

APPENDIX 5.4.2A: AREA 1 LAKE STURGEON

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Table 5.4.2A-1: Adult Lake Sturgeon population estimates for the Lower Nelson River and other waterbodies in Manitoba.

Waterbody	Location	Year	Estimate	95% Confidence Limits	
				Lower	Upper
Nelson River	Landing River area	1993	2,939	1,666	5,673
		1994	2,097	1,305	3,569
		1995	1,489	1,237	1,671
		1996	1,212	669	2,424
		1997	929	513	1,859
		1998	951	588	1,649
		1999	1,010	602	1,852
		2000	692	392	1,336
		2006	1,944	1,426	4,723
		2007	1,940	1,620	2,575
		2008	2,783	2,210	4,301
		2009	2,362	1,955	3,208
		2010	2,431	2,006	3,333
		2011	3,638	2,842	5,989
Upper Split Lake	Nelson River from Kelsey GS to Split Lake; and Burntwood River from First Rapids to Split Lake	2001	183	122	576
		2002	228	106	735
		2005	592	245	1,815
		2006	505	325	947
		2007	654	528	975
		2009	585	478	824
		Nelson River	Birthday to Gull Rapids	2001	461
2002	355			277	434
2003	496			410	581
2004	380			298	463
2006	722			590	854
2008	572			443	701
2010	764			524	1,005
2012	707			480	935
		2014	596	466	725

Table 5.4.2A-1: Adult Lake Sturgeon population estimates for the Lower Nelson River and other waterbodies in Manitoba.

Waterbody	Location	Year	Estimate	95% Confidence Limits	
				Lower	Upper
Nelson River	Lower Limestone Rapids to Deer Island	1996	356	320	392
		1997	1,910	1,566	2,254
		1998	1,773	1,452	2,095
		2004	2,108	1,658	2,558
		2005	5,595	5,218	5,993
		2006	5,195	4,823	5,601
		2007	5,643	5,103	6,223
		2008	6,206	5,339	7,200
		2010	5,480	4,668	6,376
		2013	8,413	6,498	10,758
Churchill River	Confluence of Churchill and Little Churchill rivers	2003	1,812	1,304	2,320
Fox River	Rainbow Falls to Great Falls	2004	646	312	980
Winnipeg River	Seven Sisters GS to Slave Falls GS	1992-1997	3,000–27,000		
	Slave Falls GS to Pointe Du Bois GS	2007	2,205	921	4,095

Table 5.4.2A-2: Mean catch-per-unit-effort (CPUE), number of fish sampled, mean condition factor, and the length-weight relationship from eight studies in Area 1, 1953-2014.

Study	Location	N ¹	Mean CPUE ² (#LKST/100 m/24 h)	Mean K ³	St Dev K	Length-weight relationship ⁴
Sunde 1953-1956	Sipiwesk Lake	378	-	0.81	0.14	y = 3.12x - 12.83
Sopuck 1976-1978	Sipiwesk Lake	315	-	0.83	0.11	y = 3.10x - 12.64
Patalas 1987-1988	Sipiwesk Lake	190	-	0.81	0.12	y = 3.01x - 11.80
NRSB 1993-1997	Cross Lake to Kelsey GS	1192	-	0.82	0.14	y = 2.95x - 11.60
McDougall and Pisiak 2012	Sea Falls to Sugar Falls	91	1.40 juvenile gang; 0.40 large mesh	0.66	0.09	y = 3.13x - 13.14
McDougall and Pisiak 2013	Sea Falls to Sugar Falls; Pipestone Lake	207	2.16	0.66	0.08	y = 3.10x - 12.91
Groening <i>et al.</i> 2014a	Vicinity of Landing River confluence	129	1.80	0.73	0.1	y = 3.19x - 13.43
Henderson <i>et al.</i> 2014	Downstream of Jenpeg	26	0.12	0.74	0.13	y = 3.49x - 15.38
Macdonald 2006–2014	Landing River area	3308	-	0.75	0.17	y = 3.25x - 13.76

1. N - number of fish sampled
2. CPUE (catch-per-unit-effort); # Lake Sturgeon/100 m/24 h)
3. K - mean condition factor
4. After ln-transformation; y=weight. x=length

Table 5.4.2A-3: Average Weights and Frequency of Lake Sturgeon in Weight Groups from the Nelson River, 1953–1956. Source: Sunde 1959

Season	Average Weight (kg)	% Frequency under 9 kg	% Frequency under 11 kg	% Frequency over 18 kg	% Frequency over 23 kg
1953	31.4	5	29	36	11
1954	29.1	13	41	39	17
1955	28.7	19	44	38	14
1956	27.4	27	52	46	19
Average	28.9	16	42	38	15

Table 5.4.2A-4: Annual Management Unit Quotas (in dressed weight) for Lake Sturgeon Harvest in the Nelson River, 1970–1987. Source: Patalas 1988

Time Period	Unit 1 Quota (kg)	Unit 2 Quota (kg)	Unit 3 Quota (kg)	Unit 4 Quota (kg)	Unit 5 Quota (kg)
1970–1979	2268	1814	1361	1361	907
1980–1983	2300	1900	1400	1400	1000
1984–1986	2300	1900	1816	1400	1000
1987	2300	1710	1816	1400	1000

Table 5.4.2A-5: Annual commercial harvest of Lake Sturgeon in each management unit of the Nelson River, 1970–1989. Note: Harvest is given as dressed weight (kg) and as the percentage (%) of the annual quota for each management unit. Source: Patalas (1988)

Year	Unit 1		Unit 2		Unit 3		Unit 4		Unit 5		Total	
	(kg)	%	(kg)	%	(kg)	%	(kg)	%	(kg)	%	(kg)	%
1970	190	8	472	26	355	26	110	8	0	0	1127	15
1971	168	7	1403	77	1052	77	165	12	566	62	3354	43
1972	0	0	2100	116	1575	116	0	0	115	13	3790	49
1973	0	0	1493	82	1191	88	389	29	0	0	3073	40
1974	0	0	576	32	844	62	219	16	0	0	1639	21
1975	0	0	241	13	1527	112	0	0	0	0	1768	23
1976	31	1	429	24	1465	108	0	0	0	0	1925	25
1977	10	0	1322	73	1138	84	945	69	0	0	3415	44
1978	274	12	1909	105	1490	109	782	57	0	0	4455	58
1979	698	31	655	36	1488	109	466	34	227	25	3534	46
1980	904	39	1646	87	1648	118	824	59	0	0	5021	63
1981	314	14	1998	105	1401	100	155	11	500	50	4368	55
1982	66	3	1720	91	1171	84	251	18	700	70	3908	49
1983	51	2	2271	120	2221	159	0	0	0	0	4543	57
1984	0	0	1605	84	1391	77	0	0	0	0	2996	36

Table 5.4.2A-5: Annual commercial harvest of Lake Sturgeon in each management unit of the Nelson River, 1970–1989. Note: Harvest is given as dressed weight (kg) and as the percentage (%) of the annual quota for each management unit. Source: Patalas (1988)

Year	Unit 1		Unit 2		Unit 3		Unit 4		Unit 5		Total	
	(kg)	%	(kg)	%	(kg)	%	(kg)	%	(kg)	%	(kg)	%
1985	279	12	1888	99	1689	93	0	0	0	0	3856	46
1986	162	7	1572	83	932	51	0	0	0	0	2666	32
1987	211	9	1439	84	1079	59	0	0	0	0	2729	33
Zone Total	3359		24739		23656		4305		2108		58168	
Zone Mean	187	8	1374	74	1314	91	239	17	117	12	3232	41

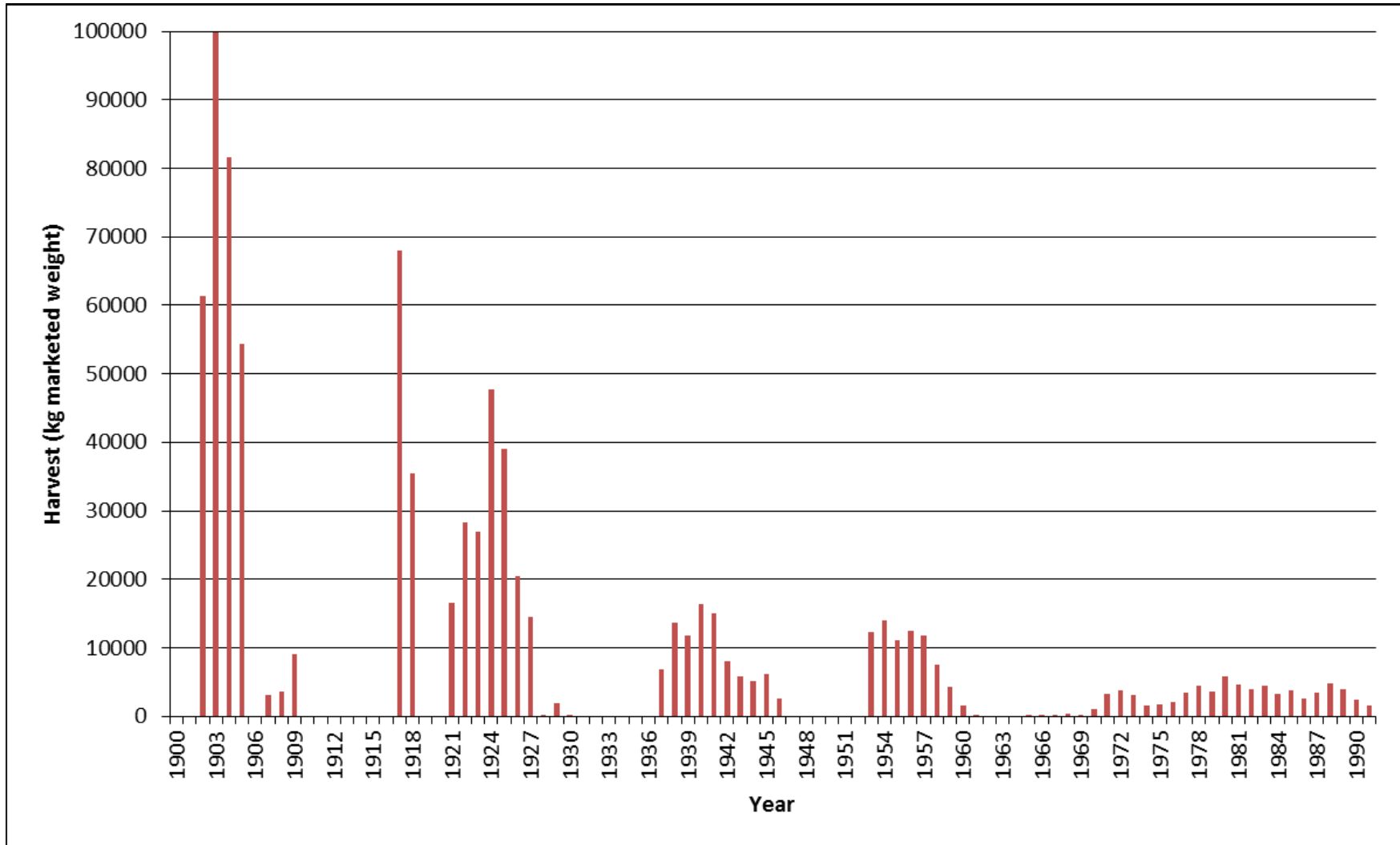


Figure 5.4.2A-1: Commercial harvest of Lake Sturgeon from the Nelson River, 1902-1991.

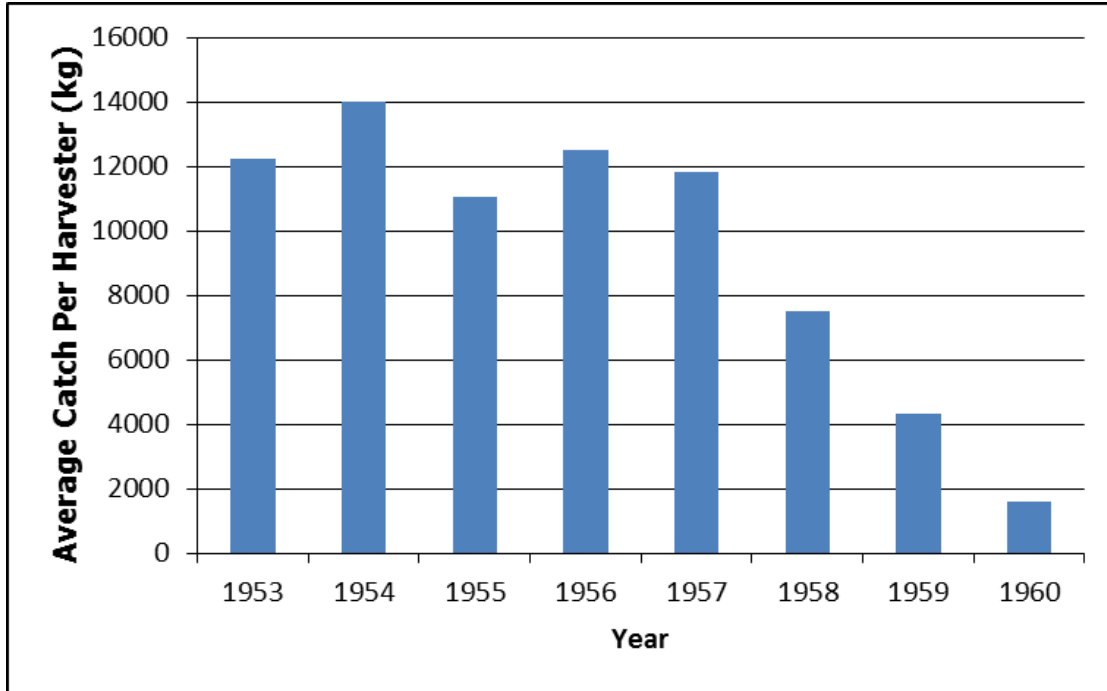


Figure 5.4.2A-2: Mean catch per harvester in the Nelson River Lake Sturgeon commercial fishery, 1953-1960. Source: Sunde 1961

