



Trapping Activities and Population Estimates of Sea Lamprey in Tributaries of Lake Superior During 2019

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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 2019, work included trapping adult spawning-phase lamprey in four rivers. Results of the trapping season for 2019 are reported.

The four rivers sampled in spring 2019 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 2019, 711 adult spawning-phase sea lampreys were captured in these four tributaries. The majority of spawning-phase sea lampreys captured came from the Middle and Bad rivers (352 and 318, respectively). Adjusted Petersen estimates of adult spawning-phase lamprey abundance calculated for each tributary in 2019 were 5,307 in the Middle River, 4,333 in the Bad River and 50 in the Misery River. A population estimate could not be calculated in the Silver River 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 2019). 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 2019 trapping season for the four tributaries monitored cooperatively by GLIFWC, KB-NRD, USFWS-SLC, and BR-NRD.

In 2019 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.

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 2019.

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 both dorsal fins with a v-notch tool, then released back into the river. Prior to 2019, the fins were clipped with a different combination of clips to identify the week of capture and release. However, starting in 2019 the same clip was used throughout the trapping season. 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 2).

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.

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 711 adult spawning-phase sea lampreys were captured in the four sampled tributaries. Catches were highest in the Middle river (352) followed by the Bad River (318) Silver River (25), and Misery River (16) (Table 3, Figure 2).

Other than sea lamprey, 19 fish species, six fish taxa, and three other taxa were captured during the 2019 spawning-phase trapping (Table 4). White Sucker (*Catostomus commersonii*) (N=602) were captured most often followed by Creek Chub (*Semotilus atromaculatus*, N=271) and Crayfishes (*Cambaridae*, N=235), primarily from the Middle River. Other commonly captured fish were the Rainbow Trout (*Oncorhynchus mykiss*, N=227), primarily from the Misery River, Burbot (*Lota lota*, N=145) and various species of Chub (Cyprinidae species, N=126), primarily from the Middle River.

Length and Weight

Mean length of spawning phase lampreys was 424 mm and 418 mm for males and females, respectively (Table 5). These lengths were within the range of lengths observed during the period from 1988 to 2018 (Figure 3). The mean weight of male lamprey was 246 grams, while the mean weight of female lamprey was 199 grams (Table 5). These weights were within the range of weights observed during the period from 1988 to 2018 (Figure 4).

Population Estimates

Adjusted Petersen estimates of adult spawning-phase lamprey abundance were calculated for each tributary with sufficient recaptures in 2019 (Table 6, Figure 5). Abundance estimates were 5,307 in the Middle River, 4,333 in the Bad River and 50 in the Misery River. A population estimate could not be calculated in the Silver River due to insufficient recaptures. The Middle, Bad and Misery river estimates were within the range of population estimates given for the rivers since 1989 (Middle River range: 20-13,515, Bad River range: 570-18,912 and Misery River range: 20-8,859) (Table 6).

REFERENCES CITED

- Mattes, W.P. 2019. Trapping activities and population estimates of adult sea lamprey in tributaries of Lake Superior during 2019. Biological Services Division Administrative Report 19-01. 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.

