BLACK CRAPPIE AGE AND GROWTH FROM 10 NEW HAMPSHIRE WATERBODIES
(2013-2015)

STATE: New Hampshire

GRANT: F-50-R-31

GRANT TITLE: Anadromous and Inland Fisheries Operational Management
                                     Investigations

JOB 9:   Warmwater and Coolwater Fisheries Population
                                     Assessments

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INTRODUCTION

Black Crappie (*Pomoxis nigromaculatus*) has quickly become a very popular sport fish in NH in recent years. Black Crappie were first surveyed by the New Hampshire Fish and Game Department (NHFGD) in 1938 in the Merrimack River (Nashua) and in Horseshoe Pond (Merrimack) which were the result of illegal introductions. The NHFGD transferred Black Crappie into 18 waterbodies from 1990 to 1992 and two more waterbodies in 2001 and 2002. There are currently 120 waterbodies statewide that have Black Crappie populations, mostly the results of illegal introductions. Black Crappie populations in the state are solely managed by natural reproduction, are a very popular sport fish, and the NHFGD currently has limited data for Black Crappie. Accordingly, it is important for the NHFGD to learn more about their populations in order to better manage the fishery. The objective of this study was to collect Black Crappie scale samples from a number of NH waterbodies to conduct age and growth analysis and create a statewide data base.

METHODS

Black Crappie samples were taken from waterbodies in Regions 2, 3, and 4. Waterbodies sampled included: Bellamy Reservoir, Madbury; Contoocook Lake, Jaffrey/Rindge; Contoocook River, Concord; Crooked Pond, Loudon; Forest Lake, Winchester; Harrisville Pond, Harrisville; Harvey Lake, Northwood; Hermit Lake, Sanbornton; Highland Lake, Stoddard/Washington; Lake Todd, Newbury; Melendy Pond, Brookline; Merrimack River Oxbow, Concord; New Wilton Reservoir, Wilton; Pemigewasset Lake, New Hampton; Pratt Pond, Mason; Turtletown Pond, Concord; Wickwas Lake, Meredith; and Lake Winnipesaukee, Greens Basin, Moultonborough (Table 1).

In the fall of 2013 and 2014, fish were caught in open water by means of angling (vertical jigging) from a boat using sonar to locate fish. From ice-in to the end of March 2014 and 2015, fish were caught through the ice by means of jigging with the aid of sonar. Black Crappie sampled in Highland Lake, in addition to angling, were sampled using five New Hampshire design fyke nets from April 28 to May 16, 2014 (Carrier and Gries 2014). All Black Crappie that were caught were measured to the nearest millimeter (mm). For aging purposes, scale samples were taken in the region below the lateral line and slightly posterior to the pectoral fin on the left side of the fish. Scales were cataloged, then permanently recorded in an acetate impression and aged using an Eyecom 1100 microfiche projector. In this report, only fish aged as $\leq$ 6 years of age and having scales with ageing confidence ratings of 1 or 2 (very confident or confident, respectively) were analyzed. The Fraser-Lee method for back-calculation was performed on all scales aged $\leq$ 6. The Fraser-Lee equation is:

$$L_i = \frac{L_c - a}{S_c} S_i + a;$$

L_i = back-calculated length of the fish when the *i*th increment was formed,
L_c = total length of the fish at capture,
S_c = radius of scale at capture,
S_i = radius of scale at *i*th increment,
a = intercept parameter.

The intercept parameter (i.e. correction factor; fish length at which scales begin to form) used was 35 for Black Crappie. Total length versus age plots in MS-Excel used average length at age per species and plots were fitted with a logarithmic trendline. Only values for ages $\leq$ 6 were used to create the trendline in order to standardize this comparison among waterbodies. The equation for this trendline was used to obtain age at quality size (200 mm for Black Crappie; Gablehouse 1984).

Eight of the eighteen waterbodies had sample sizes of less than ten fish. Age and growth data were not compared or categorized for these eight waterbodies due to low sample sizes.

RESULTS

Bellamy Reservoir (*Madbury*)

Mean back-calculated length at age, total number of fish aged, logarithmic trendline correlation coefficient, and age at quality size for Black Crappie are presented in Table 2 and Figure 1. Average length at age was below statewide values (2013-2015) for Black Crappie ages 1- 6. Black Crappie took an average of 4.34 years to reach quality size (200 mm) compared to the statewide average of 3.09 years (2013-2015).

Contoocook Lake (*Jaffrey*)

Mean back-calculated length at age, total number of fish aged, logarithmic trendline correlation coefficient, and age at quality size for Black Crappie are presented in Table 2 and Figure 2. Average length at age was above statewide values (2013-2015) for Black Crappie ages 1- 2 and below statewide values for ages 3-6. Black Crappie took an average of 3.32 years to reach quality size (200 mm) compared to the statewide average of 3.09 years (2013-2015).

Forest Lake (*Winchester*)

Mean back-calculated length at age, total number of fish aged, logarithmic trendline correlation coefficient, and age at quality size for Black Crappie are presented in Table 2 and Figure 3. Average length at age was above statewide values (2013-2015) for Black Crappie ages 1- 6.

Black Crappie took an average of 2.54 years to reach quality size (200 mm) compared to the statewide average of 3.09 years (2013-2015).

