



**Trapping Activities and Population Estimates of
Adult Sea Lamprey in Tributaries of
Lake Superior
During 2005**

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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 2005 trapping season are reported.

The six rivers sampled in 2005 were the Amnicon, Middle, and Bad rivers in Wisconsin, and the Silver, Firesteel, and Misery rivers in Michigan. In 2005 1,944 lamprey were captured, of which 1,124 were taken from the Bad river. For these six rivers, the catch in 2005 was below the seventeen-year average of 2,572 from 1988 to 2004.

Schaefer estimates of adult spawner abundance were calculated for 3 of the 6 tributaries in 2005. Spawner abundance estimates were 594 in the Amnicon river, 1,049 in the Middle river, and 12,383 in the Bad 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 2005, Mattes 2003). 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 2005 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. The Poplar river was trapped in 2003 and 2004 but was dropped from sampling in 2005.

METHODS

Capture Gear and Sites

Three tributaries in Wisconsin and three tributaries in the Upper Peninsula of Michigan were trapped from late April 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 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 2000-2005 four PAT's were set in the Middle river in an effort to increase the catch of male lamprey 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 and three PAT's were set in the Bad river directly below and against a natural rock shelf which transects the river. In the remaining three tributaries (Amnicon, 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, five days per week in the Bad and Misery rivers, and seven days per week in the Middle and Amnicon 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, except in the Bad and Middle rivers where male lamprey were placed in holding cages in the rivers and later removed for use in the sterile male release program. 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. All dead lamprey 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 tagging 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 are made and combined to estimate the population in U.S. 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

In 2005, 1,944 lamprey were captured in the six tributaries where trapping occurred which was below the seventeen-year average (1988-2004) of 2,572 for these six tributaries (Table 4). The majority of lamprey captured came from the Bad river (1,124) followed by the Middle river (620). Since 1988, annual catch for the six tributaries has ranged between 566 (1995) and 10,908 (2000), with total annual catch being largely driven by catch in the Middle, Misery, and Bad rivers.

Other than sea lamprey, 30 fish species, 11 fish genera, and 8 other taxa were captured during 2005 (Table 5). Suckers (*Catostomus sp.*) were captured most often (N=2,650). Fair numbers of brook trout (*Salvelinus fontinalis*) (N=479) and rainbow trout (*Oncorhynchus mykiss*) (N=122) were captured primarily from the Misery and Bad rivers. Other fish commonly captured were shiners and minnows (*Cyprinidae sp.*) including species such as the creek chub (*Semotilus atromaculatus*), hornyhead chub (*Nocomis biguttatus*) and longnose dace (*Rhinichthys cataractae*).

Biological Characteristics

The mean length of male lamprey was 429 mm, while the mean length of female lamprey was 420 mm (Table 6). These lengths were within the range of lengths observed during the nineteen year period from 1986 to 2004 (Figure 2).

The mean weight of male lamprey was 195 grams, while the mean weight of female lamprey was 186 grams (Table 6). These weights were within the range of weights observed during the previous nineteen 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 3 of the 6 tributaries in 2005 (Table 7). Spawner abundance estimates were 594 in the Amnicon river, 1,049 in the Middle river, and 12,383 in the Bad river. The population estimates for the Bad river for the past ten years have been higher (1996 to 2005 average: 8,419) than they were in the previous ten years (1986 to 1995 average: 4,447) (Table 8).

REFERENCES CITED

- Heinrich, J.W., Mullet, K.M., M.J. Hansen, J.V. Adams, G.T. Klar, D.A. Johnson, G.C. Christie, and R.J. Young. 2003. Sea Lamprey Abundance and Management in Lake Superior, 1957-1999. *Journal of Great Lakes Research*. 29 (Supplement 1): p. 566-583.
- Mattes, W.P. 2003. Trapping activities and population estimates of adult sea lamprey in tributaries of Lake Superior during 2001 and 2002. Biological Services Division Administrative Report 03-13. Great Lakes Indian Fish and Wildlife Commission, Odanah, WI. 17 p.
- Mattes, W.P. 2005. Trapping activities and population estimates of adult sea lamprey in tributaries of Lake Superior during 2003 and 2004. Biological Services Division Administrative Report 05-01. Great Lakes Indian Fish and Wildlife Commission, Odanah, WI. 16 p.
- Mullet, K.M., J.W. Heinrich, J.V. Adams, R.J. Young, M.P. Henson, R.B. McDonald, and M.F. Fodale. 2003. Estimating lake-wide abundance of spawning-phase sea lampreys (*Petromyzon marinus*) in the Great Lakes: extrapolating from sampled streams using regression models. *Journal of Great Lakes Research*. 29 (Supplement 1): p. 240-252.
- Ricker, W.E. 1975. Computation and Interpretation of Biological Statistics of Fish Populations. *Bulletin of the Fisheries Research Board of Canada*. Department of Fisheries and Oceans. Bulletin 191.