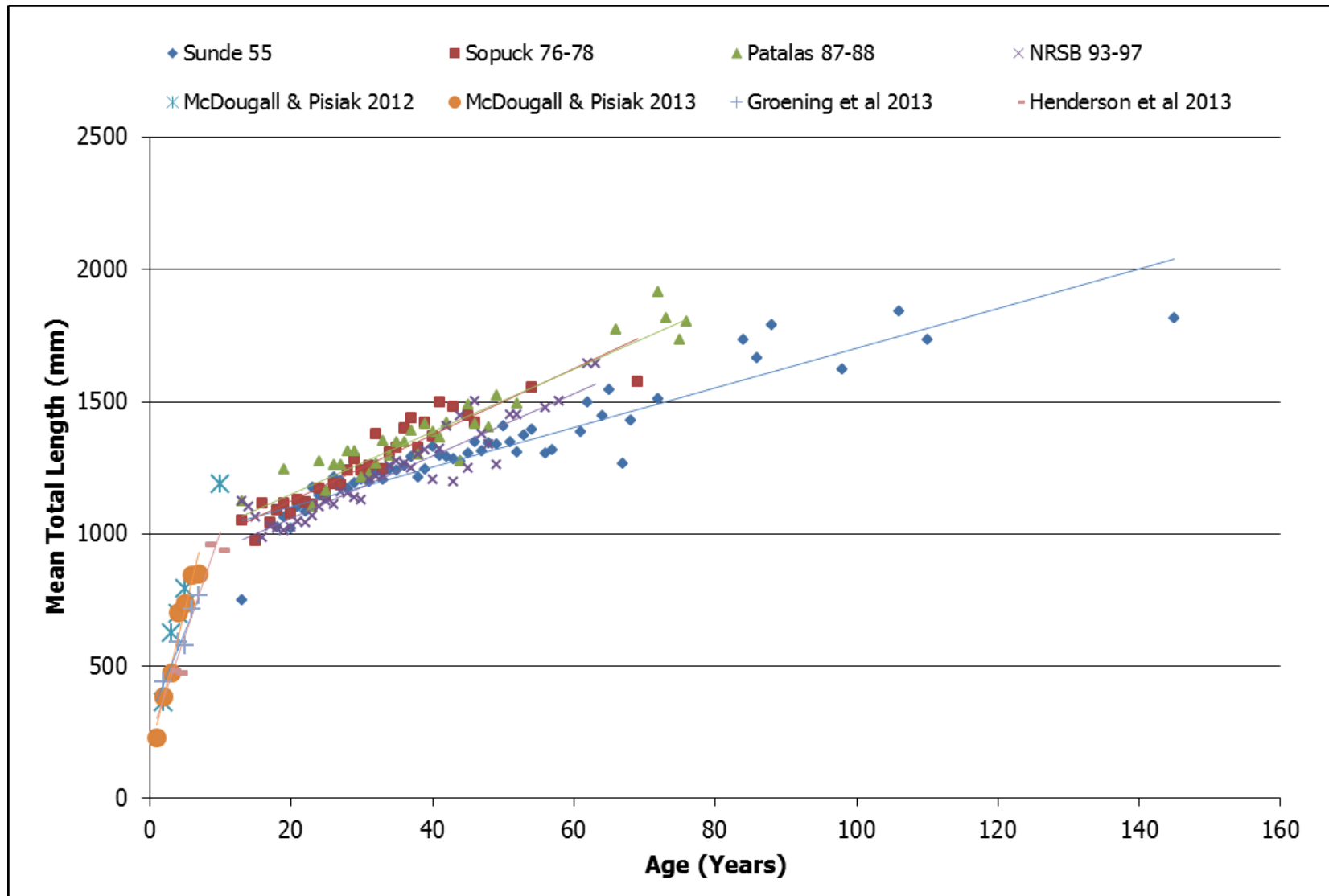


Figure 5.4.2A-3: Length-at-age for eight data sets collected from various reaches of the Nelson River, 1954-2014. Note: More recent studies collected ages only from juveniles < 14 years of age.

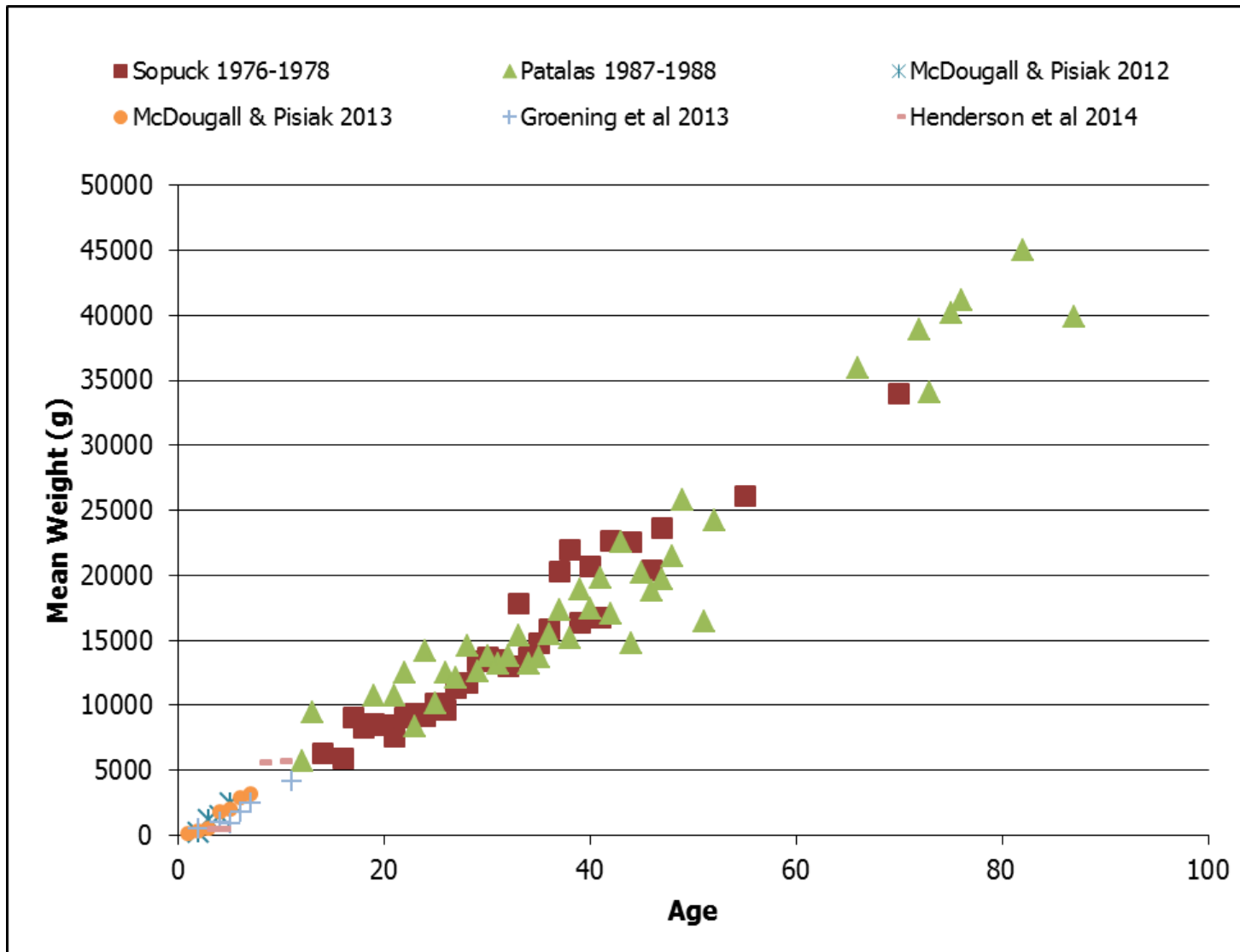


Figure 5.4.2A-4: Mean weight-at-age relationships (in-transformed) for Lake Sturgeon from five studies conducted in Area 1 in the vicinity of the Landing River between 1953–2014.

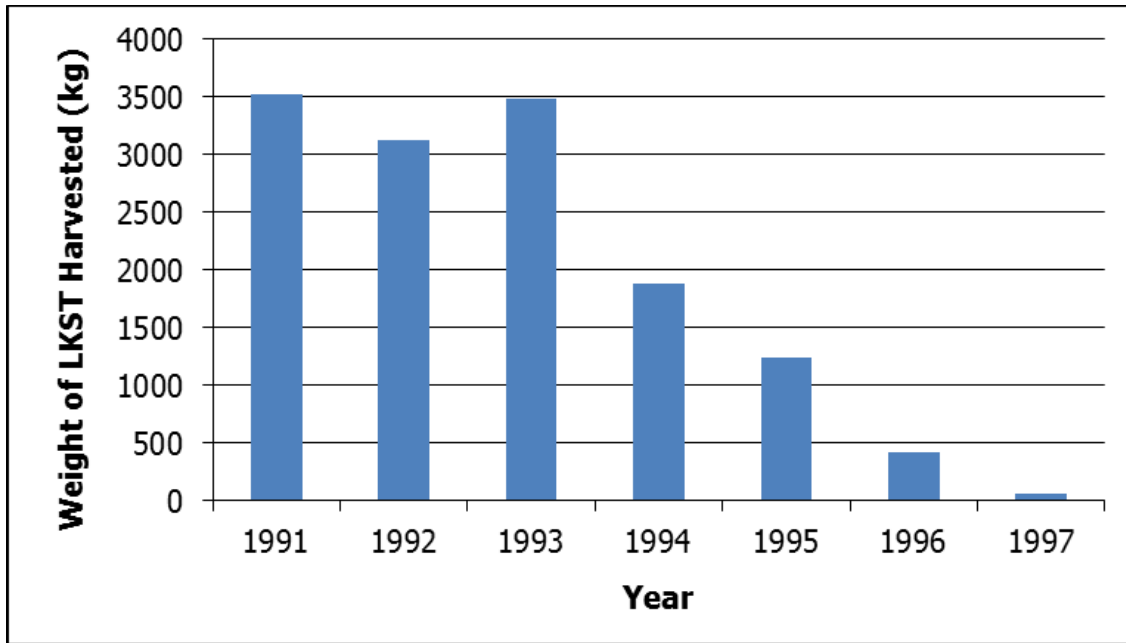


Figure 5.4.2A-5: Domestic harvest in the Landing River area 1991–1997. Source: Macdonald 1998



Figure 5.4.2A-6: Peterson population estimate for Lake Sturgeon sampled in the Nelson River in the vicinity of the Landing River, 1993–2000 and 2006–2013. Note: The red line represents the population estimate for the year, while the black lines represent the upper and lower confidence intervals. Figure taken from Don Macdonald

APPENDIX 5.4.3A: AREA 2 LAKE STURGEON

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Table 5.4.3A-1: Lake Sturgeon studies conducted in Area 2 by North/South Consultants Inc. for Manitoba Hydro, 1986–2014.

Life Stage	Study Year	Reference
Adult	1986–1992	MacDonell, D.S. 1992. Final results of Lake Sturgeon radio telemetry studies conducted on the lower Nelson River between 1986 and 1992. A report prepared for Manitoba Hydro by North/South Consultants Inc., Winnipeg, MB. 27 pp.
Adult/Juvenile	1995–2011	Nelson, P.A., and C.C. Barth. 2012. Abundance of Lake Sturgeon in the Keeyask Study Area: 1995 to 2011. A report prepared for Manitoba Hydro by North/South Consultants Inc. 36pp.
Adult	1998	Barth, C.C., and MacDonell, D.S. 1999. Lower Nelson River Lake Sturgeon spawning study, Weir River, 1998. A report prepared for Manitoba Hydro by North/South Consultants Inc., Winnipeg, MB. 59 pp.
Adult/Juvenile	2001	Barth, C.C. and Mochnacz, N.J. 2004. Lake Sturgeon Investigations in the Gull (Keeyask) Study Area, 2001. A report prepared for Manitoba Hydro by North/South Consultants Inc., Winnipeg, Manitoba. 130 pp.
Adult/Juvenile	2002	Barth, C.C. 2005. Lake Sturgeon Investigations in the Keeyask Study Area, 2002. A report prepared for Manitoba Hydro by North/South Consultants Inc., Winnipeg, Manitoba. 115 pp.
Adult/Juvenile	2003	Barth, C. and Murray, L. 2005. Lake Sturgeon Investigations in the Keeyask Study Area, 2003. A report prepared for Manitoba Hydro by North/South Consultants Inc., Winnipeg, Manitoba. 111 pp.
Adult/Juvenile	2004	Barth, C.C. and Ambrose, K.M. 2006. Lake Sturgeon Investigations in the Keeyask Study Area, 2004. A report prepared for Manitoba Hydro by North/South Consultants Inc., Winnipeg, Manitoba. 91 pp.
Adult/Juvenile	2004	Holm, J., Ambrose, K., and MacDonell, D. 2006. Results of the 2004 fish community investigation focusing on Lake Sturgeon. Conawapa Generation Project Environmental Studies Program Report # 04-05. A report prepared for Manitoba Hydro by North/South Consultants Inc., Winnipeg, MB. 87 pp.
Adult/Juvenile	2005	Ambrose, K.M., McDougall, C.A., Nelson, P.A., Murray, L., and MacDonell, D.S. 2007. Results of the 2005 fish community investigations focusing on Lake Sturgeon in the Conawapa study area. Conawapa Project Environmental Studies Program Report # 05-08. A report prepared for Manitoba Hydro by North/South Consultants Inc., Winnipeg, MB. 176 pp.
Adult/Juvenile	2005	Barth, C. and MacDonald, J. 2008. Lake Sturgeon Investigations in the Keeyask Study Area, 2005. A report prepared for Manitoba Hydro by North/South Consultants Inc., Winnipeg, Manitoba. 50 pp. #5386.05-05

Table 5.4.3A-1: Lake Sturgeon studies conducted in Area 2 by North/South Consultants Inc. for Manitoba Hydro, 1986–2014.