Harrisville Pond (*Harrisville*)

Mean back-calculated length at age, total number of fish aged, logarithmic trendline correlation coefficient, and age at quality size for Black Crappie are presented in Table 2 and Figure 4. Average length at age was above statewide values (2013-2015) for Black Crappie ages 3- 6 and below statewide values for ages 1-2. Black Crappie took an average of 2.7 years to reach quality size (200 mm) compared to the statewide average of 3.09 years (2013-2015).

Hermit Lake (*Sanbornton*)

Mean back-calculated length at age, total number of fish aged, logarithmic trendline correlation coefficient, and age at quality size for Black Crappie are presented in Table 2 and Figure 5. Average length at age was above statewide values (2013-2015) for Black Crappie age 5, below statewide values for ages 1- 3, and equal for age 4. Black Crappie took an average of 3.05 years to reach quality size (200 mm) compared to the statewide average of 3.09 years (2013-2015).

Highland Lake (*Stoddard-Washington*)

Mean back-calculated length at age, total number of fish aged, logarithmic trendline correlation coefficient, and age at quality size for Black Crappie are presented in Table 2 and Figure 6. Average length at age was above statewide values (2013-2015) for Black Crappie age 1 and below statewide values for ages 2- 6. Black Crappie took an average of 3.47 years to reach quality size (200 mm) compared to the statewide average of 3.09 years (2013-2015).

Merrimack River Oxbow (*Concord*)

Mean back-calculated length at age, total number of fish aged, logarithmic trendline correlation coefficient, and age at quality size for Black Crappie are presented in Table 2 and Figure 7. Average length at age was above statewide values (2013-2015) for Black Crappie ages 1- 3 and 6 and below statewide values for ages 4- 5. Black Crappie took an average of 2.87 years to reach quality size (200 mm) compared to the statewide average of 3.09 years (2013-2015).

Pemigewassett Lake (*New Hampton-Meredith*)

Mean back-calculated length at age, total number of fish aged, logarithmic trendline correlation coefficient, and age at quality size for Black Crappie are presented in Table 2 and Figure 8. Average length at age was above statewide values (2013-2015) for Black Crappie age 4 and

below statewide values for ages 1- 3 and 5- 6. Black Crappie took an average of 3.12 years to reach quality size (200 mm) compared to the statewide average of 3.09 years (2013-2015).

Wickwas Lake (*Meredith*)

Mean back-calculated length at age, total number of fish aged, logarithmic trendline correlation coefficient, and age at quality size for Black Crappie are presented in Table 2 and Figure 9. Average length at age was above statewide values (2013-2015) for Black Crappie ages 2- 6 and below statewide values for age 1. Black Crappie took an average of 2.77 years to reach quality size (200 mm) compared to the statewide average of 3.09 years (2013-2015).

Lake Winnipesaukee, Greens Basin (*Moultonborough*)

Mean back-calculated length at age, total number of fish aged, logarithmic trendline correlation coefficient, and age at quality size for Black Crappie are presented in Table 2 and Figure 10. Average length at age was above statewide values (2013-2015) for Black Crappie ages 3- 6 and below statewide values for ages 1- 2. Black Crappie took an average of 2.75 years to reach quality size (200 mm) compared to the statewide average of 3.09 years (2013-2015).

DISCUSSION

Black Crappie in the 10 waterbodies sampled varied by time (years) to reach quality size (200 mm). There was a difference of 1.8 years from the fastest growth rate of 2.54 years to reach quality size in Forest Lake to the slowest growth rate of 4.34 years to reach quality size in Bellamy Reservoir. Time to reach quality size from fastest to slowest was as follows: Forest Lake (2.54 years), Harrisville Pond (2.70 years), Lake Winnepesaukee (2.75 years), Wickwas Lake (2.77 years), Merrimack River Oxbow (2.87 years), Hermit Lake (3.05 years), Pemigewasset Lake (3.12 years), Contoocook Lake (3.32 years), Highland Lake (3.47 years), Bellamy Reservoir (4.34 years).

RECOMMENDATIONS

The NHFGD should continue to assess Black Crappie populations throughout the state and continue to update the statewide database. This database will allow biologists to target specific water bodies for more detailed assessments and make well-informed management recommendations to preserve and improve the quality of Black Crappie populations state-wide.

ACKNOWLEDGEMENTS

LITERATURE CITED

Carrier, J. and G. Gries. 2014. Assessment of Black Crappie and White Perch in Highland Lake, Stoddard-Washington, NH (2014). F-50-R-31. Segment Report. New Hampshire Fish and Game Department. Concord, NH.

Gablehouse, D. W. 1984. A length-categorization system to assess fish stocks. North American Journal of Fisheries Management 4:273-285.

Table 1. Summary of Black Crappie waterbodies sampled 2013-2015.

