Marquette State Fish Hatchery
Production Analysis Report
Fiscal Year 2012-13

Executive Summary

Administration: Operating expenses for Marquette Hatchery during fiscal year 2012-13 (FY2013) totaled $723,490 which was $84,816 under the total hatchery allotment. All budget areas with the exception of state workers were under spent. The cost to raise fish at Marquette Hatchery increased significantly this year due to higher salary and wages and lower production weight compared to FY2012.

Facilities: Mandated spending restrictions and a shift in emphasis to preventative maintenance translated into few large maintenance projects this fiscal year. Major maintenance funding was limited this year to completion of the enclosures on the upper production building and an emergency furnace replacement in one residence. Several small but important projects and purchases were made this year however. A state worker was utilized on a part time basis all year to help with various projects and general maintenance including janitorial and lawn care duties.

Fish Rearing: Production at Marquette State Fish Hatchery during FY2013 totaled 21,607 kg of splake, brook, and lake trout. The previous fiscal year's production was 28,046 kg. This year's production included nearly 341,288 lake trout yearlings (Seneca and Lake Superior strain) and 66,565 brook trout yearlings and 32,793 fall fingerling (Assinica strain) and 229,228 splake stocked into Michigan's public waters. A decrease in total weight produced is attributable to producing less lake trout due to EEDv mortalities during the year. This decrease was off-set by coming closer to the brook trout rearing assignment and an increase in all the species total weights due to warmer Cherry Creek water temperatures.

Broodstock Management: Fertility and eye-up rates were lower than average across all lot strains. The fertility and eye-up rates have been consistent over the years, but dip slightly in the lake trout after the bi-annual Aeromonas vaccine injections. Long-term egg quality and eye-up has increased as a result of the improved broodstock fish health conditions. All egg requests were met to cover the next year's rearing assignments. Timing for both lake trout and brook trout spawning was as expected. All eggs were incubated on ambient water temperature using hydrogen peroxide treatments to control fungus.

Fish Health: The fish health program at Marquette Hatchery continues to be a major emphasis of the staff. Enhanced biosecurity measures along with utilizing younger brood fish, reduced densities, vaccinations and cultural changes intended to reduce stress has provided lasting benefits. All production lots of fish were cleared for stocking. No pre-stocking therapeutic treatments were required. In September of 2012, the Lake Superior lean strain production lake trout became sick with what was initially diagnosed as bacterial gill disease and coldwater disease. Subsequent testing in the new fiscal year

confirmed that they were also positive for epizootic epitheliotropic disease virus (EEDv). EEDv subsequently became expressed in the Seneca strain lake trout too. Both lots of lake trout recovered and were stocked but EEDv losses resulted in a loss of 25% of the lake trout inventory.

Fish Quality: Fish quality inspections indicated no major fish quality problems in any of the grading areas. Minor fin erosion was noted in the brook trout and splake lots. This occurred even though the brook trout received an external parasite treatment. It is possible that larger fish and higher raceway densities played a part in this fin erosion. The average sizes of the fish in all the lots were on par or above previous year's lots.

Performance of Stocked Fish: All the Seneca Lake lake trout yearlings were marked using the USFWS's mass marking trailer. No short term worker wages were incurred for fish marking activities. Use of the mass-marking trailer saved the Division approximately $8,000. This was the cost of the short term worker hours that were used back in FY2010 to manually clip the lake trout.

Fish Distribution: There were 166 plants made in 96 trips requiring 648 hours of driving. It required 11 fewer stocking trips than the previous year because the hatchery reared fewer lake trout and stocked less surplus broodstock. Driving hours and mileage were all down from FY2012 levels. This has been the trend for several years. It will likely level off soon as rearing assignments/allocations will stabilize while fish growth will soon maximize and the number of fish per truck will be more consistent.

Administration

The full time equivalent (FTE) count increased slightly over the previous fiscal year due to addition of state worker hours to compensate for the vacancy in the Fisheries Assistant position. The state worker budget category was overspent by 155% as a result. Wages and salaries decreased slightly this year as compared to last year due to the afore mentioned vacancy. During most of the fiscal year, the Division was under severe spending restrictions due to a long term funding deficit in the Fish and Game fund. Late in the fiscal year a license fee restructuring package was approved by the legislature. The increased funding made available in the following fiscal year will stabilize the Division and the unit budget, but no increases in budget or staffing will be immediately realized as a result of this act. The hatchery only spent 53% of its CSS&M allotment. Travel and VTS allotments were also under spent by 36% and 79%, respectively. The reduced VTS spending is attributed to a reduction in lease fees for two vehicles which have fully depreciated. A new replacement pickup truck was ordering in FY2014 which will likely return the VTS budget category to a negative value for next year's report. Fish food costs were similar to last year's levels, while utility costs were slightly higher. Utility costs rose primarily because fingerlings were kept inside on well water longer than in previous years due to late snow melt and spring plant out. Production weight was lower than any year in recent history resulting in a significantly higher cost/pound for fish produced this fiscal year. Table 1 below summarizes fiscal and production information this fiscal year and the previous six years.

Table 1. Hatchery Fiscal and Production Information Summary						
ITEM	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
FTE	7.1	7.1	7.1	7.2	6.9	7.2
WAGES	$559,417	$600,442	$644,359	$626,432	$672,920	$599,972
CSS&M	$83,147	$68,771	$68,982	$48,005	$42,327	$44,730
FISH FOOD	$81,614	$78,023	$71,397	$66,745	$56,665	$55,690
UTILITIES	$75,865	$48,612	$51,402	$47,422	$42,816	$53,231
#KG PROD	39,966	39,026	32,139	32,156	28,064	21,607
COST/LB	$8.94	$9.25	$11.57	$10.97	$13.34	$15.22

Hatchery Facilities

Maintenance projects in FY2013 are listed below in Table 2. Maintenance staff continues to emphasize facility maintenance rather than fabrication/construction projects. A few small projects were completed in-house this year including work on the aeration cans for Thompson Hatchery and annual emergency backup generator service which was contracted to Cummins Great Lakes in 2013 since the FMFM mechanic was not available. All went well.

The furnace in residence #2 failed in the early winter months and had to be replaced by emergency purchase order. No damage was caused by this event.

We had been working on getting our elevator at MSFH decommissioned for the past couple years and this year we were successful. It took good rationale, documentation, and a hearing at the State level to complete this request. The elevator is only decommissioned and can be put back into service at a later date if needed. The cost of bringing it back on line will depend on what standards need to be met for elevators at that time. By decommissioning this elevator we will save the facility at least $2,000 annually for service and testing on a piece of equipment that does not get used.

The lower end of the upper production building enclosure was completed this year. All that is left unfenced is the upper and lower ends of the lower production building. Due to nature of the project and the relatively low cost, DTMB allowed us to bid and award the project which made the process go much more smoothly. The project was completed on time and the workmanship was better than in the previous two phases. A ventilation exhaust hood was installed in the lower level lab of the main hatchery building. Air quality in that working area has been a staff concern for some time.

