



Trapping Activities and Population Estimates of Adult Sea Lamprey in Tributaries of Lake Superior During 2012

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ABSTRACT

The Great Lakes Section of the Great Lakes Indian Fish and Wildlife Commission (GLIFWC) has conducted a cooperative sea lamprey (*Petromyzon marinus*) trapping project with the U.S. Fish and Wildlife Service Sea Lamprey Control Station in Marquette, Michigan (USFWS-SLC) since 1986. The purpose of the project is to gather information on adult spawning-phase sea lamprey ascending various tributaries to Lake Superior. Results of the 2012 trapping season are reported.

The seven rivers sampled in 2012 were the Amnicon, Middle, Poplar, and Bad rivers in Wisconsin, and the Silver, Firesteel, and Misery rivers in Michigan. Except for the Poplar, these six rivers have been trapped annually since 1988. In 2012 a total of 1,383 sea lampreys were captured in these six tributaries which was below the twenty-four year average (1988-2011) of 2,656 (range: 566-10,908). The majority of lamprey captured came from three rivers: the Bad (741), the Middle (363), and the Amnicon (208).

Modified Schaefer estimates of adult spawner abundance were calculated for 4 of the 7 tributaries in 2012. Spawner abundance estimates were 17,080 in the Bad, 1,683 in the Middle, 156 in the Amnicon, and 23 in the Firesteel river.

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INTRODUCTION

The Great Lakes Section of the Great Lakes Indian Fish and Wildlife Commission (GLIFWC) has conducted a cooperative sea lamprey (*Petromyzon marinus*) trapping project with the U.S. Fish and Wildlife Service Sea Lamprey Control Station (USFWS-SLC) in Marquette, Michigan since 1986. Results of this work have been reported in GLIFWC administrative reports (e.g. Mattes 2009, Mattes 2008). The purpose of the project is to gather information on and estimate the population size of adult spawning-phase sea lamprey ascending various tributary streams of Lake Superior during their May-June spawning run. Objectives of the project are: (1) to monitor the upstream spawning movements of sea lamprey, (2) to collect data on the biological characteristics of spawning sea lamprey, (3) to estimate the number of lamprey spawning in each tributary, and (4) to reduce the spawning potential of sea lamprey by removing a portion of the run.

Information collected by GLIFWC supplements that collected by USFWS-SLC and other agencies, and is included in a lake wide management plan to control and reduce the lamprey population. Results of the mark-recapture study are used in a Discharge Regression model developed by USFWS-SLC to estimate total number of spawning-phase lamprey in United States waters of Lake Superior, and to evaluate the effectiveness of regional lamprey control efforts (Mullet et al. 2003). This report presents results of the 2012 trapping season.

Tributaries selected for trapping by GLIFWC were known to contain spawning runs of adult sea lamprey and represent a range of stream sizes based on in-stream flows. Several of these tributaries contained natural or man-made barriers. The number of tributaries trapped by GLIFWC has varied from 5 rivers in 1986 and 1987 to 13 rivers in 1990 and 1991. Due to sampling difficulties and low catch in several streams, the number of rivers trapped was reduced to eight in 1992. These eight rivers were among those sampled annually between 1988 and 1996. In 1997, the Traverse river was dropped from the sampling schedule due to low catch rates since 1993. The Falls river was added in 1997 because of its comparability to the Traverse river in mean annual discharge and to determine if lamprey catches would be sufficient to calculate a mark-recapture population estimate. In 1998, the Falls and Huron rivers were dropped from the sampling schedule while the West Branch of the Ontonagon was added. These changes were made in response to a report by an independent review panel released in August 1997 which recommended sampling fewer mid-size streams and more small and large streams. In 2001, the West Branch of the Ontonagon river was dropped from sampling due to low catches. Since 2001, six streams have been trapped annually: the Amnicon, Middle, and Bad rivers in Wisconsin and the Firesteel, Misery, and Silver rivers in Michigan. In 2007, trapping resumed in the Poplar river, after being dropped from sampling in 2005 following two years of low catches (2003 and 2004).

