# LAKE SUPERIOR STATE UNIVERSITY'S CENTER FOR FRESHWATER RESEARCH AND EDUCATION FISH HATCHERY

# 2018 ANNUAL REPORT

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LAKE SUPERIOR STATE UNIVERSITY

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## ACKNOWLEDGMENTS

We are extremely grateful to Cloverland Electric Cooperative for providing space within their facility and electricity, which are essential to our hatchery operations. We are also appreciative of Lighthouse.net and Packerland Broadband for graciously providing broadband internet service for broadcasting our fishcam (https://www.lssu.edu/cfre/cfre-fishcam/). The Michigan Department of Natural Resources supplies the feed necessary to sustain our hatchery operation, funds all disease testing, and provides expertise and additional supplies as needed. We also acknowledge numerous student employees and volunteers that contribute to the success of the Center for Freshwater Research and Education Fish Hatchery.



## HATCHERY OPERATIONS

### *Sub-adult Rearing*

A total of 51,514 age-0 Atlantic Salmon moved into fry raceways in late February 2017 survived until the time of early feeding and were reared in filtered and heated water until June 2017. About 36,300 fry survived through mid-June of 2017, at which time they were transferred into large raceways and were reared in ambient river water. On average, these fish grew about 136 mm in total length during March-December 2017 (Table 1).

Table 1. Biweekly rearing data of age-0 Atlantic Salmon reared in heated water in 2017 (lot: P-ATS-LL-W-16-SM-LS-LS). The number of fish initially moved into fry raceways was 51,514.

| Mid date of biweekly summary | Ending # of fish | Mean temp (°C) | Mean length (mm) | Mean biomass (kg) | TUGR (mm/°C) | FCR | Biweekly mortality (%) | Avg. density ($kg/m^3$) | Flow (L/min) |
|---|---|---|---|---|---|---|---|---|---|
| 14-Mar | 51,187 | 10.09 | 30.81 | 12.499 | 0.017 | 1.02 | 0.63 | 9.05 | 45.9 |
| 28-Mar | 49,888 | 9.25 | 33.61 | 16.255 | 0.025 | 0.95 | 2.54 | 11.74 | 69.0 |
| 11-Apr | 46,820 | 8.91 | 37.13 | 21.43 | 0.030 | 0.71 | 6.15 | 15.41 | 69.0 |
| 25-Apr | 44,400 | 8.76 | 41.19 | 28.26 | 0.035 | 0.70 | 5.17 | 20.33 | 92.0 |
| 9-May | 38,873 | 8.87 | 44.99 | 34.321 | 0.026 | 0.91 | 12.45 | 19.23 | 118 |
| 23-May | 37,168 | 8.87 | 48.80 | 40.792 | 0.036 | 1.04 | 4.38 | 27.57 | 118 |
| 6-Jun | 36,625 | 9.63 | 53.66 | 53.713 | 0.040 | 0.99 | 1.46 | 30.08 | 118 |
| 20-Jun | 36,205 | 10.37 | 59.46 | 73.873 | 0.043 | 1.02 | 1.14 | 11.43 | 213 |
| 4-Jul | 36,075 | 14.37 | 66.16 | 103.40 | 0.035 | 0.98 | 0.36 | 10.95 | 940 |
| 18-Jul | 35,841 | 15.64 | 73.69 | 145.67 | 0.036 | 0.97 | 0.64 | 7.71 | 1,253 |
| 1-Aug | 35,747 | 15.90 | 81.97 | 204.49 | 0.039 | 1.42 | 0.26 | 10.82 | 1,253 |
| 15-Aug | 35,604 | 18.41 | 90.93 | 284.93 | 0.036 | 1.34 | 0.40 | 11.81 | 1,600 |
| 29-Aug | 35,424 | 16.61 | 100.51 | 391.95 | 0.042 | 1.31 | 0.50 | 8.67 | 3,000 |
| 12-Sep | 35,228 | 15.69 | 110.63 | 531.62 | 0.047 | 1.42 | 0.55 | 11.76 | 3,000 |
| 26-Sep | 35,197 | 17.97 | 121.23 | 712.18 | 0.043 | 1.05 | 0.09 | 15.78 | 3,000 |
| 10-Oct | 35,172 | 13.62 | 132.23 | 942.26 | 0.059 | 0.72 | 0.07 | 20.88 | 3,000 |
| 24-Oct | 35,157 | 12.49 | 143.58 | 1228.63 | 0.066 | 0.57 | 0.04 | 27.23 | 3,000 |
| 7-Nov | 35,149 | 8.24 | 155.19 | 1579.18 | 0.101 | 0.38 | 0.02 | 49.21 | 2,133 |
| 21-Nov | 35,145 | 6.16 | 167.01 | 2001.27 | 0.138 | 0.33 | 0.01 | 37.28 | 3,133 |

*High densities were because fish were combined in raceways to accommodate brood stock collection

## *Stocking & Disease Testing*

A total of 34,937 age-1 Atlantic Salmon *Salmo salar* were reared at Lake Superior State University's Center for Freshwater Research and Education (CFRE) Fish Hatchery and stocked into the St. Marys River, Chippewa County, Michigan, on 11 June 2018 (Table 2). These fish were our 32nd stocking in the St. Marys River from our hatchery. The fish (lot P-ATS-LL-W-16-SM-LS-LS) were stocked directly into the river at 22:30 at a water temperature of 10 °C. Each fish received a left pelvic (ventral; LV) clip and averaged 16.9 cm in total length and 50 g in weight or 20/kg. In the spring of 2018, 60 of these age-1 fish were tested for the presence of *Aeromonas salmonicida*, Bacterial Kidney Disease (BKD), Infectious Hematopoietic Necrosis Virus, Infectious Pancreatic Necrosis Virus, Viral Hemorrhagic Septicemia Virus, and *Yersinia ruckeri* by Michigan State University (MSU) personnel prior to stocking. All fish tested negative for pathogens, except for three that had low antigen concentrations of BKD (Appendix 1).

Survival of this 2016 lot of Atlantic Salmon, from the eyed-egg stage through stock-out at age 1, was just over 67%. Survival rates have been around 80% since 2008 when our water filtration system was installed. This 67% survival rate to age 1 is the second lowest since 2008 (45% for age-1 fish stocked out in 2016), and our fish were infested with the parasite *Ichthyobodo*. This relatively poor survival rate and the presence of a parasite occurred even though we installed six additional filters, bringing the total to 12, and lowered the size of the filters from 25 µm to 10 µm.

We also finished rearing Atlantic Salmon that were initially reared by MI DNR. Personnel form MI DNR delivered fish from the Platte River State Fish Hatchery on 7 May 2018 and placed them into an acclimation area within the first tailrace of the hydro plant. This acclimation area was created by placing a blocker net on the downstream end of the first tailrace tunnel. These Atlantic Salmon were held and fed for 36 d, and released at 21:30 on 12 June 2018 by removing the blocker net. Personnel from the Platte River State Fish Hatchery conducted a fish quality assessment prior to release.