Life Stage	Study Year	Reference
Adult/Juvenile	2005–2009	Côté, G., Nelson, P.A., and Bernatchez, L. 2011. Final report on population genetics of Lake Sturgeon Churchill, Nelson, and Hayes rivers. Conawapa Project Environmental Studies Program Report # 08-08. A report prepared for Manitoba Hydro by IBIS, Québec, QC, and North/South Consultants Inc., Winnipeg, MB. 67 pp.
Adult/Juvenile	2005–2012	Gosselin, T., Nelson, P.A., McDougall, C.A. and Bernatchez, L. 2014. Population genomics of Lake Sturgeon (<i>Acipenser fulvescens</i>) in the Nelson and Hayes rivers. A report prepared for Manitoba Hydro by IBIS, Quebec QC and North/South Consultants Inc. Winnipeg MB. 69 pp.
Adult/Juvenile	2006	Ambrose, K.M., Murray, L., Nelson, P.A., and MacDonell, D.S. 2008. Results of the 2006 fish community investigations focusing on Lake Sturgeon in the Conawapa study area. Conawapa Project Environmental Studies Program Report # 06-09. A report prepared for Manitoba Hydro by North/South Consultants Inc., Winnipeg, MB. 217 pp.
Adult/Juvenile	2006	MacDonald, J. 2008. Lake Sturgeon Investigations in the Keeyask Study Area, 2006. A report prepared for Manitoba Hydro by North/South Consultants Inc., Winnipeg, Manitoba. 95 pp.
Adult/Juvenile	2007	Ambrose, K.M., Murray, L., Nelson, P.A., and MacDonell, D.S. 2009. Results of the 2007 fish community investigations focusing on Lake Sturgeon in the Conawapa study area. Conawapa Project Environmental Studies Program Report # 07-04. A report prepared for Manitoba Hydro by North/South Consultants Inc., Winnipeg, MB. 297 pp.
Adult/Juvenile	2007–2008	MacDonald, J.E. 2009. Lake Sturgeon Investigations in the Keeyask Study Area, 2007-2008. A report prepared for Manitoba Hydro by North/South Consultants Inc., Winnipeg, Manitoba. 100 pp.
Adult/Juvenile	2008	Ambrose, K.M., Pisiak, D.J., Nelson, P.A., and MacDonell, D.S. 2010. Results of the 2008 fish community investigations focusing on Lake Sturgeon in the Conawapa study area. Conawapa Project Environmental Studies Program Report # 08-06. A report prepared for Manitoba Hydro by North/South Consultants Inc., Winnipeg, MB. 150 pp.
Adult/Juvenile	2009	Ambrose, K.M., Pisiak, D.J., and MacDonell, D.S. 2010. Results of the 2009 fish community investigations focusing on Lake Sturgeon in the Conawapa study area. Conawapa Project Environmental Studies Program Report # 09-05. A report prepared for Manitoba Hydro by North/South Consultants Inc., Winnipeg, Manitoba. 107 pp.
Adult/Juvenile	2009	Michaluk, Y. and J.E. MacDonald. 2010. Lake Sturgeon Investigations in the Keeyask Study Area, 2009. A report prepared for Manitoba Hydro by North/South Consultants Inc., Winnipeg, Manitoba. 83 pp.

Table 5.4.3A-1: Lake Sturgeon studies conducted in Area 2 by North/South Consultants Inc. for Manitoba Hydro, 1986–2014.

Life Stage	Study Year	Reference
Juvenile	2010	Henderson, L., Barth, C.C., MacDonald, J.E., and Blanchard, M. 2011. Keeyask Project: Young-of-the-year and sub-adult Lake Sturgeon investigations in the Keeyask study area, spring and fall 2010. Keeyask Project Environmental Studies Program Report # 10-07. A report prepared for Manitoba Hydro by North/South Consultants Inc., Winnipeg, MB. 46 pp.
Adult/Juvenile	2010	MacDonald, J.E. and Barth, C.C. 2011. Lake Sturgeon Investigations in the Keeyask Study Area, Spring 2010. A report prepared for Manitoba Hydro by North/South Consultants Inc., Winnipeg, Manitoba. 64 pp.
Adult/Juvenile	2010	Pisiak, D.J., Dolce Blanchard, L.T., Barth, C.C., and MacDonell, D.S. 2011. Conawapa Project: Results of the 2010 fish community investigations focusing on Lake Sturgeon in the Conawapa study area. Conawapa Project Environmental Studies Program Report # 10-02. A report prepared for Manitoba Hydro by North/South Consultants Inc., Winnipeg, MB. 82 pp.
Juvenile	2011	Henderson, L., and Pisiak, D.J. 2012. Keeyask Project: Results of young-of-the-year and sub-adult Lake Sturgeon investigations in the Keeyask study area, spring and fall 2011. Gull (Keeyask) Project Environmental Studies Program Report # 11-04. A report prepared for Manitoba Hydro by North/South Consultants Inc., Winnipeg, MB. 46 pp.
Adult	2011	Hrenchuk, C.L., and McDougall, C.A. 2012. Keeyask Project: Adult Lake Sturgeon investigations in the Keeyask study area, 2011. Keeyask Project Environmental Studies Program Report # 11-01. A report prepared for Manitoba Hydro by North/South Consultants Inc., Winnipeg, MB. 167 pp.
Adult	2011	Klassen, C.N. 2012. Conawapa Project: Results of the 2011 Gods River Lake Sturgeon spawning and movement investigation. Conawapa Project Environmental Studies Program Report # 11-02. A report prepared for Manitoba Hydro by North/South Consultants Inc., Winnipeg, MB. 20 pp.
Juvenile	2011	McDougall, C.A., Hrenchuk, C.L., and Barth, C.C. 2013a. Results of juvenile Lake Sturgeon movement and habitat utilization studies in Stephens Lake - 2011. Keeyask Project Environmental Studies Program Report # 11-06. A report prepared for Manitoba Hydro by North/South Consultants Inc., Winnipeg, Manitoba. 92 pp.
Adult	2011–2012	Hrenchuk, C., and Barth, C. 2013. Results of Adult Lake Sturgeon Movement Monitoring in the Nelson River between Clark Lake and the Long Spruce Generating Station, October 2011 to October 2012. A report prepared for Manitoba Hydro by North/South Consultants Inc. 137 pp.

Table 5.4.3A-1: Lake Sturgeon studies conducted in Area 2 by North/South Consultants Inc. for Manitoba Hydro, 1986–2014.

Life Stage	Study Year	Reference
Juvenile	2011–2012	McDougall, C.A., Hrenchuk, C.L., and Barth, C.C. 2013b. Results of juvenile Lake Sturgeon movement studies in Stephens Lake October 2011 to October 2012. Keeyask Project Environmental Studies Program Report # 12-10. A report prepared for Manitoba Hydro by North/South Consultants Inc., Winnipeg, Manitoba. 52 pp.
Adult	2012	Hrenchuk, C. 2013. Adult Lake Sturgeon investigations in the Keeyask study area, 2012. Keeyask Project Environmental Studies Program Report # 12-06. A report prepared for Manitoba Hydro by North/South Consultants Inc., Winnipeg, Manitoba. 62 pp.
Adult	2012	Lavergne, S.C. 2012. Lake Sturgeon Spawning Investigations in the Long Spruce Forebay, Spring 2012. Lake Sturgeon Stewardship and Enhancement Program Report # 12-01. A report prepared for Manitoba Hydro by North/South Consultants Inc., Winnipeg, MB. 27 pp.
Adult/Juvenile	2012	Lavergne, S.C., and Barth, C.C. 2012. Inventory of the Lake Sturgeon Population in the Long Spruce Forebay, September 2012. Lake Sturgeon Stewardship and Enhancement Program Report # 12-02. A report prepared for Manitoba Hydro by North/South Consultants Inc., Winnipeg, MB. 39 pp.
Adult	2012–2013	Hrenchuk, C.L., Henderson, L.M., and Barth, C.C. 2014. Results of adult Lake Sturgeon movement monitoring in the Nelson River between Clark lake and the Long Spruce Generating Station, October 2012 to October 2013. A report prepared for Manitoba Hydro by North/South Consultants Inc. Winnipeg MB. 132 pp.
Adult	2013	Groening, L.D., Henderson, L.M., and Hrenchuk, C.L. 2014. Adult Lake Sturgeon investigations in the Keeyask study area, 2013. Keeyask Project Environmental Studies Program Report # 13-04. A report prepared for Manitoba Hydro by North/South Consultants Inc., Winnipeg, MB.
Adult	2013–2014	Hrenchuk, C.L. and Barth, C.C. 2015. Results of adult Lake Sturgeon movement monitoring in the Nelson River between Clark Lake and the Long Spruce Generating Station, October 2013 to October 2014. A report prepared for the Keeyask Hydropower Limited Partnership by North/South Consultants Inc. Winnipeg MB. 142 pp.
Juvenile	2013–2014	Lacho, C.D., Hrenchuck, C.L., and Barth, C.C. 2015. Results of juvenile Lake sturgeon movement monitoring in the Nelson River between Clark Lake and the Long Spruce Generating Station, October 2013 to October 2014. A report prepared for the Keeyask Hydropower Limited Partnership by North/South Consultants Inc. 91 pp.
Juvenile	2014	Henderson, L.M., Barth, C.C., Hrenchuk, C.L. 2015 Results of juvenile lake sturgeon population monitoring, fall 2014. A report prepared for the Keeyask Hydropower Limited Partnership by North/South Consultants Inc. Winnipeg MB. 61 pp.

Table 5.4.3A-1: Lake Sturgeon studies conducted in Area 2 by North/South Consultants Inc. for Manitoba Hydro, 1986–2014.

Life Stage	Study Year	Reference
Adult	2014	Hrenchuk, C.L., Barth, C.C., and Nelson, P.A. 2015. Results of adult Lake Sturgeon population monitoring in the Keeyask area and Stephens Lake, 2014. A report prepared for the Keeyask Hydropower Limited Partnership by North/South Consultants Inc. Winnipeg MB. 51 pp.

Table 5.4.3A-2: Annual management unit quotas for Lake Sturgeon harvest in the Nelson River, 1970–1987. Note: Measures are in dressed weight (kg). Source: Patalas 1988

Time Period	Unit 1 Quota (kg)	Unit 2 Quota (kg)	Unit 3 Quota (kg)	Unit 4 Quota (kg)	Unit 5 Quota (kg)
1970–1979	2268	1814	1361	1361	907
1980–1983	2300	1900	1400	1400	1000
1984–1986	2300	1900	1816	1400	1000
1987	2300	1710	1816	1400	1000

Table 5.4.3A-3: Annual Commercial Harvest of Lake Sturgeon in each management unit of the Nelson River, 1970–1991. Note: Harvest is given as marketed weight (kg) and as the percentage (%) of the annual quota for each management unit. Adapted from MacDonell (1997) ^{1,2}

Year	Unit 1		Unit 2		Unit 3		Unit 4		Unit 5		Total	
	(kg)	%	(kg)	%	(kg)	%	(kg)	%	(kg)	%	(kg)	%
1970	190	8	829	46	355	26	110	8	0	0	1484	19
1971	118	5	2461	136	165	12	165	12	568	63	3477	45
1972	0	0	3684	203	0	0	0	0	115	13	3799	49
1973	0	0	1497	83	1193	88	390	29	0	0	3080	40
1974	0	0	578	32	845	62	220	16	0	0	1643	21
1975	0	0	242	13	1530	112	0	0	0	0	1772	23
1976	31	1	431	24	1468	108	0	0	0	0	1930	25
1977	11	0	1325	73	1140	84	947	69	0	0	3423	44
1978	275	12	1913	105	1493	110	784	58	0	0	4465	58
1979	700	31	656	36	1492	110	467	34	227	25	3542	46
1980	906	39	1651	87	1651	118	825	59	0	0	5033	63
1981	314	14	1998	105	1401	100	155	11	500	50	4368	55
1982	66	3	1720	91	1171	84	251	18	700	70	3908	49
1983	51	2	2271	120	2221	159	0	0	0	0	4543	57
1984	0	0	1605	84	1391	77	0	0	0	0	2996	36
1985	279	12	1888	99	1689	93	0	0	0	0	3856	46
1986	162	7	1572	83	932	51	0	0	0	0	2666	32
1987	211	9	1438	84	1079	59	0	0	0	0	2728	33
1988	992	43 ³	2048	120	1469	81	0	-	0	-	4509	-
1989	688	30	1824	107	1464	81	0	-	0	-	3976	-
1990	439	19	1385	81	516	28	0	-	0	-	2340	-
1991	506	101	485	57	538	59	0	-	0	-	1529	-
Zone Total	5939	-	33501	-	25203	-	4314	-	2110	-	71067	-
Zone Mean	270	15	1523	85	1146	77	196	17	96	12	3230	41

1. Where annual production values were missing in the MacDonell data, other sources were used, on the assumption that the most likely source of error was underreporting due to missed or lost harvest records. Additional data sources are thus noted as follows: 1970 Item 3, 1982 Items 1 and 4: Patalas (1988); 1991 Items 1 and 3: Peters and Wall (1980).
2. 1970–1987 quotas from Patalas (1988). 1988 quotas for Item 2 and 3 from McCart 1992. 1989–1991 quotas for Items 1–3 from Manitoba Department of Natural Resources 1991.
3. Item 1 1988 quota interpolated based on 1987 and 1989 quotas.