METHODS

Capture Gear and Sites

Four tributaries in Wisconsin and three tributaries in the Upper Peninsula of Michigan were trapped from late March through early July (Figure 1). The Middle and Misery rivers possess man-made barriers that were specially built to prevent the upward movement of sea lamprey. The Amnicon and Silver rivers possess natural barriers which prevent sea lamprey from moving through the entire system. The Bad, Poplar, and Firesteel rivers possess no impassable barriers.

Portable assessment traps (PAT's) and fyke nets were used to capture lamprey (Table 1). PAT's were the preferred gear and were used in three tributaries with a suitable barrier. PAT's were set below and against the man-made barriers on the Middle and Misery rivers. From 2000-2012 four PAT's were set in the Middle river with catch of male lamprey through 2011 used for the sterile male release program. Previously, two PAT's had been set in the Middle river. Two PAT's were set in the Misery river. Three PAT's were set in the Bad river directly below and against a natural rock shelf which transects the river. In the remaining four tributaries (Amnicon, Poplar, Firesteel, and Silver rivers) without a suitable barrier for PAT's to be used, one fyke net was set in the lower portion of each river.

Data Collection

Traps or fyke nets were emptied at least three times per week (i.e., Monday, Wednesday, and Friday) in the Firesteel and Silver rivers, and five days per week in the Bad, Misery, Middle, Amnicon, and Poplar rivers. A sub-sample of live lamprey were transported downstream (Table 1) and marked by clipping one or both dorsal fins, then released back into the river. The fins were clipped with a v-notch tool and a different combination of clips was used to identify the week of capture and release (Table 2). Lamprey not marked and released were destroyed. Water and air temperature were recorded at the time traps or nets were emptied (Table 3).

The number of live and dead marked and unmarked lamprey captured each sampling day was counted, along with the number of fish species, fish genera, and other taxa in the traps or nets. Each sampling day all dead and recaptured lampreys, as well as, a sub-sample of ten female and ten male lampreys from the Bad river were measured to the nearest millimeter, weighed to the nearest gram, and sex determined. The fin clip combination on recaptured lamprey was also recorded.

Population Estimates

Mark-recapture population estimates were attempted based on the marking procedure described above. When sample size was sufficient population estimates were calculated using the modified Schaefer method (Ricker 1975). When the number of recaptures was deemed too low, no such estimate was calculated. Population estimates of adult spawning lamprey in these and other streams were made and combined to estimate the population in all waters of Lake Superior for determining the effectiveness of efforts to control lamprey and the number of lean lake trout killed by lamprey (Heinrich et al. 2003).

RESULTS AND DISCUSSION

Trap Catches

A total of 1,383 sea lampreys were captured in the six tributaries which have been trapped annually since 1988, below the twenty-four year average (1988-2011) of 2,656 (range: 566-10,908) (Table 4). The majority of lamprey captured came from three rivers: the Bad (741), Middle (363), and Amnicon (208).

Other than sea lamprey, 17 fish species, 8 fish taxa, and 4 other taxa were captured during 2012 (Table 5). White sucker (*Catostomus commersoni*) and longnose sucker (*C. catostomus*) were captured most often (N=2,076 and N=1,423, respectively) followed by sucker species (N=440). Next in abundance were crayfish (N=107), captured primarily from the Middle river, rainbow trout (*Oncorhynchus mykiss*, N=100), captured primarily from the Misery river, and rock bass (*Ambloplites rupestris*, N=98), captured mainly in the Silver and Firesteel rivers.

Biological Characteristics

The mean length of male lamprey was 438 mm, while the mean length of female lamprey was 430 mm (Table 6). These lengths were within the range of lengths observed during the twenty-six year period from 1986 to 2011 (Figure 2).

The mean weight of male lamprey was 190 grams, while the mean weight of female lamprey was 178 grams (Table 6). These weights were within the range of weights observed during the previous twenty-six years (Figure 3). Mean weight of male and female lamprey has been similar within a year but has varied considerably between years.

Population Estimates

Modified-Schaefer estimates of adult spawner abundance were calculated for 4 of the 7 tributaries in 2012 (Table 7). Spawner abundance estimates were 17,080 in the Bad, 1,683 in the Middle, 156 in the Amnicon and 23 in the Firesteel river. Low sample size led to no population estimate for the other three rivers. For the Bad river, the population estimate (17,080) was the second highest recorded during the 27 year period 1986-2012 (Table 8).

