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MOOSELOOKMEGUNTIC LAKE FISHERY MANAGEMENT**

BY

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SUMMARY

Mooslookmeguntic Lake is the largest of the Rangeley Chain of Lakes and supports sport fisheries for wild landlocked salmon and brook trout. These fisheries have been monitored by periodic season-long creel surveys and aerial angler counts since 1981. Growth rates for salmon declined considerably beginning in the late 1990's; brook trout growth also declined during that period but not as dramatically. The decline in fish quality for both species was attributed to a decline in harvest rates resulting from reduced fishing pressure and increased release rates of legal fish by anglers. Salmon regulations were liberalized slightly in 2000 to encourage harvest of smaller fish and improve fish quality. Salmon quality continued to deteriorate, so harvest regulations were further liberalized in 2006 (three salmon daily bag limit; minimum length limit 12 inches; only one may exceed 16 inches). Additional salmon harvest was also encouraged through an educational program involving signage, oral presentations, and written articles.

Salmon growth declined from 2007 to 2010, despite increased angler harvest. High salmon densities in a large waterbody such as Mooslookmeguntic Lake will require a long-term effort to improve growth. The more liberal salmon rules, combined with the education effort, are resulting in an increased salmon harvest, but this level of harvest must be sustained or increased for a number of years to realize dramatic improvements in salmon growth rates and size quality. We recommend continuance of the current liberalized harvest regulations to encourage additional improvements in salmon quality.

Brook trout growth rates have stabilized since 2004, and older-age fish continue to be present in the fishery. Brook trout density appears to be higher as catch rates have increased in recent years. The combination of stable growth and increased population density indicates that brook trout have suitable habitat and available forage. Continued good growth rates of brook trout are attributed to the fact this species is less dependant on smelts for forage.

KEY WORDS: BKT,LLS,AGE AND GROWTH,ANGLER SURVEY,REGULATIONS

INTRODUCTION

Mooselookmeguntic Lake is the largest of the Rangeley Chain of Lakes and supports important sport fisheries for landlocked salmon (*Salmo salar*) and brook trout (*Salvelinus fontinalis*). Brook trout are native to the drainage; salmon were introduced in 1875. Neither trout nor salmon have been stocked since 1984. Mooselookmeguntic Lake has had moderately restrictive brook trout regulations (2-trout daily bag limit; minimum length 10 inches; only 1 may exceed 12 inches) since 1996. Salmon regulations were liberalized somewhat in 2000 (two salmon daily bag limit; minimum length 14 inches; only one may exceed 18 inches) to encourage harvest of smaller fish and improve fish quality. Salmon quality continued to deteriorate, so harvest regulations were further liberalized in 2006 (three salmon daily bag limit; minimum length limit 12 inches; only one may exceed 16 inches). Additional salmon harvest was also encouraged through an educational program of signage, oral presentations, and written articles.

The lake's sport fisheries have been monitored by season-long creel surveys and aerial angler counts since 1981. Abbreviated creel surveys (weekends from ice-out through July 4) are occasionally conducted between scheduled season-long surveys to supplement catch rate and fish growth information. Findings from earlier surveys were reported by Bonney (1982, 1987, 2000, 2004, and 2005), DeSandre (1991), and Boucher (1996, 1999, and 2008). This report summarizes the results of a season-long survey completed in 2010 and voluntary angler information. Previous reports have summarized data collected during the Kennebago River seining efforts. High river flows thwarted this effort in 2010, preventing the collection of this important supplemental data. Where appropriate, characteristics of fish populations and fisheries in 2010 are compared to those from earlier surveys.

STUDY AREA

Mooselookmeguntic Lake has a surface area of 16,300 acres and mean and maximum depths of 60 ft and 139 ft, respectively. A water storage dam (Upper Dam) partially impounds the lake and allows a maximum drawdown of about 12 feet. Summer water temperatures, oxygen concentrations, and the lake's physical habitat are ideal for coldwater fishes. The Kennebago River provides extensive spawning and nursery areas for wild salmon. Brook trout spawning and rearing occurs in the Kennebago River, the Cupsuptic River, Bemis Stream, and several smaller tributaries. Rainbow smelts (*Osmerus mordax*) provide the principal forage for the lake's salmonids, and spawn in most the tributaries. Landlocked alewives (*Alosa pseudoharengus*) were introduced in 1971 to augment the forage for salmon.