Table 5.4.3A-4: Total numbers of gillnet sites, total numbers of Lake Sturgeon collected, and catch-per-unit-effort (CPUE) of adult and juvenile Lake Sturgeon captured during studies conducted between 2001 and 2014.

Location	Season	Year	Adult			Juvenile		
			# Sites	Total Lake Sturgeon	Total CPUE	# Sites	Total Lake Sturgeon	Total CPUE
Burntwood River	Spring	2001	26	23	0.14	-	-	-
		2002	30	16	0.19	-	-	-
		2005	18	14	0.09	-	-	-
		2006	16	37	0.17	-	-	-
		2007	27	60	0.12	-	-	-
		2009	21	70	0.27	-	-	-
		2010	15	30	0.21	-	-	-
		2011	29	65	0.25	10	55	4.10
		2012	19	29	0.59	-	-	-
		2013	79	123	0.19	-	-	-
	All Years	280	467	0.19	10	55	4.10	
	Fall	2012	-	-	-	37	33	1.03
		2014	-	-	-	28	42	1.37
All Years		-	-	-	65	75	1.20	

Table 5.4.3A-4: Total numbers of gillnet sites, total numbers of Lake Sturgeon collected, and catch-per-unit-effort (CPUE) of adult and juvenile Lake Sturgeon captured during studies conducted between 2001 and 2014.

Location	Season	Year	Adult			Juvenile		
			# Sites	Total Lake Sturgeon	Total CPUE	# Sites	Total Lake Sturgeon	Total CPUE
Kelsey GS Area (NR-SPL)	Spring	2001	44	13	0.06	-	-	-
		2002	26	5	0.03	-	-	-
		2005	20	7	0.05	-	-	-
		2006	56	29	0.04	-	-	-
		2007	47	60	0.08	-	-	-
		2009	42	45	0.17	-	-	-
		2010	5	1	0.05	-	-	-
		2011	34	46	0.13	3	1	0.21
		2013	138	123	0.23	-	-	-
		All Years	412	329	0.10	3	1	0.21
Grass River		2007	31	9	0.03	-	-	-
		2009	19	3	0.02	-	-	-
		2011	16	4	0.03	-	-	-
		2013	12	2	0.04	-	-	-
		All Years	78	18	0.03	-	-	-

Table 5.4.3A-4: Total numbers of gillnet sites, total numbers of Lake Sturgeon collected, and catch-per-unit-effort (CPUE) of adult and juvenile Lake Sturgeon captured during studies conducted between 2001 and 2014.

Location	Season	Year	Adult			Juvenile		
			# Sites	Total Lake Sturgeon	Total CPUE	# Sites	Total Lake Sturgeon	Total CPUE
Keeyask Area	Spring	2001	37	60	0.32	-	-	-
		2002	19	59	0.29	-	-	-
		2003	30	85	0.27	-	-	-
		2004	17	51	0.18	-	-	-
		2006	22	150	0.29	-	-	-
		2008	16	52	0.13	-	-	-
		2010	18	65	0.17	-	-	-
		2011	38	34	0.12	-	-	-
		2012	42	116	0.25	-	-	-
		2014	62	239	0.32	-	-	-
	All Years	301	911	0.24	-	-	-	
	Fall	2007	-	-	-	26	0	0
		2008	-	-	-	15	126	0.98
		2010	-	-	-	27	69	1.95
		2011	-	-	-	25	121	4.39
		2012	-	-	-	30	101	3.25
		2014	-	-	-	30	112	3.51
		All Years	-	-	-	153	529	2.03

Table 5.4.3A-4: Total numbers of gillnet sites, total numbers of Lake Sturgeon collected, and catch-per-unit-effort (CPUE) of adult and juvenile Lake Sturgeon captured during studies conducted between 2001 and 2014.

Location	Season	Year	Adult			Juvenile		
			# Sites	Total Lake Sturgeon	Total CPUE	# Sites	Total Lake Sturgeon	Total CPUE
Stephens Lake	Spring	2001	18	24	0.09	-	-	-
		2002	15	4	0.03	-	-	-
		2003	29	24	0.06	-	-	-
		2004	8	5	0.03	-	-	-
		2005	72	7	0.01	-	-	-
		2006	40	14	0.04	-	-	-
		2010	37	17	0.08	15	5	0.42
		2011	49	18	0.06	-	-	-
		2012	23	15	0.105	-	-	-
		2014	5	9	0.45	-	-	-
	All Years	296	137	0.06	15	5	0.42	
	Fall	2007	-	-	-	15	0	0
		2008	-	-	-	12	8	0.65
		2009	-	-	-	18	23	0.87
		2010	-	-	-	18	32	1.26
		2011	-	-	-	30	37	0.91
		2012	-	-	-	19	87	1.75
		2014	-	-	-	9	47	1.23
		All Years	-	-	-	121	234	1.20

Table 5.4.3A-5: Mean fork length (standard deviation; range) weight, and condition factor for adult and juvenile Lake Sturgeon captured by location during Keeyask GS environmental studies from 2001 to 2014.

Waterbody	Year	Adult Gill Nets (Spring)											Juvenile Gill Nets (Fall)										
		Fork Length (mm)				Weight (g)				K			Fork Length (mm)				Weight (g)				K		
		n	Mean	SD	Range	n	Mean	SD	Range	n	Mean	Range	n	Mean	SD	Range	n	Mean	SD	Range	n	Mean	Range
Burntwood River	2001	23	945	189	600-1436	22	6620	3279	1600-15600	22	0.76	0.46-1.04	-	-	-	-	-	-	-	-	-	-	-
	2002	15	982	173	644-1315	16	9227	5716	2200-22000	15	0.81	0.71-0.92	-	-	-	-	-	-	-	-	-	-	-
	2005	14	1002	146	838-1310	14	9542	5637	4990-22226	14	0.86	0.70-1.01	-	-	-	-	-	-	-	-	-	-	-
	2006	37	1014	148	734-1325	37	9654	5030	3629-23133	37	0.86	0.66-1.02	-	-	-	-	-	-	-	-	-	-	-
	2007	59	984	159	354-1362	57	9179	4324	2727-25000	57	0.88	0.71-1.12	-	-	-	-	-	-	-	-	-	-	-
	2009	69	965	156	485-1360	69	8263	3864	907-21772	68	0.85	0.56-1.09	-	-	-	-	-	-	-	-	-	-	-
	2010	30	919	166	242-1100	28	6520	2277	1361-10886	28	0.76	0.52-1.11	-	-	-	-	-	-	-	-	-	-	-
	2011	63	987	133	641-1350	63	8686	4066	2100-25855	63	0.85	0.57-1.10	55	506	91	311-680	55	1057	520	175-2510	55	0.74	0.56-1.01
	2012	29	966	76	809-1105	26	7820	1874	4082-12701	26	0.87	0.71-1.11	33	437	156	107-715	28	876	592	60-2125	28	0.66	0.41-0.80
	2013	119	942	173	560-1720	122	7714	6025	1247-54658	119	0.76	0.47-1.07	-	-	-	-	-	-	-	-	-	-	-
2014	-	-	-	-	-	-	-	-	-	-	-	42	428	153	215-807	40	835	922	50-4100	40	0.71	0.34-1.35	
Kelsey GS Area	2007	60	906	185	605-1475	56	7565	5988	1588-33112	56	0.88	0.54-1.15	-	-	-	-	-	-	-	-	-	-	-
(NR-SPL)	2009	44	886	122	688-1295	44	7093	3074	3175-19958	44	0.98	0.63-1.26	-	-	-	-	-	-	-	-	-	-	-
	2010	1	-	-	955	1	-	-	7711	1	-	0.89	-	-	-	-	-	-	-	-	-	-	-
	2011	46	890	148	292-1403	46	7753	3597	702-24040	46	1.02	0.70-1.46	1	704	-	-	1	3345	-	-	1	0.96	-
	2013	122	911	145	270-1438	121	8035	4056	75-26082	121	0.99	0.38-2.20	-	-	-	-	-	-	-	-	-	-	-
Grass River	2007	9	1191	248	840-1640	9	21747	13902	6804-49895	9	1.14	0.89-1.36	-	-	-	-	-	-	-	-	-	-	-
	2009	3	1310	382	910-1670	2	29257	32395	6350-52163	2	0.74	0.56-0.91	-	-	-	-	-	-	-	-	-	-	-
	2011	4	1353	335	888-1650	4	32432	19811	9979-19811	4	1.19	0.97-1.43	-	-	-	-	-	-	-	-	-	-	-
	2013	2	935	3	932-937	2	7598	340	7257-7938	2	0.93	0.90-0.10	-	-	-	-	-	-	-	-	-	-	-

Table 5.4.3A-5: Mean fork length (standard deviation; range) weight, and condition factor for adult and juvenile Lake Sturgeon captured by location during Keeyask GS environmental studies from 2001 to 2014.

Waterbody	Year	Adult Gill Nets (Spring)											Juvenile Gill Nets (Fall)											
		Fork Length (mm)				Weight (g)				K			Fork Length (mm)				Weight (g)				K			
		n	Mean	SD	Range	n	Mean	SD	Range	n	Mean	Range	n	Mean	SD	Range	n	Mean	SD	Range	n	Mean	Range	
Nelson River (CL-GR)	2001	79	1022	148	739-1355	78	9984	5059	3500-24000	78	0.88	0.64-1.26	-	-	-	-	-	-	-	-	-	-	-	
	2002	67	1055	149	680-1415	66	12198	6367	2722-34020	66	0.97	0.73-1.44	-	-	-	-	-	-	-	-	-	-	-	
	2003	92	1067	148	700-1540	87	11949	6681	3000-54431	87	0.94	0.67-1.49	-	-	-	-	-	-	-	-	-	-	-	
	2004	51	1149	152	870-1468	51	14115	6747	5443-31298	51	0.87	0.67-1.10	-	-	-	-	-	-	-	-	-	-	-	
	2006	150	1003	217	300-1550	146	10343	7071	1134-43091	146	0.86	0.61-1.44	-	-	-	-	-	-	-	-	-	-	-	
	2008	92	1057	223	648-1551	50	12186	8207	2268-40823	50	0.87	0.66-1.09	-	-	-	-	-	-	-	-	-	-	-	-
	2010	65	901	267	443-1390	65	8056	6977	500-29937	65	0.83	0.57-1.11	-	-	-	-	-	-	-	-	-	-	-	-
	2011	34	1090	219	664-1610	34	13209	9052	2268-43092	34	0.89	0.61-1.19	121	433	90	263-835	121	657	647	100-4950	121	0.68	0.42-0.99	
	2012	116	844	284	330-1620	116	7536	8214	200-37648	116	0.85	0.51-1.23	101	488	99	250-842	98	825	544	75-3150	98	0.65	0.45-0.81	
	2014	239	838	229	449-1640	238	6111	5873	650-29710	238	0.82	0.38-1.39	112	533	140	225-946	110	1286	997	50-5750	110	0.72	0.38-1.20	
Stephens Lake	2001	24	1077	181	792-1447	24	13148	9499	4400-40000	24	0.94	0.71-1.56	-	-	-	-	-	-	-	-	-	-	-	
	2002	4	1045	51	1001-1100	4	10888	2995	8050-15000	4	0.94	0.80-1.13	-	-	-	-	-	-	-	-	-	-	-	
	2003	24	1018	206	555-1340	23	11212	7205	1700-26000	23	0.90	0.61-1.20	-	-	-	-	-	-	-	-	-	-	-	
	2004	5	1180	112	1025-1324	4	15347	4577	9450-20412	4	0.97	0.72-1.32	-	-	-	-	-	-	-	-	-	-	-	
	2005	7	922	130	763-1100	7	8701	4989	3636-15455	7	1.00	0.82-1.44	-	-	-	-	-	-	-	-	-	-	-	
	2006	14	1144	162	902-1421	13	13224	6071	5897-24948	13	0.86	0.73-1.03	-	-	-	-	-	-	-	-	-	-	-	-
	2010	17	1028	162	730-1349	16	9993	5272	3200-24040	16	0.83	0.65-0.98	-	-	-	-	-	-	-	-	-	-	-	-
	2011	18	890	255	362-1208	12	9053	3984	1082-16556	12	0.87	0.76-0.99	37	450	109	168-756	36	920	894	375-4125	36	0.81	0.58-1.03	
	2012	15	896	144	645-1176	11	7468	3113	3901-14969	11	0.92	0.74-1.07	87	539	124	250-970	82	1387	1175	75-5525	82	0.74	0.41-0.99	
	2014	9	941	115	810-1150	9	6854	3374	4082-13608	9	0.77	0.66-1.01	47	593	101	373-796	47	1757	932	350-4900	47	0.77	0.62-1.36	

Table 5.4.3A-6: Adult Lake Sturgeon population estimates for the Lower Nelson River and other waterbodies in Manitoba.

Waterbody	Location	Year	Estimate	95% Confidence Limits	
				Lower	Upper
Nelson River	MU6	2005	5,467	3,768	8,018
		2013	8,413	6,498	10,758
Nelson River	MU3 Clark Lake to Gull Rapids	2001	406	330	638
		2002	344	246	665
		2003	550	429	861
		2004	481	316	876
		2006	1275	875	2,078
		2008	643	384	1,178
		2010	764	524	1,005
		2012	707	480	935
		2014	596	466	725
Upper Split Lake Area	MU3 Includes Nelson River Kelsey GS to Split Lake; and the Burntwood River from First Rapids to Split Lake	2001	183	122	576
		2002	228	106	735
		2005	592	245	1,815
		2006	505	325	947
		2007	654	528	975
		2009	585	478	824

Table 5.4.3A-6: Adult Lake Sturgeon population estimates for the Lower Nelson River and other waterbodies in Manitoba.