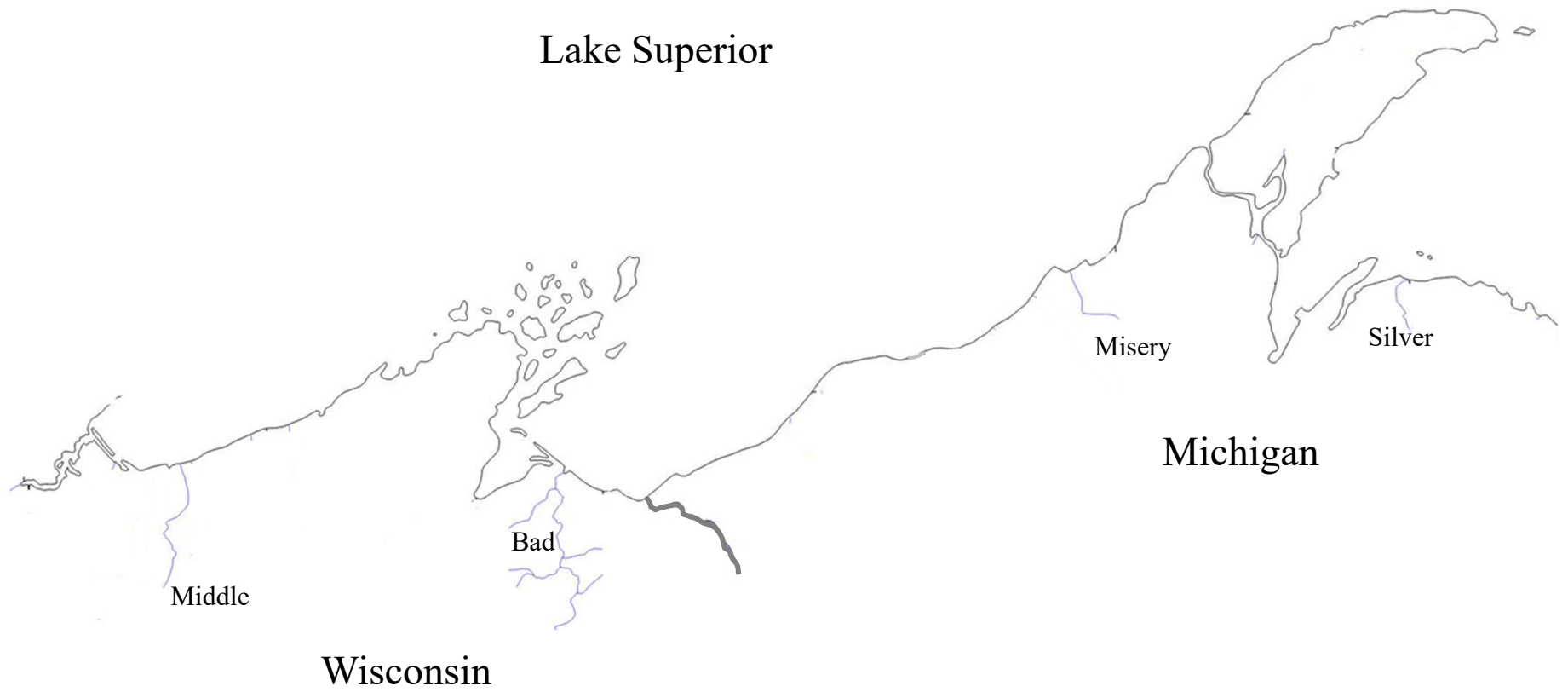


Figure 1. Location of rivers in which sea lampreys were trapped in 2019.

