



PEACE/WILLISTON  
FISH & WILDLIFE  
COMPENSATION  
PROGRAM

**BChydro** 



# Recreational Fishery Stock Assessment of Butternut Lake, 2008

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R.J. Zemplak

September 2010

PFWWCP Report No. 341

Lake: Butternut

The Peace/Williston Fish & Wildlife Compensation Program is a cooperative venture of BC Hydro and the provincial fish and wildlife management agencies, supported by funding from BC Hydro. The Program was established to enhance and protect fish and wildlife resources affected by the construction of the W.A.C. Bennett and Peace Canyon dams on the Peace River, and the subsequent creation of the Williston and Dinosaur Reservoirs.

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This report has been approved by the Peace/Williston Fish and Wildlife  
Compensation Program Fish Technical Committee.

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## Butternut Lake Assessment 2008

### Executive Summary

Recreational fishing is an integral part of northern B.C.'s life style and highly valued by residents in the Williston Watershed. One of the strategic objectives of the Peace/Williston Fish and Wildlife Compensation Program is to provide for a number of recreational fishing opportunities through stocking efforts. The Program stocks a number of lakes within the watershed and continual assessments are important to ensure the goals of the stocking program are being met.

A fish stocking assessment was conducted at Butternut Lake on August 5 to 7, 2008. This was the third assessment since the lake was originally stocked in 1991. The current management goal for this lake is to maintain a family fishery (high CPUE < 30 cm fish) for rainbow trout. Three sinking multi-mesh gill nets (two set over night) were used and the total sampling effort was 37.5 hours. The objective of this 2008 assessment was 1) to assess the rainbow trout population after the recent change in strain and increase in stocking rate and 2) to document the status of the current fishery, including changes in fish growth. Standard B.C. Resource Inventory Committee methods were used to complete the assessment.

Butternut Lake is a "closed" lake system without spawning habitat. The previous switch to a sterile (non-reproductive) strain of fish in 2001 has alleviated the spawn bound condition. The switching to an annual stocking cycle in 2004 has resulted in an increase in the gill net catch. The overall mean fish size for all Blackwater captured fish in 2008 was 206 mm (n=76).

Based on this assessment, the gill net CPUE was still low and is not maintaining a family fishery. The current stocking rate of 70 fish/ha has resulted in a gill net CPUE of only 2.08 RB/hour. This low stocking rate is believed to be partially responsible for the low angler use (only 8 boats were observed from June through September). It is now recommended to increase the stocking rate to maintain the existing objective of a family fishery. The new recommended stocking rate is 99 fish/ha (3,500 fish annually). This higher stocking density is anticipated to improve the number of anglers using this lake. The survival of the current Blackwater strain appears low in Butternut Lake. Fishery management objectives for this lake could be better achieved with a change in trout strain. It is now recommended switching back to the Pennask AF strain as this strain appears to survive better in Butternut Lake and is more suited for a family fishery. The next scheduled assessment should take place in about 8 years (2016) to determine the effects of the stocking changes.

Lake: Butternut

**OMINECA REGION**  
**LAKE STOCK ASSESSMENT REPORT**

**LAKE NAME:** Butternut

**BC WBID:** 00120CARP

**ALIAS:** Butternut

**LAKE LOCATION:**

*Nearest center:* 34 km south of Mackenzie

*Drainage:* Peace R.

*UTM:* 10.493706.6097175 (NAD 1983)

**LAKE ATTRIBUTES:**

*Surface Area:* 35.5 Ha

*Elevation:* 747 m

*Littoral Area:* 11.0 Ha

*T.D.S.:* 60 ppm

*Max Depth:* 12.0 m

*Mean depth:* 7.1 m

**MANAGEMENT OBJECTIVE (mean length in gillnet (cm)):**

Objective 1	Family Fishery (High CPUE <30 cm)	<u>yes</u>
Objective 2	Average Quality (30-40 cm)	
Objective 3	Above Average (40-50 cm)	
Objective 4	Trophy ( 20% > 50 cm for RB, 20% > 40 cm for EB)	

**MANAGEMENT/SURVEY HISTORY:**

Previous gill net assessment(s): yes

Year(s) Surveyed: 1990, 1999, 2004

PFWWCP report #: 99, 213, 304

**STOCKING DATA:**

Fish Species: Rainbow Trout (also marked for age determination)

Strain: Blackwater AF3N

Stocking Schedule: Annually (2,500)

Current Stocking Rate: 70 /Ha

**Recommended Stocking Rate:**

**(Stringer, 1988)**

	Total	Fish/Ha
<i>Un-fed Fry</i>		
<i>Fall Fry</i>		
<i>Yearlings</i>	<u>5770</u>	<u>162</u>

**SURVEY DETAILS:**

Date (yy.mm.dd)

Survey Agency

Crew

2009-08-05

PFWWCP

Randy Zemlak, Perry Hogan (McLeod Lake Indian Band)

**Netting Specifications:**

*Net type:* Standard Experimental

*Net length:* 105 m (7x15m)

*Setting:* Sinking and Floating

*Panel Mesh:* RISC- Standard Gill Net

*Duration:* Overnight Note: only day sets in 1999.