Mooselookmeguntic Lake is closed to ice fishing. Other fishing regulations currently in effect include: lake closed to the taking of smelts except by hook and line; tributaries closed to the taking of smelts; and use or possession of live fish as bait is prohibited.

Boat access to Mooselookmeguntic Lake is available at Haines Landing in Rangeley Township, near the mouth of the Cupsuptic River off Route 16, and near Toothaker Island at southern end of this 13-mile long lake.

METHODS

Aerial counts of boats were used to estimate fishing effort at Mooselookmeguntic Lake. Counts were made on a randomized schedule from ice-out to September 30, generally 3 days each week, including 1 weekend day per week. Counts were usually made between the hours of 0900 and 1200. Angler counts were expanded from a composite use curve developed from earlier surveys. Angler interviews conducted at the access points listed above provided catch and harvest data that were mostly from completed fishing trips. Clerks conducted interviews on one weekend day and two weekdays per week from ice out (early to mid May) to early July.

Length and weight of 2-stream year, age V+, angler-harvested fish were used to assess trends in growth rate and body condition (Fulton's K) of salmon. These data were supplemented with salmon collected annually in October from the Kennebago River spawning run. High river flows prevented the collection of Kennebago River salmon in 2010, but data collected in 2008 and 2009 are incorporated in this report (Table 7). Growth and condition of brook trout were analyzed for age III+ and age IV+ fish, which were the dominant cohorts harvested by anglers. All statistical tests were made using SAS procedures (SAS 2003).

SUMMARY OF FINDINGS

Angler effort:

Angler effort in 2010 increased significantly from that measured during the 1998 to 2007 period (Table 1), but remained well below historical estimates (1981-1995). Declining angler use was observed on other lakes in the Rangeley Lakes Chain during the same period, while on others it remained stable or increased slightly (Seiders 2011 and MDIFW, unpublished data). Declining quality of salmon in Mooselookmeguntic Lake, and stable or improved salmon quality in nearby lakes (MDIFW, unpublished data), likely influenced the angler use patterns observed.

Landlocked salmon:

Anglers caught an estimated 4,244 legal-size salmon (≥ 12 inches) in 2010 and harvested approximately 2,200 of these (Table 2). The total catch of legal salmon was similar to previous years, but angler success at catching a legal-size salmon decreased slightly from 0.76 fish/angler in 2007 to 0.54 fish/angler in 2010. The number of sublegal salmon caught increased during the same time period. High numbers of smaller salmon, both legal and sub-legal, indicated persistently high recruitment.

The percent of legal fish released by clerk-surveyed anglers decreased from 70% in 2007 to 49% in 2010 (Table 3). The release rate reported by volunteers remained relatively stable during this same 4-year period at 39% (Table 4), but declined sharply from early in the decade. These data suggest that efforts to convince anglers to harvest additional salmon have been at least partially effective.

Age IV+ and V+ salmon were the dominant cohorts harvested by anglers in 2010, representing 63% of the sample (Table 5). Age IV+ salmon accounted for 33% of the harvest, the highest level observed during any clerk survey. This indicated many anglers took advantage of the reduced length limit (from 14 inches to 12 inches) imposed in 2006. Older-age salmon (age VII+ and older) comprised 24% of the harvest in 2010. This level was similar to previous years, with the exception of 2007. This relatively high percentage of older-age salmon indicated that salmon density remained high, and exploitation (harvest) remained relatively low.

The average length of harvested salmon examined by clerks ranged from 17 to 18 inches from 1995 to 2003; it decreased to 15.7 inches by 2004 before increasing slightly to 16.1 inches in 2007 (Table 3). The average length of harvested salmon decreased to 15 inches in 2010; this was possibly influenced by the large percentage of age IV+ salmon in the harvest. The decrease in mean length could also be attributed to angler preference for keeping smaller fish, a product of MDIFW's efforts to encourage increased harvest to improve salmon condition. Comparison of age V+, 2 stream-year salmon indicated that fish sampled in 2010 exhibited decreases in length, weight, and condition factor when compared to previous years. This further indicated salmon growth problems related to high densities and increased pressure on the forage base.