Table 2. Number and mean total length of age-1 Atlantic Salmon stocked during 1987-2018. Stocking typically occurred between mid-May and mid-June of each year.

| Year | # stocked | Mean total length |
|---|---|---|
| 1987 | 19,000 | 189 |
| 1988 | 12,751 | 196 |
| 1989 | 19,966 | 170 |
| 1990 | 31,702 | 131 |
| 1991 | 8,367 | 127 |
| 1992 | 8,048 | 179 |
| 1993 | 47,716 | 191 |
| 1994 | 20,350 | 174 |
| 1995 | 29,060 | 185 |
| 1996 | 33,756 | 183 |
| 1997 | 43,373 | 150 |
| 1998 | 41,721 | 142 |
| 1999 | 49,818 | 181 |
| 2000 | 46,220 | 179 |
| 2001 | 35,909 | 172 |
| 2002 | 29,313 | 154 |
| 2003 | 54,743 | 180 |
| 2004 | 24,811 | 211* |
| 2005 | 29,665 | 201* |
| 2006 | 38,032 | 186 |
| 2007 | 20,437 | 178 |
| 2008 | 29,373 | 186 |
| 2009 | 28,400 | 185 |
| 2010 | 26,301 | 184 |
| 2011 | 31,100 | 200 |
| 2012 | 35,230 | 189 |
| 2013 | 35,000 | 196 |
| 2014 | 40,908 | 181 |
| 2015 | 29,880 | 164 |
| 2016 | 36,790 | 183 |
| 2017 | 28,983 | 177 |
| 2018 | 34,937 | 169 |

*Fish were held until August because they were treated for BKD and furunculosis

## *Broodstock Collection, Disease Testing, Gamete Collection, and Egg Treatments*

Personnel from the CFRE Fish Hatchery, with help from volunteers, collected returning adult Atlantic Salmon for Broodstock from 31 October 2017 to 15 November 2017. Fish were captured from the St. Marys River at the Cloverland Hydroelectric Plant using a gill net that covered the opening of the first inactive turbine tailrace on the east side of the closest active turbine. The gill net used was 15.2 m (50 ft) long, 3.4 m (10 ft) high, with a 10.2 cm (4 in) stretch mesh. The net was continuously observed until a fish became entangled in the net, at which time the net was lifted and the fish was immediately removed. Upon removal, each fish was identified to species, measured for length and weight, and examined to determine sex, maturity (ripe or unripe), presence of fin clips, tags, and most were checked for Sea Lamprey (*Petromyzon marinus*) scars. After examination, Atlantic Salmon were retained for subsequent gamete collection in one of two raceways based on sex, whereas all other species were released.

The net was fished from 13:20-16:34 on 31 October 2017 (3 hr 14 min), from 13:30-16:53 on 1 November 2017 (3 hr 23 min), from 13:30-16:15 on 8 November 2017 (2 hr 45 min), from 13:15-16:30 on 9 November 2017 (3 hr 15 min) and from 13:40-14:55 on 15 November 2017 (1 hr 15 min), for a total of 13 hr 52 min. A total of 625 Atlantic Salmon were collected; 163 on 31 October, 144 on 1 November, 94 on 8 November, 156 on 9 November and 68 on 15 November. The catch rate of Atlantic Salmon was about 45 fish/hr (Table 3), the largest number of fish caught and greatest catch rate to date. The 285 males measured averaged 59.2 cm in total length and 2.05 kg in weight, whereas the 132 females sampled averaged 56.6 cm in total length and 2.0 kg in weight.

Of the 625 Atlantic Salmon caught in 2017, 383 (61%) were reared at LSSU and 242 (39%) were reared by the MI DNR (based on observed fin clips). The ages of fish reared at LSSU ranged from 1-5, but the majority (91%) were age 2 (Table 4). The average Fulton's condition factor *K* for all fish was 1.10 in 2017 and there was no discernable trend since record-keeping began in 1990 (Figure 1). Data on individual Atlantic Salmon used as broodstock is presented in Appendix 2.

Only 420 of 625 Atlantic Salmon were examined for Sea Lamprey scars to avoid crowding in holding tanks. Of these 420, about 11% had at least one Sea Lamprey scar, the lowest percentage observed since 1990 (Figure 2). Type A scars were the most common among fish that had scars (about 58%; Table 5).

Table 3. Summary data from gill-netting of Atlantic Salmon broodstock from 1990-1994 and 1998-2017.

| Year | # of fish | Mean hr/d | # of d | Area of net ($m^2$) | Mean # of fish/hr | Mean # fish/d |
|---|---|---|---|---|---|---|
| 1990 | 46 | ---- | 23 | 47 | ---- | 2.0 |
| 1991 | 65 | 6.5 | 23 | 47 | 0.4 | 2.8 |
| 1992 | 19 | 6.7 | 28 | 58 | 0.1 | 0.7 |
| 1993 | 11 | 2.5 | 18 | 56 | 0.2 | 0.6 |
| 1994 | 18 | 2.6 | 23 | 65 | 0.3 | 0.8 |
| 1998 | 87 | 2.6 | 17 | 47 | 2.0 | 5.1 |
| 1999 | 49 | 3.0 | 26 | 56 | 0.6 | 1.9 |
| 2000 | 105 | 2.8 | 18 | 47 | 2.0 | 5.8 |
| 2001 | 116 | 2.5 | 13 | 47 | 3.6 | 8.9 |
| 2002 | 104 | 2.7 | 13 | 56 | 2.9 | 8.0 |
| 2003 | 158 | 2.8 | 9 | 56 | 6.4 | 17.6 |
| 2004 | 196 | 3.1 | 14 | 56 | 4.5 | 14.0 |
| 2005 | 210 | 4.1 | 6 | 56 | 8.5 | 35.0 |
| 2006 | 111 | 2.7 | 6 | 56 | 6.8 | 18.5 |
| 2007 | 276 | 2.6 | 6 | 56 | 17.5 | 46.0 |
| 2008 | 172 | 2.8 | 4 | 47 | 15.4 | 43.0 |
| 2009 | 140 | 4.5 | 3 | 47 | 10.4 | 47.0 |
| 2010 | 212 | 4.8 | 3 | 47 | 14.8 | 70.7 |
| 2011 | 240 | 4.2 | 4 | 47 | 14.2 | 42.4 |
| 2012 | 313 | 2.0 | 6 | 47 | 26.2 | 52.2 |
| 2013 | 378 | 3.5 | 4 | 47 | 27.4 | 94.5 |
| 2014 | 225 | 2.9 | 2 | 47 | 38.8 | 112.5 |
| 2015 | 348 | 4.4 | 3 | 47 | 26.2 | 116.0 |
| 2016 | 315 | 3.3 | 4 | 47 | 23.8 | 78.8 |
| 2017 | 625 | 2.8 | 5 | 47 | 45.1 | 125 |

Table 4. Age of Atlantic Salmon captured in fall 2017 broodstock collection efforts.