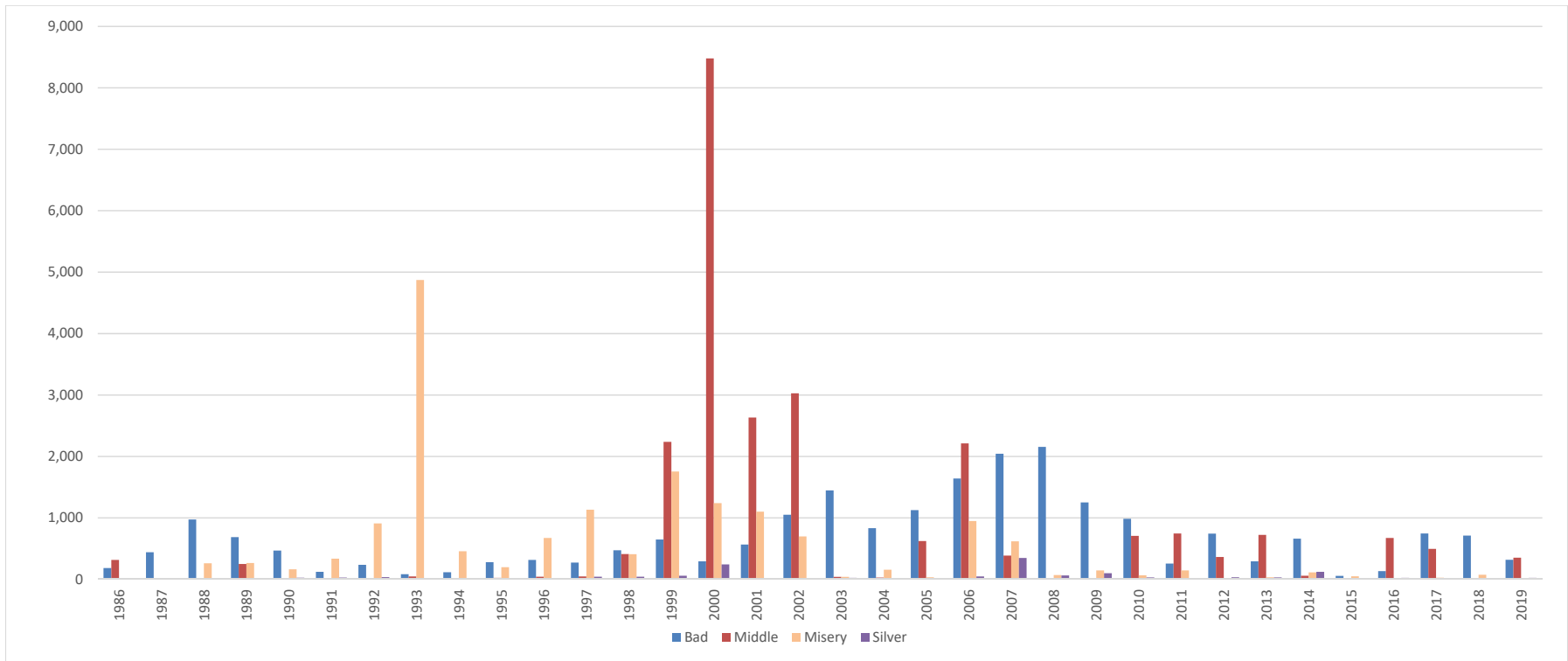


Figure 2. Annual catches of unmarked adult spawning-phase sea lamprey in spring spawning assessment traps and nets in four tributaries to Lake Superior monitored during 1986-2019.