Beginning in 2001, salmon have been sampled on their spawning run at Steep Bank Pool in the Kennebago River (Table 7). These data corroborated the clerk creel survey observations of decreased body condition of salmon in Mooselookmeguntic Lake since 2007. These data also indicated that large numbers of older-age fish remained abundant and salmon densities remained high, despite a reduced angler release rate.

In summary, salmon abundance remained high and growth rates continued to decline during the 2002-2005 period, despite a slight liberalization of harvest rules beginning in 2000. This regulation was intended to increase the salmon harvest rate by encouraging the harvest of salmon between the lengths of 14 and 18 inches, thereby reducing the number of salmon and the demand on smelts, the primary forage species. This regulation was clearly not effective in accomplishing the intended goal. Consequently, salmon fishing rules were further liberalized in 2006, and an intensive public relations program was initiated to encourage additional harvest.

The more liberal salmon rules (three fish per day, 12 inch minimum length with only one over 18 inches permitted), combined with the education effort, appeared to be successful in increasing salmon harvest. Growth rates and body condition of salmon improved measurably by 2007, but have since decreased to levels observed in the early 2000's. This

may be attributed to a series of years with ideal salmon production conditions in the Kennebago River. High salmon recruitment from the Kennebago River continued to increase the salmon population in Mooselookmeguntic Lake, despite the fact that the anglers increased their harvest of salmon at MDIFW's request.

Improving salmon growth at Mooselookmeguntic Lake (16,300 acres) is complicated by the lake's immense size and persistent high recruitment of wild salmon from the Kennebago River, particularly following several years of favorable flows and temperatures in this large nursery area. We believe it will take several years of consistently high harvest to begin to reduce salmon densities and increase smelt numbers. Therefore, we recommend continuance of the current liberalized harvest regulations to encourage improvements in salmon growth. Growth rates and condition will be monitored closely to evaluate trends in salmon abundance and growth rates.

Brook trout:

The catch and harvest of legal-size brook trout (10 inches and longer) has varied considerably at Mooselookmeguntic Lake since 1981 (Table 8). In 2010, the estimated total catch and harvest of brook trout were approximately 4,166 and 1,965 fish, respectively. Data collected through clerk and voluntary surveys showed an increase in brook trout catch rates since 2002 (Table 4 and Table 8), and indicated steady or improved brook trout growth during the same time period (Table 3 and Table 4). Anglers continued to release a high proportion of legal-size brook trout (53%), although that was a decline from 63% documented in 2002 and 2007. Release rates of legal trout appear to have stabilized in recent years, based on clerk and voluntary angler data. The percent of legal-size trout released by voluntary anglers varied greatly from 2002 to 2010, with 2010 having the highest release rate (76%).

Brook trout regulations became more restrictive for the 1996 fishing season, and included a two-fish daily bag limit (reduced from five) with a 10-inch minimum length limit; only one trout may exceed 12 inches. These regulations were designed to distribute the catch among more anglers, direct harvest toward the more abundant age groups, and provide more protection to larger, older individuals that are of high aesthetic and genetic importance. The proportion of older age (IV+ and V+) trout in the catch remained high from 2003 through 2010 (Table 9), indicating that these regulations had the intended effects.

Growth indicators for brook trout fluctuated from 1998 to 2010, but there were no clear trends upward or downward (Table 10). Declines in brook trout growth and condition were observed from 1986 to 1998 (Boucher 1996 and 1999, and Bonney 2004). However, the most recent data suggest brook trout growth has stabilized. Brook trout catch rates have increased in recent years, indicating a robust population. The stabilization of growth rates during this increase in population density indicated suitable habitat and forage availability. The continued improvement in brook trout growth is attributed to the fact this species is more dependent upon macroinvertebrates for forage rather than smelts.