**GILL NET CATCH COMPARISON:**

Survey Date	24-Jun-99		29-Sep-04		5-Aug-08			
	Net Hours	# of Sets:	Catch	CPUE	Catch	CPUE		
	8.90	2	68	7.62	10	0.40	78	2.08
			not present	n/a	not present	n/a	not present	n/a
			0	0.00	1	0.04	0	0.00
			9	1.00	392	15.50	169	4.51
			20	2.24	216	8.55	83	2.21

Lake: Butternut

**SURVEY CONCLUSIONS:**

Objective	Objectives Achieved		If no, what is the reason
	Yes	No	
1. Family		<u>X</u>	Gill net catch was 2.08 fish/hr.
2. Average			
3. Above Average			
4. Trophy			

<b>Next Assessment :</b>	<b>2016</b>
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Figure 1. This age 4+ Pennask fish was 455 mm (fork length) and caught in gill net set #1.

**NOTES/RECOMMENDATIONS:**

**Assessment:** The overall mean fish size for all Blackwater captured fish was 206 mm (n = 76, ages 1 -3). Only 2 larger Pennask fish were captured (age 4 and 6). Switching to annual stocking cycle in 2004 has worked to increase CPUE but still not meeting the objective of a family fishery (high yield). The current stocking rate of 70 fish/ha has resulted in an overall gill net CPUE of only 2.08 RB/hour. The current

low stocking rate is believed to be partially responsible for the low angler use (only 8 boats were observed from June through September).

No signs of stunting as the mean lengths increase with age. The mean body condition of the 78 rainbow trout sampled in 2008 was equal to 3.39 indicating they are exhibiting good growth.

**Comments:** Very good gill net catch in 1999 (7.62 fish/hr). Gill net CPUE dropped dramatically to 0.4 fish/hr in 2004. This decline resulted in an increase in stocking frequency from bi-annual to annual to increase CPUE. This goal has improved (2.08 fish/hr obtained in 2008 gill net catch). But, there is still a need to increase gill net CPUE to meet the goal of family fishery (high yield).

**Uncertainties:** Only 12 RB captured in 2004 (Pennask strain) and cannot accurately compare to the 2008 captured Blackwater fish. RB survival in 2004 was questionable and could be due to either high angling pressure or competition with other fish species. No creel data (angler effort) is available. Anecdotal information in 2004 suggested angling use was high and well used in both the summer and winter periods. In addition, there was a lot of bi-catch (lake whitefish and longnose suckers) captured in 2004 and may have reduced survival of stocked RB.

No marked 1 year old fish captured in 2008. Survival of Blackwater AF3N in this lake appears low (when compared to previous AF Pennask strain stocked in mid 1990s).

**Recent Brood Request Comments:** 1999 assessment: good gill net CPUE, spawn bound condition exists, switch to sterile strain (AF3N)  
2004 assessment: very low CPUE, switch to annual stocking and switch strain to Blackwater, and consider marking fish for age determination  
2008 assessment: low gill net CPUE, needs to be improved and propose to increase annual stocking to 3,500 fish in 2011 and switch strain back to previous Pennask AF, and mark for age

**History of Angling Regulations:** No special restrictions.

**Estimate of Angler Use:** Two trail cameras were set up to take photos of boats hourly from 7:A.M. to 9:00 P.M. (starting June 18 to September 11). The *north* camera focused on the single access point while the *south* camera

focused on the larger southern bay. The *south* camera quit on August 15 due to faulty batteries. On average, visibility of the photos was typically good between 10:00 and 4:00 PM. Photos taken in the early morning and at dusk had either direct sunlight or shadows along the shoreline which reduced lake visibility. Overall, 8 separate boats were observed (all between June 22 and August 28). Interestingly, the two *south* boat observations were not picked up by the *north* camera which means additional anglers could have arrived at the lake throughout the summer without being noticed by the *north* camera.

**Management:** Current angler effort on this lake appears low and needs to be improved. It is anticipated by increasing stocking rates will accomplish this goal. Survival of recent Blackwater strain is also questionable. There is an even distribution of age classes present in 2008 but gill net CPUE is still low (when compared to the 1999 survey). With the given lake characteristics (mixed species lake, low TDS, less than one third of the lake has littoral habitat, relatively deep in the middle, and the lake productivity does not appear to be conducive to a above average quality fishery), the previous stocked Pennask AF strain appeared to provide a better fishery in Butternut Lake. The one drawback of this naturalised strain is once these fish reach maturity; the fish will be of low quality due to the spawn bound condition. It is anticipated that once the anglers experience higher catch rates on this lake, most of the fish will be captured before they become mature.

