



**Trapping Activities and Population Estimates of
Sea Lamprey in Tributaries of Lake Superior
During 2015**

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 gather information on sea lamprey in various tributaries to Lake Superior. In 2015 work included both adult spawning-phase (4 rivers) and downstream trapping for transformer-phase (2 rivers) lampreys. Results of the 2015 trapping season are reported.

The four rivers sampled in spring 2015 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 2015 a total of 123 adult spawning-phase sea lampreys were captured in these four tributaries which was the lowest catch recorded in the twenty-eight years. The majority of spawning-phase sea lampreys captured came from the Bad River (56). Adjusted Petersen estimates of adult spawning-phase lamprey abundance calculated for 2 of the 4 tributaries in 2015 were 570 in the Bad River and 59 in the Misery River.

The Bad and Potato rivers were sampled for transformer-phase lamprey in fall 2015. A total of 4 transformer-phase sea lampreys were captured.

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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 have been reported in GLIFWC administrative reports (e.g. Mattes 2015). 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 and to remove pre-adult transformer-phase sea lamprey migrating downstream during October-November. Objectives of the project are: (1) to monitor the in-stream movements of sea lamprey, (2) to collect data on the biological characteristics 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 and transformer-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 2015 trapping season for the four tributaries monitored cooperatively by GLIFWC, KB-NRD, USFWS-SLC, and BR-NRD.

In 2015 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 which are not currently being trapped (Mattes 2015).

Streams trapped for transformer-phase lampreys were based upon USFWS assessment data which tracks sea lamprey abundance in tributaries. Tributaries that were estimated to have high abundances of transformer-phase sea lampreys were selected for trapping. In 2015, the Bad and Potato rivers in Wisconsin were trapped.

METHODS

Capture Gear and Sites

Two tributaries in Wisconsin and two tributaries in the Upper Peninsula of Michigan were trapped for spawning-phase sea lampreys from late April through early July while the Bad and Potato rivers in Wisconsin were trapped for transformer-phase sea lampreys from October through November (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.

For spawning-phase sea lampreys portable assessment traps (PAT's) and fyke nets were used to capture lamprey (Table 1a). 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. Since 2000 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 Silver River, which does not have a suitable barrier, one fyke net was set in the lower portion of the river with the cod end upstream.

For transformer-phase sea lampreys 3-fyke nets on the Bad River and 1-fyke net on the Potato River were used for capture and set in the lower portion of the river with the cod end downstream (Table 1b). Nets were set from October to November.

Data Collection

Traps or fyke nets were emptied at least three times per week (i.e., Monday, Wednesday, and Friday) in the four rivers fished for adult spawning-phase and two rivers fished for transformer-phase sea lamprey. A sub-sample of live spawning-phase lamprey were transported downstream (Table 1a) 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). Spawning-phase lampreys not marked and released were destroyed. Water and air temperature were recorded at the time traps or nets were emptied (Table 3).

The numbers of live and dead marked and unmarked spawning-phase lampreys captured each sampling day were 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 were measured to the nearest millimeter, weighed to the nearest gram, and sex determined. The fin clip combination on recaptured spawning-phase lamprey was also recorded. During fall sampling in the Bad and Potato rivers the number of transformer-phase sea lampreys was counted each sampling day and all were measured to the nearest millimeter.

Population Estimates

Mark-recapture population estimates for spawning-phase sea lampreys were attempted based on the marking procedure described above. From 1986-2014, when sample size was sufficient population estimates were calculated using the modified Schaefer method (Ricker 1975). In 2015, due to sample size the adjusted Petersen Estimator was calculated. In either instance, when the number of recaptures was deemed too low no such estimate was calculated.

RESULTS AND DISCUSSION

Trap Catches

Spawning-phase

A total of 123 adult spawning-phase sea lampreys were captured in the four sampled tributaries. This was the lowest catch recorded since sampling began in 1986.. Fifty-six spawning-phase sea lampreys captured came from the Bad River followed by 49 from the Misery River, 17 from the Silver River and one from the Middle River (Table 4).