Waterbody	Sample Date	Region	Acreage	Town	County	Fishery	Sampling Method	Number of Black Crappie Aged
Bellamy Reservoir	1/31/14, 3/7/14	3	383	Madbury	Strafford	Warmwater	Angling	67
Contoocook Lake	10/29/13, 10/29/14, 1/22/15	4	380	Jaffrey	Cheshire	Warmwater	Angling	47
Contoocook River	3/8/2014	3	-	Concord	Merrimack	Warm/Coldwater	Angling	7
Crooked Pond	2/15/2014	3	30	Loudon	Merrimack	Warmwater	Angling	1
Forest Lake	3/15/2014	4	86	Winchester	Cheshire	Warmwater	Angling	20
Harrisville Pond	10/17/13, 3/11/14	4	121	Harrisville	Cheshire	Warmwater	Angling	19
Harvey Lake	12/28/2013	3	106	Northwood	Rockingham	Warmwater	Angling	5
Hermit Lake	12/19/13, 10/9/14	2	175	Sanbornton	Belknap	Warmwater	Angling	43
Highland Lake	10/5/13, 1/27/14, 3/28/14, May 2014	4	711	Stoddard - Washington	Cheshire - Sullivan	Warmwater	Angling - Fyke nets	94
Lake Todd	2/26/2014	2	168	Newbury	Merrimack	Warmwater	Angling	2
Mellendy Pond	10/18/2013	4	17	Brookline	Hillsborough	Warmwater	Angling	4
Merrimack River Oxbow	10/18/2013	3	-	Concord	Merrimack	Warmwater	Angling	36
New Wilton Reservoir	10/13/2013	4	-	Wilton	Hillsborough	Warmwater	Angling	3
Pemigewasset Lake	11/7/13, 3/19/14, 9/24/14	2	242	New Hampton - Meredith	Belknap	Warmwater	Angling	34
Pratt Pond	10/4/2013	4	35	Mason	Hillsborough	Warmwater	Angling	4
Turtletown Pond	1/5/2014	3	121	Concord	Merrimack	Warmwater	Angling	3
Wickwas Lake	10/14/2014	2	329	Meredith	Belknap	Warmwater	Angling	16
Lake Winnipesaukee, Greens Basin	9/26/13, 10/2/14	2	-	Moultonborough	Carroll	Warm/Coldwater	Angling	57

Table 2. Mean back-calculated length at age, total number of fish aged, logarithmic trendline correlation coefficient and age at quality size for Black Crappie from 2013 to 2015.

| Waterbody | Sample Year(s) | Species | Maximum age used for back-calculations | Mean back-calculated length (mm) at age | | | | | | Number of fish aged | | R^{2a} | Age at quality size |
				1	2	3	4	5	6	≥1	5-6		200 mm
Bellamy Reservoir	2014	BC	6	69	119	159	197	222	226	67	8	0.99	4.34
Contoocook Lake	2013-2015	BC	6	78	143	196	228	242	249	47	23	0.99	3.32
Forest Lake	2014	BC	6	71	161	236	271	287	304	20	3	0.99	2.54
Harrisville Pond	2013-2014	BC	6	60	137	221	267	296	310	19	11	0.99	2.70
Hermit Lake	2013-2014	BC	5	60	121	193	243	275	-	43	5	0.98	3.05
Highland Lake	2013-2014	BC	6	75	134	185	222	237	255	94	14	0.99	3.47
Merrimack River Oxbow	2013	BC	6	88	160	206	236	257	281	36	7	1.00	2.87
Pemigewasset Lake	2013-2014	BC	6	69	129	198	244	261	270	34	18	0.98	3.12
Wickwas Lake	2014	BC	6	67	143	219	258	283	292	16	9	0.99	2.77
Lake Winnipesaukee	2013-2014	BC	6	65	135	214	263	288	308	57	24	0.99	2.75
Statewide Average	2013-2015	BC	6	70	138	203	243	265	277	43	12	0.99	3.09

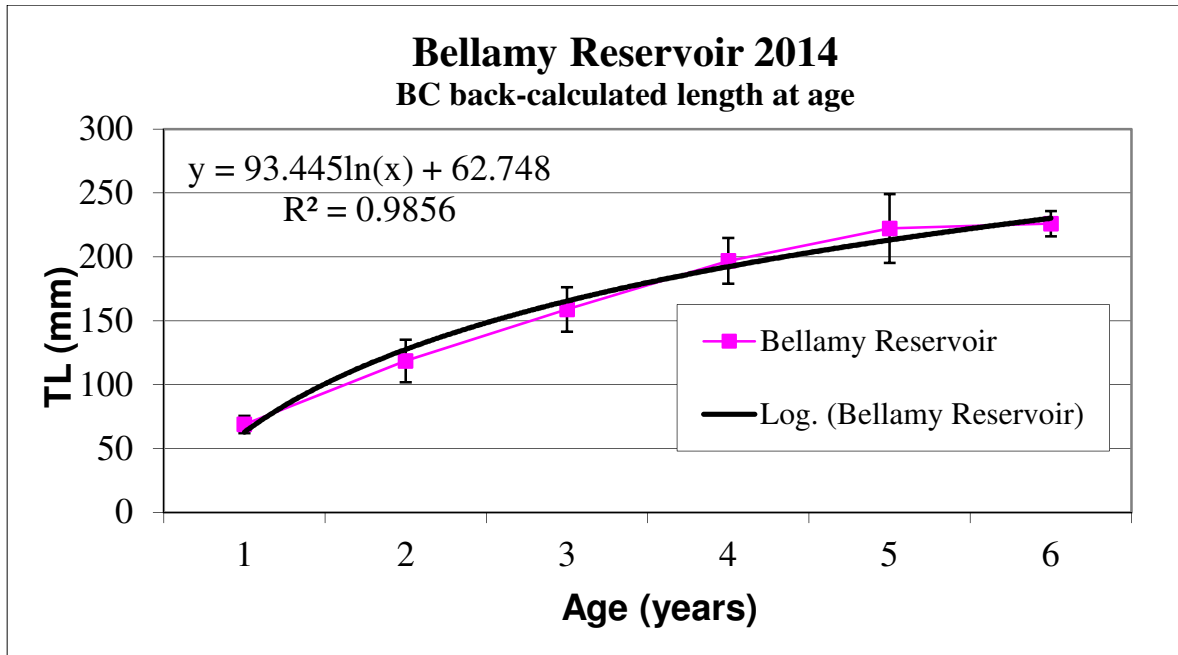[a.] Correlation coefficient for logarithmic trendline.