It is now recommended to increase the stocking rate to maintain the existing objective of a family fishery. The new recommended stocking rate is 99 fish/ha (3,500 fish annually). During the next assessment, the objective is to observe at least 30% of the gill net catch in the 250 to 300 mm proportion of the catch. It is also recommended to switch back to the Pennask AF strain. In addition, keep marking fish for accurate age determination which allows assessment crew to continue capturing fish until a minimum of 10 fish from each age class is obtained. Continue using remote cameras to determine further angler use on the lake and determine if the recent stocking changes have resulted in higher angler use.

**Outlet stream:** The physical characteristics of the outlet have not changed much since the previous survey. There is an old beaver dam on the outlet and is still a fish barrier to migrating fish. At the time of the survey, lake level would have to rise 15 cm to flow over the top of the beaver dam.

**Benchmark:** Is located on the north shore near the outlet. Found 2.7 m from shore, height = 1.82 m, indicating a 2 cm drop since 2004.

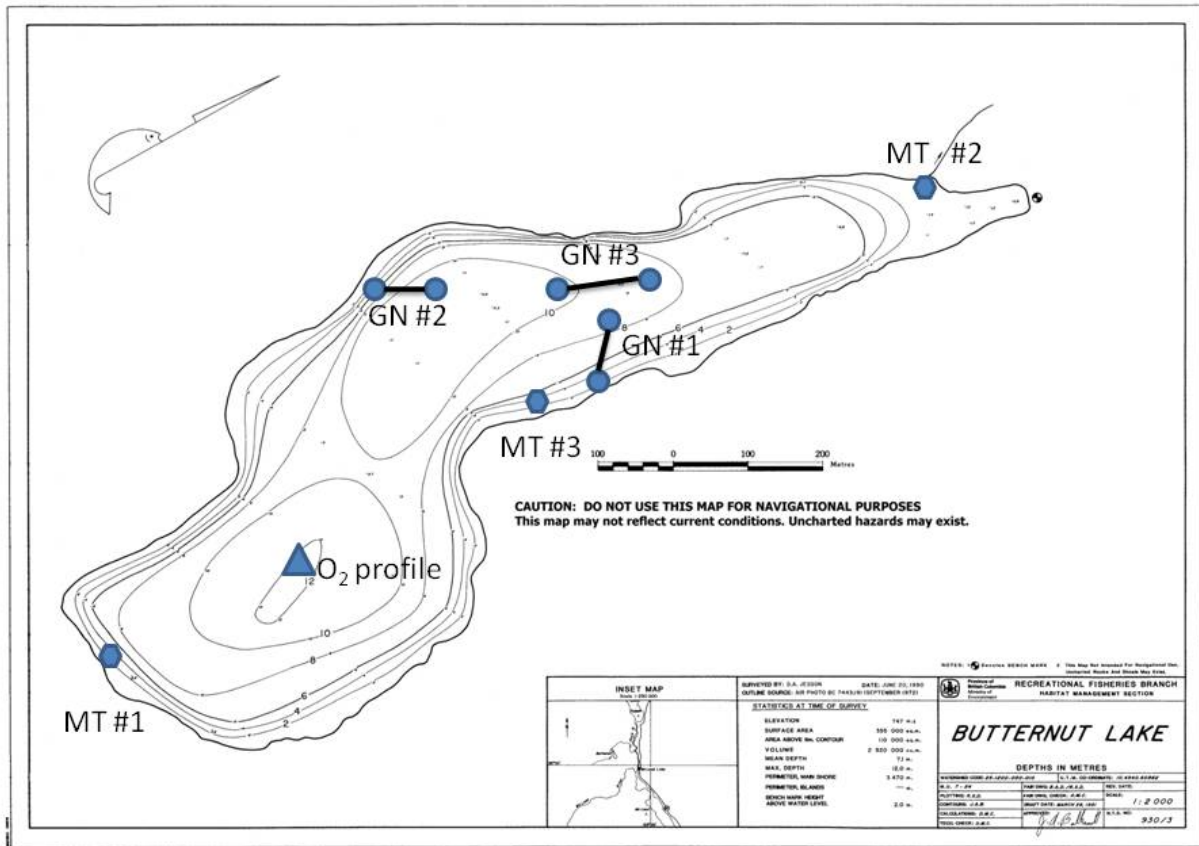


Figure 2. Bathymetric map of Butternut Lake showing gill net locations, minnow traps, and oxygen/temperature profile locations.

Table 1. Physical attributes for all captured rainbow trout by age (1999 and 2008).