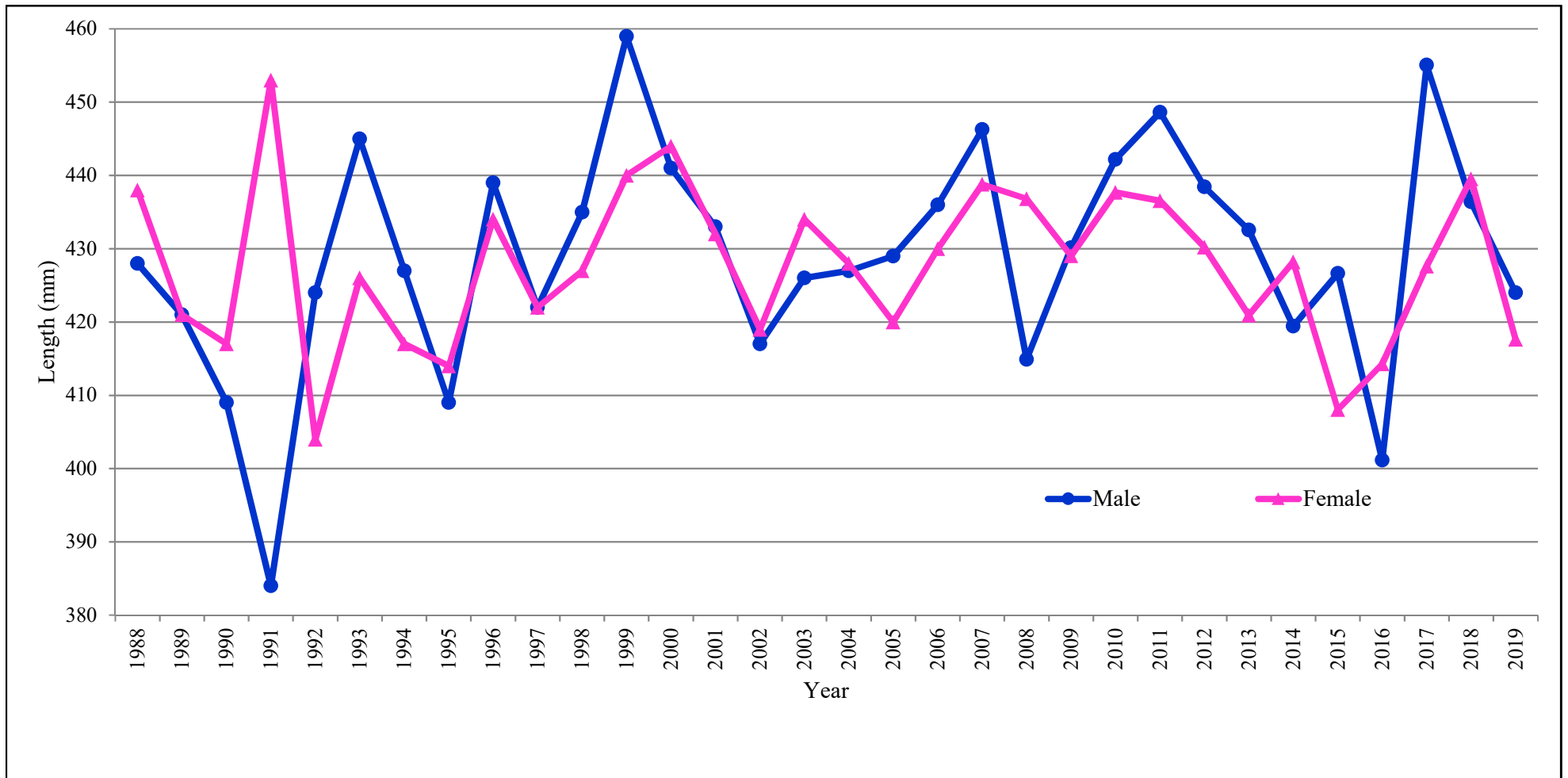


Figure 3. Mean length (mm) for male and female spawning-phase lamprey from rivers trapped during 1988-2019.