Figure 1. Average back-calculated length at age for Black Crappie sampled in Bellamy Reservoir in 2014 (+ 1 SD), and corresponding logarithmic trendline and equation.
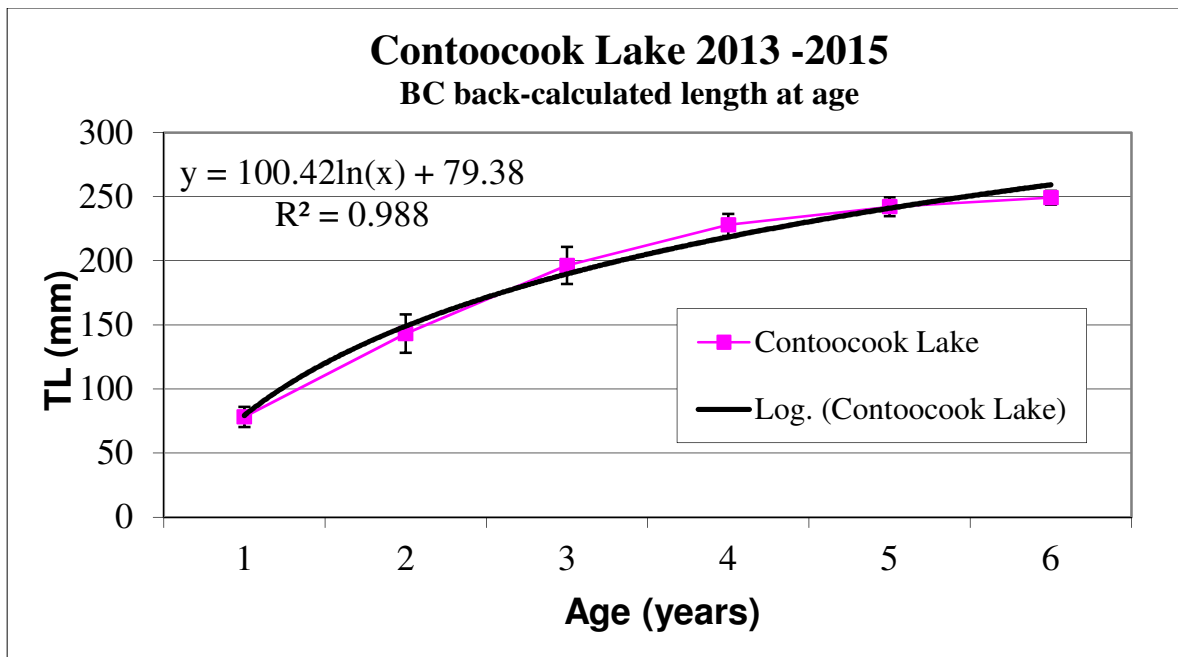