Waterbody	Location	Year	Estimate	95% Confidence Limits	
				Lower	Upper
Churchill River	Confluence of Churchill and Little Churchill rivers	2003	1,812	1,304	2,320
Fox River	Rainbow Falls to Great Falls	2004	646	312	980
Winnipeg River	Seven Sisters GS to Slave Falls GS	1992-1997	3,000-27,000		
	Slave Falls GS to Pointe Du Bois GS	2007	2,205	921	4,095

Table 5.4.3A-7: Catch-per-unit-effort (CPUE #fish/22.9 m mesh/24 h) for juvenile, sub-adult and adult Lake Sturgeon captured during gillnetting studies in the vicinity of spawning areas in management unit 6 during spring 2004–2010.

Location	Sampling Information					Juvenile LKST (≤ 599 mm)			Sub-Adult LKST (600-799 mm)			Adult LKST (≥ 800 mm)		
	Year	Start Date	End Date	# GN Sites	Total GN Hours	# Juvenile LKST	CPUE ± SD	Range	# Sub-Adult LKST	CPUE ± SD	Range	# Adult LKST	CPUE ± SD	Range
LMST GS Tailrace and LMST Q	2004	11-Jun	23-Jun	7	2286.28	0	-	-	2	0.02 ± 0.09	0.00-0.46	13	0.13 ± 0.29	0.00-1.35
	2006	23-May	20-Jun	11	8582.13	0	-	-	3	0.01 ± 0.06	0.00-0.59	15	0.04 ± 0.12	0.00-0.53
	2010	31-May	14-Jun	18	3958.57	0	-	-	0	-	-	9	0.05 ± 0.20	0.00-1.41
Sundance Shelf to LLR	2004	23-Jun	1-Jul	4	1126.27	0	-	-	0	-	-	1	0.01 ± 0.02	0.00-0.08
	2005	5-Jun	10-Jun	3	417.00	0	-	-	0	-	-	2	0.09 ± 0.18	0.00-0.47
	2006	23-May	20-Jun	5	5276.43	0	-	-	0	-	-	8	0.04 ± 0.18	0.00-1.30
Lower Limestone Rapids	2004	14-Jun	9-Jul	5	3639.12	0	-	-	2	0.01 ± 0.05	0.00-0.30	52	0.72 ± 2.30	0.00-15.88
	2005	4-Jun	7-Jul	8	6875.30	0	-	-	7	0.02 ± 0.10	0.00-0.50	112	0.36 ± 0.65	0.00-3.93
	2006	24-May	20-Jun	9	7784.68	0	-	-	3	0.01 ± 0.07	0.00-0.54	87	0.26 ± 0.64	0.00-5.25
	2007	28-May	07-Jul	20	5544.37	0	-	-	0	-	-	61	0.26 ± 0.52	0.00-4.00
	2008	11-Jun	19-Jun	8	2044.18	0	-	-	2	0.02 ± 0.11	0.00-0.51	7	0.08 ± 0.21	0.00-1.01
	2009	17-Jun	24-Jun	3	679.86	0	-	-	1	0.05 ± 0.16	0.00-0.48	50	1.95 ± 1.74	0.00-4.71
	2010	29-May	4-Jun	8	957.92	0	-	-	0	-	-	9	0.29 ± 0.46	0.00-1.66
Angling River	2005	7-Jun	7-Jul	5	4191.57	6	0.03 ± 0.12	0.00-0.61	11	0.06 ± 0.18	0.00-1.06	69	0.41 ± 0.54	0.00-2.56
	2006	23-May	21-Jun	5	5537.58	11	0.05 ± 0.15	0.00-0.62	55	0.24 ± 0.40	0.00-2.33	182	0.72 ± 0.81	0.00-3.64
	2007	30-May	07-Jul	10	5374.55	12	0.06 ± 0.19	0.00-1.01	19	0.09 ± 0.21	0.00-1.03	105	0.47 ± 1.06	0.00-5.62
	2008	11-Jun	19-Jun	16	1957.56	1	0.01 ± 0.10	0.00-0.64	9	0.11 ± 0.25	0.00-1.01	23	0.29 ± 0.66	0.00-3.19
Weir River	2004	08-Jun	25-Jun	7	752.43	2	0.03 ± 0.18	0.00-1.09	8	0.12 ± 0.39	0.00-1.90	198	6.59 ± 7.72	0.00-48.00
	2005	05-Jun	13-Jun	4	1767.16	0	-	-	14	0.19 ± 0.45	0.00-2.00	140	2.41 ± 3.27	0.00-20.57
	2006	25-May	6-Jun	4	2263.83	1	0.01 ± 0.09	0.00-0.83	12	0.13 ± 0.34	0.00-1.46	296	3.41 ± 4.78	0.00-39.43
	2008	6-Jun	19-Jun	12	3473.23	0	-	-	28	0.19 ± 0.37	0.00-1.82	138	1.06 ± 1.97	0.00-12.59
	2010	27-May	06-Jun	19	428.32	0	-	-	29	1.18 ± 2.19	0.00-6.53	132	6.78 ± 4.79	0.00-18.25
Hayes and Pennycutaway	2008	05-Jun	15-Jun	14	2718.10	2	0.02 ± 0.13	0.00-0.74	4	0.04 ± 0.14	0.00-0.74	5	0.04 ± 0.17	0.00-1.00
Gods River	2011	05-Jun	15-Jun	13	3732.93	1	0.01 ± 0.05	0.00-0.48	19	0.12 ± 0.28	0.00-1.47	39	0.25 ± 0.42	0.00-1.63

Table 5.4.3A-8: Catch-per-unit-effort (CPUE #fish/22.9 m mesh/24 h) of juvenile, sub-adult and adult Lake Sturgeon captured during directed juvenile Lake Sturgeon sampling using mesh sizes ranging from 1 to 5 inch in several reaches of management unit 6 from 2007 to 2010.

Location	Year	Start Date	End Date	# GN Sites	Total GN Hours (dec. hours)	Juvenile LKST (≤ 599 mm)			Sub-Adult LKST (600-799 mm)			Adult LKST (≥ 800 mm)		
						# Juvenile LKST	CPUE ± SD	Range	# Sub-Adult LKST	CPUE ± SD	Range	# Adult LKST	CPUE ± SD	Range
Limestone GS to LLR	2007	4-Jul	7-Jul	6	420.70	0	-	-	0	-	-	1	0.05 ± 0.15	0.00-0.45
LLR to Conawapa	2007	10-Jul	12-Jul	8	369.50	0	-	-	0	-	-	0	-	-
Conawapa to Angling R.	2007	12-Jul	16-Jul	15	721.50	15	0.54 ± 0.62	0.00-1.59	11	0.38 ± 0.51	0.00-1.59	0	-	-
	2008	30-Sep	6-Oct	3	196.00	0	-	-	0	-	-	0	-	-
	2010	26-Sep	28-Sep	6	606.33	0	-	-	0	-	-	0	-	-
Angling R. to Jackfish Island	2007	15-Jul	23-Jul	11	506.67	15	0.68 ± 0.92	0.00-2.99	12	0.53 ± 0.63	0.00-1.88	1	0.05 ± 0.17	0.00-0.55
	2008	29-Sep	6-Oct	14	3267.05	81	0.60 ± 0.92	0.00-4.64	47	0.35 ± 0.54	0.00-1.93	9	0.07 ± 0.15	0.00-0.66
	2010	20-Sep	29-Sep	20	2108.20	31	0.37 ± 0.87	0.00-3.85	25	0.30 ± 0.55	0.00-1.92	3	0.03 ± 0.08	0.00-0.26
Jackfish Island to Deer Island	2007	21-Jul	26-Jul	6	255.90	1	0.11 ± 0.26	0.00-0.65	3	0.31 ± 0.53	0.00-1.30	0	-	-
	2009	24-Sep	25-Sep	4	156.30	0	-	-	0	-	-	0	-	-
Deer Island to Estuary	2007	25-Jul	27-Jul	9	374.37	0	-	-	2	0.12 ± 0.23	0.00-0.53	0	-	-
	2009	21-Sep	24-Sep	12	504.70	0	-	-	0	-	-	0	-	-
Estuary	2007	5-Jul	27-Aug	35	2511.30	9	0.08 ± 0.23	0.00-0.92	2	0.02 ± 0.09	0.00-0.61	0	-	-

Table 5.4.3A-9: Tagging and recapture locations of Lake Sturgeon marked with tags during gillnetting studies conducted in the Conawapa study area, 1986-2012.

Tagging Area	Zone tagged	Number Tagged	Long-4	Lime-4	LR-1	1	2	3	AL-1	AR-1	4	5	WR-1	6	7	Total Number Recaptured	Recapture Rate (%)	Comments
Number Recaptured/Zone																		
Long Spruce Forebay	Long-4	10	-	1	-	-	-	-	-	-	-	-	-	-	-	1	10.0	
Limestone Forebay	Lime-4	44	-	5	-	1	-	-	-	-	-	-	-	-	-	6	13.6	
Limestone River	LR-1	0	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0.0	
Limestone GS to Lower Limestone Rapids	1	92	-	-	-	20	8	-	-	5	-	-	4	1	-	38	41.3	5 domestic harvest ¹
Lower Limestone Rapids to Conawapa	2	255	-	-	-	1	46	5	-	42	17	-	21	11	1	144	56.5	1 domestic harvest ¹
Conawapa to Sturgeon Island	3	125	-	-	-	-	6	4	-	17	7	-	6	4	-	44	35.2	1 domestic harvest ¹
Angling Lake	AL-1	7	-	-	-	-	-	-	-	2	1	-	-	-	-	3	42.9	
Angling River	AR-1	472	-	-	-	3	35	21	-	79	40	-	23	10	1	212	44.9	6 domestic harvest ¹
Sturgeon Island to Weir Island	4	432	-	-	-	-	17	4	-	27	31	-	47	1	2	129	29.9	7 domestic harvest ¹
Weir Island to Deer Island	5	6	-	-	-	-	1	-	-	-	-	-	-	-	-	1	16.7	
Weir River	WR-1	1320	-	-	-	4	47	7	3	45	81	-	712	52	3	954	72.3	19 domestic harvest ¹ , 9 radio-tags with 1 recap included
Deer Island to Nelson River mouth	6	216	-	-	-	2	5	1	-	13	27	-	30	35	-	113	52.3	3 domestic harvest ¹
Hayes River	7	106	-	-	-	-	-	-	-	-	-	-	-	1	10	11	10.4	
Overall Total		3085	0	6	0	31	165	42	3	230	204	0	843	115	17	1656	53.7	

1. Domestic harvest with no locations were excluded from the recapture total.

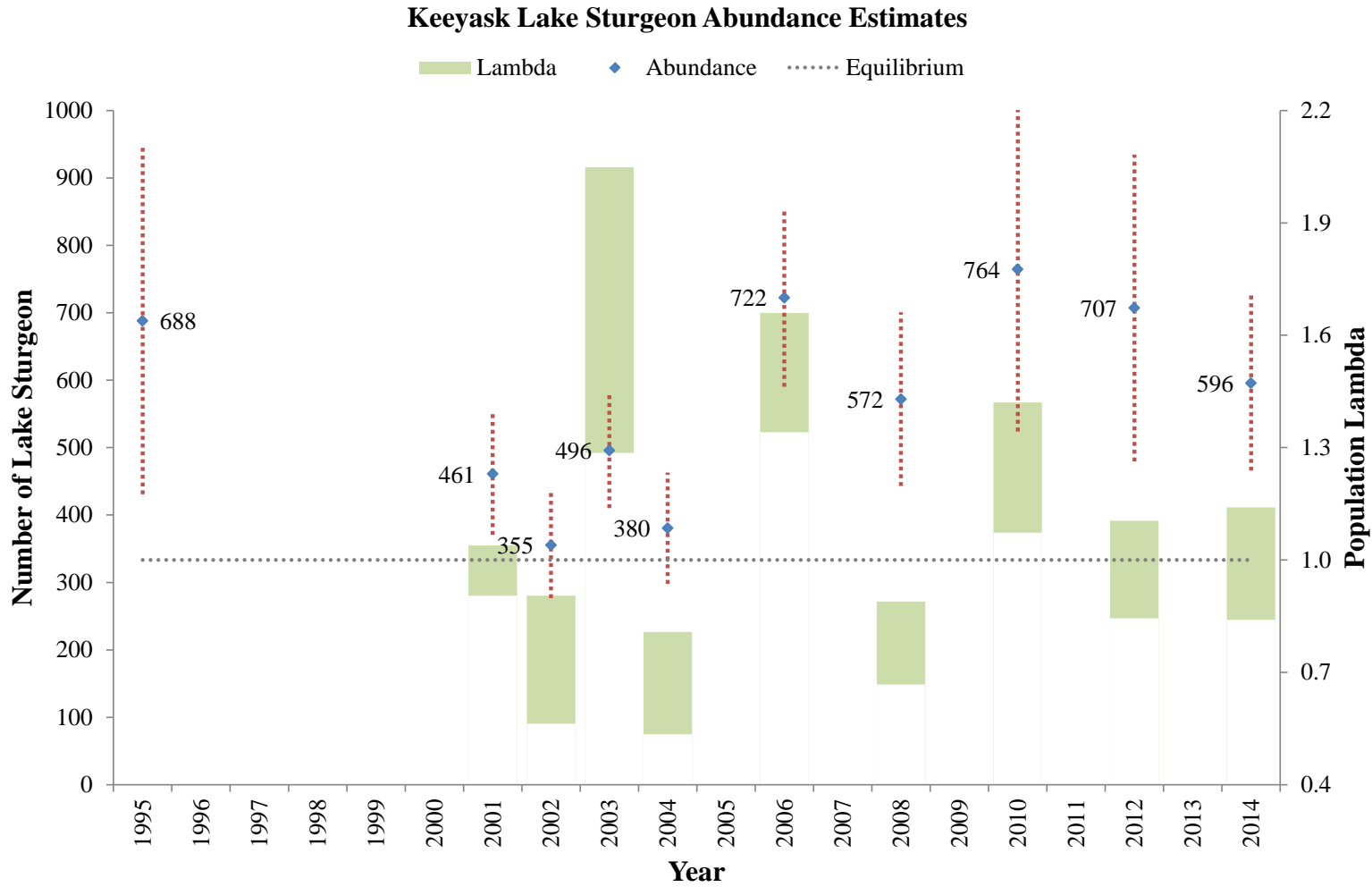


Figure 5.4.3A-1: Adult Lake Sturgeon abundance estimates between 1995 and 2014 for the Keeyask area showing the estimate (blue dot and text) and the upper and lower 95% confidence intervals (dotted lines). The 95% confidence intervals surrounding the population lambda (growth rate) are presented relative to 1 (equilibrium, dotted horizontal line) as green boxes.