Other than sea lamprey, 20 fish species, three fish taxa, and four other taxa were captured during the 2015 spawning-phase trapping (Table 5). Rainbow Trout (*Oncorhynchus mykiss*, N=395) were captured most often, primarily from the Misery River. Lake Chub (*Couesius plumbeus*, N=222), crayfish (Cambaridae family, N=200), Creek Chub (*Semotilus atromaculatus*, N=119) and Burbot (*Lota lota*, N=98) were also commonly captured in the Middle and Misery rivers.

Transformer-phase

A total of four transformer-phase sea lampreys were captured in the Bad River during the fall of 2015 while none were captured in the Potato River (Table 6b). The Bad and Potato rivers were trapped from October 14 to October 30, 2015 following lampricide treatment of the rivers.

Biological Characteristics

For spawning-phase sea lampreys mean length was 427 mm for male lampreys, while the mean length of female lamprey was 408 mm (Table 6a). These lengths were within the range of lengths observed during the period from 1988 to 2014 (Figure 2). The mean weight of male lamprey was 184 grams, while the mean weight of female lamprey was 172 grams (Table 6a). These weights were within the range of weights observed during the period from 1988 to 2014 (Figure 3).

Captured transformed lampreys were measured and had a mean length of 143 mm (range: 140 to 147 mm) (Table 6b).

Population Estimates

Adjusted Petersen estimates of adult spawning-phase abundance were calculated for the Bad and Misery rivers in 2015 (Table 7). Abundance estimates were 570 in the Bad river and 59 in the Misery river. This was the lowest recorded population estimate for the Bad River in the since trapping began in 1986 (range: 2,048-18,912). The population estimate of 59 in the Misery River was the third lowest estimate since sampling began in 1988. (range: 39-8,859) (Table 7). Low sample sizes prevented population estimates for the other two rivers.

REFERENCES CITED

- Mattes, W.P. 2015. Trapping activities and population estimates of adult sea lamprey in tributaries of Lake Superior during 2014. Biological Services Division Administrative Report 15-3. Great Lakes Indian Fish and Wildlife Commission, Odanah, WI. 15 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.