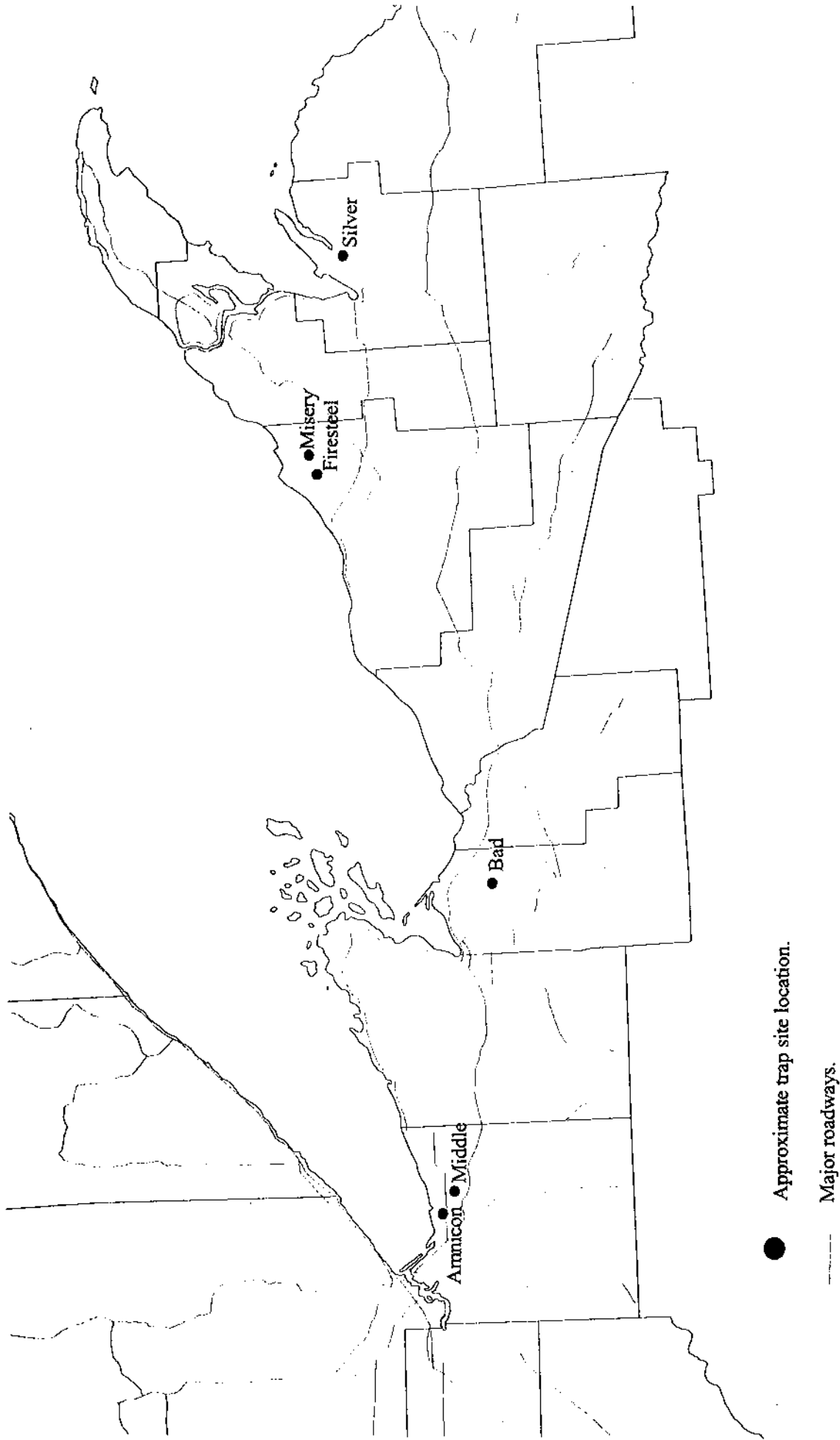


Figure 1. Location of rivers in which spawning-phase lampreycy were trapped in 2005.