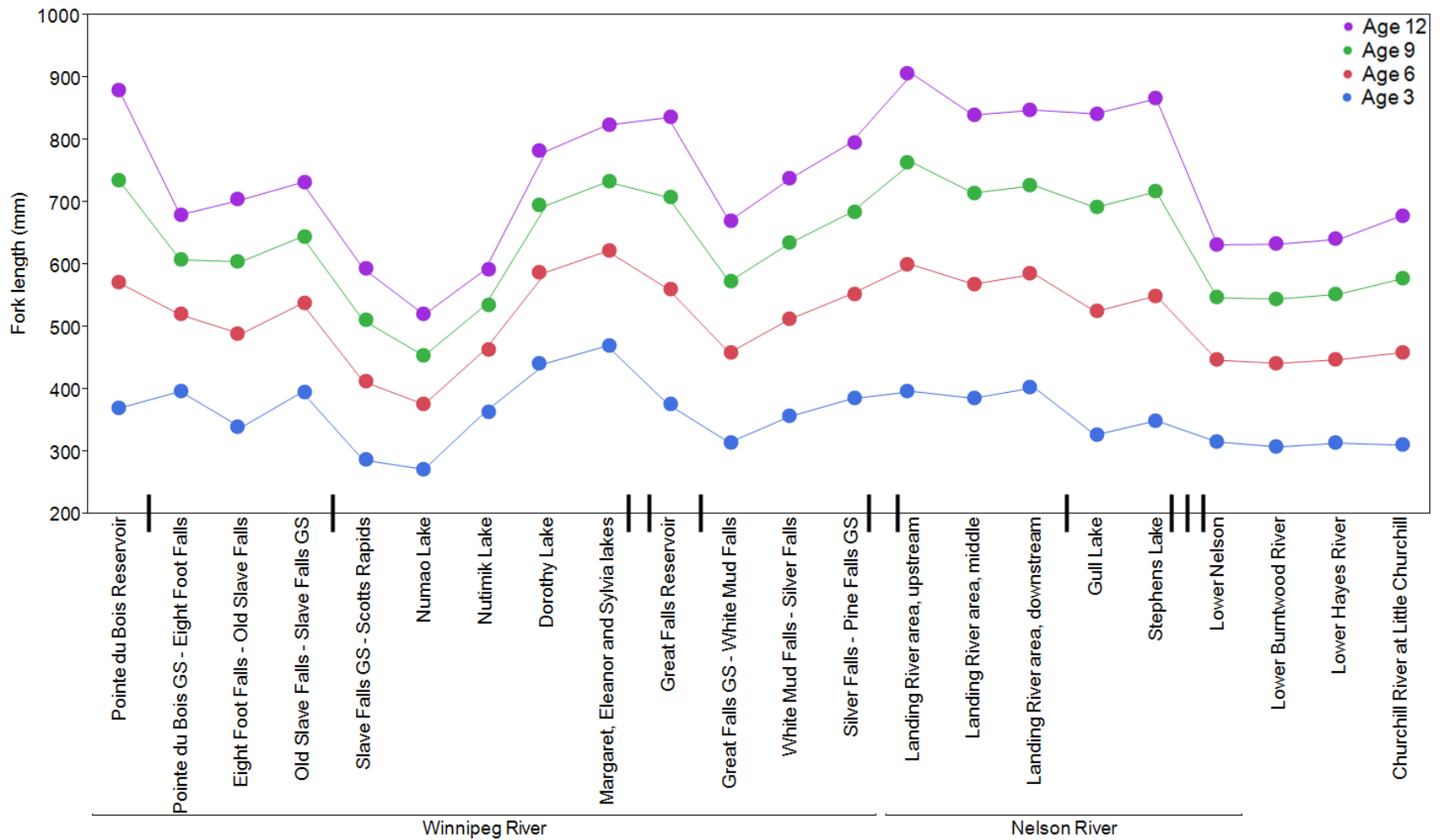


Figure 5.4.3A-2: Fork length (mm) at-age 3, 6, 9, and 12 calculated based on aging structures collected from 23 different Lake Sturgeon populations in Manitoba. Note: Black bars represent generating stations.

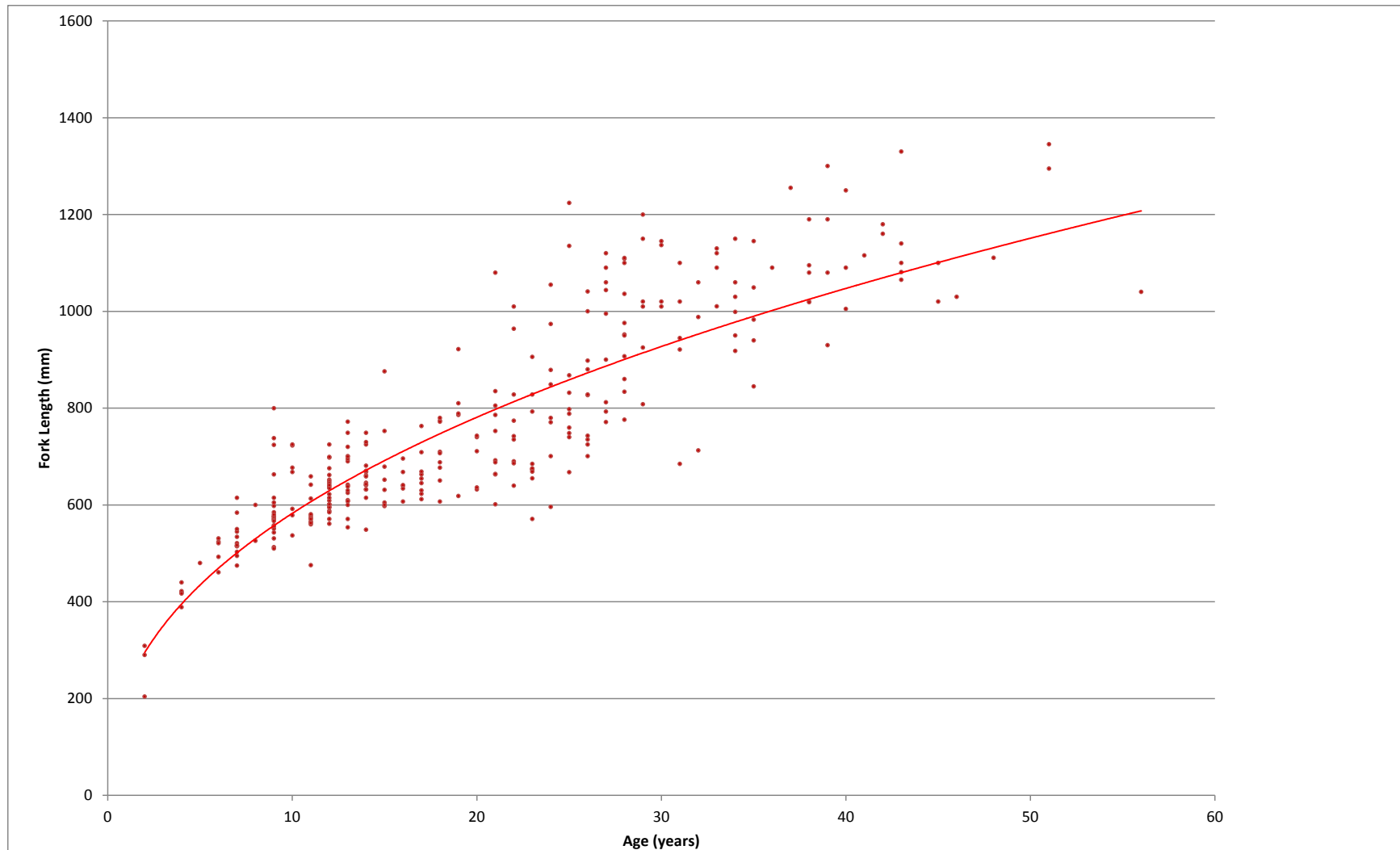


Figure 5.4.3A-3: Length-at-age relationship for Lake Sturgeon captured in management unit 6 between 1986 and 2012.

APPENDIX 5.4.4A: AREA 3 LAKE STURGEON

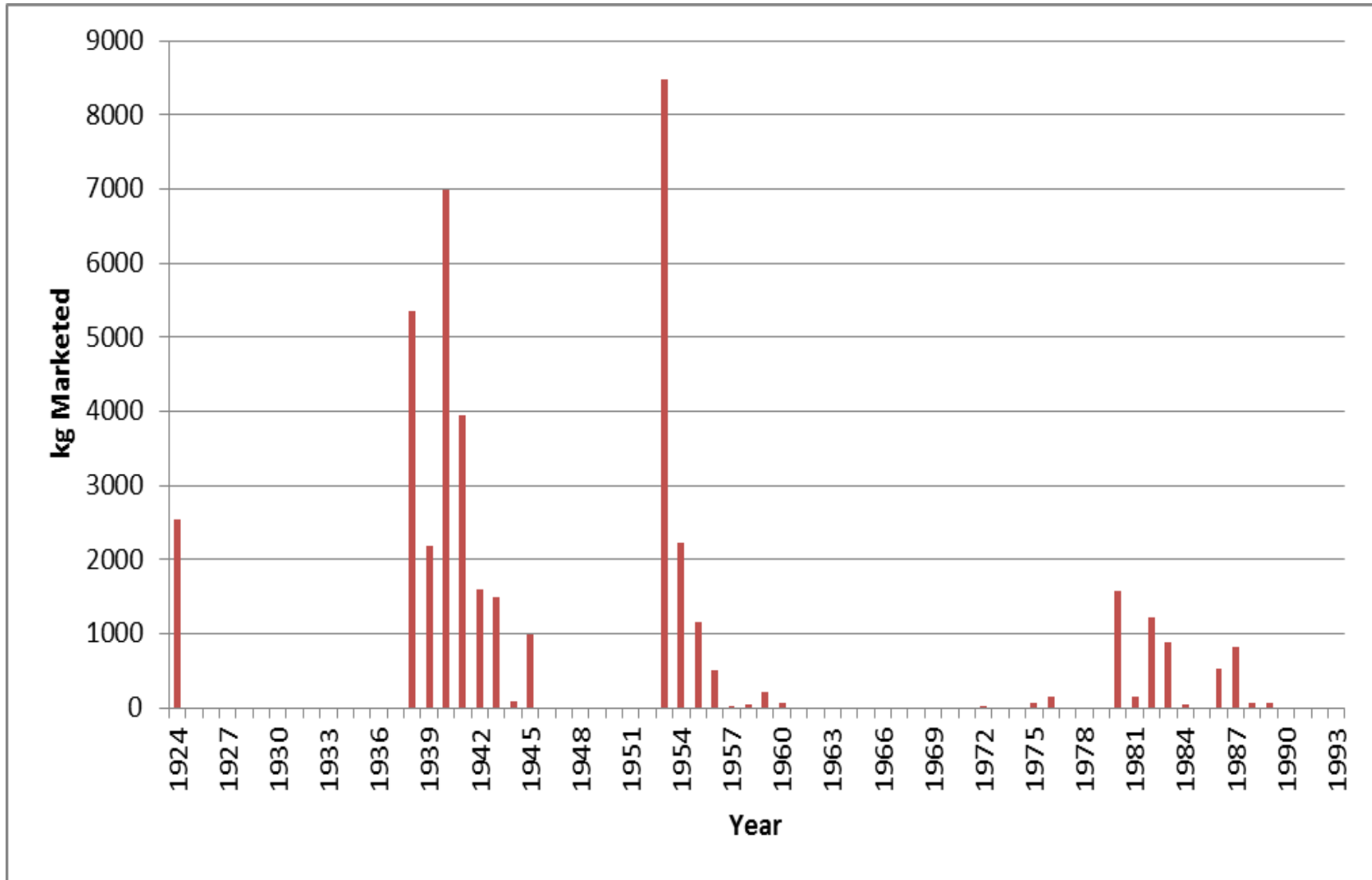


Figure 5.4.4A-1: Lake Sturgeon Harvest (kg) from the Churchill River from 1925 to 1992. Source Stewart 2009

APPENDIX 5.5.1A: EFFECTS OF MERCURY ON FISH HEALTH

There is increasing evidence that fish health may be affected by mercury concentrations at levels that are frequently measured in wild populations. Sub-lethal and reproductive effects of methylmercury (MeHg) exposure have been documented for multiple freshwater fish species.