Significant maintenance accomplishments and facility improvements that occurred during FY2013 are detailed in Table 2 below.

Table 2. Hatchery Maintenance and Improvements						
Item Description	**Fiscal Year**	**Contractor**	**Completion Date**	**Estimated Cost**	**Final Cost**	**Notes**
Genset Annual Service	2013	Inland Power Group	Winter 2013	$991	$991	CSS&M
Residence #2 Furnace Replacement	2013	Trudell Plumbing	Winter 2013	$3,475	$3,475	MM
Decommissioned Elevator	2013	Otis Elevator	Summer 2013	$1,025	$1,025	CSS&M
Upper Production Lower End Enclosure Project	2013	Fortress Fence	Summer 2013	$14,983	$14,983	MM
Lower Level Lab Exhaust Hood	2013	In-House	Summer 2013	$1,295	$1,295	CSS&M

There were five alarm call backs after normal working hours in FY2013. Four were for true power outages caused by inclement weather and one for a "brown out" type of outage that caused the main and tie breaker to switch, but no power was transferred as power loss was only momentary. The brown out issue is being looked into with Chris Klage. Simply adjusting some time delays may remedy this issue. The alarm and life support system worked very well. None of the alarms this year resulted in loss of fish life. Table 3 below provides a summary of alarms this past year.

Table 3. Summary of call backs		
Date	**Alarm**	**Outcome**
12/21/2012	Power Outage	Everything OK
07/16/2013	Power Outage	Everything OK
08/21/2013	Power Outage	Everything OK
08/26/2013	Power Outage	Everything OK
09/19/2013	Brown Out	Everything OK
Total number of call-backs for FY2013-5		

Electrical use rose slightly again this year with the cost per kw*hr rising slightly as well. The reason for the rise in usage can be attributed to a late spring and keeping fish inside longer this past year. Natural gas usage and cost were up slightly from the previous year which can be attributed to a colder winter. For a reference point, our natural gas cost is the total ccf for the main hatchery building and the fin clip building combined. For billing purposes the cost of the main hatchery building is split with Marquette Research. LOX cost rose slightly this year but this can be attributed to billing and filling cycles. The economic tradeoff for conversion to LOX is still very positive. Just considering annual operating expenses including electric use and LOX costs, the conversion saved the hatchery about $15,000 in the first year of operation. Taking the analysis a step further, the LOX system will pay for itself in just over seven years considering the system cost $110,000. Additionally, the increased reliability the system affords with decreased maintenance costs compared to compressors/Xorbox units make the net benefit for conversion huge. Neither settling pond was pumped this year due to the lack of a secure spoils site. A new location was secured and plans are made to pump at least one,

possibly both ponds in the next year. Table 4 below shows energy use for the past six fiscal years.

Table 4. Energy Consumption History

	2008	2009	2010	2011	2012	2013
Electrical Use (kw-hrs)	1,005,264	566,928	542,304	474,212	478,368	511,056
Electric costs	$62,228	$39,148	$40,279	$37,004	$39,355	$44,872
Natural Gas Use (ccf)	12,449	12,525	10,219	7,168	5,482	6,845
Natural Gas Cost	$12,862	$12,968	$8,176	$5,347	$3,819	$4,423
Liquid Oxygen Use (ccf)		571,702	431,855	524,741	403,080	452,458
Liquid Oxygen Cost		$5,145	$3,779	$4,592	$3,527	$3,982
Waste Disposal (gal)			31,200	0	42,000	0
Waste Disposal (cost)			$2,496	$0	$2,496	$0

Fish Rearing

Brook trout- Assinica: October fall fingerling production (brood year 2011) totaled 32,793 fish stocked which was within seven fish of the rearing assignment target. Stocking of the corresponding yearling production lot totaled 66,565 fish stocked and was well within the normal inventory variation (Table 5). Spring fingerling production (brood year 2012) exceeded the rearing assignment by 90%. Minimal effort is made to reduce inventory of these early life stages due to minimal space and cost of holding these extra small fry. Inventory variations are always greatest in these small-later hatching fish. In the past, there have been attempts to correct overages and too few fish were kept. All the production and brood lots were produced by crossing three year old females with two year old males. The individual families were screened using QELISA and both production and future broodstock eggs lots were established using only the negative families. Even with the increased handling of the eggs, eye-up and hatching rates for both egg lots were within low-normal ranges (Appendix 2). Both groups were vaccinated with an Aeromonas vaccine as two gram spring fingerlings. Yearlings were given MSU's oral BKD vaccine and transferred to outside raceways after the 40 day holding period on pathogen free well water. The fall fingerling group (BY2011) was reared in the upper pass production area and did not need a parasite or bacterial gill infection treatment. The BY2011 fall fingerlings exceeded all previous growth records of Assinica lots at Marquette Hatchery. The lot achieved a size of 30 fish/kg by early October when they were stocked. Some of this growth was due to warmer summer water temperatures, changes in rearing location, and improvements in culture practices.

In late December and mid-January, the yearlings (BY2011) became infected with an external parasite (*Gyrodactylus* spp). With standard operating procedures (SOP) from previous coordination events in place with MDEQ, MSU, and Mark Gaikowski of USGS a series of hydrogen peroxide static bath treatments were completed halting further damage and disease progression. For the third year running, Chloramine-T treatments were not required. This is a significant improvement in brook trout culture methods at Marquette. Late winter was unseasonably cold and spring snow storms delayed early yearling stocking trips. The size of the yearling Assinica lot exceeded the normal range for Marquette Hatchery (Table 6). Both lots were started on BioVita starter and switched

to Silver Cup steelhead diet which continues to save our fish food budget significant money.

Lake trout- Lake Superior: Since the first production lot (BY2008), the Lake Superior strain has surpassed all expectations of rearing a wild strain fish in the hatchery. The fourth production lot (BY2011) was established by rotationally crossing between the 2001, 2003, and 2004 male and female brood lots. Persistent, warm, and lengthy late September rain is thought to have contributed to a bacterial gill infection in these fish, which then progressed to what was thought to be a coldwater disease outbreak resulting in increasingly heavy fish losses. This outbreak was troubling given the history of disease free rearing in previous lots and the physical appearance of the disease signs. Fish flashing was noted and some external parasites were found. Two hydrogen peroxide treatments were administered in late September to eliminate all external parasites on the fish, but appeared to have no effect on mortalities. This was followed by two chloramine treatments that also had little effect. Increased gill and posterior area fungus were first noted on fish in R-5B and later moving to R-5A. Fish were high in the water column, crowding the middle screen, and not responsive to light. Two Aquaflor treatments were administered under a veterinary food directive, but the lot showed little improvement. Further analysis of these fish by MSU-AAHL confirmed the presence of Epizootic Epitheliotropic Disease Virus (EEDv). Mortalities began to rise sharply as the gills and posterior end of the fish became increasingly covered in fungus. The mortalities rose quickly and subsided quickly so by early February they were back down to normal background levels and exhibited all the signs of a recovered lot. Follow up testing using a PCR assay developed at the Lamar Fish Health Lab (USFWS) could no longer detect the presence of the virus by late February. Due to the mortalities, the yearling lake trout rearing assignments were not met; falling short by 26%. The surviving 111,480 fish from this lot met all fish health standards and exceeded the average length of previous lots. They contributed 2,720 kgs to the yearly total production. This lot showed all the qualities in terms of health condition and vigor as the three previous production lots of this strain.

