



# **Trapping Activities and Population Estimates of Sea Lamprey in Tributaries of Lake Superior During 2018**

by  
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## ABSTRACT

The Great Lakes Section of the Great Lakes Indian Fish and Wildlife Commission (GLIFWC) conducts a sea lamprey (*Petromyzon marinus*) trapping project in cooperation with the U.S. Fish and Wildlife Service Sea Lamprey Control Station in Marquette, Michigan (USFWS-SLC), the Bad River Band of Lakes Superior Chippewa and the Keweenaw Bay Indian Community. The purpose of the project is to estimate the abundance and to gather length and weight information on sea lamprey in various tributaries to Lake Superior. In 2018, work included trapping adult spawning-phase lamprey in four rivers. Results of the trapping season for 2018 are reported.

The four rivers sampled in spring 2018 for adult spawning-phase sea lamprey were the Bad and Middle rivers in Wisconsin and the Misery and Silver rivers in Michigan. These four rivers have been trapped annually since 1988. In 2018 a total of 809 adult spawning-phase sea lampreys were captured in these four tributaries. The majority of spawning-phase sea lampreys captured came from the Bad River (710). Adjusted Petersen estimates of adult spawning-phase lamprey abundance calculated for each tributary in 2018 were 11,301 in the Bad River and 199 in the Misery River. A population estimate could not be calculated in the Middle and Silver rivers due to insufficient recaptures.

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## INTRODUCTION

The Great Lakes Section of the Great Lakes Indian Fish and Wildlife Commission (GLIFWC) conducts an annual cooperative sea lamprey (*Petromyzon marinus*) trapping project with the U.S. Fish and Wildlife Service Sea Lamprey Control Station in Marquette, Michigan (USFWS-SLC), the Bad River Band of Lakes Superior Chippewa Natural Resources Department (BR-NRD) and the Keweenaw Bay Indian Community Natural Resources Department (KB-NRD). Results of this work are reported in GLIFWC administrative reports (e.g. Mattes 2018). The purpose of the project is to gather information on and index the number of adult spawning-phase sea lamprey ascending various tributary streams of Lake Superior during their April-July spawning run. Objectives of the project are: (1) to monitor the in-stream movements of sea lamprey, (2) to collect data on the length and weight of sea lamprey, (3) to estimate the number of sea lamprey spawning in a tributary, and (4) to reduce the effect of sea lamprey induced mortality to fish populations in Lake Superior by removing a portion of the spawning-phase sea lamprey population.

Information collected supplements that collected by USFWS-SLC and other agencies and is included in a lake wide management plan in order to control and reduce the lamprey population. Results of the monitoring efforts for each tributary are used to index the numbers of spawning-phase lampreys in United States waters of Lake Superior as an evaluation of the effectiveness of regional lamprey control efforts. This report presents results of 2018 trapping season for the four tributaries monitored cooperatively by GLIFWC, KB-NRD, USFWS-SLC, and BR-NRD.

In 2018 trapping was conducted in four streams tributary to Lake Superior to index the abundance of spawning-phase sea lamprey and when recaptures are sufficient generate a population estimate (Figure 1). The four selected index streams: the Bad and Middle rivers in Wisconsin and the Misery and Silver rivers in Michigan are known to contain spawning runs of adult sea lamprey and represent a range of stream sizes based on in-stream flows. These streams have been trapped in prior years, as well as other streams that are not currently being trapped (Mattes 2018).

In some years, streams were trapped for transformer-phase lampreys based upon USFWS assessment data that tracks sea lamprey abundance in tributaries. No tributaries in the GLIFWC work area were estimated to have high enough abundances of transformer-phase sea lampreys to be trapped in 2018.

## METHODS

### Capture Gear and Sites

Two tributaries in Wisconsin and two tributaries in the Upper Peninsula of Michigan are trapped for spawning-phase sea lampreys from late April through early July (Figure 1). The Middle and Misery rivers have man-made barriers that were specially built to prevent the upward movement of sea lamprey. The Silver River has a natural barrier which prevents sea lampreys from moving through the entire system. The Bad River has no impassable barrier.

Portable assessment traps (PATs) and fyke nets are used to capture spawning phase sea lampreys (Table 1a). PATs are the preferred gear and are used in three tributaries with a suitable barrier. PATs are set below and against the man-made barriers on the Middle and Misery rivers. Four PATs were set in the Middle River from 2000-2015 with catch of male lamprey through 2011 used for the sterile male release program. Prior to 2000 and after 2015, two PATs have been set in the Middle River. Two PATs are set in the Misery River. Three PATs are set in the Bad River directly below and against a natural rock shelf which transects the river. In the Silver River, which does not have a suitable barrier, one fyke net is set in the lower portion of the river with the cod end upstream.