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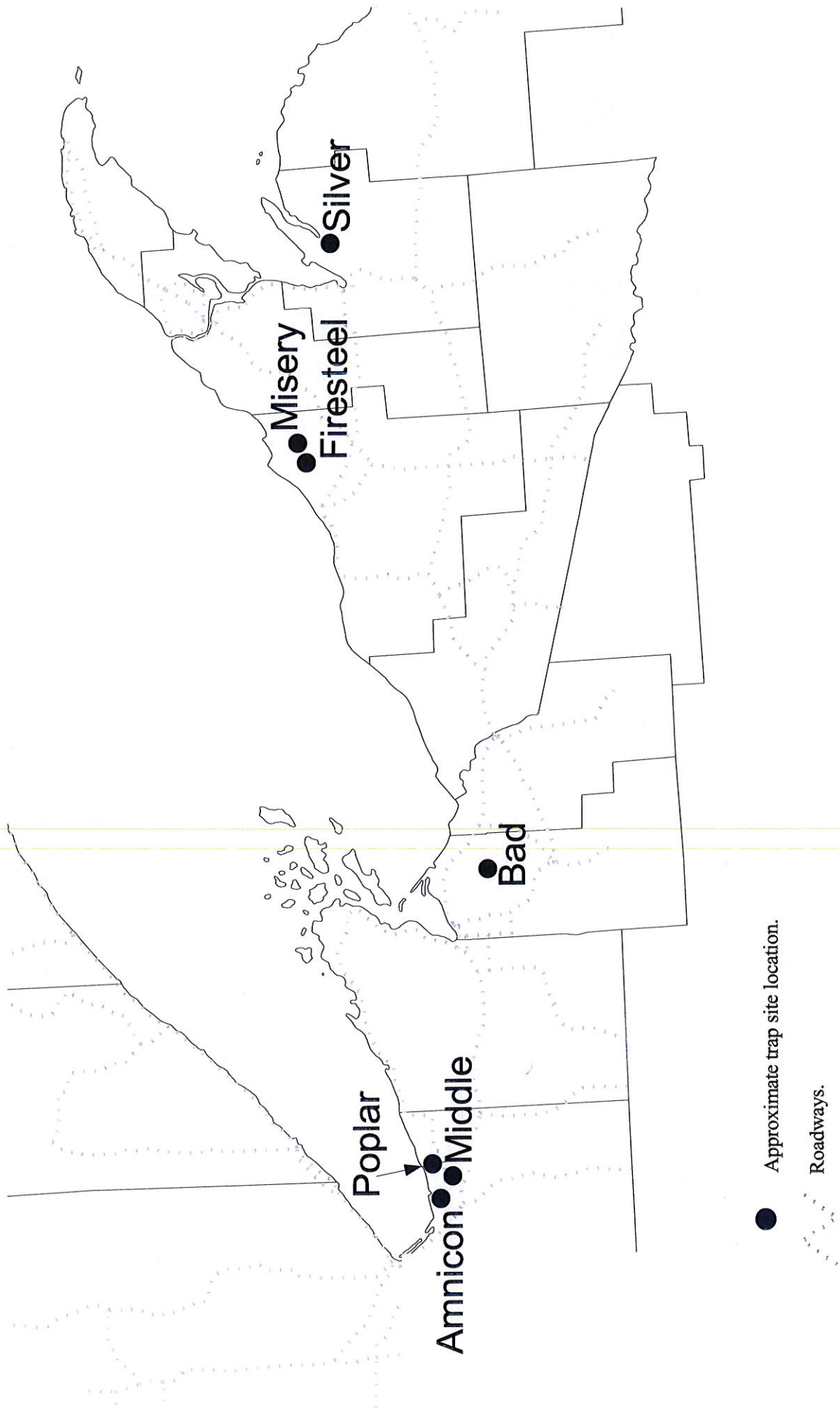


Figure 1. Location of tributaries in which spawning-phase lamprey were trapped in 2012.