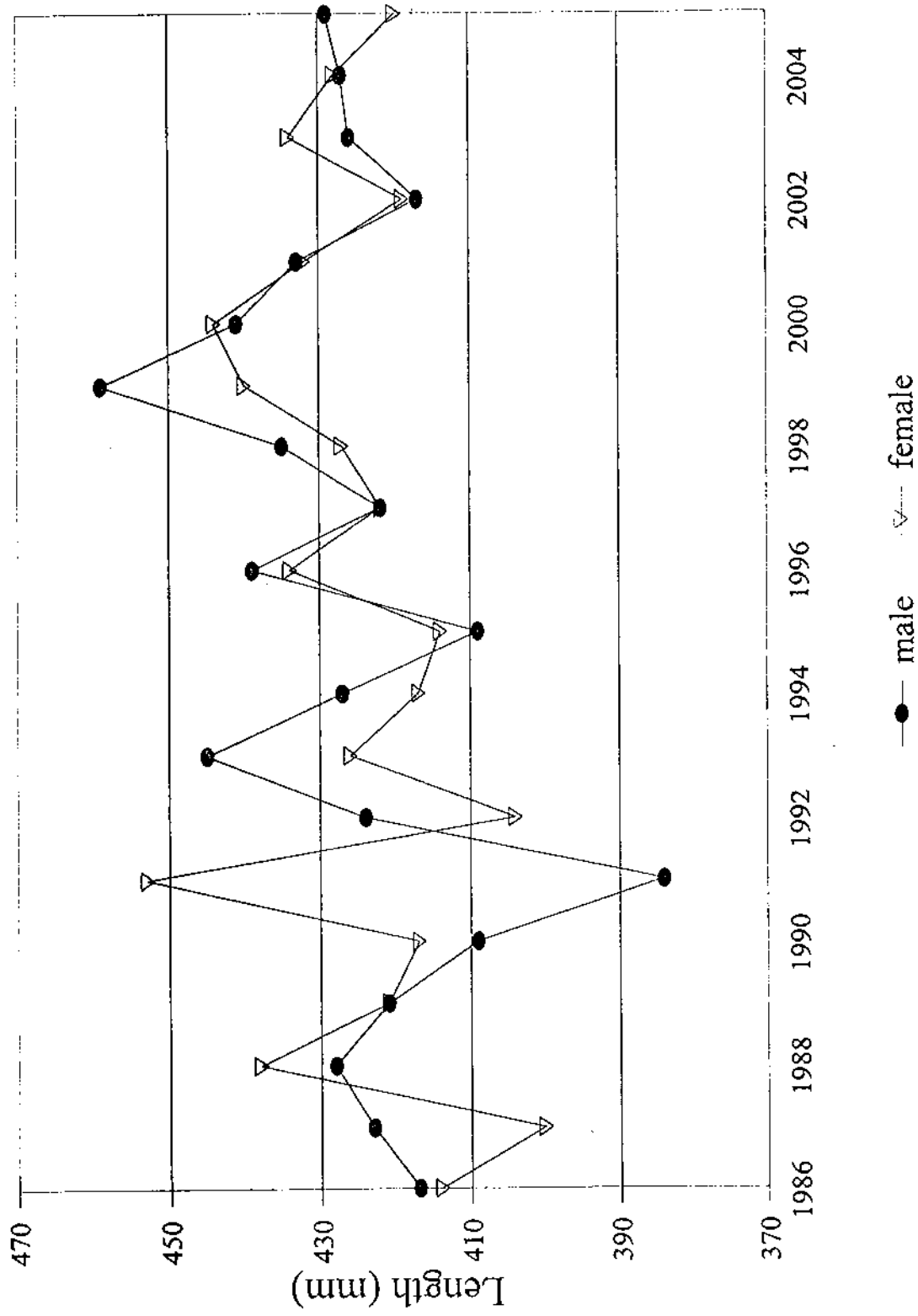


Figure 2. Mean length (mm) for male and female lamprey from rivers trapped during 1986-2005.