### Data Collection

Traps or fyke nets are emptied at least three times per week (i.e., Monday, Wednesday, and Friday) in the four rivers fished for adult spawning-phase sea lamprey. A sub-sample of live spawning-phase lamprey are transported downstream (Table 1) and marked by clipping one or both dorsal fins, then released back into the river. The fins are clipped with a v-notch tool and a different combination of clips is used to identify the week of capture and release (Table 2). Spawning-phase lampreys not marked and released are destroyed and disposed of in a landfill. All other fish and taxa captured were returned to the water. Water and air temperature are recorded at the time traps or nets are emptied (Table 3).

The numbers of live and dead marked and unmarked spawning-phase lampreys captured each sampling day are counted, along with the number of fish species, fish genera, and other taxa in the traps or nets. In addition, dead and recaptured lampreys, as well as, a sub-sample of female and male lampreys from the Bad River are measured to the nearest millimeter, weighed to the nearest gram, and sex determined. The fin clip combination on recaptured spawning-phase lamprey is also recorded.

### Population Estimates

Mark-recapture population estimates for spawning-phase sea lampreys are calculated based on the marking procedure described above. From 1986-2014, when sample size was sufficient population estimates were calculated using the modified Schaefer method. Starting in 2015 the adjusted Petersen Estimator is calculated (Ricker 1975). In either instance, when the number of recaptures is deemed too low no estimate is calculated. In some years, an estimate of population size is made by applying the estimated trap efficiency to the total catch for the year. Trap efficiency is the total catch divided by the population estimate in years where population estimates are made.

## RESULTS AND DISCUSSION

### Trap Catches

#### *Spawning-phase*

A total of 809 adult spawning-phase sea lampreys were captured in the four sampled tributaries. Catches were highest in the Bad River (710) followed by the Misery River (73), Silver River (22), and Middle River (4) and (Table 4, Figure 2).

Other than sea lamprey, 19 fish species, six fish taxa, and three other taxa were captured during the 2018 spawning-phase trapping (Table 5). White Sucker (*Catostomus commersonii*) (N=2,632) were captured most often followed by Creek Chub (*Semotilus atromaculatus*, N=380), primarily from the Middle River. Other commonly captured fish were the Rainbow Trout (*Oncorhynchus mykiss*, N=292), primarily from the Misery River and various species of Chub (Cyprinidae species, N=266), primarily from the Middle River.

### Length and Weight

Mean length of spawning phase lampreys was 436 mm and 440 mm for males and females, respectively (Table 6). These lengths were within the range of lengths observed during the period from 1988 to 2017 (Figure 3). The mean weight of male lamprey was 223 grams, while the mean weight of female lamprey was 247 grams (Table 6). These weights were within the range of weights observed during the period from 1988 to 2017 (Figure 4).

### Population Estimates

Adjusted Petersen estimates of adult spawning-phase lamprey abundance were calculated for each tributary with sufficient recaptures in 2018 (Table 7, Figure 5). Abundance estimates were 11,301 in the Bad River and 199 in the Misery River. A population estimate could not be calculated in the Middle or Silver rivers due to insufficient recaptures. The Bad and Misery river estimates were within the range of population estimates given for the rivers since 1989 (Bad River range: 570-18,912 and Misery River range: 20-8,859) (Table 7).



## REFERENCES CITED

- Mattes, W.P. 2018. Trapping activities and population estimates of adult sea lamprey in tributaries of Lake Superior during 2017. Biological Services Division Administrative Report 18-18. Great Lakes Indian Fish and Wildlife Commission, Odanah, WI. 14 p.
- 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.