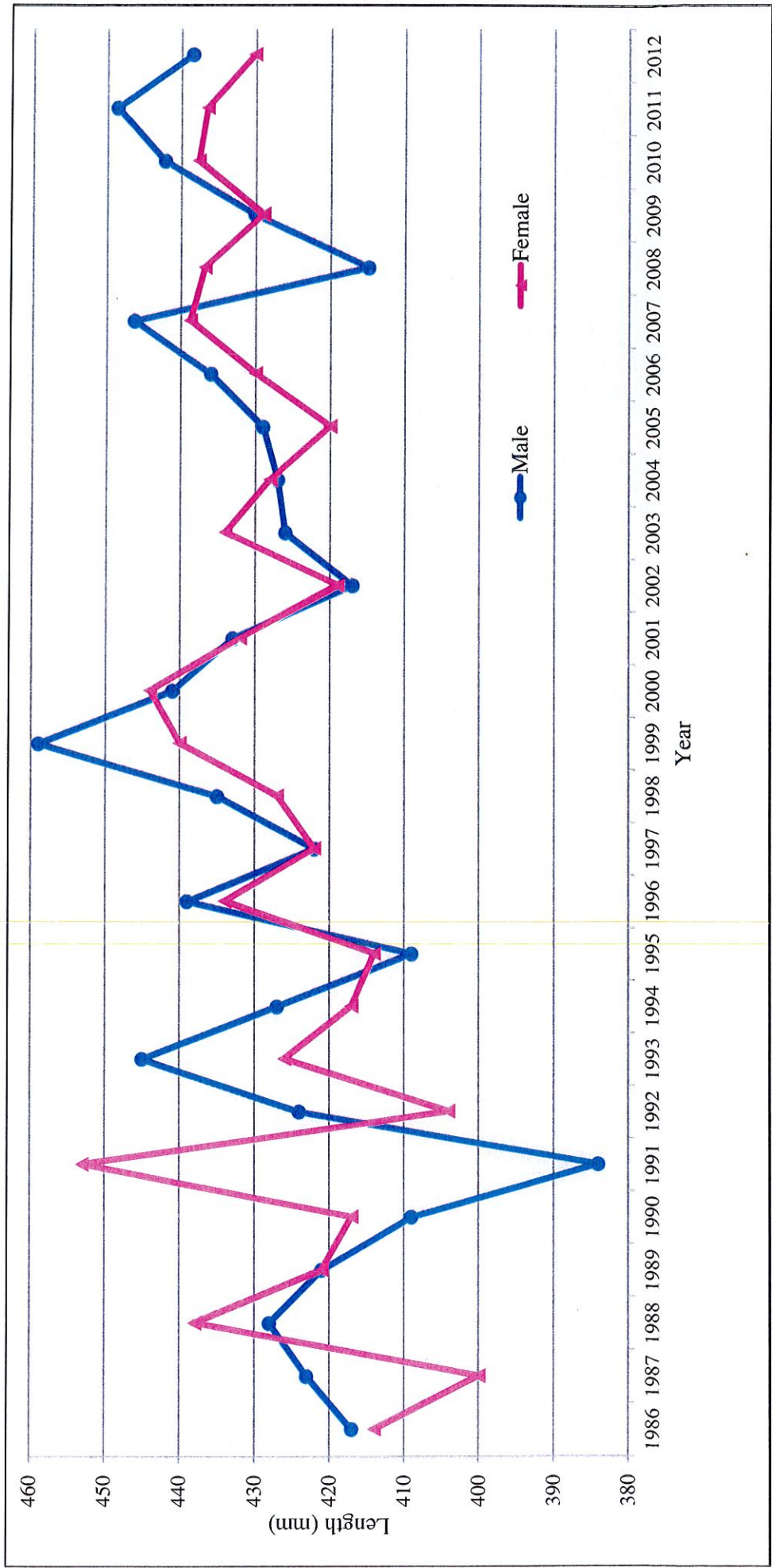


Figure 2. Mean length (mm) for male and female lamprey from rivers trapped during 1986-2012.



Figure 3. Mean weight (g) for male and female lamprey from rivers trapped during 1986-2012.

Table 1. Information on location of lamprey trapping conducted on Lake Superior tributaries during 2012.