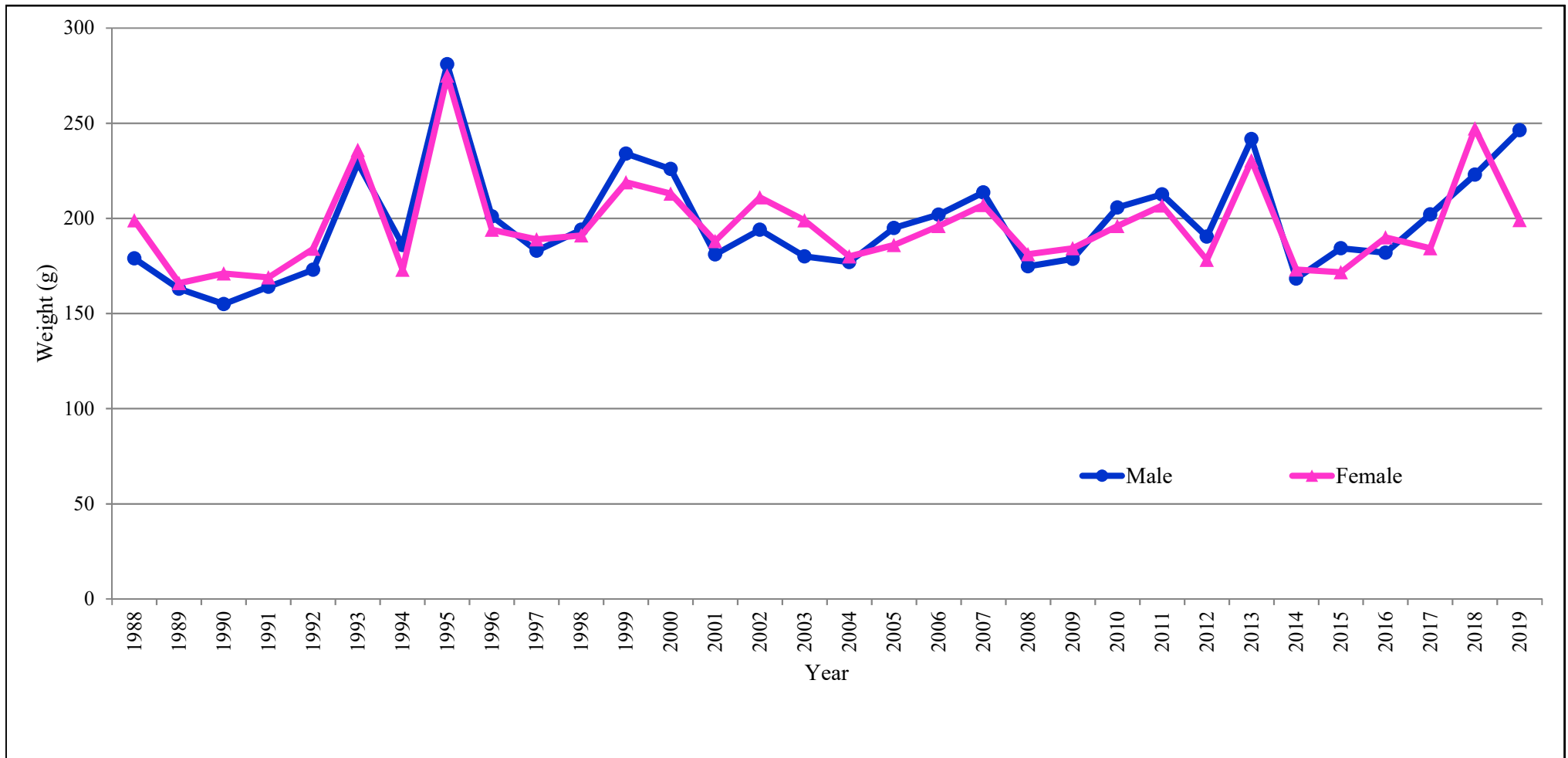


Figure 4. Mean weight (grams) for male and female spawning-phase lamprey from rivers trapped during 1988-2019.