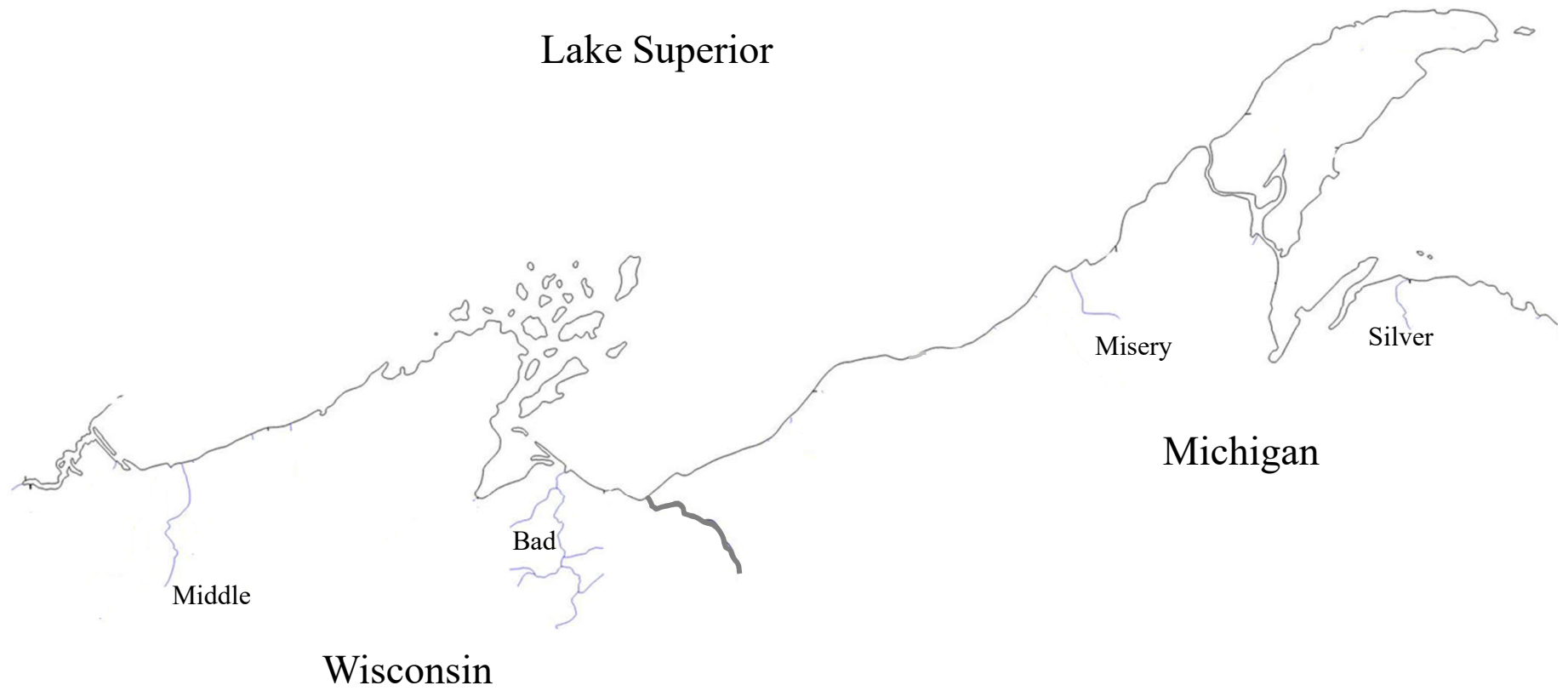


Figure 1. Location of rivers in which sea lampreys were trapped in 2018.