Tributary	State/County	Location trapped	Gear	Trap site distance from mouth	Barrier distance from mouth	Release site
Amnicon	WI/Douglas	T48N, R12W, Sec 8, SE 1/4	1-fyke net	5 km (3 miles)	17.4 km (11 miles)	Amnicon River Road Crossing
Middle	WI/Douglas	T48N, R12W, Sec 13, NE 1/4	4 traps	5 km (3 miles)	8.4 km (5 miles)	Middle River Road Crossing
Poplar	WI/Douglas	T47N, R11w, Sec 6, SC	1-fyke net	5 km (3 miles)	23 km (14 miles)	Halkett Road Crossing
Bad	WI/Ashland	T47N, R3W, Sec 36, NE 1/4	3-traps	30 km (19 miles)	no barrier	Government Road Crossing
Firesteel	MI/Ontonagon	T51N, R38W, Sec 27, SE 1/4	1-fyke net	11.2 km (7 miles)	no barrier	Lake Shore Road Crossing
Misery	MI/Ontonagon	T52N, R37W, Sec 15, NE 1/4	2-traps	1.6 km (1 mile)	1.6 km (1 mile)	Misery Bay Park (river mouth)
Silver	MI/Baraga	T51N, R31W, Sec 13, SE 1/4	1-fyke net	1.6 km (1 mile)	5 km (3 miles)	Townline Road Crossing

Table 2. Type and combination of marks (v-notch fin clips) used on adult lamprey by week for rivers trapped during 2012.

Week of trapping	Mark (anterior, posterior)		Week of trapping	Mark (anterior, posterior)	
	Dates in 2012	Mark (anterior, posterior)		Dates in 2012	Mark (anterior, posterior)
1	4/15/2012 - 4/21/2012	(0,3)	7	5/27/2012 - 6/2/2012	(0,2)
2	4/22/2012 - 4/28/2012	(2,2)	8	6/3/2012 - 6/9/2012	(1,2)
3	4/29/2012 - 5/5/2012	(2,0)	9	6/10/2012 - 6/16/2012	(2,1)
4	5/6/2012 - 5/12/2012	(0,1)	10	6/17/2012 - 6/23/2012	(3,0)
5	5/13/2012 - 5/19/2012	(1,0)	11	6/24/2012 - 6/30/2012	(3,1)
6	5/20/2012 - 5/26/2012	(1,1)	12	7/1/2012 - 7/7/2012	(1,3)

Table 3. Water and air temperature (degrees Centigrade) for seven tributaries to Lake Superior during lamprey trapping in 2012.

Tributary	Code	<u>Water Temperature</u>			
		N*	average	S.D.	min max
<u>Michigan Tributaries</u>					
Firesteel	289	30	13.5	5.2	5 24
Misery	284	26	11.5	4.0	5 20
Silver	190	23	14.8	5.1	5 21
<u>Wisconsin Tributaries</u>					
Amnicon	705	16	12.2	2.1	9 15
Bad	611	39	13.5	5.0	5 24
Middle	703	15	12.1	2.6	8 16
Poplar	701	14	11.6	2.7	6 15
<u>Air Temperature</u>					
		N*	average	S.D.	min max
<u>Michigan Tributaries</u>					
Firesteel	289	30	13.6	8.1	-1 31
Misery	284	26	13.7	6.8	-3 26
Silver	190	23	18.6	7.0	6 32
<u>Wisconsin Tributaries</u>					
Amnicon	705	16	12.2	4.2	6 18
Bad	611	38	15.9	8.5	0 33
Middle	703	15	14.2	2.8	10 17
Poplar	701	13	13.8	4.2	5 21

*N= number of days where measurement was recorded.

Table 4. Annual catches of unmarked adult sea lamprey in spring spawning assessment traps and nets, in tributaries to Lake Superior monitored by GLIFWC from 1986-2012.