Figure 2. Average back-calculated length at age for Black Crappie sampled in Contoocook Lake from 2013 to 2015 (+ 1 SD), and corresponding logarithmic trendline and equation.
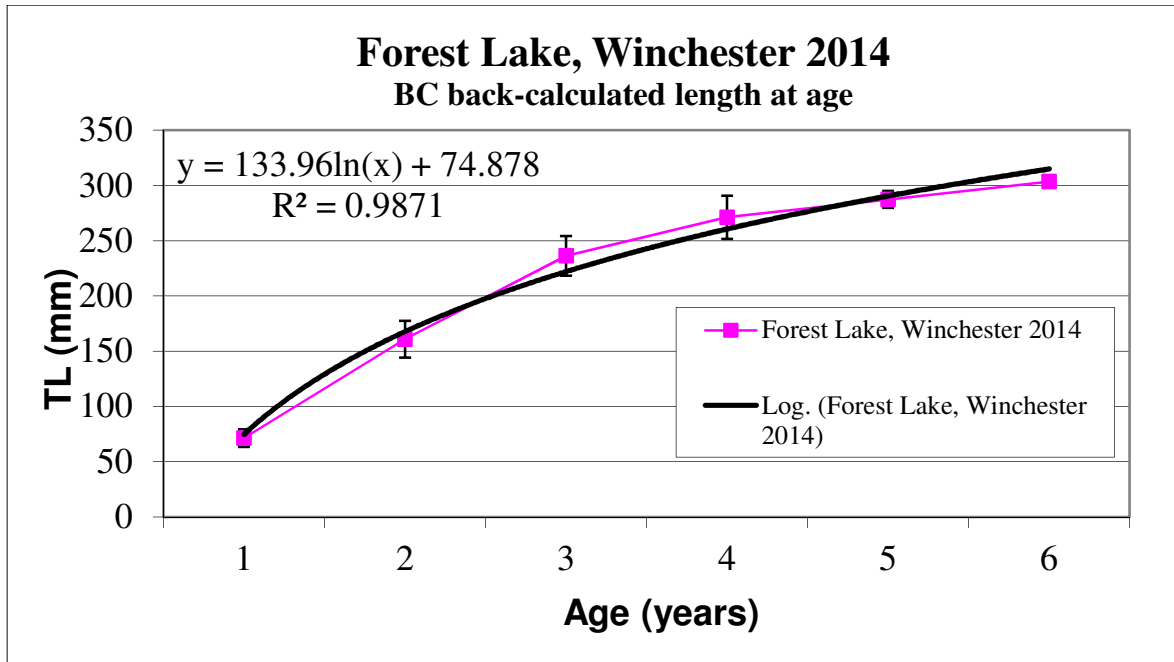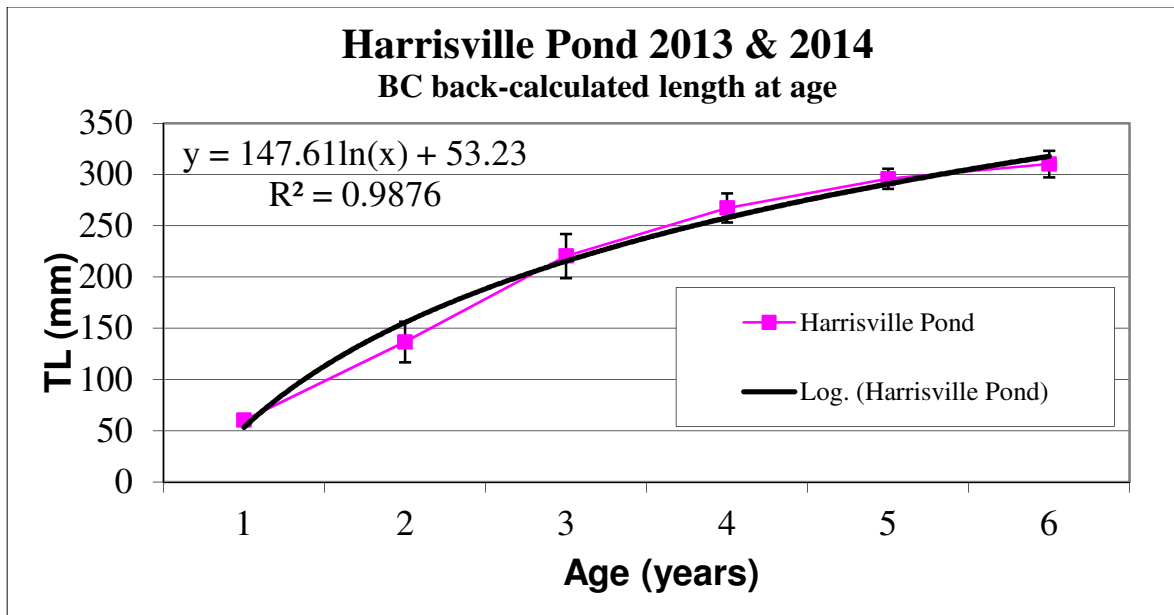
Figure 3. Average back-calculated length at age for Black Crappie sampled in Forest Lake in 2014 (+ 1 SD), and corresponding logarithmic trendline and equation.

Figure 4. Average back-calculated length at age for Black Crappie sampled in Harrisville Pond from 2013-2014 (+ 1 SD), and corresponding logarithmic trendline and equation.
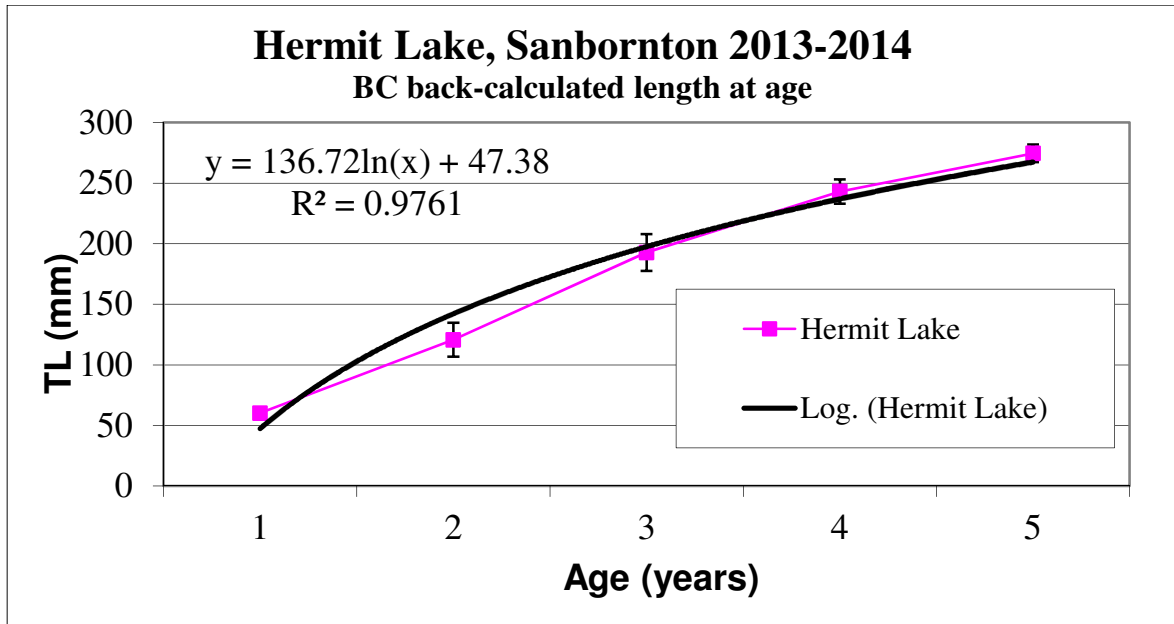
Hermit Lake, Sanbornton 2013-2014
BC back-calculated length at age