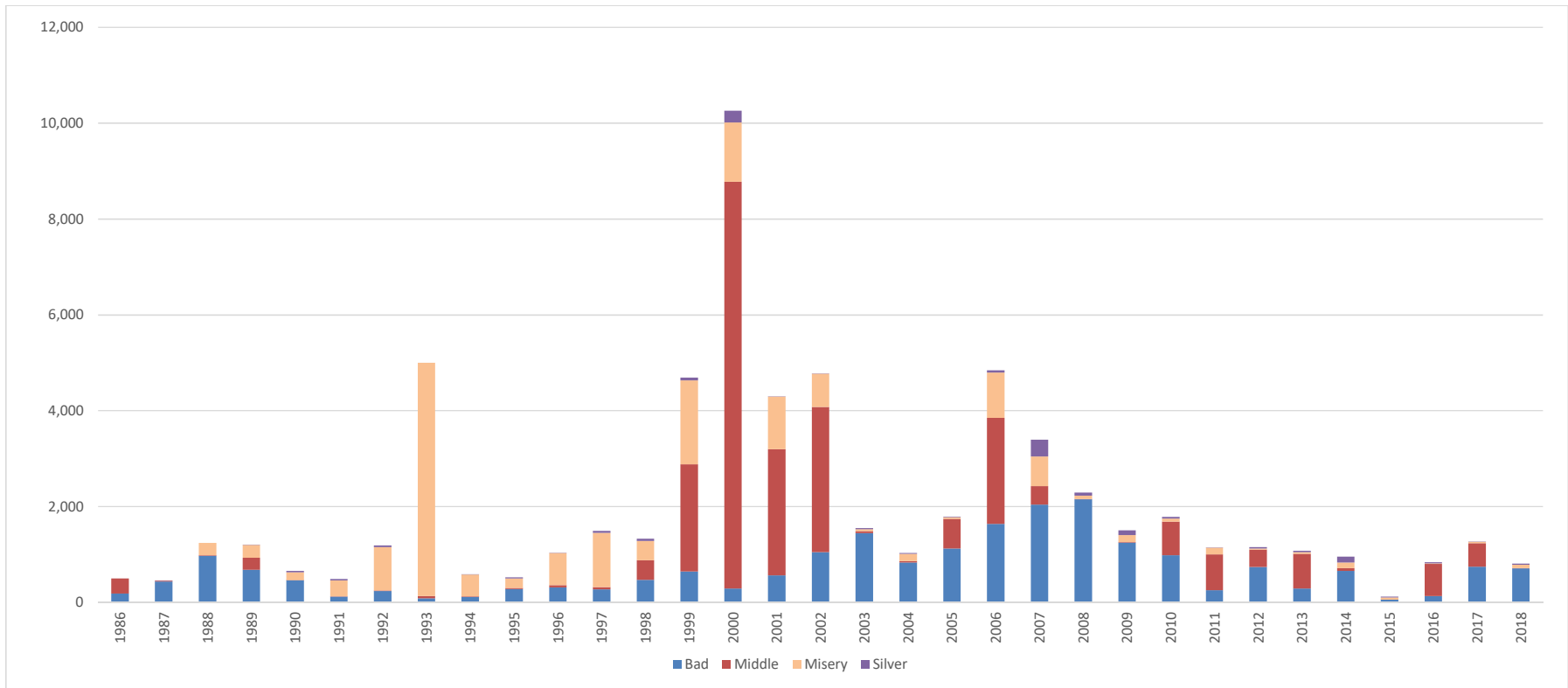


Figure 2. Annual catches of unmarked adult spawning-phase sea lamprey in spring spawning assessment traps and nets in four tributaries to Lake Superior monitored during 1986-2018.