CONCLUSION AND RECOMMENDATIONS

The size quality of wild landlocked salmon in Mooselookmeguntic Lake decreased from 2007 to 2010, despite liberalized regulations and increased harvest rates. Improvement in salmon growth, in a waterbody as large as Mooselookmeguntic Lake, will require several years of consistently high salmon harvest. MDIFW's outreach to anglers regarding salmon harvest appears to be working, but it will require more time to realize its intended effect. We recommend that the current salmon regulations (three fish daily bag limit; 12-inch minimum length limit, only one over 16 inches permitted) be retained through the 2013 fishing season to achieve additional improvements in salmon size quality. We are not recommending more liberal brook trout regulations because their growth rates appear to have stabilized, and they are less reliant on smelts as forage than are salmon.

Mooselookmeguntic Lake's sport fisheries will be closely monitored through triennial clerk creel surveys and angler counts, beginning again in 2013, and by annual sampling of the salmon spawning run in the Kennebago River.

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Table 1. Angler effort estimates for Mooselookmeguntic Lake, 1981-2010

Year	Angler days (95% CI)	Angler days/acre (95% CI)
1981	10,126 (8,142-12,106)	0.62 (0.50-0.74)
1986	10,196 (8,859-11,533)	0.63 (0.55-0.71)
1991	9,148 (8,002-10,294)	0.56 (0.49-0.63)
1995	9,580 (7,884-11,276)	0.59 (0.49-0.69)
1998	6,081 (5,269-6,893)	0.37 (0.32-0.42)
2002	6,304 (5,247-7,361)	0.39 (0.32-0.45)
2007	4,731 (3,878-5,584)	0.29 (0.24-0.34)
2010	7,860 (6,507-9,213)	0.48 (0.40-0.56)

Table 2. Estimated catch and harvest of *salmon* from Mooselookmeguntic Lake, 1981-2010. Confidence limits (95%) are in parentheses.

Year	No. legal salmon caught	No. legal salmon harvested	Percent legals released
1981	2,734 (2,198-3,270)	2,430 (1,954-2,906)	11
1986	3,671 (3,190-4,152)	2,753 (2,392-3,114)	27
1991	3,934 (3,441-4,427)	1,738 (1,526-1,956)	57
1995	3,934 (3,441-4,427)	3,161 (2,592-3,730)	65
1998	3,405 (2,950-3,860)	1,459 (1,264-1,654)	57
2002	1,513 (1,259-1,767)	630 (524-736)	60
2007	3,596 (2,947-4,244)	1,088 (892-1,284)	70
2010	4,244 (3,514-4,974)	2,200 (1,822-2,578)	49

Table 3. *Clerk creel survey* summary, Mooselookmeguntic Lake, 1998-2010.
(LLS=Landlocked salmon; BKT=Brook trout)

Statistic		Survey year						
		1998	1999	2002	2003	2004	2007	2010
No. anglers surveyed		350	502	495	355	315	374	438
No. angler hours surveyed		1,394	2,107	1,949	1,576	1,483	1,493	2080
	Species							
Percent successful anglers	LLS	36	26	22	26	27	43	34
	BKT	28	15	13	16	17	34	38
No. legal fish ¹ kept	LLS	84	81	48	53	32	86	121
	BKT	71	53	38	40	19	69	109
No. (%) legal fish released	LLS	113 (57)	111 (58)	71 (60)	71 (64)	100 (76)	198 (70)	115 (49)
	BKT	75 (51)	39 (42)	64 (63)	28 (41)	40 (68)	120 (63)	124 (53)
No. (%) sublegal fish released	LLS	407 (67)	305 (61)	495 (81)	518 (81)	414 (76)	169 (37)	335 (59)
	BKT	62 (30)	55 (37)	57 (36)	22 (24)	4 (6)	120 (63)	171 (42)
No. legals caught/angler	LLS	0.56	0.38	0.24	0.35	0.42	0.76	0.54
	BKT	0.42	0.18	0.21	0.19	0.19	0.51	0.53
No. legals kept/angler	LLS	0.24	0.16	0.10	0.15	0.10	0.23	0.28
	BKT	0.20	0.11	0.08	0.11	0.06	0.18	0.25
Hours to catch a legal fish	LLS	7.1	11.0	16.4	12.7	11.2	5.3	8.8
	BKT	9.5	22.9	19.1	23.2	23.2	7.9	8.9
Mean length±SE of harvested fish (in)	LLS	17.1±0.2	18.0±0.3	17.4±0.4	16.9±0.3	15.8±0.3	16.1±0.2	15.0±0.1
	BKT	12.9±0.2	13.8±0.4	12.2±0.2	13.9±0.5	14.7±0.7	13.0±0.3	13.2±0.2
Mean weight±SE of harvested fish (lb)	LLS	1.6±0.06	2.0±0.12	1.9±0.15	1.5±0.13	1.3±0.12	1.4±0.07	1.1±0.1
	BKT	0.8±0.7	1.2±0.12	0.7±0.04	1.3±0.28	1.7±0.35	0.9±0.12	0.8±0.1