Sample Year	Age	Sample Size	Length (mm)				Weight (g)			
			Mean	Min	Max	StdDev	Mean	Min	Max	StdDev
1999	1	19	143	127	167	0.99	31.8	20.2	47.4	6.63
2008	1	19	163	120	216	2.75	45.6	17.0	106.7	22.95
1999	2	0	-	-	-	-	-	-	-	-
2008	2	7	250	234	266	1.15	153.7	112.3	190.1	28.08
1999	3	37	389	350	440	2.33	666.0	522.0	889.0	100.00
2008	3	23	299	268	320	1.74	264.8	165.0	361.5	63.49
1999	4	0	-	-	-	-	-	-	-	-
2008	4	1	455	455	455	-	1252.0	1252.0	1252.0	-
1999	5	12	413	385	438	1.54	885.6	676.0	1040.0	115.88
2008	5	0	-	-	-	-	-	-	-	-
1999	6	1	500	500	500	-	-	-	-	-
2008	6	1	426	426	426	-	675.0	675.0	675.0	-

Note: No accurate age data for the 12 rainbow trout captured in 2004. Ages ranged from 3 to 7 year olds but none were accurate.

Table 2. Condition factors for all captured rainbow trout (by sample year).

Sample		Condition (k)			
Year	Number	Mean	Min	Max	StdDev
1999	61	1.15	0.69	1.51	0.12
2004	12	1.15	0.93	1.83	0.25
2008	78	1.00	0.75	1.33	0.09

Table 3. Proportion of all captured rainbow trout (by survey year).

Survey Year	2008 (n = 78)	2004 (n = 12)	1999 (n = 70)
Less than 250 mm	62.8 %	33.4 %	27.1 %
Between 250-300 mm	20.5 %	8.3 %	0.0 %
Between 300-400 mm	14.1 %	50.0 %	45.8 %
Greater than 400 mm	2.6 %	8.3 %	27.1 %
Greater than 500 mm	0.0 %	0.0 %	0.0 %

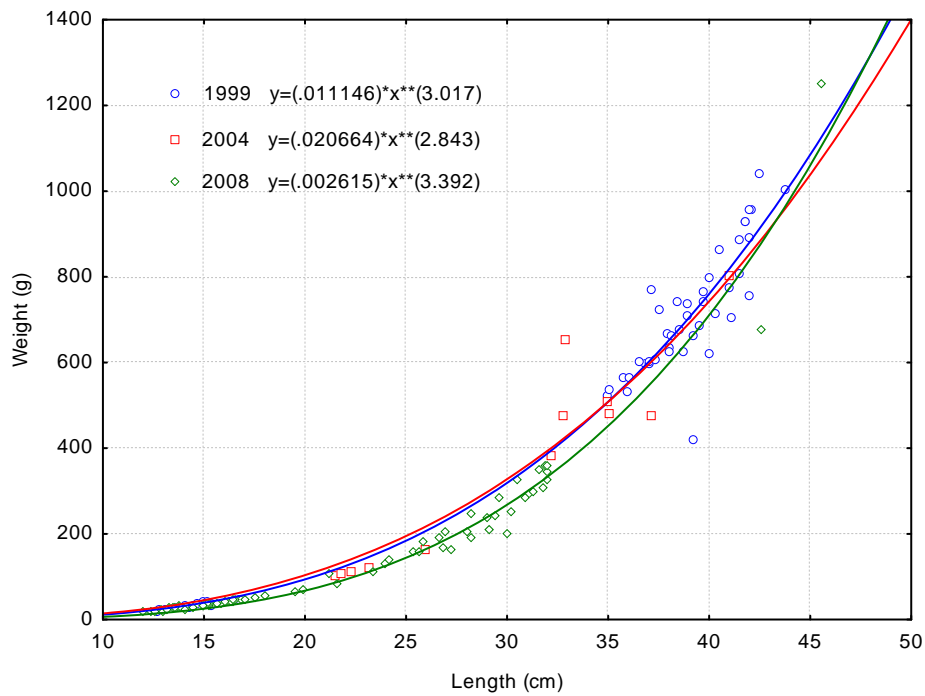


Figure 3. Length weight power relationship (1999, 2004, and 2008).