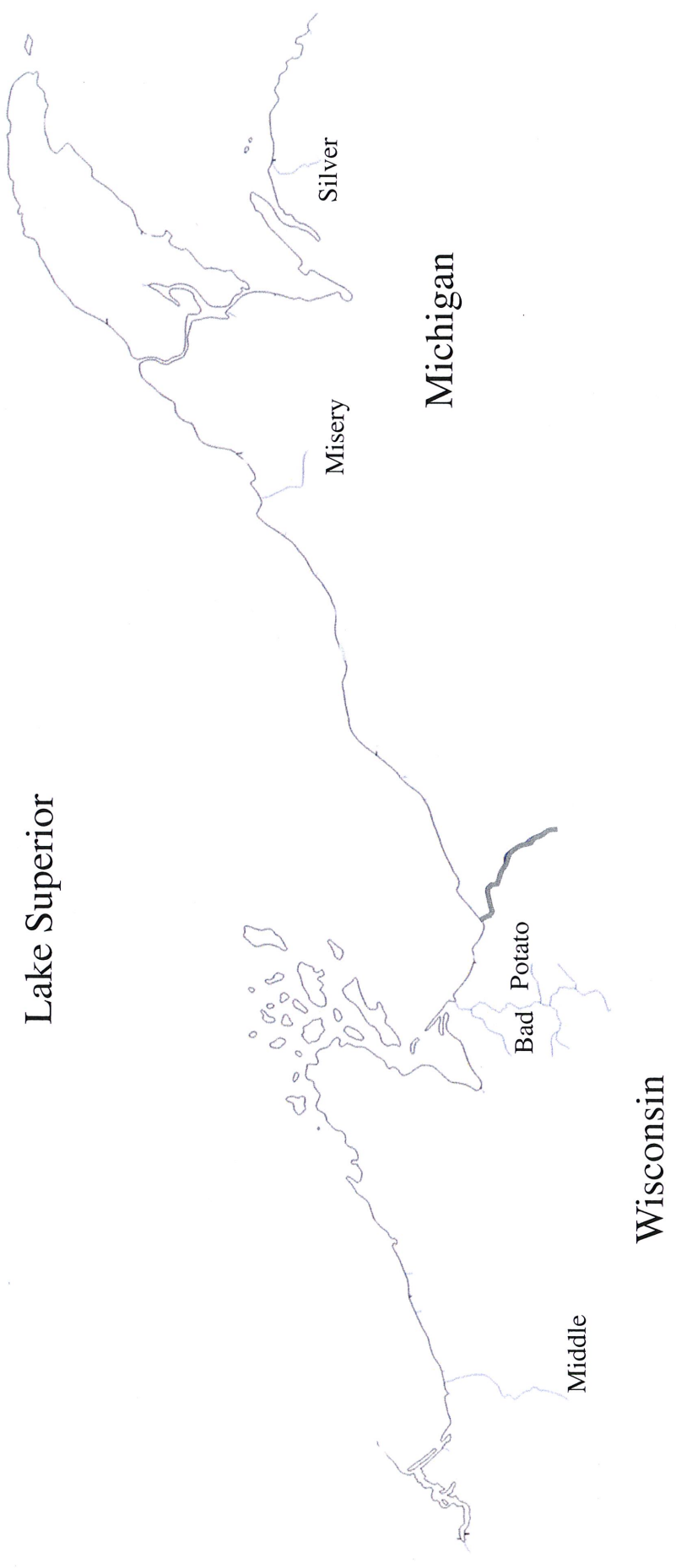


Figure 1. Location of rivers in which sea lampreys were trapped in 2015.