The BY2012 production and brood lots of Lake Superior lake trout was established from crossing 2001, 2003, and 2004 male and female brood lots. Eye-up rates from the multiple broodstock lot targeted egg takes were on the low/normal side (Appendix 2). As in other years, the likely cause for the low eye up rate is the required egg handling process 36 hours after the egg take when the QELISA results are obtained from the lab. The rearing assignment for this lot was reduced by 25% in order to reduce stress in hopes that this would reduce the risk of another EEDv outbreak. The new rearing assignment was established at 110,000 yearlings for the foreseeable future. As of March 2014, this lot is in excellent condition with no disease concerns. These fish will be used to fill inland stocking requests in the spring 2014. The status of these fish will be summarized in next year's report. All fingerlings from both lots were Aeromonas dip vaccinated at two grams and orally vaccinated with the BKD vaccine.

Lake trout- Seneca Lake: Approximately 450,000 eyed eggs were received from Sullivan Creek NFH to establish the yearling lot of BY2011. The following year, approximately

450,000 eyed eggs were received to establish the BY2012 lot. Both lots are used to fill Great Lakes requests for Northern and Southern Lake Huron and Southern Lake Michigan. Yearling production from the BY2011 totaled 229,808 fish which was 23% under the rearing assignment (Table 5). This variation is due to the EEDv outbreak which started in the Lake Superior strain and spread to the Seneca strain within weeks. The Seneca strain yearlings in second pass raceway (R-6) first showed the disease signs noted above for the Lake Superior strain. By mid-October, fish in R-4B were infected followed shortly by the fish in R-4A. Mortalities were highest in lake trout of second pass R-6, but then these fish demonstrated some resistance to the disease by late January when mortalities in R-6 were at normal background levels and fully infected fish were staged above in R-4A and B. BY2011 Seneca Lake fish were treated in late September with Aquaflor for what was thought to be coldwater disease and later confirmed to be EEDv. By February the Seneca strain fish had recovered and subsequent follow up testing could not detect the presence of the virus. The BY2011 fish were stocked in April 2013.

A lower rearing assignment (210,000) was assigned to Marquette Hatchery for the BY2012 lot of Seneca Lake strain because of the previous year's disease outbreak. These fish are being reared in raceways R-4A and B. Currently there are no disease concerns with this lot. They are scheduled for stocking in April of 2014. Both BY2011 and BY2012 groups were vaccinated with emersion Aeromonas vaccine at the two gram fingerling stage and transferred to outside raceways in early June of their respective year. The both lots (BY2011 and 2012) of spring fingerlings were fin-lipped using a mass marking trailer operated by the Fish and Wildlife Service.

Splake- Marquette: The yearling splake lot, BY2011 was established by crossing the BY2003 and BY2004 lean lake trout lots with the BY2008 Assinica brook trout male lot. Eye-up rates and hatching rates were average in the BY2011 lot (Appendix 2). This lot had consistently higher monthly length averages when compared to previous lots along with an unremarkable rearing record to stocking. Fish stocking started later than normal with cold temperatures still occurring in late-April. However, the fish were in exceptionally good condition. Each production year, splake face the challenges of being reared downstream on second pass water used by fish infected with cold water disease and now this group continued to show disease resistance throughout the lake trout EEDv outbreaks. It is highly likely this impacted growth rates, but there is enough disease resistance in this hybrid strain to prevent infections of both diseases. There were 229,228 yearlings stocked in the spring of 2013 which was again within the 10% normal variation of the rearing assignment (Table 5). The yearling group was on the "higher side" of average in length compared to previous years (Table 6).

The BY2012 lot was established by crossing BY2001 and BY2003 lake trout with BY 2009 Assinica brook trout. There has been a recent trend toward fewer prescriptions for splake. This year the 2013 rearing assignment has dropped to a new low of 205,000 fish. The fish were reared in raceways R-8 thru R-11. Summer months were slightly cooler than average resulting in some negative impact on growth. Currently, there are no disease concerns with this lot.

Both lots were vaccinated with Aeromonas emersion vaccine as two gram fingerlings and sent to outside raceways in early June. Marquette Hatchery received gift purchase of $1,000 of fish food from the Keweenaw Splake Anglers in both March of 2012 and again in 2013. Fish food was purchased directly by the group and shipped to the hatchery.

Table 5. Comparison of actual plants made and the rearing assignment

Species-strain	Age	Number Stocked	Number Assigned	Percent Variation	Reason for Variation
BKT-AS	A	1,042	N/A		No assignment on adult fish
BKT-AS	FF	32,793	32,800	0	Normal inventory variation
BKT-AS	SF	15,175	8,000	90	Surplus (small, young fish at inventory)
BKT-AS	YR	66,565	68,935	-3	Normal inventory variation
BKT Total		**115,575**	**109,735**	5	
LAT-SE	SF	48,852	N/A		No assignment-inventory adjustment
LAT-SE	YR	229,808	300,000	-23	EEDv mortality
LAT-LS	A	128	N/A		No assignment-surplus brood
LAT-LS	YR	111,480	150,000	-26	EEDv mortality
LAT Total		**341,288**	**450,000**	-24	
SPL	YR	229,228	235,000	-2	Normal 10% variation
SPL Total	YR	229,228	235,000	-2	

Table 6. Fish Stocked

Species - Strain	Lot	Age	Mean Length	Number Stocked	Weight Stocked (Kg)
BKT-AS	B-BKT-AS-D-0?-MA	Adult	35.2	1,042	781
BKT-AS	P-BKT-AS-D-11-MA	FF	14.2	32,793	1091
BKT-AS	P-BKT-AS-D-12-MA	SF	6.3	15,175	32.0
BKT-AS	P-BKT-AS-D-11-MA	YR	21.8	66,565	5,877.3
Species Total				**115,575**	**7781.3**
LAT-SE	P-LAT-SE-D-12-HI-MA	SF		48,852	414
LAT-SE	P-LAT-SE-D-11-HI-MA	Y	14.7	229,808	3604
LAT-LS	B-LAT-LS-W-??-MA	Adult		128	800
LAT-LS	P-LAT-LS-W-11-MA	Y	14.9	111,480	2719.9
Species Total				**390,268**	**7,538**
SPL-MA	P-SPL-MA-D-11-MA	Y	19.6	229,228	17,263.00
Grand Total				**735,071**	**32,582.2**

Marquette State Fish Hatchery transferred 9000 fish in FY2013. All fish transfers were lake trout to MSU-AAHL. These fish were to be used as EEDv study fish.