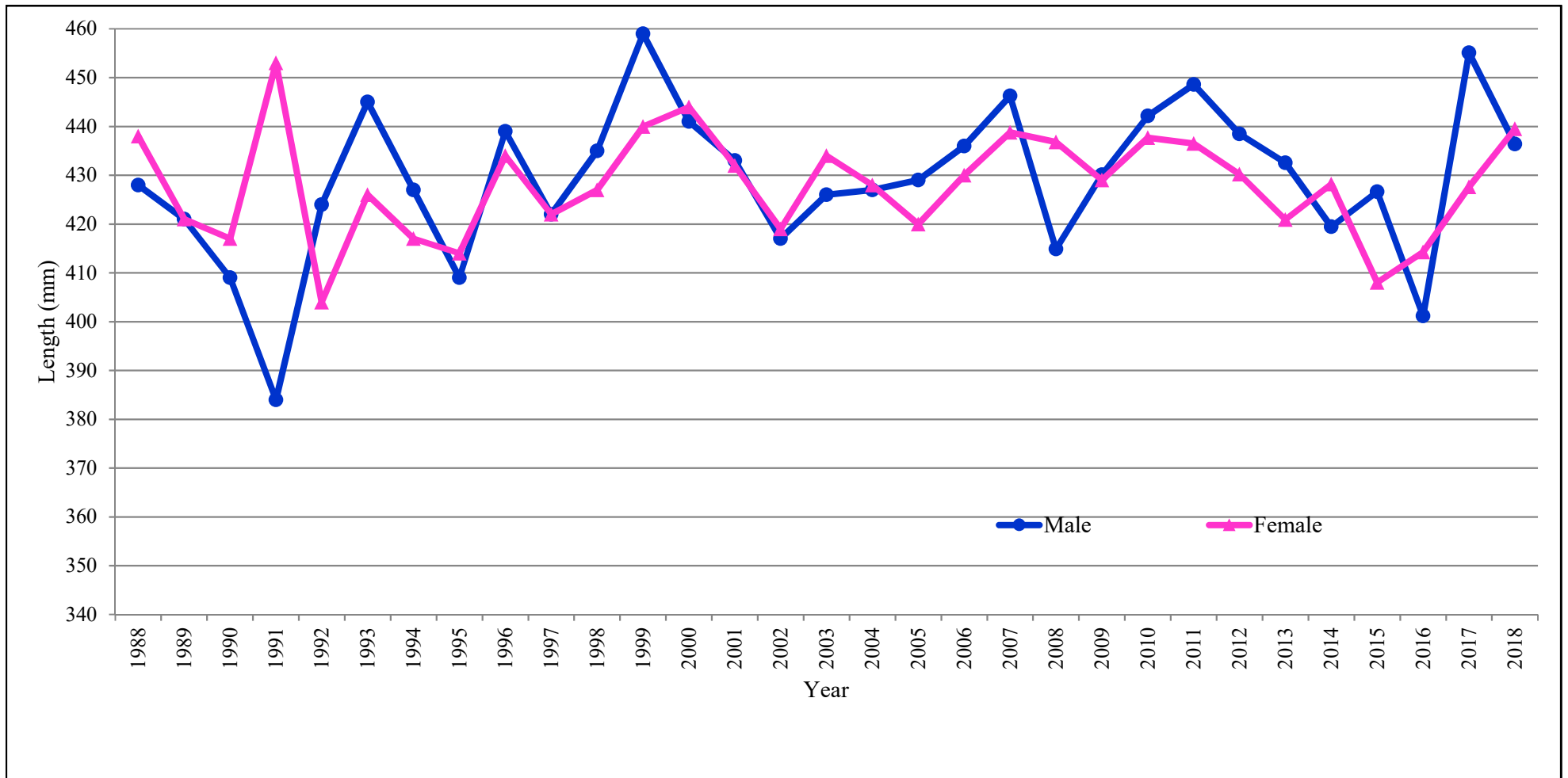


Figure 3. Mean length (mm) for male and female spawning-phase lamprey from rivers trapped during 1988-2018.

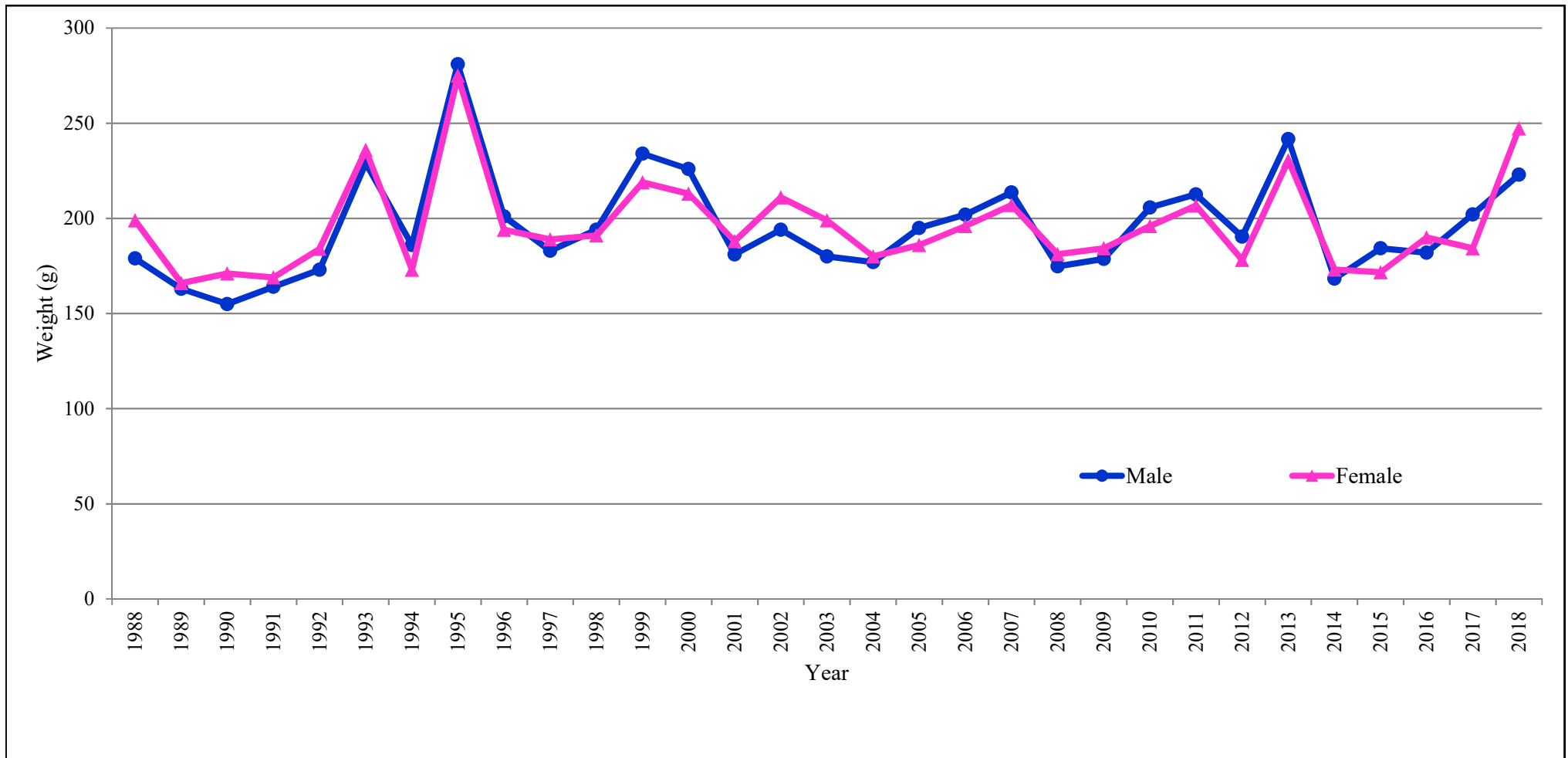


Figure 4. Mean weight (grams) for male and female spawning-phase lamprey from rivers trapped during 1988-2018.