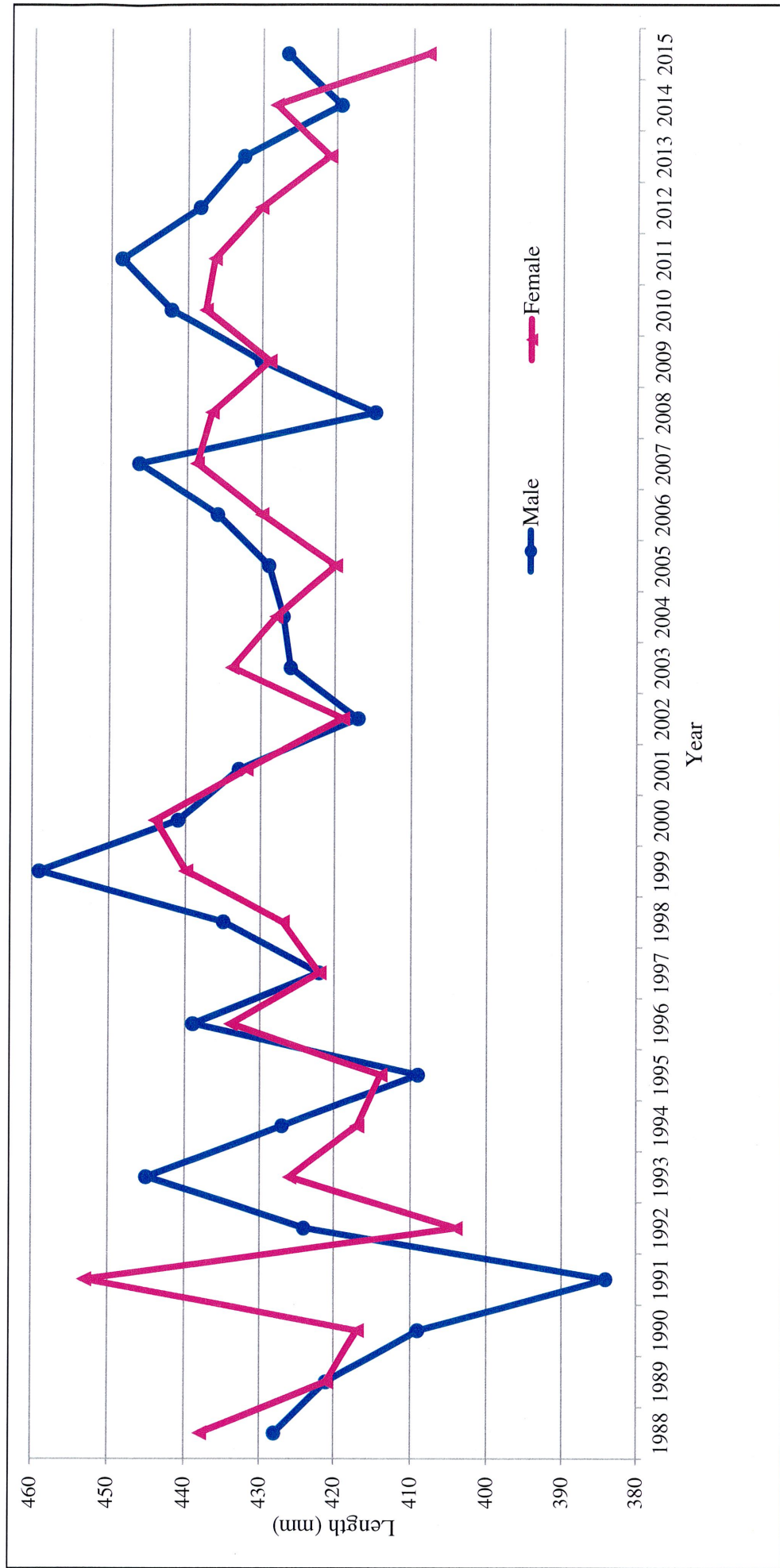


Figure 2. Mean length (mm) for male and female spawning-phase lamprey from rivers trapped during 1988-2015.