$y = 136.72\ln(x) + 47.38$
$R^2 = 0.9761$

(Legend: Hermit Lake; Log. (Hermit Lake))

TL (mm) vs Age (years)

Figure 5. Average back-calculated length at age for Black Crappie sampled in Hermit Lake from 2013-2014 (+ 1 SD), and corresponding logarithmic trendline and equation.
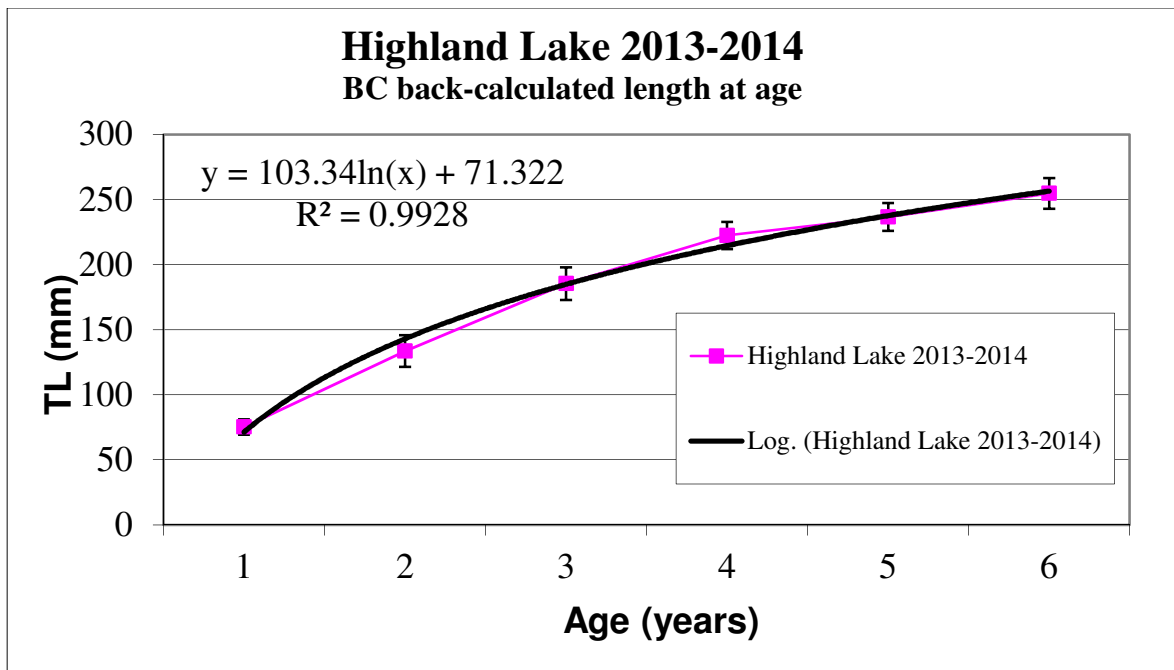
Highland Lake 2013-2014
BC back-calculated length at age

$y = 103.34\ln(x) + 71.322$
$R^2 = 0.9928$

(Legend: Highland Lake 2013-2014; Log. (Highland Lake 2013-2014))

TL (mm) vs Age (years)

Figure 6. Average back-calculated length at age for Black Crappie sampled in Highland Lake from 2013-2014 (+ 1 SD), and corresponding logarithmic trendline and equation.