| Age | Type of clip | # of males | # of females | Total # of fish |
|---|---|---|---|---|
| 1 | LP | 0 | 0 | 0 |
| 2 | RV | 276 | 75 | 351 |
| 3 | RP | 9 | 4 | 13 |
| 4 | LV | 5 | 2 | 7 |
| 5 | LP | 1 | 5 | 6 |
| | NC | 6 | 0 | 6 |
| Unknown | AD | 195 | 47 | 242 |
| | | | Total | 625 |

Table 5. Classification of Sea Lamprey scars observed on Atlantic Salmon captured in 2017 broodstock collection efforts. Percentages are based on fish that had scars, which was about 11% of all fish collected.

| Species | Gender | Scar Type | Scar Stage | # Scars | Percent |
|---|---|---|---|---|---|
| ATS | Male | A | I | 3 | 5.3 |
| | | A | II | 2 | 3.5 |
| | | A | III | 0 | 0 |
| | | A | IV | 9 | 15.8 |
| | | Subtotal | | 14 | 24.6 |
| | | B | I | 4 | 7.0 |
| | | B | II | 2 | 3.5 |
| | | B | III | 3 | 5.3 |
| | | B | IV | 4 | 7.0 |
| | | Subtotal | | 13 | 22.8 |
| | Female | A | I | 0 | 0.0 |
| | | A | II | 1 | 1.8 |
| | | A | III | 0 | 0.0 |
| | | A | IV | 18 | 31.6 |
| | | Subtotal | | 19 | 33.3 |
| | | B | I | 1 | 1.8 |
| | | B | II | 3 | 5.3 |
| | | B | III | 2 | 3.5 |
| | | B | IV | 5 | 8.8 |
| | | Subtotal | | 11 | 19.3 |
| | | Total-A | | 33 | 57.9 |
| | | Total-B | | 24 | 42.1 |

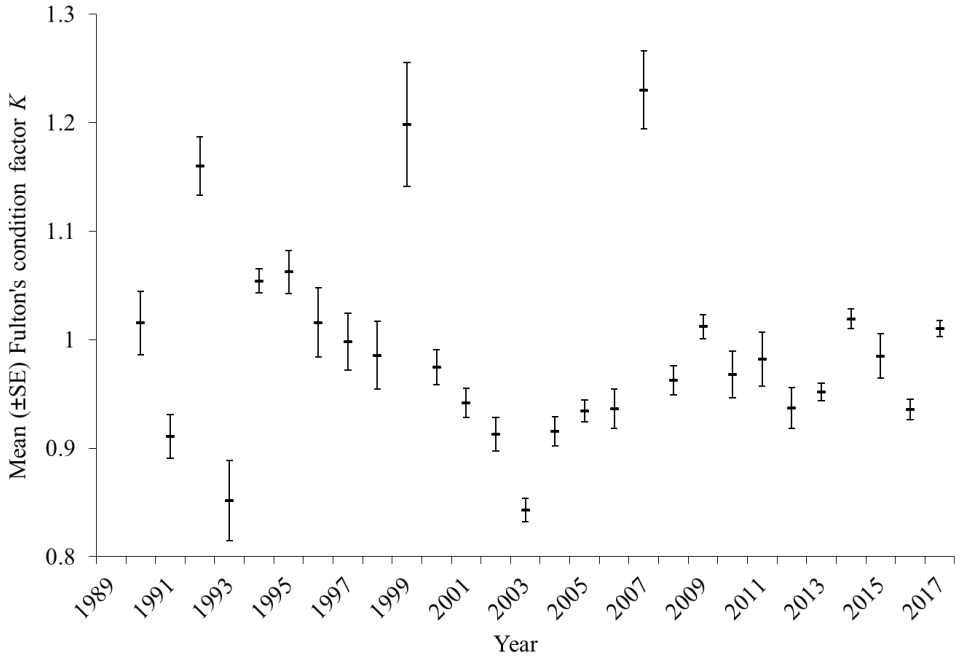


Figure 1. Annual mean (±SE) Fulton's condition factor *K* for Atlantic Salmon netted during 1990-2017.

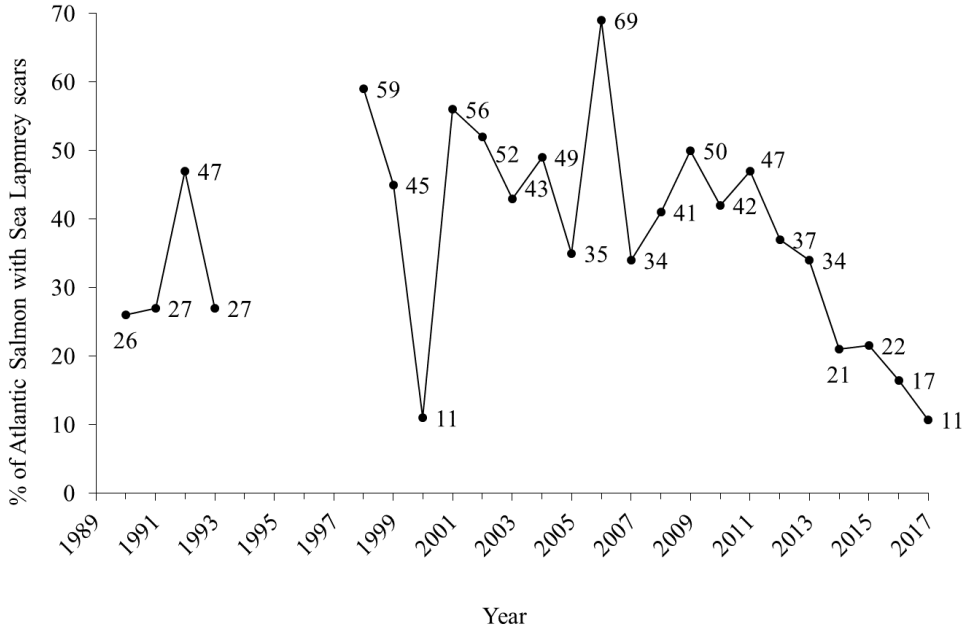


Figure 2. Percent of Atlantic Salmon broodstock that had at least one lamprey scar during 1990-1993 and 1998-2017.

Fish were held in raceways for at least one week prior to gamete collection, which occurred on 13, 16, 20 and 21 November 2017. A 1 female: 1 male crossing scheme and the dry method were used during artificial spawning of 121 pairs of Atlantic Salmon. Fertilized eggs from each cross were isolated in buckets until testing was completed for BKD by LSSU's Fish Disease Laboratory (usually within 24 hr). After gametes from all 242 Atlantic Salmon brood fish tested negative for BKD (Appendix 1), fertilized eggs were mixed together according to the date of collection and placed into egg trays. Personnel from MSU arrived on 14 November 2017 and completed a 2017 broodstock and 2018 production health inspection for the presence of *Aeromonas salmonicida*, BKD, Infectious Hematopoietic Necrosis Virus, Infectious Pancreatic Necrosis Virus, *Myxobolus cerebralis*, Viral Hemorrhagic Septicemia Virus, and *Yersinia ruckeri* on 60 adult fish that had been previously tested and resulted negative for BKD by LSSU. Personnel from MSU also tested the gametes and kidney and spleen tissue from these 60 broodstock fish for BKD, Infectious Hematopoietic Necrosis Virus, Infectious Pancreatic Necrosis Virus, *Aeromonas salmonicida*, *Oncorhynchus masu* Virus, and Viral Hemorrhagic Septicemia Virus; gametes of two fish tested positive (low antigen concentrations) for BKD and eight tested positive (low antigen concentrations) in body tissues (Appendix 1).

