	0	0	14	14
9	0	0	19	19
10	0	0	7	7
11	0	0	1	1
12	10	4	1	15
13	44	10	3	57
14	43	13	1	57
15	77	12	0	89
16	243	61	1	305
17	309	63	0	372
18	185	19	1	205
19	81	4	1	86
20	41	1	4	46
21	23	1	1	25
22	2	0	0	2
23	2	0	0	2
24	0	0	0	0
25	0	0	0	0
<b>Totals</b>	1060	196	261	1517

**Table 3.** Length frequency of smallmouth bass captured during spring surveys of Butternut Lake, Forest County, 2014 (Unmarked fish only).

Inch Group	Spring Netting	6/3 Spring Electrofishing	Total
< 7.0			
7	0	5	5
8	0	6	6
9	1	12	13
10	0	9	9
11	0	11	11
12	1	6	7
13	1	14	15
14	0	21	21
15	0	54	54
16	1	60	61
17	0	29	29
18	0	18	18
19	0	3	3
20			
<b>Totals</b>	4	248	252

**Table 4.** Length frequencies for subsamples of panfish measured during spring surveys of Butternut Lake, Forest County, 2014.

Inch Group	Bluegill	Black Crappie	Rock Bass	Yellow Perch
< 3.0	6		2	22
3	15		9	4
4	49		19	56
5	28		11	42
6	8		13	16
7	1		17	19
8			3	7
9			5	6
10				0
11				1
12				0
13		2		1
14				
<b>Sample Size</b>	107	2	79	174

## Appendix B – Average Length at Age

**Table 1.** Mean length (inches) at age for northern pike captured during a spring fyke net survey of Butternut Lake in 2014, compared to previous surveys of Butternut Lake and Northern Region of WI averages (2014: Male: N=48, Female: N=48, UNK: N=7).

	2014			2001	1997	1984	1983	NOR Ave
Age	Male	Female	Combined	Combined	Combined	Combined	Combined	Combined
1	12.2		11.5	12.2	11.2	11.5		10.6
2	14.7	17.4	15.6	13.5	16.0	17.3	12.1	13.1
3	19.6	23.1	20.3	19.6	21.7	18.9	21.0	16.3
4	22.0	22.1	22.0	22.1	24.6	23.6	24.0	19.5
5	24.4		24.4	23.6	25.3	29.6	29.6	22.0
6	23.6		23.6	25.6	28.2			24.5
7	25.4	29.1	27.6	27.4	29.3	38.8		27.7
8		29.8	29.8	29.4				30.3
9				33.6				31.5
10		38.5	38.5					34.1
11								37.3

**Table 2.** Mean length (inches) at age for walleye captured during a spring survey of Butternut Lake in 2014, compared to previous surveys of Butternut Lake and Northern Region of WI averages (2014: Male: N=67, Female: N=49, UNK: N=2).

	2014		1997		1992		1990		1984		1983		NOR Ave
Age	Male	Female	Combined										
1													6.4
2			10.6				10.9						9.5
3	12.6		11.7		12.3	14.2	12.8				11.3		11.7
4	13.7		14.1		13.6	15.0	15.0	16.4	12.8	14.0	13.9		13.8
5	14.3		15.5	19.4	15.7	16.0	16.5	17.4	14.4	15.7	15.6		15.8
6	14.7	16.3	17.4	20.2	16.8	19.1	17.5	19.0	16.4	20.1	17.0	17.6	17.5
7	14.6	16.8	17.3	20.6	17.5	20.6	17.8	21.6	17.3	20.4	18.0	20.1	19.1
8	16.4	19.4	17.2	20.2	18.7	21.0	20.2	21.7	18.4	22.4	18.8	20.9	20.5
9	17.4	19.1	20.1	22.2	19.7	23.2	20.2	23.6	22.0	22.9	19.3	23.8	21.6
10	17.4	19.6			20.1	23.7	19.8	24.3	18.8	25.4		25.3	22.7
11	17.8	20.7			20.8	26.8	20.2	26.4	21.2	24.7		27.5	23.7
12	18.7	21.8			21.4	26.8	20.3	26.8	26.6	26.2			24.4
13	19.0						19.6	22.6		27.9			25.2
14													25.8
15							20.3	28.2					25.6
16							20.2	22.6					25.6
17								27.3					25.2

**Table 3.** Mean length (inches) at age for smallmouth bass captured during a spring survey of Butternut Lake in 2014, compared to previous surveys of Butternut Lake and Northern Region of WI averages (2014: N=91).

Age	2014	1997	1994	1985	1984	1983	1978	NOR Ave
1								3.4
2		7.2	6.9	7.2		6.3	6.7	7.2
3	8.5	10.1	9.4	9.8	11.1	9.9	9.1	9.1
4	10.2	11.8	12.1	11.7	13.5	12.0	12.8	11.2
5	12.3	14.2	13.7	14.8	14.5	13.9		13.6
6	14.2	14.8	15.7	16.0	16.8	15.1		15.5
7	14.8	16.1	16.0	17.5	17.2	17.6		16
8	16.4	16.7		18.3	18.7			17.8
9	16.5	17.0	18.1					18.6
10	16.4	17.6						19.9
11	18.3	18.2						
12	18.2							18.7
13	18.2							19.6
14	19.2							
15	18.9							

**Table 4.** Mean length (inches) at age for yellow perch captured during a spring survey of Butternut Lake in 2014, compared to previous surveys of Butternut Lake and Northern Region of WI averages (2014: N=58).