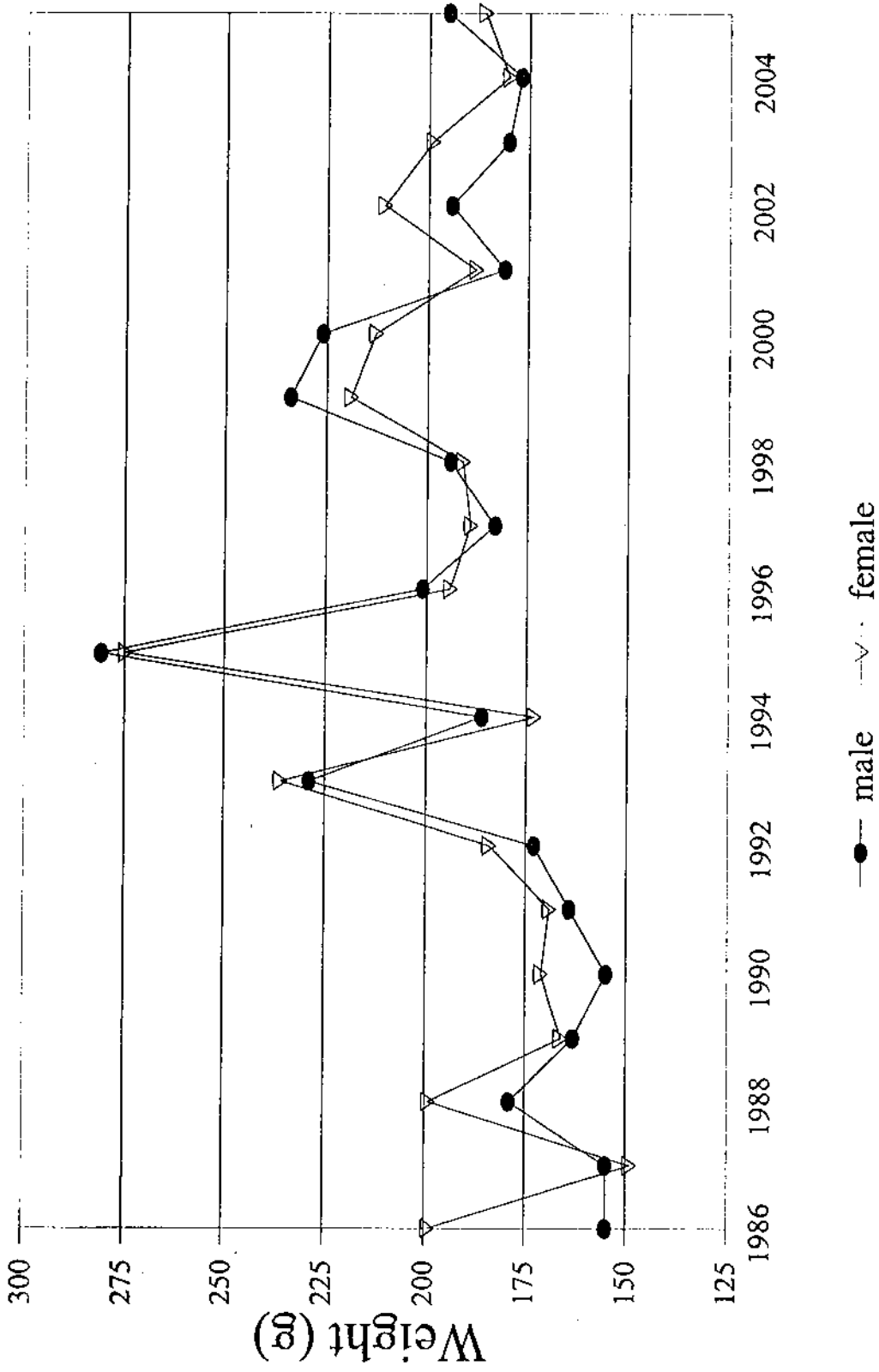


Figure 3. Mean weight (grams) for male and female lamprey from rivers trapped during 1986-2005.