A total of 409,637 Atlantic Salmon eggs were collected and 398,844 were used in 2017 (Table 6). All fertilized eggs were treated according to MI DNR protocols, which included saline baths, erythromycin treatment, and disinfection in iodine. Dosages for each treatment are described in Appendix 3. On 10 January 2017, about 300,000 (our count = 314,118, MI DNR count = 280,767) eyed eggs were transported by MI DNR personnel to the Platte River State Fish Hatchery.

Our Atlantic Salmon eggs were given thiamine treatments during the water hardening stage for the second year, instead of post-hatch as was done prior to 2016. The thiamine treatments were conducted at the same time as our erythromycin bath, with both solutions present in the same bath. Thiamine baths were at a concentration of 20.4 g of 98% buffered thiamine per 20 L of filtered river water (thiamine provided by MI DNR). Our fish showed no signs of thiamine deficiency once the sac fry stage was reached, so no additional thiamine baths were conducted.

Table 6. Summary data of egg collection efforts in 2017.

| Date | # of pairs | Mean # of eggs/fish | Total # eggs |
|---|---|---|---|
| 13-Nov-17 | 29 | 3,400 | 98,612 |
| 16-Nov-17 | 31 | 2,891 | 85,549 |
| 20-Nov-17 | 26 | 3,896 | 97,183 |
| 21-Nov-17 | 35 | 3,432 | 117,500 |
| Grand total | 121 | 3,405 | 398,844 |

## *Use of Atlantic Salmon for Education and Research*

During July 2017-May 2018, a total of 168 Atlantic Salmon of various life stages were used and sacrificed for education, research, and MI DNR activities (Table 7). Adult broodstock were only sacrificed for a fish health inspection conducted by MSU. Fish of various size categories, ranging from sac-fry to yearlings, were used to support education and research at LSSU.

Table 7. Summary data of Atlantic Salmon used and sacrificed for education, research, and MI DNR activities during July 2017-May 2018.

| Date | Number | Size category | Use |
|---|---|---|---|
| 8-July-17 | 20 | Fingerlings | Frog Fest community event |
| 13-Nov-17 | 3 | Fall fingerlings | Dr. Li - class |
| 14-Nov-17 | 15 | Fall fingerlings | Dr. Li - class |
| 14-Nov-17 | 60 | Broodstock | MSU health inspection |
| 21-Feb-18 | 65 | Yearlings | MSU health inspection |
| 13-Mar-18 | 100 | Sac-fry | Dr. Evans |
| 16-May-18 | 10 | Yearlings | Dr. Li - student |
| 17-May-18 | 20 | Yearlings | MI DNR - FQA |

# APPENDICES

Appendix 1. Results of fish health inspection of age-1 Atlantic Salmon from lot P-ATS-LL-W-16-SM-LS-LS conducted by Michigan State University.

**FISH HEALTH INSPECTION REPORT--FISHERIES DIVISION**
**MICHIGAN DEPARTMENT OF NATURAL RESOURCES**
**Fish Health Inspection Report**

**AAHL Number:** 171114-1-BI-LSSU

This report is not evidence of future disease status. To determine current status, contact Fish Health Official below.

| Name and Location of Fish Source: | Owner/Manager: | Inspection Date(s): Fall 2017 | Type of Water Supply: |
|---|---|---|---|
| Lake Superior State University<br>Sault Ste. Marie, MI | Roger Greil | This: 11/14/17<br>Prior: 11/17/16 | Stream |
| | | Classification:<br>B-BK | Origin of Fish Examined:<br>Hatchery |
| | | | Type of Fish Examined:<br>Salmonid |

| Species[1] | Designation | AAHL # | Age[1] | Number in Lot | Obtained as Eggs (E) or Fish (F) From: | Pathogens[2] Inspected for and Results[a] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | *As* | *Yr* | *Rs*[b] | VHS | IHN | IPN | *Om* V[c] | WD |
| ATS | Feral Fall Atlantic Salmon Spawners (kidney & spleen samples) | 171114-1-BI-LSSU | b | n/a | Wild | 60 (0) | 60 (0) | 60 (8: 8L) | 60 (0) | 60 (0) | 60 (0) | NR[d] | 60 (0) |
| ATS | Feral Fall Atlantic Salmon Spawners (gamete samples) | 171114-1-BI-LSSU | b | n/a | Wild | NR | NR | 60 (2: 2L) | 60 (0) | 60 (0) | 60 (0) | 60 (0) | NR |
| | | | | | | | | | | | | | |
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Remarks/Recommendations:

a: Laboratory assays were conducted in accordance with the guidelines of the Great Lakes Fishery Commission (GLFC), the American Fisheries Society (AFS), and the World Organization for Animal Health (OIE).
b: The presence of *Renibacterium salmoninarum* was tested with quantitative QELISA, which is more sensitive than the direct fluorescent antibody technique; H=high, M=medium, L=low antigen concentrations.
c: *Oncorhynchus mosv.* virus testing is done on ovarian fluid samples only as per GLFC recommendations.
d: NR=Test not required.

Address/Phone of Contracted Fish Health Official

Aquatic Animal Health Laboratory
College of Veterinary Medicine
Michigan State University
1129 Farm Lane, Room 177K
Food Safety & Toxicology Building
East Lansing, MI 48824
PHONE: 517/884-2024; FAX: 517/432-2310

Signature of Contracted Fish Health Official

Mohamed Faisal

Mohamed Faisal, D.V.M., PhD.

[1]For juv. hatchery fish give age in months; for feral and adult hatchery fish use symbols e=eggs or fry; f=fingerlings; y=yearlings; b=older fish.
[2]See list of pathogen and spp. abbreviations (pg 2).
cc: Gary Whelan

FISH HEALTH INSPECTION REPORT CONTINUED. REPORT NUMBER:

| Species | Designation | AAHL # | Age | Number in Lot | Obtained as Eggs (E) or Fish (F) From: | Pathogens Inspected for and Results | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | *As* | *Yr* | *Rs* | VHS | IHN | IPN | *Om* V | WD |
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SUPPLEMENTAL INSPECTION INFORMATION

| Date | Species | Lot # | Findings |
|---|---|---|---|
| | | | |
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**Pathogen Abbreviations**

| | | | |
|---|---|---|---|
| IHN | Infectious Hematopoietic Necrosis Virus | IPN | Infectious Pancreatic Necrosis Virus |
| VHS | Viral Hemorrhagic Septicemia Virus | *As* | (BF) *Aeromonas salmonicida* (furunculosis) |
| *Rs* | (BK) *Renibacterium salmoninarum* (BKD) | WD | *Myxobolus cerebralis* (whirling disease) |
| *Yr* | *Yersinia ruckeri* (ERM) | X | Various (see remarks box) |
| Y | Various (see remarks box) | Z | Various (see remarks box) |