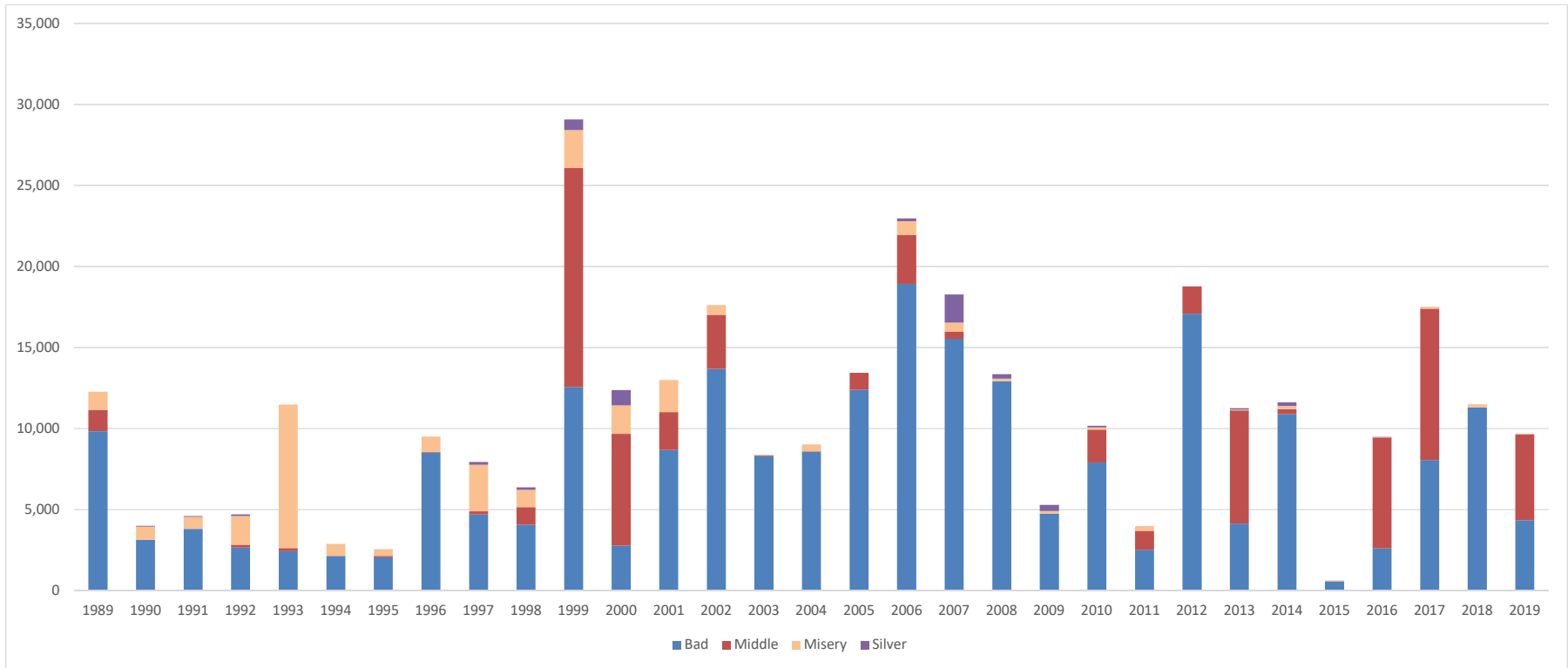


Figure 5. Population estimates (PE) for spawning-phase lamprey from four monitored tributaries to Lake Superior during 1986-2019.

Table 1. Information on location and gear used during spawning-phase sea lamprey trapping conducted on Lake Superior tributaries during 2019.

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. Water and air temperature (degrees Centigrade) for tributaries to Lake Superior sampled during spawning-phase lamprey trapping in 2019.

Tributary	<u>Water Temperature</u>				
	N*	average	S.D.	min	max
Michigan Tributaries					
Misery	22	13.6	3.5	8	19
Silver	24	15.0	4.2	8	23
Wisconsin Tributaries					
Bad	25	12.1	4.0	5	18
Middle	31	13.3	4.8	3	21
	<u>Air Temperature</u>				
	N*	average	S.D.	min	max
Michigan Tributaries					
Misery	22	15.9	4.2	10	24
Silver	24	18.0	4.9	7	26
Wisconsin Tributaries					
Bad	25	12.3	3.8	5	18
Middle	31	14.9	6.8	2	26

*N= number of days where measurement was recorded.

Table 3. Annual catches of unmarked adult spawning-phase sea lamprey in spring spawning assessment traps and nets in four tributaries to Lake Superior monitored during 1986-2019.