¹ Legal salmon were 14 inches prior to 2006 and 12 inches thereafter.

Table 4. *Voluntary creel survey* summary, Mooselookmeguntic Lake, 2002-2010.
(LLS=Landlocked salmon; BKT=Brook trout)

Statistic	Species	Survey year								
		2002	2003	2004	2005	2006	2007	2008	2009	2010
No. anglers reporting		96	111	76	26	48	74	66	40	61
No. angler hours reporting		543	516	381	137	174	352	216	166	330
	Species									
Percent successful anglers	LLS	50	60	47	12	52	67	71	65	56
	BKT	32	19	21	27	33	51	47	50	62
No. legal fish¹ kept	LLS	9	16	11	3	20	44	40	32	39
	BKT	20	15	9	4	16	29	31	22	23
No. (%) legal fish released	LLS	51 (85)	92 (85)	41 (80)	1 (25)	13 (39)	60 (58)	45 (53)	21 (40)	25 (39)
	BKT	11 (36)	8 (35)	9 (50)	10 (71)	8 (33)	16 (32)	36 (54)	10 (31)	71 (76)
No. (%) sublegal fish released	LLS	172 (74)	234 (68)	62 (55)	24 (86)	31 (48)	45 (30)	42 (33)	12 (19)	39 (38)
	BKT	8 (21)	7 (23)	2 (10)	0 (0)	7 (23)	12 (19)	9 (12)	9 (24)	13 (12)
No. legals caught/angler	LLS	0.63	0.97	0.67	0.15	0.69	1.41	1.29	1.28	1.05
	BKT	0.32	0.21	0.24	0.53	0.50	0.68	1.02	0.73	1.54
No. legals kept/angler	LLS	0.09	0.14	0.13	0.12	0.42	0.60	0.61	0.75	0.64
	BKT	0.21	0.14	0.12	0.15	0.33	0.39	0.47	0.48	0.38
Hours to catch a legal fish	LLS	9.1	4.8	7.5	34.1	5.3	3.4	2.5	3.3	5.2
	BKT	17.5	22.4	21.2	9.8	7.3	7.0	3.2	5.7	3.5
Mean length±SE of harvested fish (in)	LLS	16.4±0.3	16.1±0.2	15.6±0.3	18.4±2.8	14.2±0.3	15.0±0.3	14.8±0.2	15.3±0.3	14.7±0.2
	BKT	12.6±0.4	12.6±0.4	11.8±0.4	14.2±0.8	12.4±0.5	12.0±0.2	12.3±0.3	12.5±0.3	12.9±0.2

¹ Legal salmon were 14 inches prior to 2006 and 12 inches thereafter.

Table 5. Age group composition of harvested *salmon*, Mooselookmeguntic Lake, 1998-2010.

Year	Number (%) at age						No. fish
	III+	IV+	V+	VI+	VII+	VIII+ and older	
1998	0	3 (4)	25 (31)	41 (51)	8 (10)	4 (5)	81
1999	0	3 (4)	21 (30)	15 (21)	26 (37)	6 (9)	71
2002	0	2 (5)	14 (34)	11 (27)	12 (29)	2 (5)	41
2003	0	1 (2)	10 (21)	17 (35)	15 (31)	5 (10)	48
2004	0	0	11 (38)	11 (38)	6 (21)	1 (4)	29
2007	0	9 (11)	38 (45)	25 (29)	8 (9)	5 (6)	85
2010	2 (2)	37 (33)	34 (30)	12 (11)	16 (14)	11 (10)	112

Table 6. Mean size and condition (Fulton's K) of age V+, 2 stream-year *salmon* from Mooselookmeguntic Lake, 1998-2010.