**Species Abbreviations**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ATS | Atlantic Salmon | BKT | Brook Trout | BNT | Brown Trout | CHS | Chinook Salmon |
| COS | Coho Salmon | FCS | Fall Chinook Salmon | LAT | Lake Trout | Mixed | Mixed species |
| OSA | Other Salmonids | RBT | Rainbow Trout | SPL | Splake (Brook x Lake) | STN | Sturgeon |
| STT | Steelhead Trout | | | | | | |

[1]For juv. hatchery fish give age in months; for feral and adult hatchery fish use symbols e=eggs or fry; f=fingerlings; y=yearlings; b=older fish.
[2]See list of pathogen and spp. abbreviations (pg 2).
cc: Gary Whelan

# FISH HEALTH INSPECTION REPORT--FISHERIES DIVISION

## MICHIGAN DEPARTMENT OF NATURAL RESOURCES

**Fish Health Inspection Report**

**AAHL Number:** 180221-1-PI-LSSU

This report is not evidence of future disease status. To determine current status, contact Fish Health Official below.

| Name and Location of Fish Source: | Owner/Manager: | Inspection Date(s): Spring 2018 | Type of Water Supply: Stream |
|---|---|---|---|
| Lake Superior State University<br>Sault Ste. Marie, MI | Roger Greil | This: 2/21/18<br>Prior: 3/28/17 | Origin of Fish Examined: Hatchery |
| | | Classification: B-BK | Type of Fish Examined: Salmonid |

| Species[1] | Designation | AAHL # | Age[1] | Number in Lot | Obtained as Eggs (E) or Fish (F) From: | Pathogens[2] Inspected for and Results[a] | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | *As* | *Yr* | *Rs*[b] | VHS | IHN | IPN | WD |
| ATS-LL | P-ATS-LL-W-16-SM-LS-LS* | 180221-1-PI-LSSU | 13 | 33,000 | E: St. Marys R. | 60 (0) | 60 (0) | 60 (3: 3L) | 60 (0) | 60 (0) | 60 (0) | 60 (0) |
| | | | | | | | | | | | | |
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| Remarks/Recommendations: | Address/Phone of Contracted Fish Health Official | Signature of Contracted Fish Health Official |
|---|---|---|
| **Lot P-ATS-LL-W-16-SM-LS-LS can be stocked in Michigan's public waters.**<br><br>a: Laboratory assays were conducted in accordance with the guidelines of the Great Lakes Fishery Commission (GLFC), the American Fisheries Society (AFS), and the World Organization for Animal Health (OIE).<br>b: The presence of *Renibacterium salmoninarum* was tested with quantitative QELISA, which is more sensitive than the direct fluorescent antibody technique; H=high, M=medium, L=low antigen concentrations.<br>c: Test not required. | Aquatic Animal Health Laboratory<br>College of Veterinary Medicine<br>Michigan State University<br>Food Safety & Toxicology Building<br>1129 Farm Lane, room 177K<br>East Lansing, MI 48824<br>PHONE: 517/884-2024<br>FAX: 517/432-2310 | Mohamed Faisal<br><br>Mohamed Faisal, D.V.M., PhD. |

[1]For juv. hatchery fish give age in months; for feral and adult hatchery fish use symbols e=eggs or fry; f=fingerlings; y=yearlings; b=older fish.
[2]See list of pathogen and spp. abbreviations (pg 2).
cc: Gary Whelan

FISH HEALTH INSPECTION REPORT CONTINUED. REPORT NUMBER:

| Species | Designation | AAHL # | Age | Number in Lot | Obtained as Eggs (E) or Fish (F) From: | Pathogens Inspected for and Results | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | *As* | *Yr* | *Rs* | VHS | IHN | IPN | WD |
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SUPPLEMENTAL INSPECTION INFORMATION

| Date | Species | Lot # | Findings |
|---|---|---|---|
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**Pathogen Abbreviations**

| | | | |
|---|---|---|---|
| IHN | Infectious Hematopoietic Necrosis Virus | IPN | Infectious Pancreatic Necrosis Virus |
| VHS | Viral Hemorrhagic Septicemia Virus | *As* | (BF) *Aeromonas salmonicida* (furunculosis) |
| *Rs* | (BK) *Renibacterium salmoninarum* (BKD) | WD | *Myxobolus cerebralis* (whirling disease) |
| *Yr* | *Yersinia ruckeri* (ERM) | X | Various (see remarks box) |
| Y | Various (see remarks box) | Z | Various (see remarks box) |

**Species Abbreviations**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ATS | Atlantic Salmon | BKT | Brook Trout | BNT | Brown Trout | CHS | Chinook Salmon |
| COS | Coho Salmon | FCS | Fall Chinook Salmon | LAT | Lake Trout | Mixed | Mixed species |
| OSA | Other Salmonids | RBT | Rainbow Trout | SPL | Splake (Brook x Lake) | STN | Sturgeon |
| STT | Steelhead Trout | | | | | | |

This is to certify that the above-mentioned fish were collected and laboratory assays conducted in accordance with the guidelines of the Great Lakes Fishery Commission (GLFC), the American Fisheries Society (AFS), and the World Organization for Animal Health (OIE). Samples received in the laboratory were examined for disease signs and were subjected to laboratory testing for the fish pathogens as listed.

[1]For juv. hatchery fish give age in months; for feral and adult hatchery fish use symbols e=eggs or fry; f=fingerlings; y=yearlings; b=older fish.
[2]See list of pathogen and spp. abbreviations (pg 2).
cc: Gary Whelan

Appendix 2. Data on individual Atlantic Salmon used for gamete collection in 2016. Note: 000-099 and 000A-020A are females, 100-199 and 100A-120A are males, and fin tissue samples were collected from each.