Tributary	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	
Wisconsin Tributaries																												
<i>Primary</i>																												
Amnicon	61	14	3	118	67	101	7	39	24	40	83	83	79	278	132	31	59	137	178	707	62	48	517	69	2	208		
Bad	184	439	972	684	465	121	236	84	114	280	316	272	471	646	293	563	1,050	1,446	831	1,124	1,638	2,042	2,154	1,249	983	257	741	
Middle	315	16	11	249	1	4	12	46	11	24	42	47	408	2,235	8,481	2,633	3,026	41	29	620	2,212	387	4	9	704	744	363	
<i>Secondary</i>																												
Arrowhead	1																											
Black				3	8																							
Nemadji				0	1																							
Poplar	0																											
Raspberry																												
Red Cliff Cr.				14	15																							
Subtotal-3 primary	499	516	997	936	584	192	349	137	164	328	398	402	962	2,960	9,052	3,328	4,107	1,546	997	1,922	4,557	2,491	2,206	1,775	1,756	1,003	1,312	
Total-WI	500	516	997	936	601	216	349	137	164	328	398	402	962	2,960	9,052	3,328	4,107	1,573	997	1,922	4,557	2,707	2,206	1,775	1,764	1,056	1,313	
Michigan Tributaries																												
<i>Primary</i>																												
Firesuel	17	40	44	86	43	74	24	21	0	37	79	35	375	7	97	8	94	27	3	36	7	33	33	19	19			
Misery	261	265	164	336	907	4,871	455	197	672	1,131	406	1,753	1,238	1,100	695	39	155	33	946	617	70	145	64	144	20			
Silver	0	4	0	6	26	29	36	0	6	20	6	42	42	59	243	6	7	24	14	12	47	348	63	100	31	5	32	
Huron	1	51	6	9	14	41	54	2	35	2	18																	
Traverse	10	10	10	31	33	11	4	0	0	1																		
Falls																												
Ontonagon				56	18																							
Otter				0	0																							
Subtotal-3 primary	0	4	278	311	234	451	986	4,945	485	238	678	1,210	527	1,847	1,856	1,113	799	71	263	72	996	1,001	140	278	128	168	71	
Total-MI	0	5	339	327	330	516	1,038	5,003	487	273	681	1,231	527	1,856	1,869	1,113	799	71	263	72	996	1,001	140	278	128	168	71	
Total-6 primary	1,275	1,247	818	643	1,335	5,082	649	566	1,076	1,612	1,489	4,807	10,908	4,441	4,906	1,617	1,260	1,994	5,553	3,492	2,346	2,053	1,884	1,171	1,383			
Grand total	500	521	1,336	1,263	931	732	1,387	5,140	651	601	1,079	1,633	1,489	4,816	10,921	4,441	4,906	1,644	1,260	1,994	5,553	3,708	2,346	2,053	1,892	1,224	1,384	
Average catch-6 primary:	1,261	1,113	996	1,064	1,733	1,578	1,452	1,410	1,430	1,436	1,717	2,424	2,568	2,724	2,654	2,572	2,540	2,699	2,739	2,720	2,690	2,654	2,650	2,650	2,656			

Table 5. Number of fish species, fish taxa, and other taxa captured during trapping in seven Lake Superior tributaries in 2012.

<i>Fish Species</i>	Wisconsin Tributaries					Michigan Tributaries				Grand Total
	Bad	Amnicon	Middle	Poplar	Total-WI	Firesteel	Misery	Silver	Total-MI	
Sea Lamprey adult	741	208	363	1	1,313	19	20	32	71	1,384
Bluegill					0	1			1	1
Brook Trout		1			1		13	49	62	63
Brown Trout			1		1	8			8	9
Burbot			2		2		4		4	6
Creek Chub	25		2		27	3	3	9	15	42
Hornyhead Chub					0	31		2	33	33
Lake Chub			66		66				0	66
Longnose Dace	19		1		20				0	20
Longnose Sucker					0	1,423			1,423	1,423
Northern Pike	1				1				0	1
Pumpkinseed	3		1					1	1	1
Rainbow Trout			7		7	17	63	13	93	100
Rock Bass	7	7			14	30	5	49	84	98
Ruffe					0		3		3	3
Smallmouth Bass	3				3	3			3	6
White Sucker	21		33		54	463	23	1,536	2,022	2,076
Yellow Perch	1				1				0	1
<i>Fish taxa</i>										
Bullhead	1	2	6		9				0	9
Chub (Cyprinidae)		20	22	50	92				0	92
Chubs (Coregonus)			3	84	87				0	87
Dace	24									
Redhorse		6			6	6			6	12
Sculpin			1		1				0	1
Shiner			21		21				0	21
Sucker	3	5	124	188	320	120			120	440
Sunfish					0		1	1	2	2
<i>Other taxa</i>										
Crayfishes	7	6	78		91			16	16	107
Frogs	1		1		2		3		3	5
Snapping Turtle	1				1			1	1	2
Turtles					0	1			1	1