Merrmack River Oxbow 2013
BC back-calculated length at age

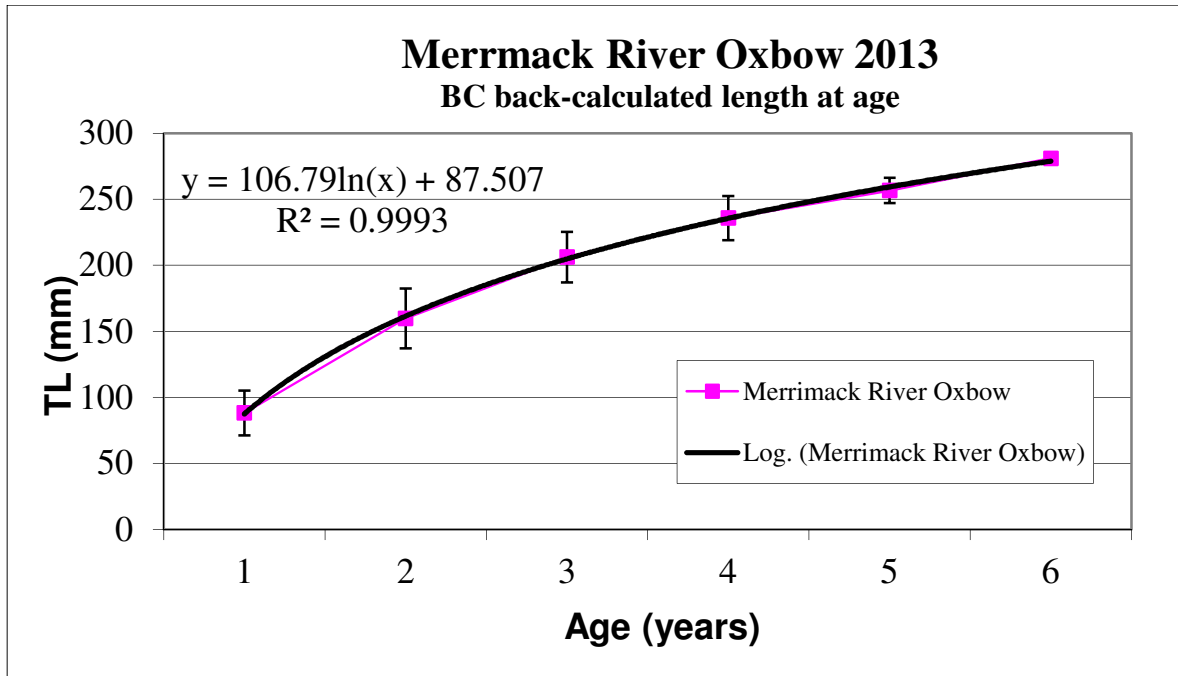$$y = 106.79\ln(x) + 87.507$$
$$R^2 = 0.9993$$

Figure 7. Average back-calculated length at age for Black Crappie sampled in the Merrimack River in 2013 (+ 1 SD), and corresponding logarithmic trendline and equation.
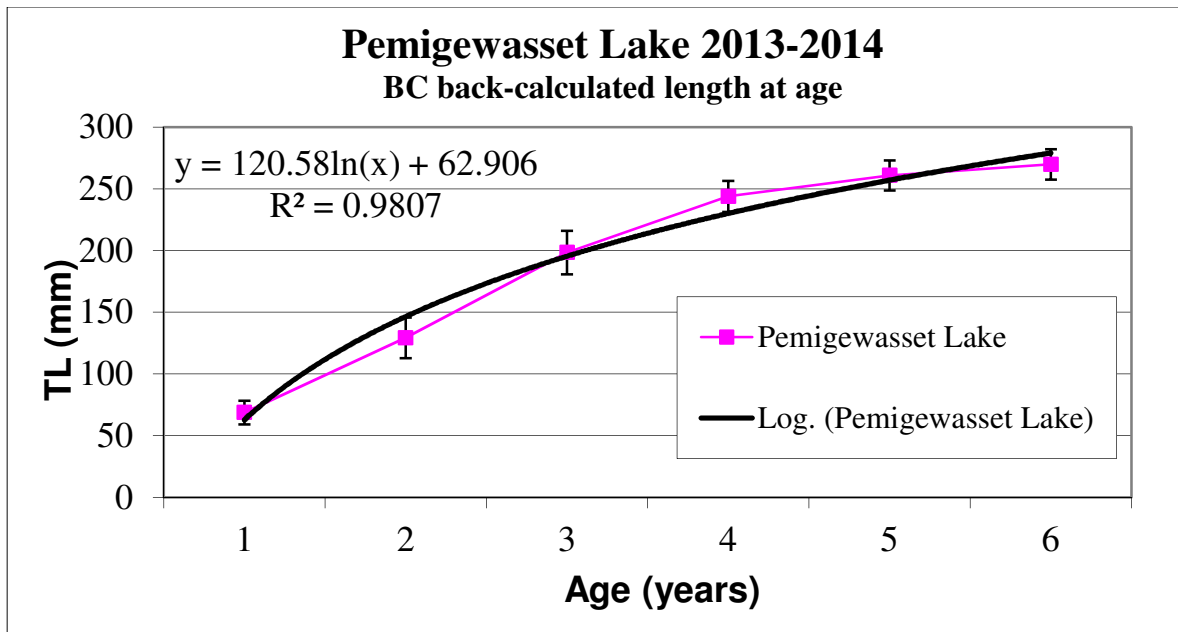
Pemigewasset Lake 2013-2014
BC back-calculated length at age