| Date | Fish ID # | Fin clip | Age | Total length (cm) | Weight (kg) | Tag # |
|---|---|---|---|---|---|---|
| 13-Nov-17 | 000 | RV | 2 | 53.5 | 1.64 | - |
| 13-Nov-17 | 100 | RV | 2 | 55.7 | 1.63 | - |
| 13-Nov-17 | 001 | RV | 2 | 55.5 | - | - |
| 13-Nov-17 | 101 | AD | - | 50.5 | 1.98 | - |
| 13-Nov-17 | 002 | RV | 2 | 57.0 | 2.47 | - |
| 13-Nov-17 | 102 | AD | - | 59.3 | 2.14 | - |
| 13-Nov-17 | 003 | AD | - | 59.5 | 2.53 | - |
| 13-Nov-17 | 103 | RV | 2 | 59.0 | 1.91 | - |
| 13-Nov-17 | 004 | AD | - | 53.9 | 1.72 | - |
| 13-Nov-17 | 104 | AD | - | 75.8 | 3.27 | - |
| 13-Nov-17 | 005 | RV | 2 | 52.9 | 1.96 | - |
| 13-Nov-17 | 105 | RV | 2 | 55.5 | 1.78 | - |
| 13-Nov-17 | 006 | RV | 2 | 53.6 | 2.00 | - |
| 13-Nov-17 | 106 | RV | 2 | 56.4 | 1.73 | - |
| 13-Nov-17 | 007 | RV | 2 | 53.5 | 1.67 | - |
| 13-Nov-17 | 107 | AD | - | 66.5 | 2.70 | - |
| 13-Nov-17 | 008 | RP | 3 | 63.6 | 2.56 | - |
| 13-Nov-17 | 108 | RV | 2 | 65.0 | 2.30 | - |
| 13-Nov-17 | 009 | RV | 2 | 53.1 | 1.82 | - |
| 13-Nov-17 | 109 | RV | 2 | 57.6 | 1.70 | - |
| 13-Nov-17 | 010 | AD | - | 56.9 | 2.00 | - |
| 13-Nov-17 | 110 | RV | 2 | 57.7 | 2.10 | - |
| 13-Nov-17 | 011 | RV | 2 | 49.9 | 1.30 | - |
| 13-Nov-17 | 111 | RV | 2 | 55.0 | 1.42 | - |
| 13-Nov-17 | 012 | RV | 2 | 52.6 | 1.60 | - |
| 13-Nov-17 | 112 | RV | 2 | 59.3 | 1.79 | - |
| 13-Nov-17 | 013 | RP | 3 | 65.5 | 3.23 | - |
| 13-Nov-17 | 113 | RV | 2 | 60.5 | 2.00 | - |
| 13-Nov-17 | 014 | RV | 2 | 51.9 | 1.70 | - |
| 13-Nov-17 | 114 | RV | 2 | 56.2 | 1.60 | - |
| 13-Nov-17 | 015 | RP | 3 | 60.5 | 2.25 | - |
| 13-Nov-17 | 115 | AD | | 50.9 | 1.43 | - |
| 13-Nov-17 | 016 | RV | 2 | 58.2 | 2.32 | - |
| 13-Nov-17 | 116 | - | - | 60.0 | 1.67 | - |
| 13-Nov-17 | 017 | AD | - | 55.6 | 1.82 | - |
| 13-Nov-17 | 117 | RV | 2 | 61.5 | 2.38 | - |
| 13-Nov-17 | 018 | RV | 2 | 58.6 | 2.51 | - |
| 13-Nov-17 | 118 | AD | - | 60.0 | 2.04 | - |

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|---|---|---|---|---|---|---|
| 13-Nov-17 | 019 | RV | 2 | 53.2 | 1.72 | - |
| 13-Nov-17 | 119 | - | - | 60.5 | 2.43 | - |
| 13-Nov-17 | 020 | RV | 2 | 56.0 | 2.14 | - |
| 13-Nov-17 | 120 | AD | - | 63.0 | 2.23 | - |
| 13-Nov-17 | 021 | AD | - | 54.4 | 2.32 | - |
| 13-Nov-17 | 121 | AD | - | 68.2 | 2.35 | - |
| 13-Nov-17 | 022 | RV | 2 | 56.2 | 2.22 | - |
| 13-Nov-17 | 122 | AD | - | 61.2 | 2.28 | - |
| 13-Nov-17 | 023 | RV | 2 | 54.9 | 1.98 | - |
| 13-Nov-17 | 123 | RV | 2 | 66.2 | 2.75 | - |
| 13-Nov-17 | 024 | AD | - | 57.3 | 2.10 | - |
| 13-Nov-17 | 124 | AD | - | 55.5 | 1.40 | - |
| 13-Nov-17 | 025 | RV | 2 | 55.1 | 1.84 | - |
| 13-Nov-17 | 125 | AD | - | 60.6 | 2.02 | - |
| 13-Nov-17 | 026 | RV | 2 | 59.5 | 2.59 | - |
| 13-Nov-17 | 126 | RV | 2 | 53.1 | 1.58 | - |
| 13-Nov-17 | 027 | RV | 2 | 61.3 | 2.61 | - |
| 13-Nov-17 | 127 | RV | 2 | 63.1 | 2.31 | - |
| 13-Nov-17 | 028 | RV | 2 | 61.0 | 2.66 | - |
| 13-Nov-17 | 128 | RV | 2 | 58.9 | 2.19 | - |
| 16-Nov-17 | 029 | RV | 2 | 56.3 | - | 672 |
| 16-Nov-17 | 129 | RV | 2 | 64.1 | - | 673 |
| 16-Nov-17 | 030 | AD | - | 53.0 | - | 674 |
| 16-Nov-17 | 130 | AD | - | 61.3 | - | 900 |
| 16-Nov-17 | 031 | RV | 2 | 54.9 | - | 901 |
| 16-Nov-17 | 131 | RV | 2 | 61.0 | - | 902 |
| 16-Nov-17 | 032 | RV | 2 | 53.7 | - | 903 |
| 16-Nov-17 | 132 | LV | 4 | 85.0 | - | 904 |
| 16-Nov-17 | 033 | RV | 2 | 54.7 | - | 906 |
| 16-Nov-17 | 133 | AD | - | 70.6 | - | 907 |
| 16-Nov-17 | 034 | LP | 5 | 75.1 | - | 908 |
| 16-Nov-17 | 134 | RV | 2 | 58.6 | - | 909 |
| 16-Nov-17 | 035 | RV | 2 | 57.7 | - | 910 |
| 16-Nov-17 | 135 | RV | 2 | 61.2 | - | 911 |
| 16-Nov-17 | 036 | AD | - | 52.1 | - | 912 |
| 16-Nov-17 | 136 | LV | 4 | 73.5 | - | 913 |
| 16-Nov-17 | 037 | LP | 5 | 70.8 | - | 914 |
| 16-Nov-17 | 137 | RP | 3 | 66.0 | - | 915 |
| 16-Nov-17 | 038 | RV | 2 | 61.1 | - | 916 |
| 16-Nov-17 | 138 | RV | 2 | 59.0 | - | 918 |
| 16-Nov-17 | 39 | RV | 2 | 57.2 | - | 919 |
| 16-Nov-17 | 139 | AD | | 61 | - | 920 |
| 16-Nov-17 | 040 | RV | 2 | 52.0 | - | 922 |