Table 6. Calculated mean length (mm), weight (grams), and standard deviation (S.D.) for male and female lamprey captured during 2012.

River	River Code	Sex	Length			Weight		
			Number	Average	S.D.	Number	Average	S.D.
Amnicon	705	Female	0			0		
		Male	1	503	0	1	212	0
		All	1	503	0	1	212	0
Middle	703	Female	6	418	13	6	173	23
		Male	3	461	53	3	277	117
		All	9	432	36	9	208	81
Bad	611	Female	57	430	35	57	180	43
		Male	57	436	39	57	186	48
		All	114	433	37	114	183	46
Misery	284	Female	0			0		
		Male	1	480	0	1	186	0
		All	1	480	0	1	186	0
Firesteel	289	Female	2	470	28	2	157	30
		Male	2	410	14	2	183	19
		All	4	440	39	4	170	26
Silver	190	Female	0			0		
		Male	0			0		
		All	0			0		
All Rivers		Female	65	430	34	65	178	42
		Male	64	438	40	64	190	54
		All	129	434	37	129	184	48

Table 7. Population estimates for spawning phase sea lamprey in GLIFWC monitored streams tributary to Lake Superior during 2012.

Tributary	Population Estimate
Wisconsin Tributaries	
Bad	17,080
Middle	1,683
Poplar	N/A
Amnicon	156
Michigan Tributaries	
Firesteel	23
Misery	N/A
Silver	N/A

Estimates provided by the USFWS- Sea Lamprey Control Program in Marquette, Michigan.

N/A=Not available, population estimate could not be calculated due to low sample size.

Table 8. Population estimates for spawning lamprey from six GLIFWC monitored tributaries to Lake Superior from 1986-2012.

River	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Amnicon		647 S			1,368 S	413 SM	1,394 SM	1,216 SM			58 SM	673 SM	605 SM	600 SM	3,380 SM	904 SM	552 SM	138 SM		594 SM	7,437 SM			4,474 SM			156 SM
Bad	6,026 S	4,654 S	7,762 S	9,818 S	3,138 S	3,806 SM	2,651 SM	2,428 SM	2,135 SM	2,048 SM	8,513 SM	4,700 SM	4,064 SM	12,552 SM	2,767 SM	8,679 SM	13,678 SM	8,297 SM	8,555 SM	12,383 SM	18,912 SM	15,531 SM	12,922 SM	4,754 SM	7,905 SM	2,514 TE	17,080 SM
Middle	1,080 S	20 S	21 S	1,328 S			172 SM	184 SM		82 SM	31 SM	186 SM	1,081 SM	13,515 SM	6,900 SM	2,327 SM	3,327 SM	41 SM	28 SM	1,049 SM	3,017 SM	434 SM		2,024 SM		1,177 SM	1,683 SM
Misery			610 S	1,124 S	800 S	737 SM	1,771 SM	8,859 SM	748 TE	413 TE	951 TE	2,881 TE	1,073 TE	2,339 SM	1,764 SM	1,975 SM	602 SM	39 SM	431 SM	855 SM	572 SM	156 SM	156 SM	141 SM	281 SM		
Firesteel				220 P	462 S	265 SM	113 SM	256 SM				76 SM	274 SM	84 SM	1,036 SM		212 SM		31 SM			14 SM		128 SM	98 SM		23 SM
Silver					56 S	61 SM	110 SM					170 SM	157 SM	651 SM	937 SM					182 SM	1,724 SM	276 SM	370 SM	98 SM			

Method of estimation:
 Schaefer=S
 Schaefer, Modified=SM
 Peterson, adjusted=P
 Trap Efficiency=TE