Year	Wisconsin Tributaries			Michigan Tributaries			Grand Total
	Bad	Middle	Subtotal	Misery	Silver	Subtotal	
1986	184	315	499		0	0	499
1987	439	16	455		4	4	459
1988	972	11	983	261	0	261	1,244
1989	684	249	933	265	6	271	1,204
1990	465	1	466	164	26	190	656
1991	121	4	125	336	29	365	490
1992	236	12	248	907	36	943	1,191
1993	84	46	130	4,871	0	4,871	5,001
1994	114	11	125	455	6	461	586
1995	280	24	304	197	20	217	521
1996	316	42	358	672	6	678	1,036
1997	272	47	319	1,131	42	1,173	1,492
1998	471	408	879	406	42	448	1,327
1999	607	2,069	2,676	1,490	55	1,545	4,221
2000	283	6,330	6,613	990	191	1,181	7,794
2001	536	2,012	2,548	799	5	804	3,352
2002	1,002	2,624	3,626	463	7	470	4,096
2003	1,372	28	1,400	37	23	60	1,460
2004	803	20	823	130	14	144	967
2005	1,090	482	1,572	31	12	43	1,615
2006	1,603	1,814	3,417	556	45	601	4,018
2007	1,987	316	2,303	528	303	831	3,134
2008	2,111	4	2,115	59	58	117	2,232
2009	1,203	9	1,212	102	88	190	1,402
2010	965	664	1,629	52	30	82	1,711
2011	256	671	927	123	5	128	1,055
2012	732	354	1,086	19	32	51	1,137
2013	286	704	990	30	26	56	1,046
2014	642	52	694	107	109	216	910
2015	55	1	56	39	17	56	112
2016	131	642	773	7	22	29	802
2017	731	481	1,212	24	2	26	1,238
2018	710	4	714	73	22	95	809
2019	318	352	670	16	25	41	711

Table 4. Number of fish by species, fish taxa, and other taxa captured during spawning-phase sea lamprey trapping in four Lake Superior tributaries in 2019.

	Wisconsin Tributaries			Michigan Tributaries			Grand Total
	Bad	Middle	Total	Misery	Silver	Total	
<i>Fish Species</i>							
Sea Lamprey adult	308	352	660	16	25	41	701
Black Bullhead		1	1			0	1
Brook Trout		2	2	32	26	58	60
Burbot	1	128	129	15	1	16	145
Central Mudminnow			0	1		1	1
Coho Salmon			0	2		2	2
Common Shiner		44	44	5	1	6	50
Creek Chub		149	149	103	19	122	271
Hornyhead Chub		20	20			0	20
Longnose Dace	4	12	16	90		90	106
Longnose Sucker		8	8			0	8
Mottled Sculpin			0	30		30	30
Rainbow Trout			0	220	7	227	227
Rock Bass			0		33	33	33
Ruffe			0	3		3	3
Smallmouth Bass			0		1	1	1
Splake			0	1		1	1
Trout-perch	1		1			0	1
Walleye	1		1			0	1
White Sucker	2	321	323	117	162	279	602
<i>Fish taxa</i>							
Bullhead species		58	58	2		2	60
Chub (Cyprinidae) species	1	125	126			0	126
Chubs (Coregonus) species		1	1			0	1
Dace species	1		1	5		5	6
Madtom species		93	93			0	93
Shiner species	3	20	23	5		5	28
<i>Other taxa</i>							
Crayfishes		212	212	11	12	23	235
Frogs species		4	4	2	1	3	7
Giant Water Bugs			0	5		5	5

Table 5. Calculated mean length (mm), weight (grams), and standard deviation (S.D.) for male and female spawning-phase lamprey captured during 2019.

River	Sex	Length (mm)			Weight (grams)		
		Number	Mean	S.D.	Number	Average	S.D.
Middle	Female	7	416	37	7	153	21
	Male	4	416	27	4	164	27
	All	11	416	32	11	157	23
Bad	Female	30	419	39	30	212	165
	Male	22	422	40	22	271	240
	All	52	420	39	52	237	200
Misery	Female	1	382	n/a	1	147	n/a
	Male	3	451	43	3	198	76
	All	4	434	49	4	185	67
Silver	Female	0	n/a	n/a	0	n/a	n/a
	Male	1	417	n/a	1	180	n/a
	All	1	417	n/a	1	180	n/a
All Rivers	Female	38	418	38	38	199	148
	Male	30	424	38	30	246	210
	All	68	420	38	68	220	178

Table 6. Population estimates (PE) and method of estimation for spawning-phase lamprey from four monitored tributaries to Lake Superior during 1986-2019.

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	-	
2019	4,333	P	5,307	P	50	P	-	

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