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|---|---|---|---|---|---|---|
| 16-Nov-17 | 140 | RV | 2 | 59.0 | - | 923 |
| 16-Nov-17 | 041 | RV | 2 | 56.0 | - | 924 |
| 16-Nov-17 | 141 | - | - | - | - | 876 |
| 16-Nov-17 | 42 | AD | - | 53.7 | - | 950 |
| 16-Nov-17 | 142 | RV | 2 | 58.4 | - | 951 |
| 16-Nov-17 | 043 | RV | 2 | 50.5 | - | 952 |
| 16-Nov-17 | 143 | RV | 2 | 57.0 | - | 953 |
| 16-Nov-17 | 044 | RV | 2 | 56.0 | - | 954 |
| 16-Nov-17 | 144 | RV | 2 | 59.5 | - | 955 |
| 16-Nov-17 | 045 | RV | 2 | 52.5 | - | 956 |
| 16-Nov-17 | 145 | RV | 2 | 59.0 | - | 957 |
| 16-Nov-17 | 046 | RV | 2 | 54.5 | - | 958 |
| 16-Nov-17 | 146 | RV | 2 | 57.0 | - | 959 |
| 16-Nov-17 | 047 | RV | 2 | 54.0 | - | 960 |
| 16-Nov-17 | 147 | AD | - | 67.0 | - | 961 |
| 16-Nov-17 | 048 | AD | - | 54.0 | - | 962 |
| 16-Nov-17 | 148 | RV | 2 | 57.5 | - | 963 |
| 16-Nov-17 | 049 | AD | - | 55.0 | - | 964 |
| 16-Nov-17 | 149 | RV | 2 | 58.0 | - | 965 |
| 16-Nov-17 | 050 | RV | 2 | 58.0 | - | 966 |
| 16-Nov-17 | 150 | RV | 2 | 53.0 | - | 967 |
| 16-Nov-17 | 051 | RV | 2 | 49.0 | - | 968 |
| 16-Nov-17 | 151 | RV | 2 | 58.0 | - | 970 |
| 16-Nov-17 | 052 | AD | - | 58.5 | - | 675 |
| 16-Nov-17 | 152 | AD | - | 59.5 | - | 676 |
| 16-Nov-17 | 053 | RV | 2 | 51.5 | - | 677 |
| 16-Nov-17 | 153 | AD | - | 61.5 | - | 678 |
| 16-Nov-17 | 054 | RV | 2 | 49.6 | - | 679 |
| 16-Nov-17 | 154 | AD | - | - | - | 682 |
| 16-Nov-17 | 055 | AD | - | 52.5 | - | 683 |
| 16-Nov-17 | 155 | AD | - | 72.5 | - | 684 |
| 16-Nov-17 | 056 | RV | 2 | 55.0 | - | 685 |
| 16-Nov-17 | 156 | AD | - | 68.0 | - | 686 |
| 16-Nov-17 | 057 | RV | 2 | 56.5 | - | 687 |
| 16-Nov-17 | 157 | - | - | 58.0 | - | 688 |
| 16-Nov-17 | 058 | RV | 2 | 54.0 | - | 891 |
| 16-Nov-17 | 158 | AD | - | - | - | - |
| 16-Nov-17 | 059 | RV | 2 | 56.0 | - | 690 |
| 16-Nov-17 | 159 | RV | 2 | 58.0 | - | 691 |
| 20-Nov-17 | 060 | RV | 2 | 51.2 | - | 692 |
| 20-Nov-17 | 160 | RV | 2 | 59.5 | - | 694 |
| 20-Nov-17 | 061 | AD | - | 48.3 | - | 695 |
| 20-Nov-17 | 161 | AD | - | 58.0 | - | 696 |

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|---|---|---|---|---|---|---|
| 20-Nov-17 | 062 | RV | 2 | 50.8 | - | 697 |
| 20-Nov-17 | 162 | AD | - | 56.1 | - | 698 |
| 20-Nov-17 | 063 | AD | - | 60.2 | - | 699 |
| 20-Nov-17 | 163 | RV | 2 | 60.1 | - | 810 |
| 20-Nov-17 | 064 | RV | 2 | 56.3 | - | 921 |
| 20-Nov-17 | 164 | RV | 2 | 56.8 | - | 811 |
| 20-Nov-17 | 065 | RV | 2 | 61.1 | - | 812 |
| 20-Nov-17 | 165 | AD | - | 61.2 | - | 813 |
| 20-Nov-17 | 066 | RV | 2 | 57.9 | - | 814 |
| 20-Nov-17 | 166 | RV | 2 | 55.8 | - | 815 |
| 20-Nov-17 | 067 | RV | 2 | 57.3 | - | 816 |
| 20-Nov-17 | 167 | AD | - | 54.9 | - | 817 |
| 20-Nov-17 | 068 | LP | 5 | 73.5 | - | 818 |
| 20-Nov-17 | 168 | RV | 2 | 61.6 | - | 819 |
| 20-Nov-17 | 069 | AD | - | 62.5 | - | - |
| 20-Nov-17 | 169 | RV | 2 | 55.7 | - | 820 |
| 20-Nov-17 | 070 | AD | - | 55.3 | - | 821 |
| 20-Nov-17 | 170 | RV | 2 | 59.3 | - | 822 |
| 20-Nov-17 | 071 | AD | - | 60.1 | - | 823 |
| 20-Nov-17 | 171 | RV | 2 | 54.3 | - | 824 |
| 20-Nov-17 | 072 | AD | - | 50.0 | - | 825 |
| 20-Nov-17 | 172 | RV | 2 | 59.0 | - | 824 |
| 20-Nov-17 | 073 | AD | - | 59.0 | - | 823 |
| 20-Nov-17 | 173 | RV | 2 | 59.5 | - | 822 |
| 20-Nov-17 | 074 | RV | 2 | 59.0 | - | 821 |
| 20-Nov-17 | 174 | AD | - | 65.5 | - | 820 |
| 20-Nov-17 | 075 | RV | 2 | 58.5 | - | 819 |
| 20-Nov-17 | 175 | RV | 2 | 60.0 | - | 818 |
| 20-Nov-17 | 076 | RP | 3 | 71.0 | - | 817 |
| 20-Nov-17 | 176 | RV | 2 | 62.5 | - | 816 |
| 20-Nov-17 | 077 | RV | 2 | 52.0 | - | 815 |
| 20-Nov-17 | 177 | RV | 2 | 61.5 | - | 814 |
| 20-Nov-17 | 078 | RV | 2 | 59.5 | - | 813 |
| 20-Nov-17 | 178 | AD | - | 59.5 | - | 812 |
| 20-Nov-17 | 079 | RV | 2 | 56.0 | - | 811 |
| 20-Nov-17 | 179 | RV | 2 | 57.5 | - | 810 |
| 20-Nov-17 | 080 | AD | - | 49.5 | - | 809 |
| 20-Nov-17 | 180 | AD | - | 56.5 | - | 808 |
| 20-Nov-17 | 081 | AD | - | 56.0 | - | 807 |
| 20-Nov-17 | 181 | RV | 2 | 58.0 | - | 806 |
| 20-Nov-17 | 082 | AD | - | 53.5 | - | 805 |
| 20-Nov-17 | 182 | RV | 2 | 62.5 | - | 804 |
| 20-Nov-17 | 083 | RP | 3 | 50.0 | - | 803 |