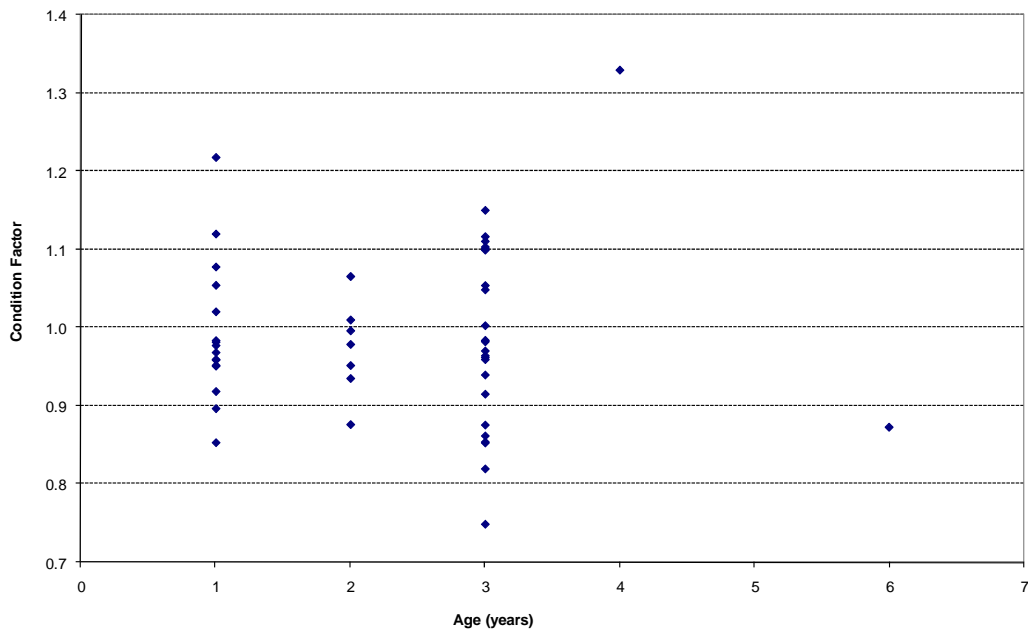


Figure 4. Condition factors versus age of all captured rainbow trout in Butternut Lake, 2008.

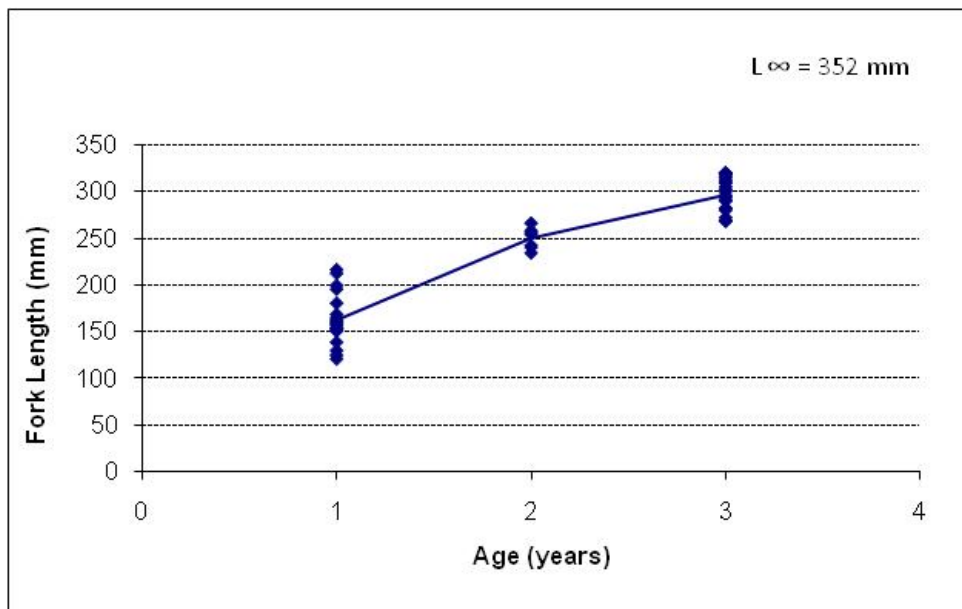


Figure 5. Age versus length of only Blackwater rainbow trout (n = 49) in Butternut Lake (von Bertalanffy growth curve), 2008.

Table 4. Minnow trap results for Butternut Lake, 2008.

Trap No.	Hours Fished	Depth (m)	Substrate	Fish Species	Number Captured	Size Range (mm)
1	23.1	1	gravel, LWD	LKC	274	43 - 88
				LSU	1	56
2	23.2	0.8	aquatic veg.	LKC	256	41 - 105
				LSU	24	45 - 145
3	22.6	0.9	aquatic veg. SWD	LKC	205	45 - 95
				LSU	3	46 - 76

Note: "LWD" is large woody debris  
 "SWD" is small woody debris

Table 5. Complete stocking history for Butternut Lake (1991 to 2008).

Year	Species Name	Fish Count	Stock	Mark	Average Size (gm)	Life Cycle Stage
1991	RB	10,000	Dragon		0.7	Fall Fry
1993	RB	5,000	Dragon/Tunkwa		3.7	Yearling
1994	RB	2,500	Pennask AF		25.6	Yearling
1995	RB	3,000	Pennask AF		18.52	Yearling
1997	RB	3,000	Pennask HATH AF		17.1	Yearling
1999	RB	3,000	Pennask BEAV AF		15.25	Yearling
2001	RB	3,000	Pennask AF3N		14.17	Yearling
2003	RB	3,000	Pennask AF3N		14.06	Yearling
2005	RB	3,000	Pennask AF3N		15.9	Yearling
2006	RB	2,500	Blackwater AF3N		26.3	Yearling
2007	RB	2,500	Blackwater AF3N		14.7	Yearling
2008	RB	2,500	Blackwater AF3N	adi	24.9	Yearling