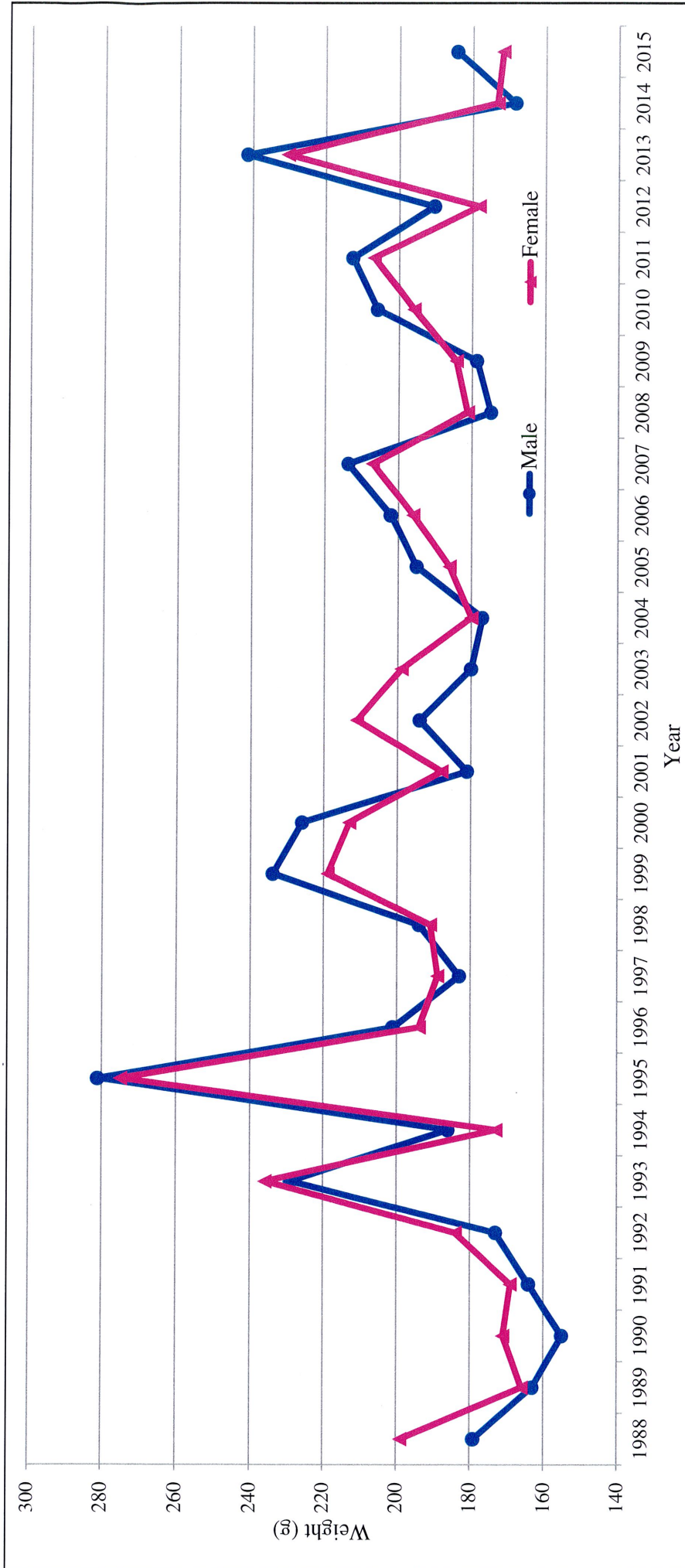


Figure 3. Mean weight (grams) for male and female spawning-phase lamprey from rivers trapped during 1988-2015.

Table 1. Information on location and gear used during spawning-phase (a) and transformer-phase (b) sea lamprey trapping conducted on Lake Superior tributaries during 2015.

(a)

| Tributary | State/County | Location trapped | Gear | Trap site distance | | Barrier distance | Release Site |
|-----------|--------------|-----------------------------|------------|--------------------|------------------|-------------------------------|--------------|
| | | | | from mouth | from mouth | | |
| 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 | |

(b)

| Tributary | State/County | Location trapped | Gear | Trap site distance | |
|-----------|--------------|-----------------------------|-------------|--------------------|------------|
| | | | | from mouth | from mouth |
| Bad | WI/Ashland | 46° 29' 13" N 90° 41' 44" W | 3-fyke nets | 35 km (22 mile) | |
| Potato | WI/Ashland | 46° 26' 59" N 90° 40' 16" W | 1-fyke net | 0.4 km (0.25 mile) | |

Table 2. Type and combination of marks (v-notch fin clips) used on adult lamprey by week for rivers trapped during 2015.

| Week of trapping | Dates in 2015 | Mark (anterior, posterior) | Week of trapping | Dates in 2015 | Mark (anterior, posterior) |
|------------------|-----------------------|----------------------------|------------------|-----------------------|----------------------------|
| 1 | 4/12/2015 - 4/18/2015 | (0,3) | 7 | 5/24/2015 - 5/30/2015 | (0,2) |
| 2 | 4/19/2015 - 4/25/2015 | (2,2) | 8 | 5/31/2015 - 6/6/2015 | (1,2) |
| 3 | 4/26/2015 - 5/2/2015 | (2,0) | 9 | 6/7/2015 - 6/13/2015 | (2,1) |
| 4 | 5/3/2015 - 5/9/2015 | (0,1) | 10 | 6/14/2015 - 6/20/2015 | (3,0) |
| 5 | 5/10/2015 - 5/16/2015 | (1,0) | 11 | 6/21/2015 - 6/27/2015 | (3,1) |
| 6 | 5/17/2015 - 5/23/2015 | (1,1) | 12 | 6/28/2015 - 7/4/2015 | (1,3) |

Table 3. Water and air temperature (degrees Centigrade) for spawning-phase (a) and transformer-phase (b) tributaries to Lake Superior sampled during lamprey trapping in 2015.