Based on laboratory studies involving 12 fish species ranging from 25 to 600 day exposures to MeHg in the diet, Depew *et al.* (2012) concluded that adverse effects at biochemical, histological, genomic, and behavioural endpoints occur at ecologically relevant levels. In general, endpoints related to mortality (proposed threshold value of 2.8 ppm) and growth (1.44 ppm) were least sensitive, followed by behavioural endpoints (0.61 ppm), and then by biochemical/histological endpoints (0.06 ppm) and reproductive endpoints (0.04 ppm). However, for all endpoint categories, substantial interspecific disparity in responses existed due to differences in, for example, life history stage (adult, juvenile), species-specific physiology, experimental design or form of the administered MeHg, and dietary selenium content. Furthermore, because of a general paucity of available studies, the authors determined threshold concentrations primarily based on no observed adverse effects levels instead of the more certain lowest observed adverse effects levels. The authors recognized the considerable uncertainty with the proposed thresholds and considered their contribution as an attempt to promote the need for better toxicological studies on the effects of dietary MeHg exposure in fish (N. Burgess *pers. comm.* 2015).

Using an alternative and complementary approach to evaluate the health risk of mercury exposure to fish, Sandheinrich and Wiener (2011) summarized toxicological effects of MeHg based on fish tissue concentrations. These authors reported that impairment of biochemical processes, damage to cells and tissues, and reduced reproduction have been observed at MeHg concentrations of about 0.3–0.7 ppm mercury in the whole body and about 0.5–1.2 ppm mercury in axial muscle. Although generally higher than the thresholds based on dietary exposure developed by Depew *et al.* (2012), such concentrations are commonly observed in piscivorous fish throughout North America. Many adult fish inhabiting natural freshwaters in the midwestern and eastern United States and the eastern half of Canada exceed muscle concentrations of 1.0 ppm wet weight (Kamman *et al.* 2005; Schetagne and Verdon 1999b). Moreover, mean muscle mercury concentrations of adult Walleye (*Sander vitreus*), Northern Pike (*Esox lucius*), Lake Trout (*Salvelinus namaycush*) and Burbot (*Lota lota*) are known to exceed 2.0 ppm in newly created reservoirs in Québec and Manitoba (Therrien and Schetagne 2008, 2009; Bodaly *et al.* 2007), and may reach 4.0 ppm in pike (Schetagne and Verdon 1999a).

Despite this potential for compromised fish health (including reproductive impairment) due to elevated body mercury concentrations, clear evidence for associated population level effects on wild fish is lacking. For example, pike and Walleye populations have not been substantially reduced (based on catch-per-unit-effort data) in any of the well-studied lakes/reservoirs in northern Manitoba (Manitoba Hydro and Nisichawayasihk Cree Nation 2003; KHLP 2012) or reservoirs on the La Grande Rivière in Québec (Schetagne *et al.* 2003; R. Schetagne *pers. comm.* 2011) during and after the period of highly elevated mercury concentrations. These findings do not indicate an absence of mercury effects on fish populations, but if such effects exist, they have not been severe enough to be detected by the sampling and analytical methods applied in these studies. Mercury effects may also be confounded by varying concentrations of other dietary components such as selenium, which is known to reduce mercury toxicity (Ralston *et al.* 2014) or by the multitude of ecological variables that structure fish populations, such as the abundance of prey and predators, parasite loads, fishing pressure, and habitat alterations. Most of these ecological variables are also affected by the physical, chemical, and biological changes in the course of reservoir creation and succession.

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APPENDIX 5.5.4A: MERCURY IN NORTHERN PIKE IN AREA 3 LAKES

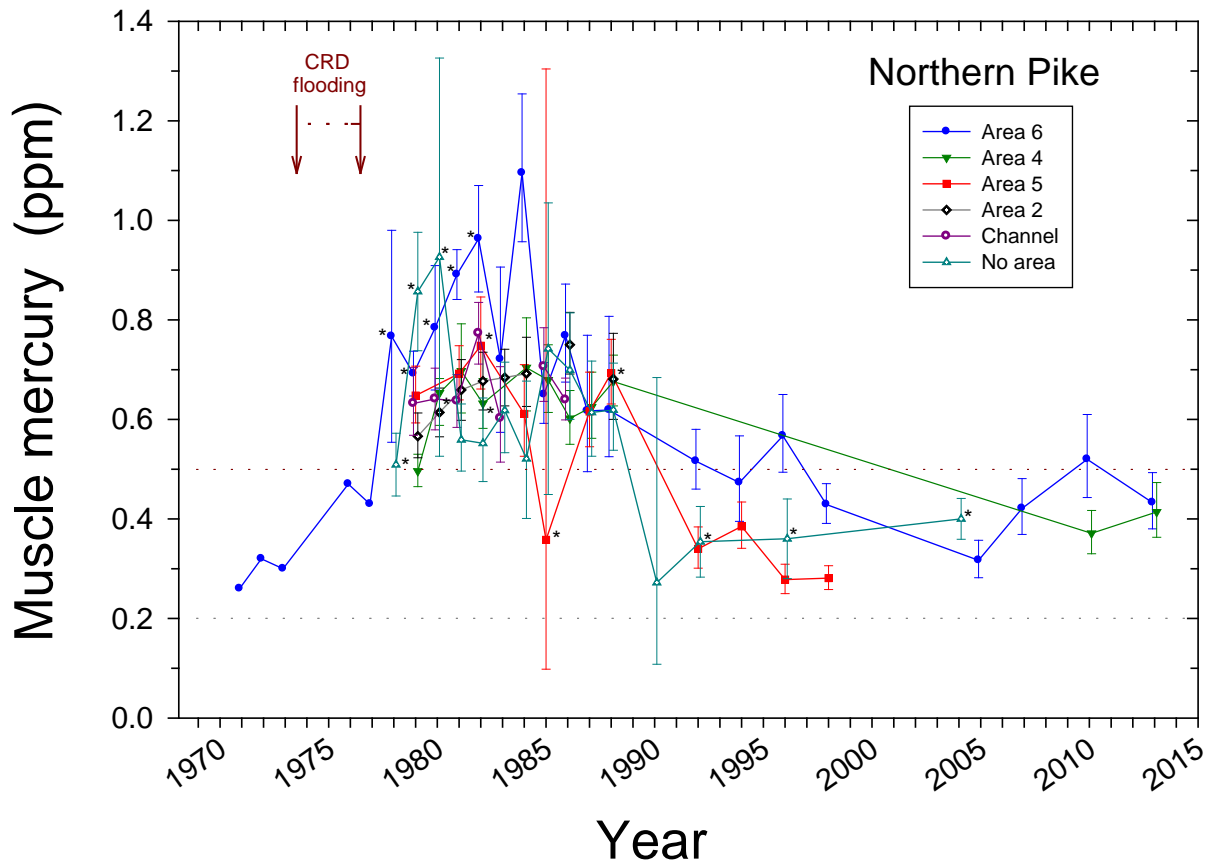
APPENDIX 5.5.4B: MERCURY CONCENTRATIONS IN FISH FROM SIL

Appendix Figures

Page

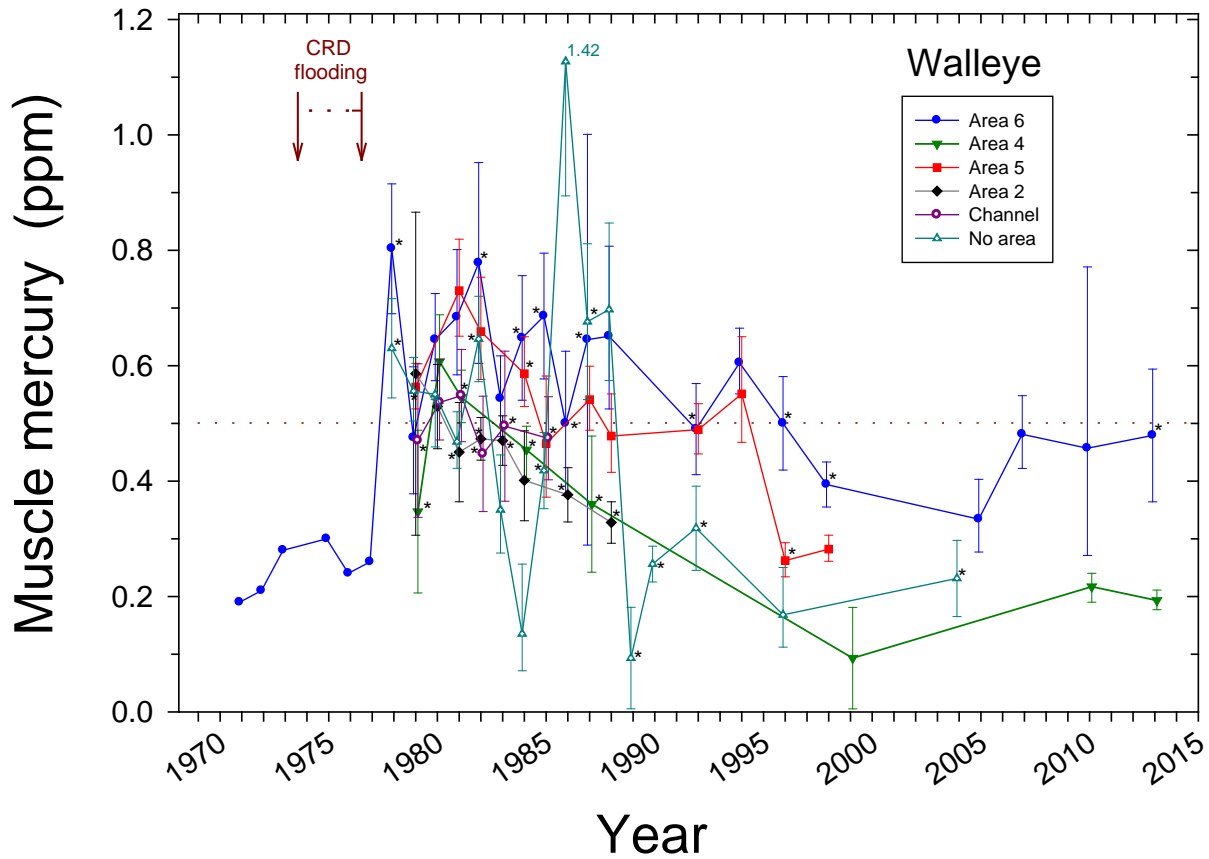
Figures

Figure 5.5.4B-1:	Mean (95% confidence limits, CL) length standardized muscle mercury concentrations of Northern Pike from different areas of Southern Indian Lake for 1971–2013.....	5.5.4B-1
Figure 5.5.4B-2:	Mean (95% confidence limits, CL) length standardized muscle mercury concentrations of Walleye from different areas of Southern Indian Lake for 1971–2013.....	5.5.4B-2
Figure 5.5.4B-3:	Mean (95% confidence limits, CL) length standardized muscle mercury concentrations of Lake Whitefish from different areas of Southern Indian Lake for 1969-2013	5.5.4B-3
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Figure 5.5.4B-5:	Mean (95% confidence limits, CL) length standardized muscle mercury concentrations of Longnose Sucker from different areas of Southern Indian Lake and Threepoint Lake for 1982–1998	5.5.4B-5



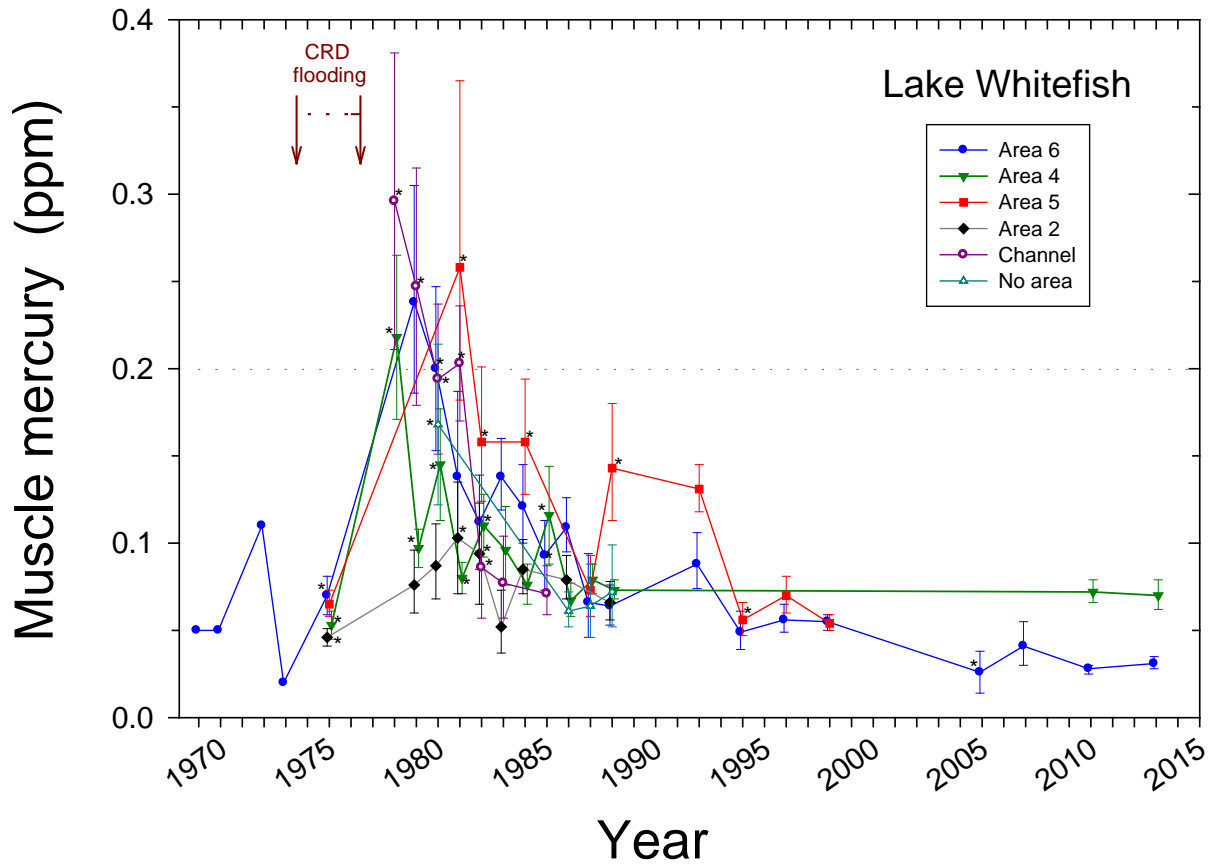
Means without CL prior to 1980 are from commercial samples. An asterisk indicates that the relationship between fish length and mercury concentration was not significant and the arithmetic mean was used. The stippled line indicates the 0.5 ppm Health Canada standard for retail fish. Channel refers to the narrow section of the lake between Areas 2 and 6. No area indicates that no specific sampling location was available.