Age	2014	1997	1984	1983	1978	NOR Ave.
1	3.5					3.5
2	5.4		8.0	4.0	4.0	4.6
3	7.7	6.9	9.4	5.5	5.5	6.0
4	6.9	8.0	9.7	7.1	6.9	6.7
5	8.6	9.1	9.9	8.7		7.5
6	8.9	8.3	10.0	9.2		8.3
7	9.9	8.5	10.9	13.5		9.3
8	11.5		10.1			10.0
9	13.0					10.7
10		14.2				11.8
11						11.3
12	13.7					

**Table 5.** Mean length (inches) at age for bluegill captured during a spring survey of Butternut Lake in 2014, compared to the Northern Region of WI averages (2014: N=26).

Age	2014	1983	NOR Ave
1	3.1		2.9
2	4.6	3.8	3.6
3	5.5		4.7
4	6.3		5.6
5	6.6		6.4
6	6.9		7.0
7			7.6

**Table 6.** Mean length (inches) at age for rock bass captured during a spring survey of Butternut Lake in 2014, compared to a previous survey of Butternut Lake and state of Wisconsin averages (2014: N=24).

<b>Age</b>	<b>2014</b>	<b>1997</b>	<b>State Ave.</b>
1	2.6		4.1
2	3.6	3.8	4.0
3	5.1	5.1	5.3
4	6.8	7.0	6.3
5	6.7	7.5	7.2
6	8.0	7.6	8.0
7	9.0		8.6
8	9.3		9.2
9	9.5		9.5
10			10.2
11	9.9		10.6

## Appendix C – Catch Per Unit Effort

**Table 1.** Gamefish catch per net-night during a spring fyke net survey of Butternut Lake, Forest County, 2014.

Species	2014
Largemouth Bass	0.06
Northern Pike	7.28
Smallmouth Bass	0.22
Walleye	38.80

**Table 2.** Panfish catch per net-night during a spring fyke net survey of Butternut Lake, Forest County, 2014.

Species	2014
Black Crappie	0.06
Bluegill	1.61
Pumpkinseed	0.22
Rock Bass	1.56
Yellow Perch	0.44

**Table 3.** Gamefish catch per mile during electrofishing surveys of Butternut Lake, Forest County, 2014.

Species	Spring	Bass Survey	Fall
Largemouth Bass	---	0.20	0.00
Northern Pike	---	---	0.00
Smallmouth Bass	---	25.05	23.40
Walleye (All)	35.26	---	30.73
Walleye (Age 0+)	---	---	23.16
Walleye (Age 1+)	---	---	5.57

\*Catch rates based on GPS mileage

**Table 4.** Summary of fish species, number and size range (inches) captured during fyke netting and electrofishing surveys conducted as part of a comprehensive survey of Butternut Lake, Forest County, 2014.

Fish Species		Catch (and Size Range in Inches) by Sampling Period											
		Spring Netting			Spring Electrofishing 1			Spring ElectroFishing 2			Fall Electrofishing		
Common Name	Scientific Name	Catch	Min. Size	Max. Size	Catch	Min. Size	Max. Size	Catch	Min. Size	Max. Size	Catch	Min. Size	Max. Size
Black Crappie	<i>Pomoxis nigromaculatus</i>	1	13.5	13.9	1	13.0	13.4	---			0	---	---
Bluegill	<i>Lepomis macrochirus</i>	28	---	---	---			107	2.5	7.4	5	2.0	4.4
Bluntnose	<i>Pimephales notatus</i>	0	---	---	---			---			3	2.5	3.9
Common Shiner	<i>Luxilus cornutus</i>	0	---	---	---			---			6	4.0	5.4
Golden Shiner	<i>Notemigonus crysoleucas</i>	1	---	---	---			---			0	---	---
Largemouth Bass	<i>Micropterus salmoides</i>	1	16.0	16.4	---			2	9.0	17.9	0	---	---
Mottled Sculpin	<i>Cottus bairdii</i>	0	---	---	---			---			2	2.5	3.4
Northern Pike	<i>Esox lucius</i>	131	10.0	38.5	---			---			0	---	---
Pumpkinseed	<i>Lepomis gibbosus</i>	4	---	---	---			19	3	6.9	0	---	---
Rock Bass	<i>Ambloplites rupestris</i>	28	---	---	---			79	2	9.9	19	3.0	6.9
Smallmouth Bass	<i>Micropterus dolomieu</i>	4	9.0	16.4	---			248	7.0	19.4	21	3	9.8
Walleye	<i>Sander vitreus</i>	693	12.0	23.4	275	5.5	21.9	---			276	3.5	21.4
White Sucker	<i>Catostomus commersoni</i>	15	---	---	---			---			0	---	---
Yellow Perch	<i>Perca flavescens</i>	8	5	13.7	94	2.5	11.9	70	2.5	7.9	45	2	8.4

**Appendix D – Survey Maps**