$$y = 120.58\ln(x) + 62.906$$
$$R^2 = 0.9807$$

Figure 8. Average back-calculated length at age for Black Crappie sampled in Pemigewasset Lake from 2013-2014 (+ 1 SD), and corresponding logarithmic trendline and equation.
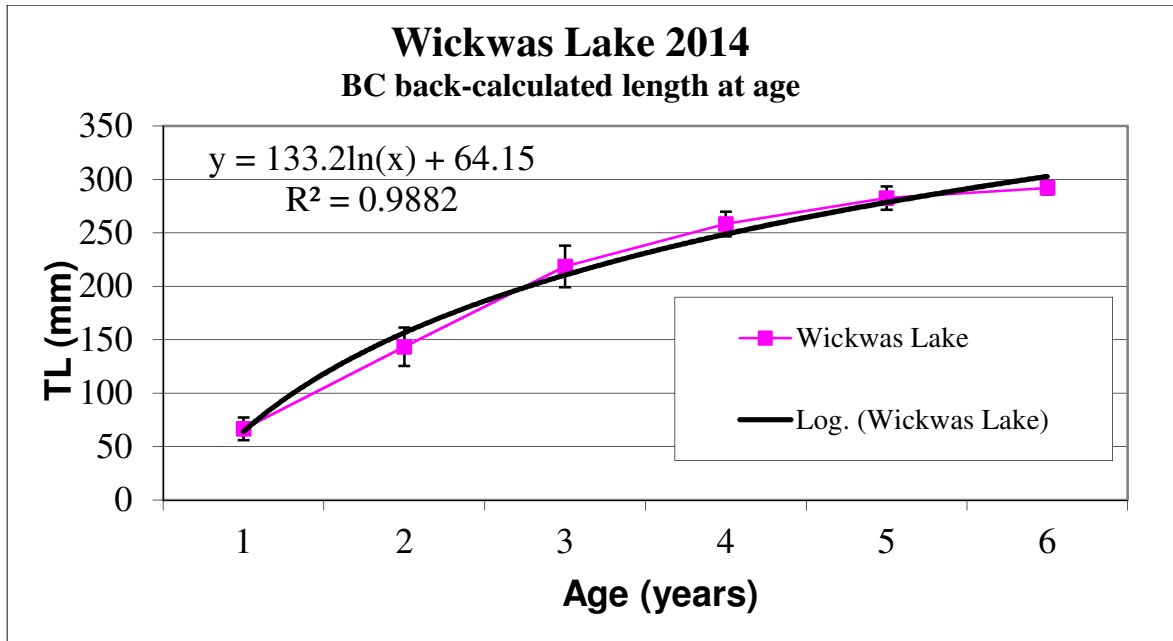
Figure 9. Average back-calculated length at age for Black Crappie sampled in Wickwas Lake in 2014 (+ 1 SD), and corresponding logarithmic trendline and equation.
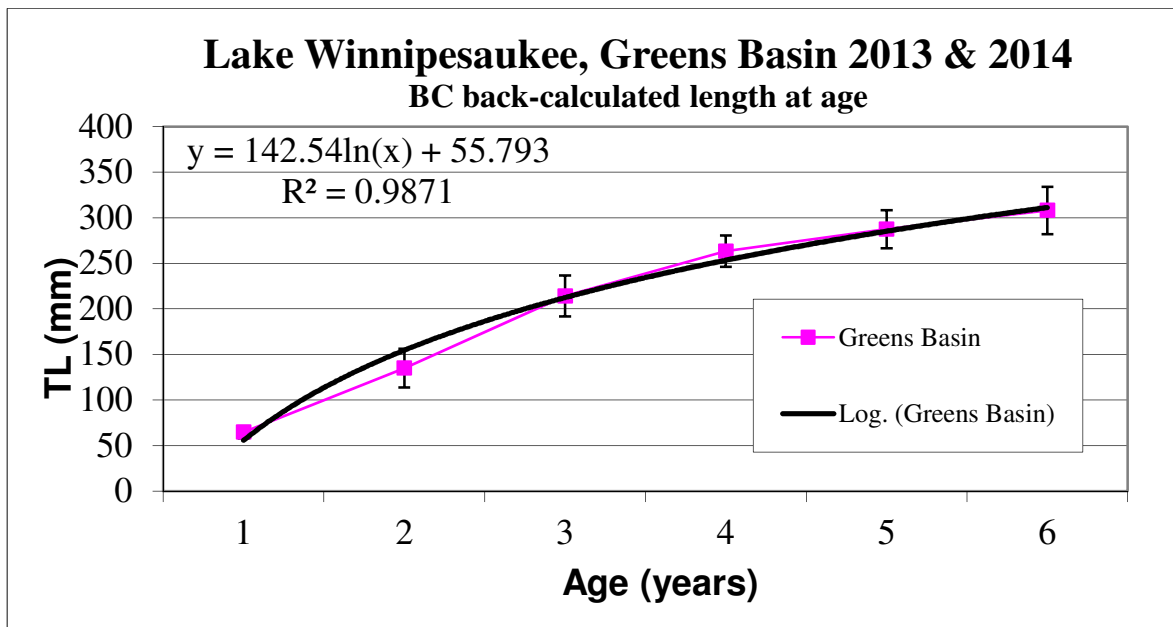

Figure 10. Average back-calculated length at age for Black Crappie sampled in Lake Winnipesaukee (Greens Basin) 2013-2014 (+ 1 SD), and corresponding logarithmic trendline and equation.