Note: "adi" is adipose clip

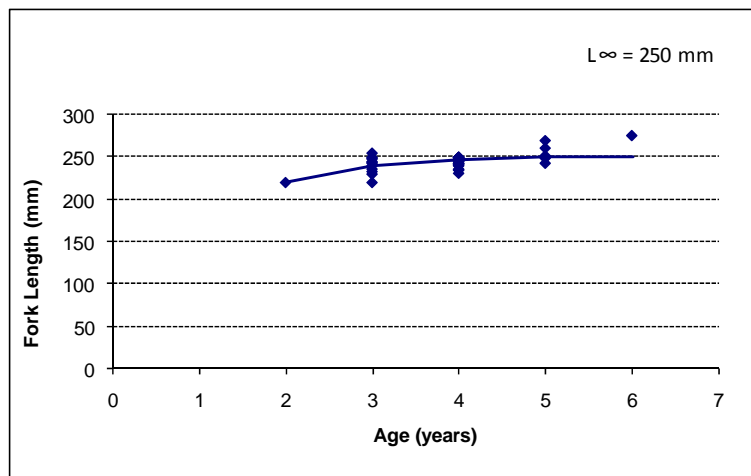


Figure 6. Age versus length of lake whitefish (n = 46) in Butternut Lake (von Bertalanffy growth curve), 2008.



Figure 7. Typical lake whitefish size (in cm), caught in Butternut Lake, 2008.

Table 6. Dissolved Oxygen / Temperature profile for 2008.

<b>Date:</b>	Aug. 5		<b>Station UTM:</b>		10.493968.6096231
<b>Depth (m)</b>	<b>DO (O<sub>2</sub>)</b>	<b>Temp. °C</b>	<b>pH</b>	<b>Conductivity (µS/cm)</b>	
Surface	9.6	18.6	6.4	106	
1	9.4	18.6			
2	9.5	18.1			
3	9.4	18.0			
4	9.4	17.8			
5	9.4	17.6	6.5	105	
6	10.8	16.4		106	
7	12.6	13.3			
8	13.2	11.0			
9	12.4	9.9			
10	10.6	9.2	6.9		
11	10.1	9.1	6.9	110	
12	bottom	bottom	bottom	bottom	

Note: A YSI model 650 MDS oxygen/temperature meter was used for these measurements.

Table 7. RB Stock Assessment Data for 2008 (see Program website for previous survey data).