(a)

| Tributary | <u>Water Temperature</u> | | | |
|-----------------------|--------------------------|------------------------|------|---------|
| | N* | average | S.D. | min max |
| Michigan Tributaries | | | | |
| Misery | 24 | 12.8 | 2.7 | 8 18 |
| Silver | 21 | 13.5 | 3.4 | 8 19 |
| Wisconsin Tributaries | | | | |
| Bad | 60 | 13.9 | 4.1 | 4 20 |
| Middle | 49 | 13.5 | 3.8 | 6 20 |
| | | <u>Air Temperature</u> | | |
| | N* | average | S.D. | min max |
| Michigan Tributaries | | | | |
| Misery | 24 | 15.5 | 5.2 | 7 28 |
| Silver | 21 | 16.4 | 4.7 | 6 25 |
| Wisconsin Tributaries | | | | |
| Bad | 59 | 13.5 | 4.6 | 1 23 |
| Middle | 49 | 13.6 | 4.8 | 4 22 |

(b)

| Tributary | <u>Water Temperature</u> | | | |
|-----------|--------------------------|---------|------|---------|
| | N* | average | S.D. | min max |
| Bad | 10 | 6.7 | 0.9 | 5.5 8 |
| Potato | 10 | 6.9 | 0.9 | 6 8 |

*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 2015.

| 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 | 646 | 2,235 | 2,881 | 1,753 | 59 | 1,812 | 4,693 |
| 2000 | 293 | 8,481 | 8,774 | 1,238 | 243 | 1,481 | 10,255 |
| 2001 | 563 | 2,633 | 3,196 | 1,100 | 6 | 1,106 | 4,302 |
| 2002 | 1,050 | 3,026 | 4,076 | 695 | 7 | 702 | 4,778 |
| 2003 | 1,446 | 41 | 1,487 | 39 | 24 | 63 | 1,550 |
| 2004 | 831 | 29 | 860 | 155 | 14 | 169 | 1,029 |
| 2005 | 1,124 | 620 | 1,744 | 33 | 12 | 45 | 1,789 |
| 2006 | 1,638 | 2,212 | 3,850 | 946 | 47 | 993 | 4,843 |
| 2007 | 2,042 | 387 | 2,429 | 617 | 348 | 965 | 3,394 |
| 2008 | 2,154 | 4 | 2,158 | 70 | 63 | 133 | 2,291 |
| 2009 | 1,249 | 9 | 1,258 | 145 | 100 | 245 | 1,503 |
| 2010 | 983 | 704 | 1,687 | 64 | 31 | 95 | 1,782 |
| 2011 | 257 | 744 | 1,001 | 144 | 5 | 149 | 1,150 |
| 2012 | 741 | 363 | 1,104 | 20 | 32 | 52 | 1,156 |
| 2013 | 293 | 722 | 1,015 | 33 | 30 | 63 | 1,078 |
| 2014 | 660 | 58 | 718 | 113 | 122 | 235 | 953 |
| 2015 | 56 | 1 | 57 | 49 | 17 | 66 | 123 |

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 2015.