Table 7. Fish Transferred								
Notice Number	**Species-strain**	**Age**	**Lot**	**Date**	**Mean Length (cm)**	**Number**	**Weight (Kg)**	**Destination**
N/A	LAT-SE	17 months	P-LAT-SE-D-2011-HI-MA	04/23/2013	12.5	400	6.1	MSU-AAHL
N/A	LAT-LS	18 months	P-LAT-LS-D-2011-MA	04/23/2013	13.5	250	8.8	MSU-AAHL
N/A	LAT-SE	6 months	P-LAT-SE-D-2012-HI-MA	05/02/2013	6.8	3000	5.8	MSU-AAHL
N/A	LAT-SE	7 months	P-LAT-LS-D-2012-MA	05/02/2013	7.2	3000	6.9	MSU-AAHL
N/A	LAT-SE	8 months	P-LAT-SE-D-2012-HI-MA	06/12/2013	8.6	3000	14.5	MSU-AAHL

Table 8 below details the cost per fish of all species, strains and ages produced at Marquette Hatchery in FY2013 for which we have a rearing assignment. The cost was estimated using a spread sheet model. These costs will be reported to the Division each year for use in the prescription process. No significant changes from last year's fish costs were noted. Items like labor, rearing practices, and raceways used were primarily the same. Brook trout and splake total lot weights increased, resulting in stocking much larger fish for the given hatchery expenditure.

Table 8. Cost per fish				
Species-strain	**Age**	**Strain cost**	**Number produced**	**Cost/fish**
BKT-AS	SF	$3,025	15,175	$0.42
BKT-AS	FF	$137,550	32,793	$4.19
BKT-AS	YR	$283,526	66,565	$4.26
LAT-SE	YR	$260,054	229,808	$1.13
LAT-LS	YR	$359,111	111,480	$3.22
SPL-MA	YR	$471,874	229,228	$2.06

Marquette Hatchery has no total phosphorus (TP) effluent limit established in its current NPDES permit (MI0035777). There is a 6 mg/l limit for total suspended solids (TSS). Net total phosphorus and suspended solids are reported each month with an occasional negative TSS value found. Occasional negative values are possible due to the design of the raceway system and the method and timing of the sample collections. The raceways and water service channel act as a large settling basin with the TSS values are commonly higher coming into the system than going out. The once per month grab sample is collected prior to daily raceway cleaning so the outlet samples may be artificially low at times for TSS. In the fall of 2012 two composite samplers were set up to compare 24

hour composite sample results with our grab samples for three months. All three grab samples showed a lower TSS value in the discharge than the intake. Two of the three corresponding composite samples show a positive effluent value (discharge higher than the intake) and one month showed a negative value. The explanation for the one errant composite value is unknown. Due to the inconclusive nature of this study and the inconvenience of composite sampling compared to grab sampling and the fact that MDEQ is not requiring additional sampling, we plan to continue to use grab sampling to describe our effluent quality. Average effluent concentrations for TSS and TP and resulting loading values are reported in Table 9. The phosphorus removal efficiency calculation was modified in this report from the phosphorus utilization efficiency to more accurately reflect how efficient our system is in removing unutilized phosphorus. The calculation assumes 0.4% phosphorus content in the fish. This new calculation accounts for the phosphorus incorporated in the production weight of the fish. The rest of the calculations remain unchanged from previous reports.

Table 9. Effluent loading parameters

Effluent Parameter	Ave. mg/L	Ave. Flow (MG/D)	Annual Loading (kgs)	Effluent Limit	Annual Product (kgs)	TP from food (kg)	Phos. Removal Efficiency	Kg pollutant / kg produced
TP	0.005669	11.94	94	N/A	21,607	337	0.626	0.0043
TSS	0.15	11.94	2,474	6	21,607	N/A	N/A	0.1145

A temporary employee was hired for spring stocking season to help with hatchery duties while the technicians were out stocking fish. Marquette Hatchery technicians completed 99% of the driving and stocking requirements. This saved the Division overtime expenses and travel costs to non-stationed employees.

Broodstock Management

Spawning started September 29, 2012 with the Lake Superior lean lake trout and concluded on November 14, 2012 with the Assinica brook trout egg take (Appendix 2). There were four lake trout egg takes (274 pairs spawned) and four Assinica (245 pair) brook trout egg takes. Aliquots from the lake trout and brook trout matings were used to establish future a brood lot.

Only minor adjustments occurred in broodstock food costs and quantities that were used in FY2013. Broodstock numbers and strains have stabilized with cost and quantity ordered reflecting on what food size and quantity is needed for the current year classes on inventory.

Fish Health-Broodstock

All breeding age brook trout broodstock were injected with erythromycin (Gallimycin) at 0.1 cc in September of 2013. Erythromycin 100 (Gallimycin) was back ordered and quantities were not available to complete the task on lake trout in August 2013. Pre-spawning erythromycin treatments are intended to control vertical transmission of BKD from parents to gametes. Injections are timed to occur approximately one month prior to