Table 1. Information on location of lamprey trapping conducted on Lake Superior tributaries during 2005.

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)	11 km (7 miles)	0.1 km downstream from net
Middle	WI/Douglas	T48N, R12W, Sec 13, NE 1/4	4 traps	5 km (3 miles)	5 km (3 miles)	HWY 13 bridge
Bad	WI/Ashland	T47N, R3W, Sec 36, NE 1/4	3-traps	30 km (19 miles)	no barrier	0.8 km downstream from trap
Firesteel	MI/Ontonagon	T51N, R38W, Sec 27, SE 1/4	1-fyke net	11.2 km (7 miles)	no barrier	bridge 0.4 km below trap
Misery	MI/Ontonagon	T52N, R37W, Sec 15, NE 1/4	2-traps	1.6 km (1 mile)	1.6 km (1 mile)	0.4 km below trap
Silver	MI/Baraga	T51N, R31W, Sec 13, SE 1/4	1-fyke net	1.6 km (1 mile)	5 km (3 miles)	0.4 km below trap

Table 2. Type and combination of marks (v-notch fin clips) used on adult lamprey by week for rivers trapped during 2005.

Week of trapping	Dates in 2005	Mark (anterior, posterior)	Week of trapping	Dates in 2005	Mark (anterior, posterior)
1	4/17-4/23	3,3	7	5/29-6/4	2,0
2	4/24-4/30	3,2	8	6/5-6/11	1,1
3	5/1-5/7	3,1	9	6/12-6/18	0,2
4	5/8-5/14	3,0	10	6/19-6/25	1,2
5	5/15-5/21	2,2	11	6/26-7/2	0,3
6	5/22-5/28	2,1			

Table 3. Water and air temperature (degrees Centigrade) for six tributaries to Lake Superior during lamprey trapping in 2005.

Tributary	Code	Water Temperature			
		N*	average	S.D.	min max
Michigan Tributaries					
Firesteel	289	16	16.8	3.9	11 24
Misery	284	31	14.8	2.8	7 20
Silver	190	16	16.7	4.3	9 24
Wisconsin Tributaries					
Annicon	705	52	13.0	4.4	5 23
Bad	611	46	13.6	3.6	7 22
Middle	703	55	13.0	4.1	5 21
Air Temperature					
		Air Temperature			
		N*	average	S.D.	min max
Michigan Tributaries					
Firesteel	289	16	18.4	6.4	7 32
Misery	284	32	19.8	5.4	7 31
Silver	190	16	21.3	4.9	12 28
Wisconsin Tributaries					
Annicon	705	52	14.0	4.7	5 24
Bad	611	46	15.7	6.3	4 30
Middle	703	55	16.2	6.3	3 34

*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 1986-2005.

Tributary	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
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	178
Bad	184	439	972	684	465	121	236	84	114	280	316	272	471	646	293	563	1,050	1,446	831	1,124
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
<i>Secondary</i>																				
Arrowhead	1																			
Black				3	8															
Nemadji				0	1															
Poplar	0																	27	0	0
Raspberry					0															
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
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
Michigan Tributaries																				
<i>Primary</i>																				
Firesteel		17	40	44	86	43	74	24	21	0	37	79	35	375	7	97	8	94	27	27
Huron	1	51	6	9	14	41	54	2	35	2	18									
Misery	261	265	164	336	907	4,871	455	197	672	1,131	406	1,753	1,238	1,100	695	39	155	33	33	33
Silver	0	4	0	6	26	29	36	6	20	6	42	42	59	243	6	7	24	14	14	12
<i>Secondary</i>																				
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
Total-MI	0	5	339	327	274	498	1,038	5,003	487	273	681	1,228	527	1,847	1,856	1,113	799	71	263	72
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
Grand total	500	521	1,336	1,263	875	714	1,387	5,140	651	601	1,079	1,630	1,489	4,807	10,908	4,441	4,906	1,644	1,260	1,994
Average catch- 6 primary :			1,261	1,113	996	1,064	1,733	1,578	1,452	1,410	1,430	1,430	1,436	1,717	2,424	2,568	2,724	2,654	2,572	2,615

Table 5. Number of fish species, fish genera, and other taxa captured during trapping in six Lake Superior tributaries in 2005.