| | Wisconsin Tributaries | | | Michigan Tributaries | | | Grand Total |
|---------------------------|-----------------------|--------|-------|----------------------|--------|-------|-------------|
| | Bad | Middle | Total | Misery | Silver | Total | |
| <i>Fish Species</i> | | | | | | | |
| Sea Lamprey adult | 56 | 1 | 57 | 49 | 17 | 66 | 123 |
| Black Bullhead | | 36 | 36 | | | 0 | 36 |
| Bowfin | | 4 | 4 | | | 0 | 4 |
| Brook Trout | | | 0 | 30 | 63 | 93 | 93 |
| Brown Bullhead | | | 0 | 3 | | 3 | 3 |
| Brown Trout | | 2 | 2 | | | 0 | 2 |
| Burbot | | 82 | 82 | 16 | | 16 | 98 |
| Chestnut Lamprey | | 1 | 1 | | | 0 | 1 |
| Common Shiner | | | 0 | 17 | | 17 | 17 |
| Creek Chub | 7 | | 7 | 110 | 2 | 112 | 119 |
| Lake Chub | | 222 | 222 | | | 0 | 222 |
| Logperch | 1 | | 1 | | | 0 | 1 |
| Longnose Dace | | | 0 | 44 | | 44 | 44 |
| Longnose Sucker | 3 | | 3 | | 23 | 23 | 26 |
| Mottled Sculpin | | | 0 | 19 | | 19 | 19 |
| Northern Pike | 1 | | 1 | | | 0 | 1 |
| Pumpkinseed | | 3 | 3 | | 1 | 1 | 4 |
| Rainbow Trout | | 1 | 1 | 389 | 5 | 394 | 395 |
| Rock Bass | 3 | 1 | 4 | | 27 | 27 | 31 |
| Round Whitefish | | | 0 | 1 | | 1 | 1 |
| Ruffe | | | 0 | 2 | | 2 | 2 |
| <i>Fish taxa</i> | | | | | | | |
| Bullhead | | | 0 | 2 | | 2 | 2 |
| Sculpin | | | 0 | 1 | | 1 | 1 |
| Dace | | 6 | 6 | | | 0 | 6 |
| <i>Other taxa</i> | | | | | | | |
| Bull Frog | | | 0 | 1 | | 1 | 1 |
| Crayfishes | | 184 | 184 | 13 | 3 | 16 | 200 |
| Giant Water Bugs | | | 0 | 12 | | 12 | 12 |
| Predaceous Diving Beetles | 4 | 2 | 6 | | | 0 | 6 |

Table 6. Calculated mean length (mm), weight (grams), and standard deviation (S.D.) for male and female spawning-phase (a) and calculated mean length (mm) for all transformer-phase (b) lamprey captured during 2015.

(a)

| River | Sex | Length (mm) | | | Weight (grams) | | |
|------------|--------|-------------|------|------|----------------|---------|------|
| | | Number | Mean | S.D. | Number | Average | S.D. |
| Middle | Female | No Data | | | | | |
| | Male | | | | | | |
| | All | | | | | | |
| Bad | Female | 9 | 416 | 36 | 9 | 163 | 43 |
| | Male | 6 | 435 | 42 | 6 | 190 | 48 |
| | All | 15 | 424 | 38 | 15 | 174 | 46 |
| Misery | Female | 8 | 399 | 21 | 8 | 182 | 29 |
| | Male | 2 | 402 | | 2 | 167 | |
| | All | 10 | 400 | 26 | 10 | 179 | 32 |
| Silver | Female | No Data | | | | | |
| | Male | | | | | | |
| | All | | | | | | |
| All Rivers | Female | 17 | 408 | 31 | 17 | 172 | 36 |
| | Male | 8 | 427 | 44 | 8 | 184 | 36 |
| | All | 25 | 414 | 36 | 25 | 176 | 36 |

(b)

| River | Length (mm) | | | | |
|--------|-------------|------|------|------|-----|
| | Number | Mean | S.D. | Min. | Max |
| Bad | 3 | 143 | 4 | 140 | 147 |
| Potato | 0 | - | - | - | - |

Table 7. Population estimates (PE) and method of estimation for spawning-phase lamprey from four monitored tributaries to Lake Superior during 1986-2015.

| 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 | - | |

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