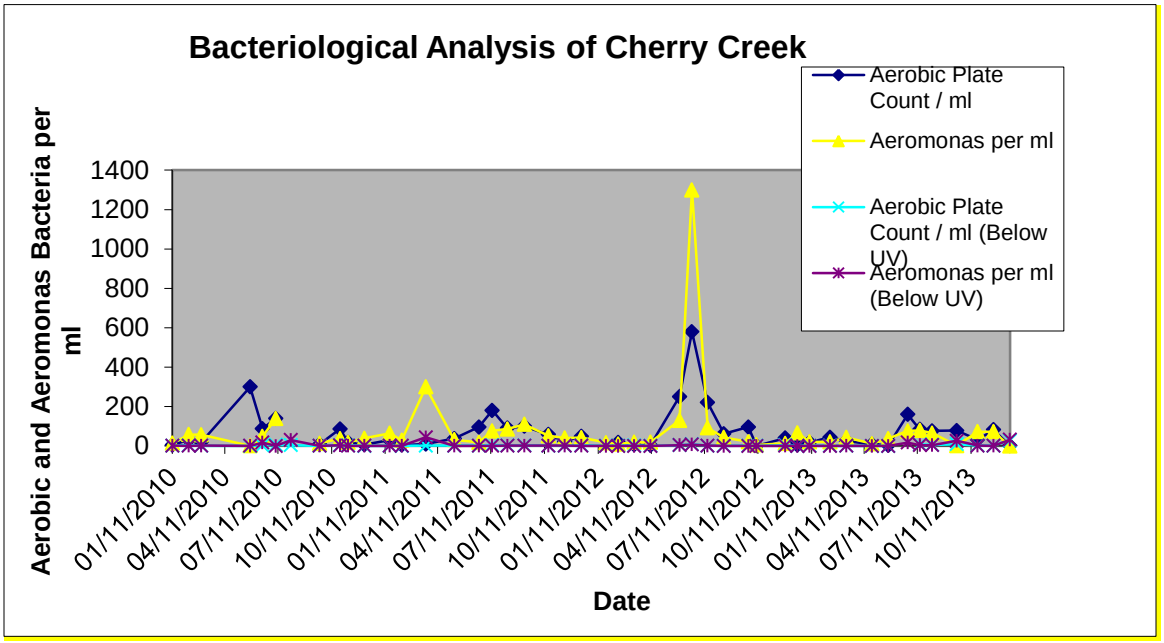
the anticipated spawning date and are an established protocol in our broodstock fish health program. A one year skip in the lake trout injections was considered less of a risk since no LAT broodstock have been BKD - QELISA positive and a new broodstock egg take was not planned. All brook trout matings are screened with QELISA for BKD incidence with a 36 hour turn-around time for results from the MSU lab. All positive families are discarded. Several years of screening brook trout for BKD and other cultural measures has drastically reduced the incidence and intensity of the infections in both brood and production fish. The incidence levels are now running around two to three percent in the brook trout broodstock and will likely remain in this range as long as the fish health program that brought us to this point continues. All QELISA test results taken on lake trout have been negative.

Spring erythromycin injections on brook trout broodstock were completed for four years (2010-2013). This action preceded the switch to crossing three year old female and two year old males, in October 2011. Since the switch no difference was noted in fish ripening period or percent eye-up. The younger year class breeding was another prospect for deducing disease and saving money, which appears to be working in both areas.

All lake trout broodstock lots are vaccinated with Aeromonas vaccine (once every two years) and an oral BKD vaccine (annually). See Appendix 4 for vaccination details. The brook trout broodstock did not require a formalin treatment to help control external parasites in FY2013. With fewer broodstock on-hand, hopefully these treatments will continue to occur less frequently. When treatments are required we follow a standard operation procedure approved by MDEQ. The procedure requires treating no more than 1/3 of a raceway (brood) in order to stay within the discharge limit of 2.1 mg/l. Until several years ago, it was not uncommon to formalin treat the Assinica lots several times per year and have successful recovery. The UV water sterilization unit and density reductions appear to have played the major role in reducing the need for parasite treatments in the broodstock. Re-infection also appears to occur less frequently.

Figure 1 below shows the results of bacteriological water testing above the UV unit in Cherry Creek from 2010 to present. We are using the testing results to monitor the bacterial load in the creek and to assess the efficiency of the UV unit. Results confirm that the unit, since installation, has consistently operated between 92% and 98% efficiency.

Figure 1. Bacteriological Testing Results - Cherry Creek 2010 to 2013.

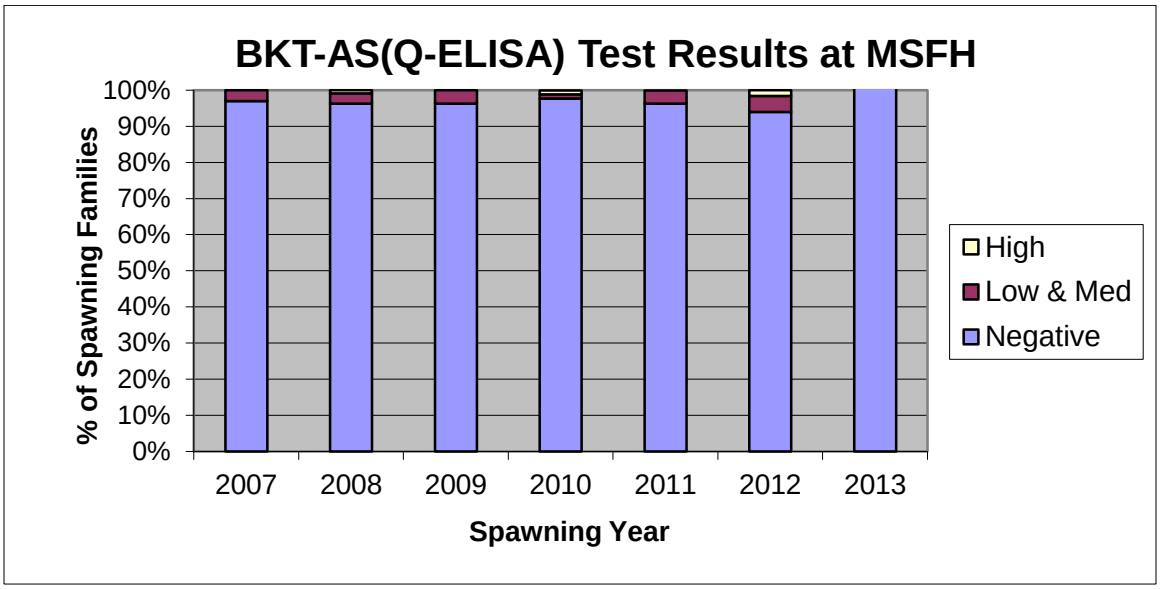


All the measures taken to reduce stress in the broodstocks and manage fish health in general has served to reduce the incidence of disease in all the brood lots and improved eye-up rates. It cannot be proven but it is also very likely that these measures are largely responsible for the improvements in production fish health that have been observed for several years.

Brook trout- Assinica: Quantitative-ELISA screening of 2011 brood year lots found eight out of 436 Assinica brook trout that were screened were positive (3L: 5M: 0H). This is a 1.8 percent positive incidence in the first year pairing of three year old females and two year old males. Screening results on the second spawning occurrence of three year old females and two year old males (BY2012 lot) showed 11 low, 6 medium and 4 high positive individuals. The number of positive individuals for both the BY2011 and BY2012 increased 1.8 to 8.1 percent, respectively. It must be remembered these two and three year old fish in both lots had older parental stocks. True results of the younger breeding practices and spring injections should show in BY2013 and later. As noted, each of the gamete lots were given a spring and fall injection of gallimycin. This new spawning plan and antibiotic application will continue in future years to try and lower BKD incidence. Production and future brood lots were established using only negative tested individuals since the beginning of testing. For record keeping purposes; all individuals tested for the BY2013 lot which spawned in October 2013 tested negative (See Figure 2 screening results 2007-2013 for comparison). This is the first time this has occurred in the ten years the broods have been screened. The 2013 pre-spawn brook trout broodstock health certification showed no positive individuals among the 20 randomly tested fish from the two lots. The year before (BY2012), fifteen families were positive because of the two males while only three families were positive because of the three year old females. Why positive individuals did not show up in the three year old females

this year is unknown. It is highly likely we will routinely see these shifts in future spawning operations. It is still hoped that we will be able to maintain a consistently low prevalence given lower broodstock densities and other continued measures, but it is unlikely we will be able to eliminate BKD given the open water source and presence of feral fish.