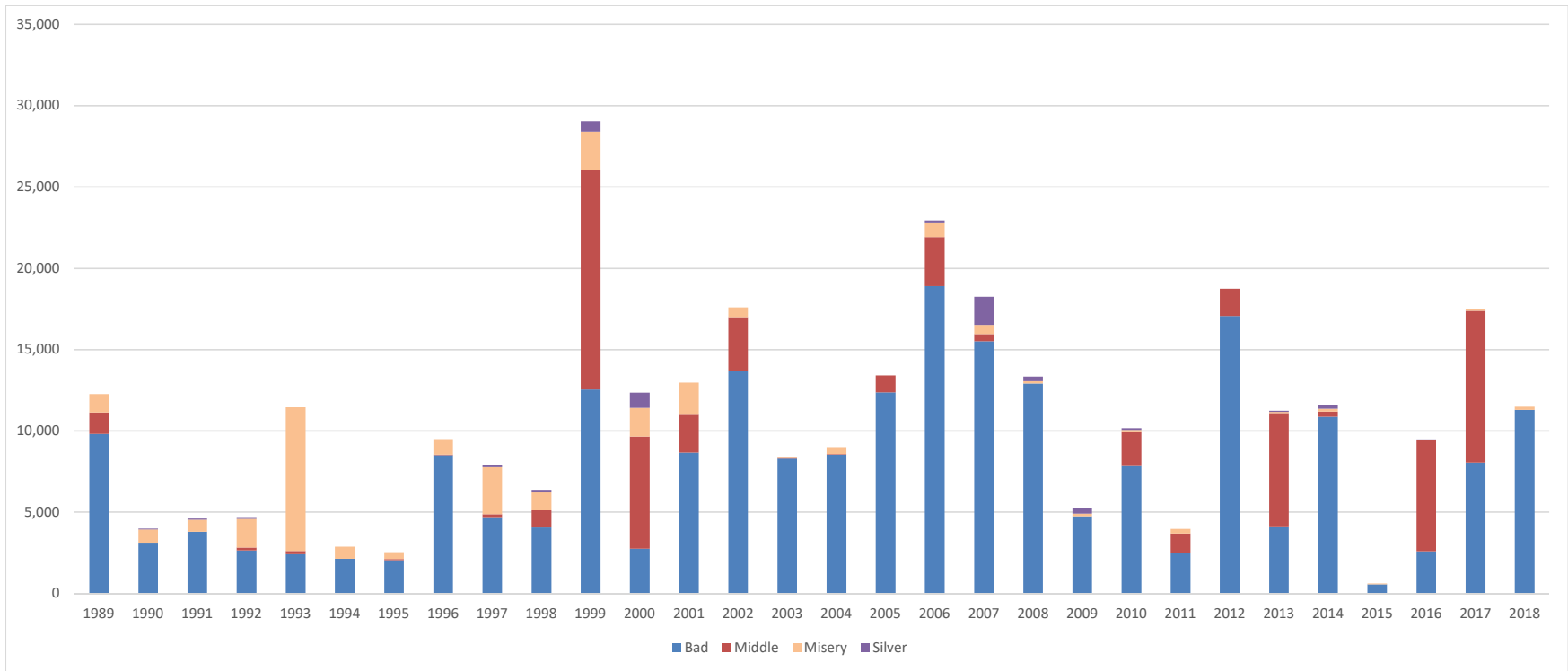


Figure 5. Population estimates (PE) for spawning-phase lamprey from four monitored tributaries to Lake Superior during 1986-2018.

Table 1. Information on location and gear used during spawning-phase sea lamprey trapping conducted on Lake Superior tributaries during 2018.

Tributary	State/County	Location trapped	Gear	Trap site distance from mouth	Barrier distance from mouth	Release Site
Middle	WI/Douglas	46° 38' 48" N 91° 48' 19" W	4 traps	5 km (3 miles)	8.4 km (5 miles)	Mouth of Middle River
Bad	WI/Ashland	46° 30' 53" N 90° 40' 54" W	3-traps	30 km (19 miles)	no barrier	Government Road Crossing
Misery	MI/Ontonagon	46° 58' 56" N 88° 59' 00" W	2-traps	1.6 km (1 mile)	1.6 km (1 mile)	Misery Bay Park (river mouth)
Silver	MI/Baraga	46° 48' 18" N 88° 18' 59" W	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 2018.