Year	No. sampled	Length (in)	Weight (lb)	Condition (K)
1998	30	16.1	1.28	0.85
1999	21	16.0	1.23	0.86
2001	28	15.8	1.30	0.86
2002	54	14.6	0.94	0.81
2003	60	14.3	0.85	0.78
2004	60	14.5	0.92	0.81
2006	49	14.7	0.99	0.84
2007	75	15.2	1.15	0.90
2010	30	14.4	0.89	0.78

Table 7. Mean length (inches) and condition (Fulton's K) of *salmon* sampled from the Kennebago River spawning run, 2001-2009 (principal cohorts only).

		Age							
		IV+		V+		VI+		VII+	
Year	No. fish	Length	K	Length	K	Length	K	Length	K
2001	71	13.5	0.83	16.1	0.87	16.5	0.87	19.0	0.88
2002	113	12.7	0.74	14.2	0.79	15.6	0.79	17.9	0.87
2003	160	12.9	0.78	14.2	0.77	16.0	0.83	17.9	0.87
2004	103	12.8	0.76	14.4	0.79	15.6	0.81	19.9	0.86
2006	150	13.4	0.85	14.6	0.84	15.7	0.88	16.9	0.87
2007	174	13.4	0.88	14.8	0.92	16.1	0.91	17.8	0.94
2008	152	14.1	0.82	15.2	0.84	16.9	0.85	18.1	0.86
2009	183	14.3	0.75	15.6	0.74	16.5	0.75	17.7	0.75

Table 8. Estimated catch and harvest of *brook trout* from Mooselookmeguntic Lake, 1981-2010. Confidence limits (95%) are in parentheses.

Year	No. legal trout caught	No. legal trout harvested	Percent legals released
1981	911 (732-1090)	871 (700-1,042)	5
1986	2,039 (1,772-2,306)	1,835 (1,595-2,075)	12
1991	1,281 (1,121-1,441)	1,098 (960-1,236)	15
1995	2,065 (1,693-2,437)	1,437 (1,183-1,691)	33
1998	1,824 (1,566-2,048)	1,216 (1,068-1,398)	51
2002	1,324 (1,102-1,546)	504 (420-589)	63
2007	2,413 (1,978-2,848)	852 (698-1,005)	63
2010	4,166 (3,449-4,883)	1,965 (1,627-2,303)	53

Table 9. Age group composition of harvested *brook trout*, Mooselookmeguntic Lake, 1998-2010.

Year	Number (%) at age				No. fish
	III+	IV+	V+	VI+	
1998	49 (72)	12 (18)	5 (7)	2 (3)	68
1999	24 (55)	17 (39)	3 (7)	0	44
2002	21 (60)	13 (37)	1 (3)	0	35
2003	8 (24)	20 (61)	4 (12)	1 (3)	33
2004	7 (39)	8 (44)	3 (17)	0	18
2007	34 (52)	27 (41)	5 (8)	0	66
2010	52 (50)	40 (38)	12 (11)	1 (1)	105

Table 10. Mean size and condition (Fulton's K) of age III+ and IV+ *brook trout* from Mooselookmeguntic Lake, 1998-2007.

Age	Year	No. sampled	Length (in)	Weight (lb)	Condition (K)
III+	1998	49	12.2	0.62	0.94
	1999	24	12.2	0.67	0.98
	2001	10	10.8	0.47	0.93
	2002	21	11.9	0.63	1.00
	2007	34	12.0	0.60	0.93
	2010	52	11.8	0.52	0.88
IV+	1998	12	13.5	0.84	0.97
	1999	17	14.2	1.20	1.07
	2002	13	12.7	0.79	1.03
	2003	20	13.6	0.98	1.06
	2007	27	12.9	0.78	0.97
	2010	40	13.9	0.99	1.00