Figure 2. Assinica Brook Trout Q-ELISA test results 2007-2013



Lake trout- Lake Superior: Fish health testing continues to show a very low incidence of BKD in the Lake Superior Lean strain broodstock lots. Past random ovarian fluid samples taken from fish in BY2001, BY2003, and BY2004 lots have all been negative. The first scheduled brood year egg take for the new Lake Superior lean strain was in 2009 with QELISA test results coming back all negative. The second QELISA testing of Lake Superior lean lots during BY2012 broodstock egg collection proved as successful. All 464 individuals used in the spawning event (232 families) were negative. QELISA testing on lake trout did not occur in FY2013 given it was only a production fish egg take year. The next scheduled future brood year egg collection is scheduled for 2015.

Fish Health-Production

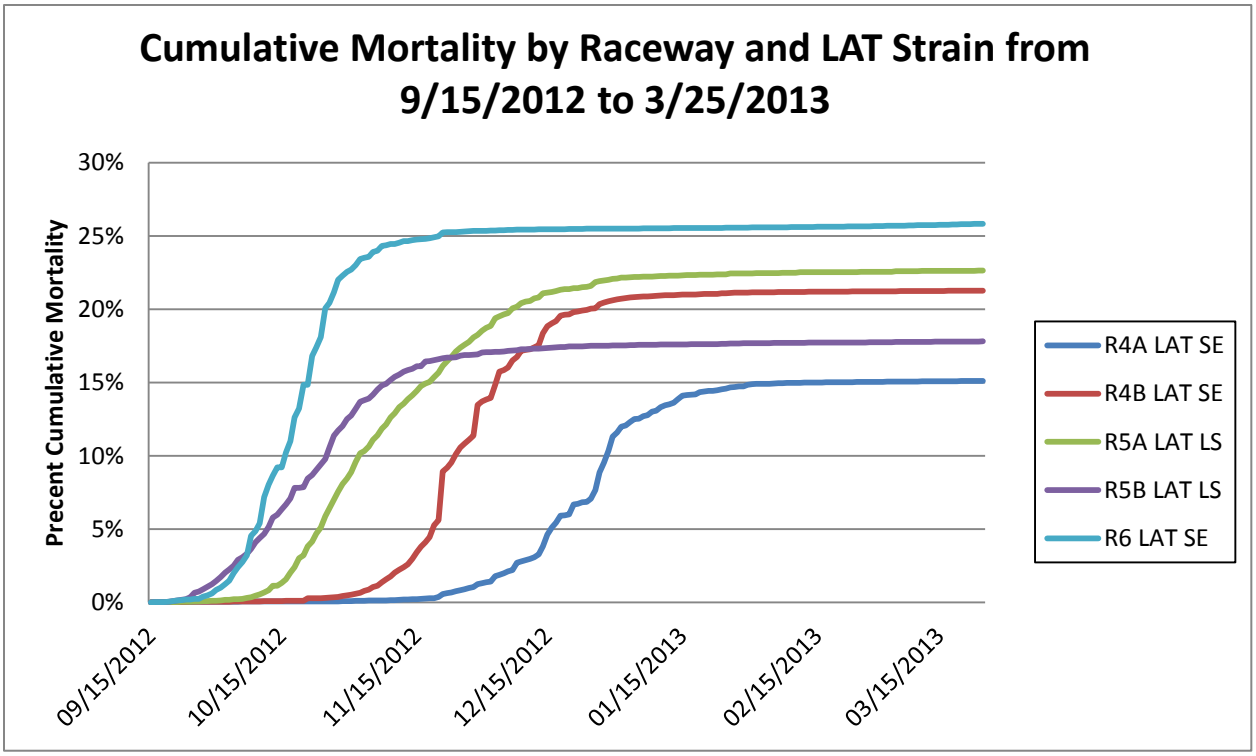
Appendix 3 summarizes all the fish health testing that was completed in FY2013. Besides EEDv in the production lake trout lots, bacterial kidney disease was the only reportable pathogen found in all production or brood lots tested. The Lake Superior lake trout, Seneca Lake lake trout, Splake, Assinica brook trout fall fingerlings and yearling production lot pre-stocking fish health results were negative, even the two lots of pre-spawn brook trout broodstock checked out BKD negative. However the same two broodstock lots had positive results on the egg take QELISA tests. As discussed in the culture section above, the Lake Superior lake trout yearlings were treated twice with a hydrogen peroxide bath for what looked to be an early presences and behavior of an external parasite infection. They were also treated in late FY 2012 with a CHL-T for bacterial gill disease. This treatment was unsuccessful and the fish were subsequently

sent into MSU-AAHL and diagnosed as having coldwater disease. The leans were treated with two applications of Florfenicol treated food. The second treatment included some Seneca Lake lake trout in the second pass raceway. The Lake Superior strain, in the past, proved especially resistant to Bacterial coldwater disease (BCWD), which has in the past only occurred in the Seneca strain fish. The mystery was solved with a later diagnosis of EEDv in both lake trout strains.

A summary of the chronology of the EEDv outbreak in 2013 is summarized below. It was taken from a briefing paper produced for the Great Lakes Fishery Commission - Fish Health Committee in April of 2013, after the fish had recovered.

MSFH 2012 Disease Chronology to Date:
Initial and unusual increases in lake trout mortality were noted in the period from September 15-20 and mortalities continued to increase through November and December with one raceway series showing increases through early January. Mortalities in all five production lake trout raceways have leveled off and are unchanged for some time. Observations of the fish have also indicated that lesions are healing and fish are recovering from the infection. No other increased mortalities were documented for any of the broodstock or production lots. Figure 1 displays percent mortality by raceway and strain and the infection locations are documented in Figures 2 and 3.

Figure 1. Cumulative percent mortality of lake trout at MSFH from September 15, 2012 to March 25, 2013.