Week of trapping	Dates in 2018		Mark (anterior, posterior)	Week of trapping	Dates in 2018		Mark (anterior, posterior)
1	4/15/2018	- 4/21/2018	(2,3)	7	5/27/2018	- 6/2/2018	(1,0)
2	4/22/2018	- 4/28/2018	(3,2)	8	6/3/2018	- 6/9/2018	(1,1)
3	4/29/2018	- 5/5/2018	(0,3)	9	6/10/2018	- 6/16/2018	(0,2)
4	5/6/2018	- 5/12/2018	(2,2)	10	6/17/2018	- 6/23/2018	(1,2)
5	5/13/2018	- 5/19/2018	(2,0)	11	6/24/2018	- 6/30/2018	(2,1)
6	5/20/2018	- 5/26/2018	(0,1)	12	7/1/2018	- 7/7/2018	(3,0)



Table 3. Water and air temperature (degrees Centigrade) for tributaries to Lake Superior sampled during spawning-phase lamprey trapping in 2018.

Tributary	<u>Water Temperature</u>				
	N*	average	S.D.	min	max
Michigan Tributaries					
Misery	17	16.2	2.4	12	19
Silver	15	15.6	3.0	11	21
Wisconsin Tributaries					
Bad	20	17.1	3.0	11	22
Middle	17	14.2	4.2	7	19
	<u>Air Temperature</u>				
	N*	average	S.D.	min	max
Michigan Tributaries					
Misery	17	22.2	4.6	14	28
Silver	15	21.1	4.2	13	28
Wisconsin Tributaries					
Bad	20	18.4	4.2	9	26
Middle	15	14.2	6.9	0	25

\*N= number of days where measurement was recorded.

Table 4. Annual catches of unmarked adult spawning-phase sea lamprey in spring spawning assessment traps and nets in four tributaries to Lake Superior monitored during 1986-2018.

Year	Wisconsin Tributaries			Michigan Tributaries			Grand Total
	Bad	Middle	Subtotal	Misery	Silver	Subtotal	
1986	184	315	499		0	0	<b>499</b>
1987	439	16	455		4	4	<b>459</b>
1988	972	11	983	261	0	261	<b>1,244</b>
1989	684	249	933	265	6	271	<b>1,204</b>
1990	465	1	466	164	26	190	<b>656</b>
1991	121	4	125	336	29	365	<b>490</b>
1992	236	12	248	907	36	943	<b>1,191</b>
1993	84	46	130	4,871	0	4,871	<b>5,001</b>
1994	114	11	125	455	6	461	<b>586</b>
1995	280	24	304	197	20	217	<b>521</b>
1996	316	42	358	672	6	678	<b>1,036</b>
1997	272	47	319	1,131	42	1,173	<b>1,492</b>
1998	471	408	879	406	42	448	<b>1,327</b>
1999	646	2,235	2,881	1,753	59	1,812	<b>4,693</b>
2000	293	8,481	8,774	1,238	243	1,481	<b>10,255</b>
2001	563	2,633	3,196	1,100	6	1,106	<b>4,302</b>
2002	1,050	3,026	4,076	695	7	702	<b>4,778</b>
2003	1,446	41	1,487	39	24	63	<b>1,550</b>
2004	831	29	860	155	14	169	<b>1,029</b>
2005	1,124	620	1,744	33	12	45	<b>1,789</b>
2006	1,638	2,212	3,850	946	47	993	<b>4,843</b>
2007	2,042	387	2,429	617	348	965	<b>3,394</b>
2008	2,154	4	2,158	70	63	133	<b>2,291</b>
2009	1,249	9	1,258	145	100	245	<b>1,503</b>
2010	983	704	1,687	64	31	95	<b>1,782</b>
2011	257	744	1,001	144	5	149	<b>1,150</b>
2012	741	363	1,104	20	32	52	<b>1,156</b>
2013	293	722	1,015	33	30	63	<b>1,078</b>
2014	660	58	718	113	122	235	<b>953</b>
2015	56	1	57	49	17	66	<b>123</b>
2016	134	671	805	9	24	33	<b>838</b>
2017	743	493	1,236	26	2	28	<b>1,264</b>
2018	710	4	714	73	22	95	<b>809</b>

Table 5. Number of fish by species, fish taxa, and other taxa captured during spawning-phase sea lamprey trapping in four Lake Superior tributaries in 2018.