Fish Sample#	Net Set	Age			Length (mm)	Weight (grams)	Condition (k)	Age	Ageing			Mark	Sex	Maturity
		Structure ID	Species Caught	Calendar Age					Age Structure	Confidence (0-9)				
1	1	1	RB	4+	455	1252.0	1.3	4	Otolith	7		U	?	
2	1	2	RB	3*	316	352.3	1.1	3	Otolith	5		U	?	
3	1	3	RB	3*	311	296.0	1.0	3	Otolith	7		U	?	
4	1	4	RB	3*	294	244.5	1.0	3	Otolith	6		U	?	
5	1	5	RB	3*	318	310.1	1.0	3	Otolith	6		U	?	
6	1	6	RB	3*	302	252.1	0.9	3	Otolith	7		U	?	
7	1	7	RB	3*	309	283.1	1.0	3	Otolith	5		U	?	
8	1	8	RB	3*	320	345.4	1.1	3	Otolith	6		U	? immature	
9	1	9	RB	1+	180	57.0	1.0	1	Otolith	7		U	?	
10	1	10	RB	2*	258	183.0	1.1	2	Otolith	7		U	?	
11	1	11	RB	3*	269	204.1	1.0	3	Otolith	7		U	?	
12	1	12	RB	3*	280	206.3	0.9	3	Otolith	6		U	?	
13	1	13	RB	2*	240	129.3	0.9	2	Otolith	7		U	?	
14	1	14	RB	3*	282	193.3	0.9	3	Otolith	6		F	spawn bound	
15	1	15	RB	3*	296	285.1	1.1	3	Otolith	7		F	?	
16	1	16	RB	3*	282	246.9	1.1	3	Otolith	6		U	?	
17	1	17	RB	1+	216	86.0	0.9	1	Otolith	6		U	?	
18	1	18	RB	2*	254	160.4	1.0	2	Otolith	7		U	?	
19	1	19	RB	3*	305	326.3	1.2	3	Otolith	7		F	spawn bound	
20	1	20	RB	1+	195	66.5	0.9	1	Otolith	7		U	?	
21	1	21	RB	3*	272	165.0	0.8	3	Otolith	7		U	?	
22	1	22	RB	3*	319	360.5	1.1	3	Otolith	7		U	?	
23	1	23	RB	3*	313	301.2	1.0	3	Otolith	7		U	?	
24	1	24	RB	2*	242	141.2	1.0	2	Otolith	7		U	?	
25	1	25	RB	3*	320	361.5	1.1	3	Otolith	7		U	?	
26	1	26	RB	3*	290	236.7	1.0	3	Otolith	6		U	?	
27	1	27	RB	3*	320	328.6	1.0	3	Otolith	7		U	?	
28	1	28	RB	1+	162	40.8	1.0	1	Otolith	8		U	? immature	
29	1	29	RB	1+	153	38.6	1.1	1	Otolith	6		U	? immature	
30	1	30	RB	1+	151	36.3	1.1	1	Otolith	8		U	? immature	
31	1	31	RB	1+	164	43.3	1.0	1	Otolith	6		U	? immature	
32	1	32	RB	1+	124	19.2	1.0	1	Otolith	7		U	? immature	
33	1	33	RB	1+	120	17.0	1.0	1	Otolith	6		U	? immature	
34	1	34	RB	1+	129	22.7	1.1	1	Otolith	9		U	? immature	
35	1	35	RB	1+	160	41.8	1.0	1	Otolith	7		U	? immature	
36	1	36	RB	1+	153	34.1	1.0	1	Otolith	7		U	? immature	
37	1	37	RB	1+	150	33.2	1.0	1	Otolith	8		U	? immature	
38	1	38	RB	1+	168	45.1	1.0	1	Otolith	7		U	? immature	
39	1	39	RB	1+	138	32.0	1.2	1	Otolith	8		U	? immature	
40	1	40	RB	1+	158	38.2	1.0	1	Otolith	7		U	? immature	
41	1	N/A	RB		175	49.7	0.9							
42	1	N/A	RB		150	33.9	1.0							
43	1	N/A	RB		126	21.1	1.1							
44	1	N/A	RB		163	41.6	1.0							
45	1	N/A	RB		145	30.2	1.0							
46	1	N/A	RB		140	27.4	1.0							
47	1	N/A	RB		130	20.9	1.0							
48	1	N/A	RB		138	26.4	1.0							
49	1	N/A	RB		135	27.7	1.1							
50	1	N/A	RB		160	42.4	1.0							
51	1	N/A	RB		133	26.5	1.1							
52	1	N/A	RB		165	47.0	1.0							
53	1	N/A	RB		170	46.4	0.9							
54	1	N/A	RB		156	39.0	1.0							
55	1	N/A	RB		164	45.5	1.0							
56	1	N/A	RB		153	38.9	1.1							
57	1	N/A	RB		152	36.3	1.0							
58	1	N/A	RB		140	27.6	1.0							
59	1	N/A	RB		140	26.4	1.0							
60	1	N/A	RB		139	29.6	1.1							
61	1	N/A	RB		141	25.8	0.9							
62	1	N/A	RB		150	34.0	1.0							
63	1	N/A	RB		126	20.4	1.0							
64	1	N/A	RB		132	22.5	1.0							
65	1	N/A	RB		150	31.4	0.9							
66	1	N/A	RB		150	34.2	1.0							
67	1	N/A	RB		136	27.3	1.1							
68	2	78	RB	6*	426	675.0	0.9	6	Otolith	6		U	?	
69	2	79	RB	3*	268	168.6	0.9	3	Otolith	7		U	?	
70	2	80	RB	2+	256	159.7	1.0	2	Otolith	6		U	?	
71	2	81	RB	1+	199	72.4	0.9	1	Otolith	3		U	?	
72	2	82	RB	2*	234	112.3	0.9	2	Otolith	7		U	?	
73	2	83	RB	1+	156	36.4	1.0	1	Otolith	6		U	? immature	
74	2	84	RB	3*	291	210.2	0.9	3	Otolith	7		U	?	
75	2	85	RB	3*	291	210.5	0.9	3	Otolith	8		U	?	
76	2	86	RB	3*	300	202.3	0.7	3	Otolith	6		U	?	
77	3	87	RB	2+	266	190.1	1.0	2	Otolith	7		U	?	
78	3	88	RB	1++	212	106.7	1.1	1	Otolith	6		U	?	

**Fish Sample:** #1 and #68 are Pennask Strain. All others are Blackwaters.  
**Stomach contents:** (40 fish assessed)  
 8 = bottom organisms,  
 4 = plankton,  
 11 = insects,  
 3 = fish  
 7 = other  
 7 = empty

**Ageing Confidence:** How strong the annulus is, and what proportion is visible. 9 is best, 1 is worst < 5 is a poor estimate

**Calendar Age:** Growth symbols are used to reflect the degree of growth observed.  
 \* is no new growth showing since last annulus formed in the spring  
 + is new growth visible, but less than 1/2 the width of the previous years growth  
 ++ is new growth visible, and more than 1/2 the width of the previous years growth

**Mark:** Used to verify aging. No adipose fish captured from 2008 stocking.

Table 7 (continued). LW Stock Assessment Data for 2008 (see Program website for previous survey data).