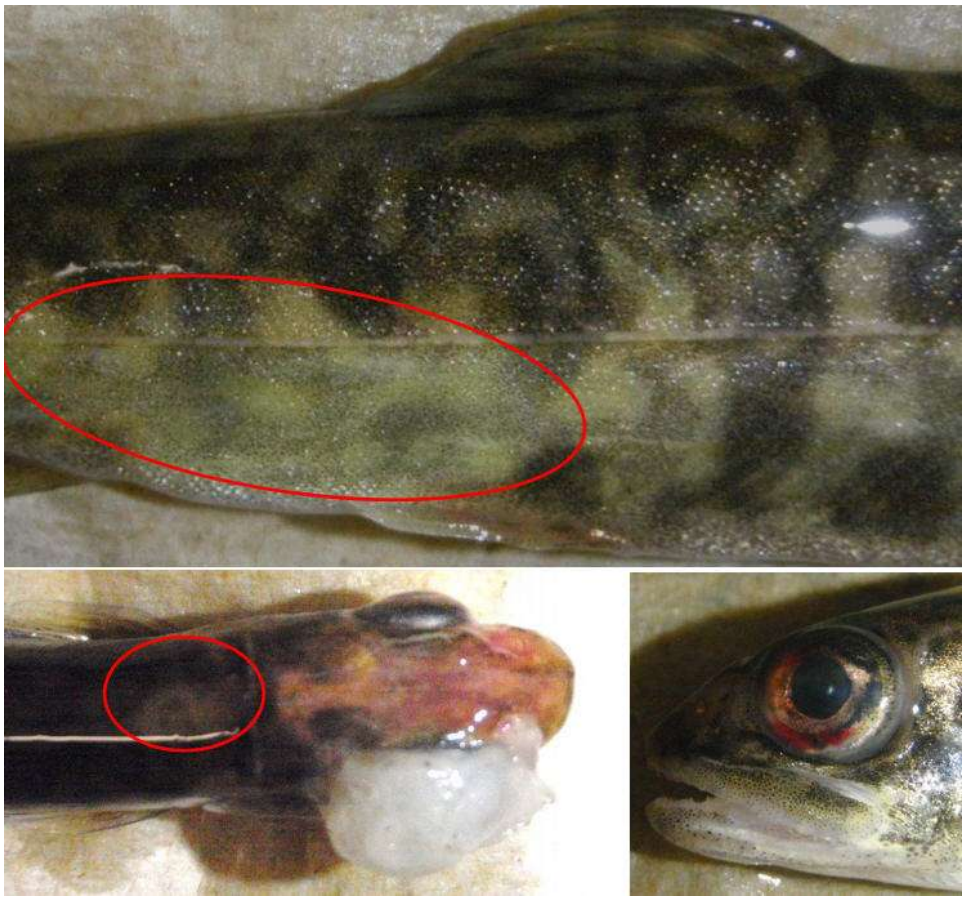


Initially, it was thought that the two MSFH production lots (P-LAT-LS-D-11-MA, P-LAT-SE-D-11-HI-MA) that demonstrated prolonged mortalities had a Bacterial Gill

Disease (BGD) or Coldwater Disease (CWD) as they exhibited typical CWD symptoms such as ulceration, secondary fungal infections, and the presence of large levels of *Flavobacterium psychrophilum*. In September, MSFH Staff observed that lake trout in Unit RW5b had what looked like BGD with fish near the surface, stressed, and "jumpy" with staff movement. Fish were sampled from this unit, gills checked and some bacterial presence was confirmed upon examination. A study request was submitted to treat these raceways for the BGD, under the Chloramine-T Investigational New Animal Drug (INAD) program. After a study number was assigned, the raceway was subsequently treated with Chloramine-T on 9/18/2012 and 9/24-26/2012. Fish were sampled from RW5A (LAT-LS), RW5B (LAT-LS), and RW6 (LAT-SE) and sent to Michigan State University-Aquatic Animal Health Laboratory (MSU-AAHL) for analysis on 9/26/2012. MSU-AAHL reported that CWD disease was consistent with the pathology and *Flavobacterium psychrophilum* bacteria were found and the fungal infection was likely a secondary issue. A treatment of Aquaflor was recommended by MSU-AAHL and rearing units RW5A (LAT-LS), RW5B (LAT-LS), and RW6 (LAT-SE) were treated with Aquaflor on 10/08-19/2012 and 10/29-11/4/2012 with little or no effect. Units R4A and R4B (LAT-SE) were treated with Aquaflor on 11/5- 11/15/2012 with no effect. MSFH staff increased biosecurity measures, picked all mortalities at least daily, and increased raceway cleaning.

September samples were analyzed and no viruses could be isolated by early November. MSU-AAHL staff noticed dermal changes such as pale patches, hemorrhages in the eye, and patches of fungal infections and suspected EEDv was the causative agent (Figure 4). Additional samples were sent from MSFH to MSU-AAHL on 11/8/2012, shared with Gavin Glenney (USFWS-Lamar), and were presumptively determined to be EEDv positive on 11/14/2012 by him.

Figure 4. Photos of MSFH lake trout with dermal changes (MSU-AADL Lab Photos).



The following 11/14/2012 email message to Dr. Mohamed Faisal summarized Gavin Glenney's findings:

> *"I have finished running your samples with the real-time assay and the first round of a nested assay we use. Both tests indicate your samples are positive for EEDV. I separated out the gills and skins you had pooled and ran those individually. For the real-time assay, I ran 8-gills, 8-skins, and the 8-kid.spleen samples for Case 121108-1 (P-LAT-SE-D-11-HI-MA). I only ran 8-skins and 8-kid/spleens for the real-time assay for Case 121108-2 (P-LAT-LS-D-11-MA) due to space constraints on the 96-well plate. Every sample came up positive for EEDV. Some of your samples were hotter than my plasmid, which was nice to see I did not contaminate the samples. It was odd for me to have such hot EEDV samples, since we are used to barely detecting it in the wild fish we generally look at. I then picked 6 of the hottest samples you gave me and ran the first round of a nested assay we have. All these samples were positive for the first round band of 324bp (photo attached). This assay uses a different primer set than the real-time assay, so these samples are both positive by two different primer sets for different location on the same gene. Both of these assays have been tested and have shown negative results for both SALHV I and II, and CCV. However, neither of our assays are published and since we cannot culture this virus, we usually sequence to make sure it is not anything else. Did you want us to do this, or would you like to do that in your lab to verify? Do you have easy access to sequencing equipment? We have to schedule a time to use a sequencer in the genetics lab here at the North East Fishery Center, and sometimes it takes a while till the machine if free. Now you know where to get plenty of positive tissues. "*

To confirm this finding, MSU-AAHL sequenced EEDv from the same samples on 11/27/2012. The calculated phylogenetic dendogram (Figures 5 and 6) based on this sequencing showed almost 100% identity between MSFH isolates and previous samples from Wisconsin. Sequencing also showed substantial differences with other viruses in the same family which ruled out other potential viruses using data in part from Waltzek et al. (2009).

MSU-AAHL has also analyzed fish from Lake Superior strain lake trout that originated from the donor broodstock lake trout that founded the current captive broodstock at MSFH. These fish were brought into the MSU-AAHL Quarantine Facility for fish health clearing and are progeny of 2003-2004 fish from Marquette Harbor MI area reefs. No EEDv have been detected in these fish which indicates that this broodstock did not carry EEDv.