	Wisconsin Tributaries			Michigan Tributaries			Grand Total
	Bad	Middle	Total	Misery	Silver	Total	
<i>Fish Species</i>							
Sea Lamprey adult	710	4	714	73	22	95	809
Bluegill		1	1			0	1
Brook Trout		3	3	39	62	101	104
Brown Trout		1	1			0	1
Burbot		25	25	35		35	60
Central Mudminnow			0	3		3	3
Coho Salmon			0	2		2	2
Common Shiner		18	18	18	1	19	37
Creek Chub	12	223	235	143	2	145	380
Longnose Dace	14	10	24	87		87	111
Longnose Sucker		25	25			0	25
Mottled Sculpin			0	12		12	12
Northern Pike		13	13			0	13
Pumpkinseed			0	3		3	3
Rainbow Trout		15	15	266	11	277	292
River Chub			0	4		4	4
Rock Bass	3		3	2	11	13	16
Smallmouth Bass			0		2	2	2
Tadpole madtom		1	1			0	1
White Sucker	2	1,726	1,728	487	417	904	2,632
<i>Fish taxa</i>							
Bullhead		1	0	1		1	1
Chub (Cyprinidae)	10	256	266			0	266
Dace			0	9		9	9
Madtom		23	23			0	23
Shiner	1	56	57	20	1	21	78
Trout		2	2			0	2
<i>Other taxa</i>							
Crayfish	1	87	88	26	17	43	131
Frogs		3	3	1	1	2	5
Water Beetles	7		7	2		2	9

Table 6. Calculated mean length (mm), weight (grams), and standard deviation (S.D.) for male and female spawning-phase lamprey captured during 2018.

River	Sex	Length (mm)			Weight (grams)		
		Number	Mean	S.D.	Number	Average	S.D.
Middle	Female	0	0	n/a	0	0	n/a
	Male	0	0	n/a	0	0	n/a
	All	0	0	n/a	0	0	n/a
Bad	Female	116	440	45	116	250	130
	Male	91	440	41	91	230	148
	All	207	440	43	207	241	138
Misery	Female	13	439	46	13	228	54
	Male	24	424	47	24	195	41
	All	37	429	46	37	206	48
Silver	Female	0	0	n/a	0	0	n/a
	Male	0	0	n/a	0	0	n/a
	All	0	0	n/a	0	0	n/a
All Rivers	Female	129	440	45	129	247	125
	Male	115	436	42	115	223	133
	All	244	438	44	244	236	129

Table 7. Population estimates (PE) and method of estimation for spawning-phase lamprey from four monitored tributaries to Lake Superior during 1986-2018.

Year	Bad		Middle		Misery		Silver	
	PE	Method	PE	Method	PE	Method	PE	Method
1986	6,026	S	1,080	S	-		-	
1987	4,654	S	20	S	-		-	
1988	7,762	S	21	S	610	S	-	
1989	9,818	S	1,328	S	1,124	S	-	
1990	3,138	S	-		800	S	56	S
1991	3,806	SM	-		737	SM	61	SM
1992	2,651	SM	172	SM	1,771	SM	110	SM
1993	2,428	SM	184	SM	8,859	SM	-	
1994	2,135	SM	-		748	TE	-	
1995	2,048	SM	82	SM	413	TE	-	
1996	8,513	SM	31	SM	951	TE	-	
1997	4,700	SM	186	SM	2,881	TE	170	SM
1998	4,064	SM	1,081	SM	1,073	TE	157	SM
1999	12,552	SM	13,515	SM	2,339	SM	651	SM
2000	2,767	SM	6,900	SM	1,764	SM	937	SM
2001	8,679	SM	2,327	SM	1,975	SM	-	
2002	13,678	SM	3,327	SM	602	SM	-	
2003	8,297	SM	41	SM	39	SM	-	
2004	8,555	SM	28	SM	431	SM	-	
2005	12,383	SM	1,049	SM	-		-	
2006	18,912	SM	3,017	SM	855	SM	182	SM
2007	15,531	SM	434	SM	572	SM	1,724	SM
2008	12,922	SM	-		156	SM	276	SM
2009	4,754	SM	-		156	SM	370	SM
2010	7,905	SM	2,024	SM	141	SM	98	SM
2011	2,514	TE	1,177	SM	281	SM	-	
2012	17,080	SM	1,683	SM	-		-	
2013	4,131	SM	6,984	SM	59	SM	78	SM
2014	10,886	SM	320	SM	175	SM	227	SM
2015	570	P	-		59	P	-	
2016	2,607	P	6,835	P	20	P	18	P
2017	8,052	P	9,343	P	108	P	-	
2018	11,301	P	-		199	P	-	

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