<i>Fish Species</i>	Wisconsin Tributaries			Michigan Tributaries				Grand Total	
	Bad	Amnicon	Middle	Total-WI	Firesteel	Misery	Silver		Total-MI
Sea Lamprey adult	1,124	178	620	1,922	27	33	12	72	1,994
Chestnut Lamprey adult		1	2	3				0	3
Brown Trout	10	4	7	21			9	9	30
Rainbow Trout	99		17	116		6		6	122
Brook Trout	112		9	121	46	271	41	358	479
Coho Salmon	1			1				0	1
Rainbow Smelt		4	41	45				0	45
White Sucker	1	53	1,974	2,028				0	2,028
Longnose Sucker		1	5	6				0	6
Shorthead Redhorse		6		6				0	6
Golden Shiner		12	136	148				0	148
Creek Chub	21	10	164	195	100			100	295
Hornyhead Chub		24	236	260				0	260
Eastern Blacknose Dace	1			1				0	1
Longnose Dace		1	196	197				0	197
Bluntnose Minnow			2	2				0	2
Black Bullhead			12	12				0	12
Stonecat			2	2				0	2
Central Mudminnow			2	2				0	2
Burbot			31	31		1		1	32
Trout-perch			6	6				0	6
Channel Catfish		1		1				0	1
Yellow Perch		1		1	1			1	2
Walleye	1	2		3				0	3
Logperch			7	7				0	7
Largemouth Bass			1	1				0	1
Pumpkinseed			7	7				0	7
Bluegill			2	2				0	2
Rock Bass	12	25	1	38				0	38
Mottled Sculpin	2			2				0	2
Ruffe		18	8	26		1		1	27
<i>Fish Genera</i>									
Sucker sp.		3		3	314	183	110	607	610
Cyprinidae			10	10				0	10
Shiner sp.		7	37	44				0	44
Bullhead sp.			2	2		3		3	5
Pike sp.	2			2				0	2
Sculpin sp.			1	1		11		11	12
Trout sp.				0			1	1	1
Dace sp.			10	10				0	10
Catfish sp.		1		1				0	1
Sunfish sp.				0	27		33	60	60
Darter sp.			1	1				0	1
<i>Other taxa</i>									
Dragonflies			1	1				0	1
Giant Water Bugs			8	8		2		2	10
Caddisflies			32	32				0	32
Predaceous Diving Beetles			5	5				0	5
Crayfish sp.			294	294		16		16	310
Frogs				0		2		2	2
Tadpoles	1		1	2				0	2
Rusty Crayfish			1	1				0	1

Table 6. Calculated mean length (mm), weight (grams), and standard deviation (S.D.) for male and female lamprey captured during 2005

River	River Code	Sex	Count	Length			Weight		
				Number	Average	S.D.	Number	Average	S.D.
Misery	284	Female	1	1	474	-	1	216	-
		Male	1	1	402	-	1	143	-
		All	2	2	438	51	2	180	52
Bad	611	Female	54	54	418	43	54	183	73
		Male	19	19	426	54	19	188	70
		All	73	73	420	46	73	185	72
Middle	703	Female	63	63	416	32	41	178	49
		Male	75	75	424	49	50	191	58
		All	138	138	420	42	91	186	55
Amnicon	705	Female	11	11	455	27	11	229	54
		Male	8	8	482	59	8	239	66
		All	19	19	466	44	19	233	58
All Rivers		Female	129	129	420	38	107	186	64
		Male	103	103	429	52	78	195	63
		All	232	232	424	45	185	190	63

Table 7. Population estimates for spawning phase sea lamprey in GLIFWC monitored streams tributary to Lake Superior during 2005.

Tributary	2005 Population Estimates	
	Schaefer Method	Mark/Recapture
Wisconsin Tributaries		
Bad		12,383
Middle		1,049
Amnicon		594
Michigan Tributaries		
Firesteel		N/A
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 1986-2005.

River	Year																			
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
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
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
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
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	
Firesteel				220 P	462 S	265 SM	113 SM	256 SM				76 SM	274 SM	84 SM	1,036 SM		212 SM		31 SM	
Silver					56 S	61 SM	110 SM					170 SM	157 SM	651 SM	937 SM					

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