Fish Sample#	Net Set	Age		Calender Age	Length (mm)	Weight (grams)	Condition (k)	Age	Age Structure	Ageing Confidence (0-9)	Mark*	Sex	Maturity
		Structure ID	Species Caught										
1	1	SC1	LW	2+	220	111.8	1.0	2	Scale			M	maturing
2	1	SC2	LW	4+	246	198.2	1.3	4	Scale			U	maturing
3	1	SC3	LW	4+	250	176.4	1.1	4	Scale			M	maturing
4	1	SC4	LW	3+	250	194.1	1.2	3	Scale			M	maturing
5	1	SC5	LW	3+	240	164.2	1.2	3	Scale			F	mature
6	1	SC6	LW	5+	243	185.0	1.3	5	Scale			M	maturing
7	1	SC7	LW	4+	246	180.2	1.2	4	Scale			M	mature
8	1	SC8	LW	4+	245	183.5	1.2	4	Scale			M	mature
9	1	SC9	LW	5+	270	250.0	1.3	5	Scale			M	mature
10	1	SC10	LW	5+	250	170.3	1.1	5	Scale			M	mature
11	1	SC11	LW	3+	236	136.2	1.0	3	Scale			F	mature
12	1	SC12	LW	5+	249	172.5	1.1	5	Scale			M	mature
13	1	SC13	LW	4+	249	184.5	1.2	4	Scale			F	mature
14	1	SC14	LW	4+	246	162.1	1.1	4	Scale			M	mature
15	1	SC15	LW	3+	220	136.5	1.3	3	Scale			F	mature
16	1	SC16	LW	6+	276	239.5	1.1	6	Scale			F	mature
17	1	SC17	LW	5+	261	226.2	1.3	5	Scale			M	mature
18	1	SC18	LW	4+	243	162.9	1.1	4	Scale			F	mature
19	1	SC19	LW	4+	235	152.5	1.2	4	Scale			F	mature
20	1	SC20	LW	5+	252	210.0	1.3	5	Scale			M	mature
21	1	SC21	LW	4+	242	159.0	1.1	4	Scale			F	mature
22	1	SC22	LW	4+	240	176.2	1.3	4	Scale			M	mature
23	1	SC23	LW	3+	248	169.7	1.1	3	Scale			F	mature
24	1	SC24	LW	4+	235	157.1	1.2	4	Scale			F	mature
25	1	SC25	LW	3+	245	174.3	1.2	3	Scale			F	mature
26	1	SC26	LW	4+	250	186.5	1.2	4	Scale			M	mature
27	1	SC27	LW	3+	244	167.9	1.2	3	Scale			F	mature
28	1	SC28	LW	4+	240	152.9	1.1	4	Scale			M	mature
29	1	SC29	LW	4+	250	186.2	1.2	4	Scale			M	mature
30	1	SC30	LW	4+	236	153.1	1.2	4	Scale			F	mature
31	1	SC31	LW	4+	245	173.8	1.2	4	Scale			F	mature
32	2		LW		240	142.5	1.0						
33	2		LW		239	120.8	0.9						
34	2		LW		236	142.0	1.1						
35	2		LW		236	110.8	0.8						
36	2	SC36	LW	3+	230	129.2	1.1	3	Scale			F	mature
37	2		LW		234	125.0	1.0						
38	2	SC38	LW	3+	233	120.9	1.0	3	Scale			F	mature
39	2		LW		240	142.7	1.0						
40	2		LW		238	117.5	0.9						
41	2	SC41	LW	3+	249	146.8	1.0	3	Scale			F	mature
42	2		LW		238	128.5	1.0						
43	2	SC43	LW	4+	250	159.3	1.0	4	Scale			M	mature
44	2	SC44	LW	4+	242	142.3	1.0	4	Scale			F	mature
45	2	SC45	LW	4+	250	153.2	1.0	4	Scale			F	mature
46	2		LW		235	116.2	0.9						
47	2	SC47	LW	4+	249	136.1	0.9	4	Scale			M	mature
48	2	SC48	LW	4+	246	163.2	1.1	4	Scale			M	mature
49	2	SC49	LW	4+	247	150.1	1.0	4	Scale			M	mature
50	2	SC50	LW	4+	243	144.9	1.0	4	Scale			M	mature
51	2		LW		234	149.8	1.2						
52	2	SC52	LW	4+	231	148.8	1.2	4	Scale			M	mature
53	2	SC53	LW	3+	255	169.9	1.0	3	Scale			F	mature
54	2		LW		232	135.0	1.1						
55	2		LW		237	140.7	1.1						
56	2	SC56	LW	4+	242	158.7	1.1	4	Scale			M	mature
57	2	SC57	LW	4+	247	164.4	1.1	4	Scale			M	mature
58	3		LW		235	153.2	1.2					U	U
59	3		LW		232	143.4	1.1					F	U
60	3	SC58	LW	3+	243	158.0	1.1	3	Scale			F	mature
61	3		LW		240	153.2	1.1					U	U

**LW Stomach Contents**

46 LW assessed for stomach contents - 1 = bottom organisms; 27 = plankton; 2 = insects; 2 = other; 5 = empty

Not reported

RB and LW ageing provided by Carol Lidstone of Birkenhead Scale Analyses.