Figure 5.5.4B-1: Mean (95% confidence limits, CL) length standardized muscle mercury concentrations of Northern Pike from different areas of Southern Indian Lake for 1971–2013



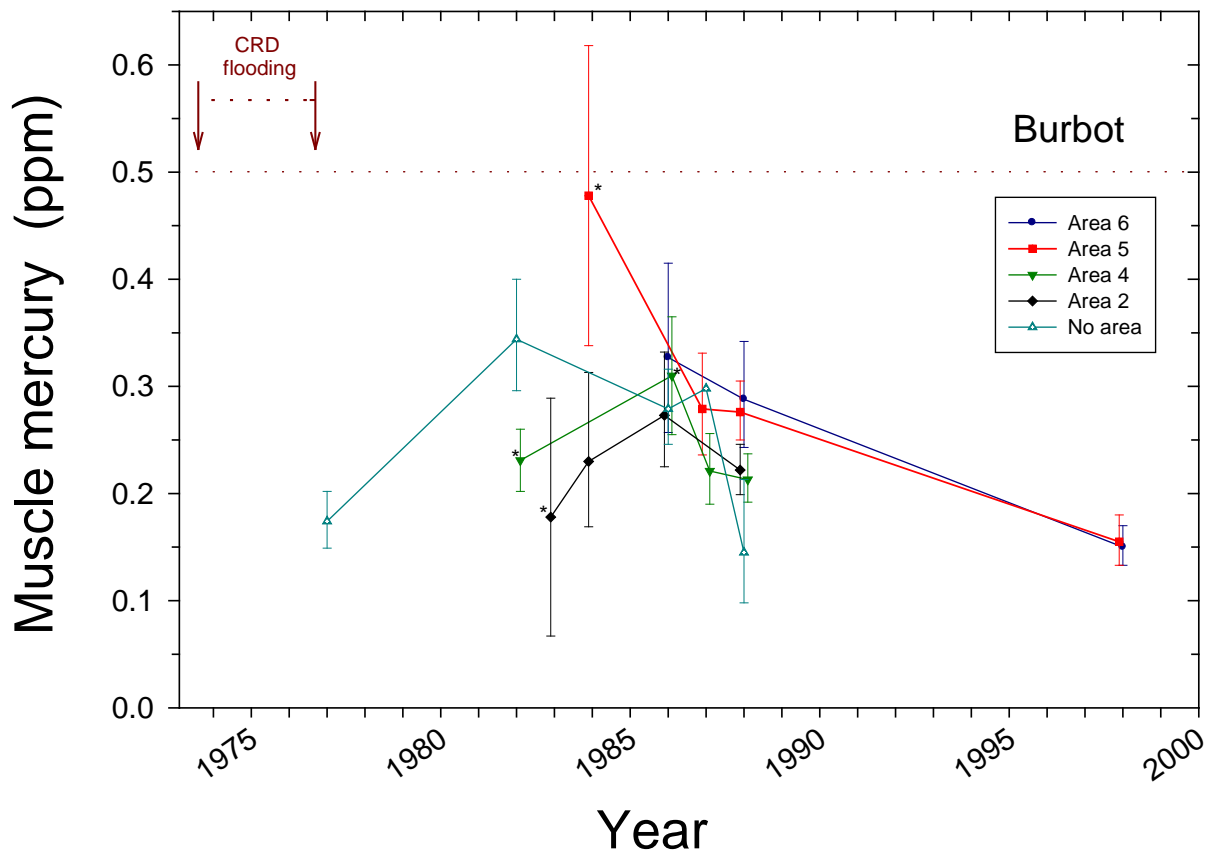
Means without CL prior to 1980 are from commercial samples. An asterisk indicates that the relationship between fish length and mercury concentration was not significant and the arithmetic mean was used. A number denotes a CL not shown as a bar. The stippled line indicates the 0.5 ppm Health Canada standard for retail fish. Channel refers to the narrow section of the lake between areas 2 and 6. No area indicates that no specific sampling location was available.

Figure 5.5.4B-2: Mean (95% confidence limits, CL) length standardized muscle mercury concentrations of Walleye from different areas of Southern Indian Lake for 1971–2013



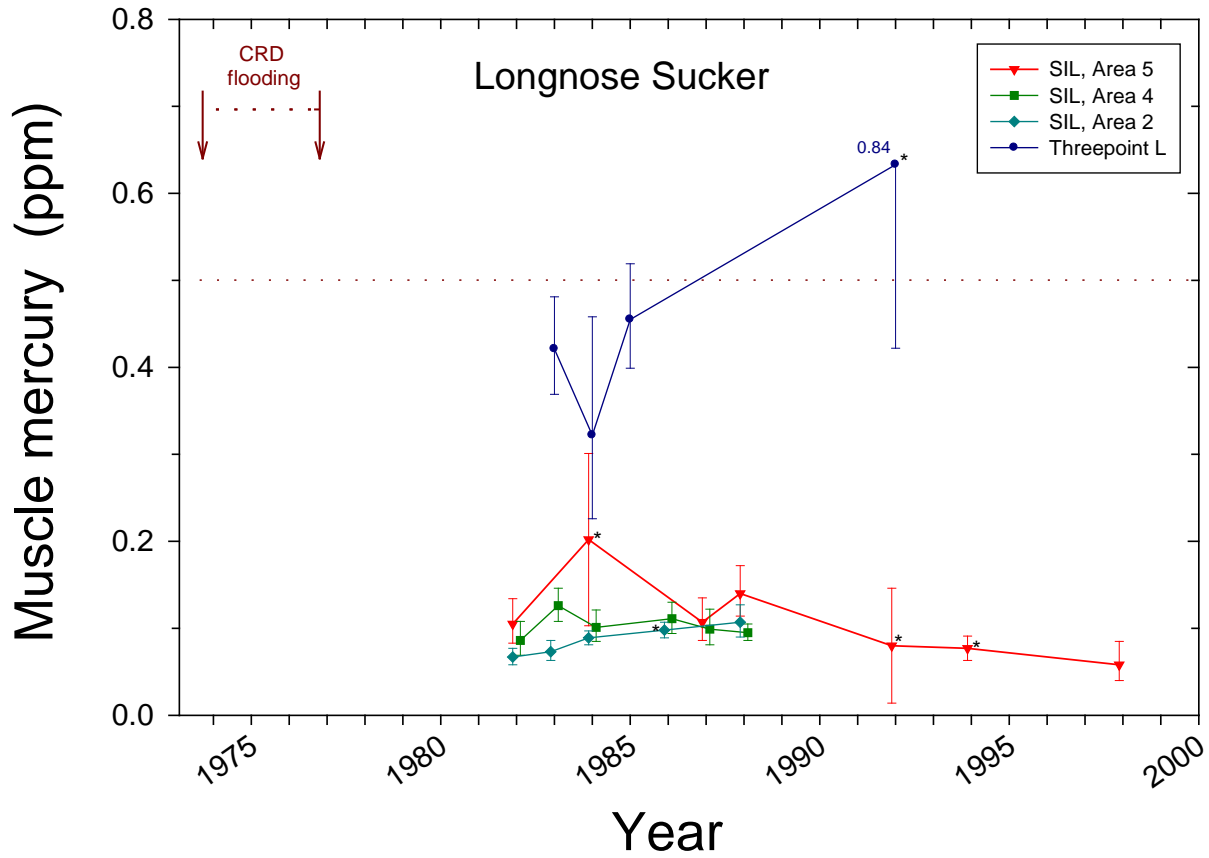
Means without CL prior to 1980 are from commercial samples. An asterisk indicates that the relationship between fish length and mercury concentration was not significant and the arithmetic mean was used. The stippled line indicates the 0.2 ppm subsistence guideline for human consumption. Channel refers to the narrow section of the lake between areas 2 and 6. No area indicates that no specific sampling location was available.

Figure 5.5.4B-3: Mean (95% confidence limits, CL) length standardized muscle mercury concentrations of Lake Whitefish from different areas of Southern Indian Lake for 1969-2013



An asterisk indicates that the relationship between fish length and mercury concentration was not significant and the arithmetic mean was used. Stippled lines indicate the 0.5 ppm Health Canada standard for retail fish and the 0.2 ppm subsistence guideline for human consumption. Channel refers to the narrow section of the lake between areas 2 and 6. No area indicates that no specific sampling location was available.

Figure 5.5.4B-4: Mean (95% confidence limits, CL) length standardized muscle mercury concentrations of Burbot from different areas of Southern Indian Lake for 1977–1998



An asterisk indicates that the relationship between fish length and mercury concentration was not significant and the arithmetic mean was used. A number denotes a CL not shown as a bar. Stippled lines indicate the 0.5 ppm Health Canada standard for retail fish.

Figure 5.5.4B-5: Mean (95% confidence limits, CL) length standardized muscle mercury concentrations of Longnose Sucker from different areas of Southern Indian Lake and Threepoint Lake for 1982–1998

APPENDIX 5.5.4C: PRE-CRD AND POST-CRD FLOODED AREAS

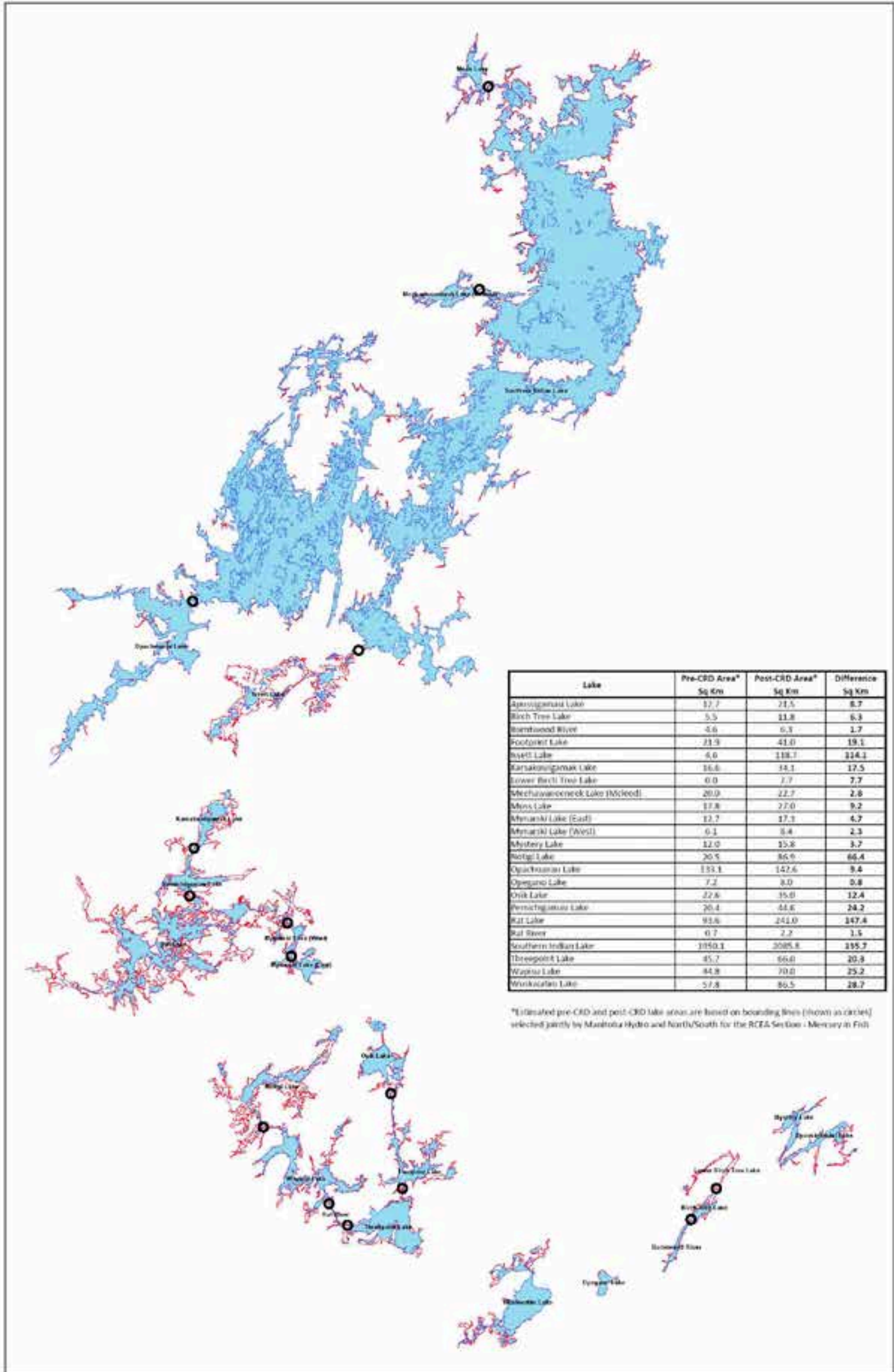


Figure 5.5.4C: Map Showing Flooded Areas (Red Lines) and Lake boundary Lines. For Illustrative Purposes Only.