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|---|---|---|---|---|---|---|
| 20-Nov-17 | 183 | AD | - | 59.0 | - | 802 |
| 20-Nov-17 | 084 | RV | 2 | 54.0 | - | 801 |
| 20-Nov-17 | 184 | RV | 2 | 56.0 | - | 771 |
| 20-Nov-17 | 085 | RV | 2 | 54.5 | - | 770 |
| 20-Nov-17 | 185 | LV | 4 | 79.5 | - | 769 |
| 21-Nov-17 | 086 | AD | - | 57.0 | - | 886 |
| 21-Nov-17 | 186 | RV | 2 | 55.0 | - | 704 |
| 21-Nov-17 | 087 | LV | 4 | 65.0 | - | 768 |
| 21-Nov-17 | 187 | AD | - | 61.0 | - | 765 |
| 21-Nov-17 | 088 | LV | 4 | 57.0 | - | 763 |
| 21-Nov-17 | 188 | RV | 2 | 54.0 | - | 762 |
| 21-Nov-17 | 089 | AD | - | 55.0 | - | 906 |
| 21-Nov-17 | 189 | RV | 2 | 58.0 | - | 761 |
| 21-Nov-17 | 090 | RV | 2 | 47.5 | - | 760 |
| 21-Nov-17 | 190 | RV | 2 | 55.0 | - | 758 |
| 21-Nov-17 | 091 | - | - | 57.0 | - | 759 |
| 21-Nov-17 | 191 | AD | - | 60.0 | - | 756 |
| 21-Nov-17 | 92 | - | - | 56 | - | 755 |
| 21-Nov-17 | 192 | AD | - | 58 | - | 754 |
| 21-Nov-17 | 093 | RV | 2 | 57.0 | - | 753 |
| 21-Nov-17 | 193 | RV | 2 | 53.5 | - | 752 |
| 21-Nov-17 | 094 | AD | - | 60.0 | - | 751 |
| 21-Nov-17 | 194 | - | - | 59.1 | - | 625 |
| 21-Nov-17 | 095 | AD | - | 60.0 | - | 624 |
| 21-Nov-17 | 195 | AD | - | 60.5 | - | 623 |
| 21-Nov-17 | 096 | RB | 3 | 58.5 | - | 669 |
| 21-Nov-17 | 196 | RV | 2 | 56.0 | - | 662 |
| 21-Nov-17 | 097 | LV | 4 | 55.6 | - | 621 |
| 21-Nov-17 | 197 | AD | - | 60.0 | - | 620 |
| 21-Nov-17 | 098 | RV | 2 | 55.0 | - | 619 |
| 21-Nov-17 | 198 | RV | 2 | 59.0 | - | 618 |
| 21-Nov-17 | 099 | - | - | 73.1 | - | 617 |
| 21-Nov-17 | 199 | - | - | 64.5 | - | 616 |
| 21-Nov-17 | 000A | RV | 2 | 57.0 | - | 755 |
| 21-Nov-17 | 100A | AD | - | 53.0 | - | 900 |
| 21-Nov-17 | 001A | RV | 2 | 56.0 | - | 899 |
| 21-Nov-17 | 101A | RV | 2 | 55.0 | - | 898 |
| 21-Nov-17 | 002A | RV | 2 | 56.5 | - | 897 |
| 21-Nov-17 | 102A | RV | 2 | 61.0 | - | 896 |
| 21-Nov-17 | 003A | RV | 2 | 59.0 | - | 895 |
| 21-Nov-17 | 103A | RV | 2 | 58.0 | - | 894 |
| 21-Nov-17 | 004A | RV | 2 | 55.0 | - | 668 |
| 21-Nov-17 | 104A | RV | 2 | 58.0 | - | 893 |

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|---|---|---|---|---|---|---|
| 21-Nov-17 | 005A | RV | 2 | 56.5 | - | 557 |
| 21-Nov-17 | 105A | RV | 2 | 55.0 | - | 892 |
| 21-Nov-17 | 006A | LP | 5 | 75.8 | - | 891 |
| 21-Nov-17 | 106A | RV | 2 | 54.3 | - | 890 |
| 21-Nov-17 | 007A | RV | 2 | 54.2 | - | 889 |
| 21-Nov-17 | 107A | RV | 2 | 56.4 | - | 888 |
| 21-Nov-17 | 008A | - | - | 74.4 | - | 670 |
| 21-Nov-17 | 108A | AD | - | 60.5 | - | 615 |
| 21-Nov-17 | 009A | RP | 3 | 67.9 | - | 614 |
| 21-Nov-17 | 109A | RV | 2 | 55.9 | - | 613 |
| 21-Nov-17 | 010A | AD | - | 49.5 | - | 612 |
| 21-Nov-17 | 110A | RV | 2 | 56.4 | - | 611 |
| 21-Nov-17 | 011A | AD | - | 55.1 | - | 609 |
| 21-Nov-17 | 111A | RV | 2 | 56.4 | - | 668 |
| 21-Nov-17 | 012A | RV | 2 | 49.5 | - | 887 |
| 21-Nov-17 | 112A | RV | 2 | 53.9 | - | 886 |
| 21-Nov-17 | 013A | RV | 2 | 54.4 | - | 885 |
| 21-Nov-17 | 113A | AD | - | 60.0 | - | 884 |
| 21-Nov-17 | 014A | - | - | 68.8 | - | 883 |
| 21-Nov-17 | 114A | RV | 2 | 54.9 | - | 882 |
| 21-Nov-17 | 015A | AD | - | 55.2 | - | 881 |
| 21-Nov-17 | 115A | AD | - | 59.2 | - | 880 |
| 21-Nov-17 | 016A | RV | 2 | 59.7 | - | 879 |
| 21-Nov-17 | 116A | AD | - | - | - | 878 |
| 21-Nov-17 | 017A | AD | - | 54.5 | - | 877 |
| 21-Nov-17 | 117A | AD | - | 56.7 | - | 876 |
| 21-Nov-17 | 018A | RV | 2 | 55.4 | - | 607 |
| 21-Nov-17 | 118A | RV | 2 | 58.9 | - | 776 |
| 21-Nov-17 | 019A | RV | 2 | 58.3 | - | 777 |
| 21-Nov-17 | 119A | AD | - | 60.9 | - | 778 |
| 21-Nov-17 | 020A | AD | - | 52.8 | - | 779 |
| 21-Nov-17 | 120A | RV | 2 | 55.2 | - | 780 |

Appendix 3. Dosages for treatments of Atlantic Salmon eggs.

**Saline Bath**
0.75% needed
0.75/100 = 0.0075
0.0075*20L = 0.15 mL or g
0.15*1,000 = 150 g needed for 20 L of $H_2O$

**Erythromycin Treatment**
2 ppm (mg/L) needed
2 mg/L*20 = 400,000 mg
400,000/0.23 = 1,739,130 (23% active)
1,739,130/10,000 = 173.9
173.9/1,000 (to get to g) = 0.174g per 20 L of $H_2O$

**Iodine Treatment**
1% active
1% free iodine to get 100 ppm (mg/L) dilute 100 times
20 L = 20,000 mL
20 L*1,000 mL = 20,000 mL
20,000 mL/100 = 2,000 mL
2,000 mL*50 = 100,000 mL
100,000 / 1,000 (to mL) = 100 mL of Iodine needed for 20 L of $H_2O$

**Thiamine Treatment**
1,000 ppm (mg/L) needed
20.4 g of 98% active, buffered thiamine added per 20 L of $H_2O$