We have examined the available length-weight information for these lake trout lots and overall, they are at expected condition values (James Aho, Marquette State Fish Hatchery, personnel communication). Growth rates are a bit behind average as a result of prolonged cold water temperatures, past disease issues with coldwater disease and EEDv, and egg sizes a bit smaller than normal. Seneca Lake strain lake trout are 55 to 78/kg (normal stocking range is 43-77/kg for this strain) and Lake Superior Inshore Lean strain are 42 to 47/kg (normal stocking range is 35-40/kg for this strain).

Some unusual abiotic conditions have been noted at MSFH including a severe long-term drought with likely higher than normal water temperatures and a number of intense precipitation events at about the time of the start of the mortalities which greatly increased sediment loads into the production fish raceways. Additional analysis will be done on these and other abiotic factors to see if they could be a trigger for outbreaks.

Next Steps

The MDNR is treating this epizootic as we would any other restricted disease outbreak and we will not stock clinically infected fish. Our strategy is to determine where it is in the hatchery and the prevalence in positive rearing units along with changes in these rates over time. These data will be used to support stocking decisions on these fish.

The MDNR is also conducting a trace back analysis to attempt to determine the source of this pathogen to help us manage the pathogen into the future. This trace back analysis was planned to examine both MDNR and USFWS broodstock sources of lake trout reared at MSFH. In March 2013, the MDNR requested multiple times the opportunity to sample USFWS LAT-SE broodstock sources that were subsequently raised at MSFH for the prevalence and intensity of EEDv. On March 29, 2013, Mr. Todd Turner (Regional USFWS Fisheries Supervisor) informed Mr. James Dexter (MDNR Fisheries Chief) that our request to sample and test their lake trout for EEDv was denied and they would not test their fish until another outbreak occurred.

To obtain the needed information, MDNR and MSU-AAHL developed a tiered sampling strategy to fully delineate the positive parts of the hatchery and to begin the trace back process on the origin of the virus (Appendix 1). The first tier of this strategy was implemented by MSU-AAHL and MDNR staff and non-lethally sampled broodstock and

lethally sampled production fish during the week of December 18, 2012. The following samples were collected that week:

Marquette State Fish Hatchery EEDv Sampling 12/2012										
Unit	**Sex**	**Species**	**Lot Year**	**Lot Size**	**Likely Positive**	**Purpose**	**Sample Size**	**Pool Size**	**Total Pools**	**Lethal/ Nonlethal**
BT-3		BKT		1,058	Unknown	P/A	60	5	12	L
BT-4		BKT		1,394	Unknown	P/A	60	5	12	L
R-01A		BKT		13,384	Unknown	P/A	60	5	12	L
R-01B		BKT		10,648	Unknown	P/A	60	5	12	L
R-02A		BKT		12,016	Unknown	P/A	60	5	12	L
R-02B		BKT		12,256	Unknown	P/A	60	5	12	L
R-03A		BKT		17,530	Unknown	P/A	60	5	12	L
R-03B		BKT		16,882	Unknown	P/A	60	5	12	L
R-04A		LAT-SE		123,747	Yes	Prevalence	60	1	60	L
R-04B		LAT-SE		111,293	Yes	Prevalence	60	1	60	L
R-05A		LAT-LS		69,800	Yes	Prevalence	60	1	60	L
R-05B		LAT-LS		58,883	Yes	Prevalence	60	1	60	L
R-06		LAT-SE		41,396	Yes	Prevalence	60	1	60	L
R-08		SPL		60,062	Unknown	P/A	60	5	12	L
R-02B		BKT		81,279	Unknown	P/A	60	1.11	12	L
R-03A		BKT		86,160	Unknown	P/A	60	0.78	12	L
R-11		SPL		62,644	Unknown	P/A	60	5	12	L
R-16A	F	BKT	2010	301	Unknown	P/A	30	5	6	N
R-16B	M	BKT	2010	301	Unknown	P/A	30			
R-17A		BKT		489	Unknown	P/A	60	5	12	N
R-17B	F	BKT	2009	87	Unknown	P/A	30			
R-20A	MIX	LAT-LS	2009	419	Unknown	P/A	30	5	6	N
R-20B	MIX	LAT-LS	2004	201	Unknown	P/A	20			
R-21	F	LAT-LS	2003	150	Unknown	P/A	60	5	12	N
R-22	MIX	LAT-LS	2009	420	Unknown	P/A	20	5	4	N
R-22B	M	LAT-LS	2004	264	Unknown	P/A	20			
R-23	F	LAT-LS	2003	149	Unknown	P/A	60	5	12	N
R-24	M	LAT-LS	2003	125	Unknown	P/A	30	5	6	N
R-25	F	LAT-LS	2001	99	Unknown	P/A	30	5	6	N
R-26	M	LAT-LS	2001	124	Unknown	P/A	30	5	6	N
R-27	F	LAT-LS	2001	100	Unknown	P/A	30	5	6	N
Federal Broodstock		LAT-SE					120	5	24	

Sampling will continue at MSFH as outlined in the sampling plan in Appendix 1. Additionally, the MDNR will sample lake trout in Lake Huron to determine EEDv prevalence and intensity in that waterbody.

Test Results

During the week of December 17, a total of 1620 lake trout, splake and brook trout were collected and submitted for EEDv analysis to the MSU AAHL. A summary of the test results received from Dr. Mohamed Faisal through March 15, 2013 are detailed in Appendix 2 and as described as follows:

Brook Trout. A total of 24 5-fish pools of brook trout from 2 broodstock rearing units and 52 5-fish pools from 6 production rearing units were tested with qPCR. All tests were negative for brook trout. No additional sampling or testing will be done at this time for brook trout.

Splake. A total of 12 5-fish pools of splake from 4 rearing units were tested with qPCR and initially 2 of the rearing units (3 of 4 pools) were initially positive for EEDv. After standardizing the approach, retesting of positive pools and all remaining pools are found to be negative. It is likely that the fish had very low titers and likely cleared the virus quickly. No additional sampling or testing will be done at this time for splake.

Lake Trout. A total of 48 5-fish pools of broodstock lake trout from 10 rearing units were tested with qPCR. Fish from 2 rearing units (RU 22 and 22B – Same physical unit) of broodstock lake trout were positive for EEDv (3 of 4 pools). All positive samples had very low titers. Additional sampling and testing will be conducted to determine prevalence and intensity.

All 5 rearing units of production lake trout were positive for EEDv. Prevalence for LAT-SE ranged were 22% and 78% for the three raceways. The majority of the LAT-SE samples demonstrated low or very low titers with individual samples. Prevalence for LAT-LS ranged were 10% and 97% for the two raceways sampled. Similar to LAT-SE, LAT-LS titers were low or very low for individual samples. There is also some evidence that titer levels are declining with recovery of the fish.

Additional LAT-SE (n=60) and LAT-LS (n=60) samples from production raceways were collected on January 22, 2013 and all samples were negative for EEDv. A total of 60 production LAT-SE collected on May 21, 2012 also tested negative for EEDv.

On March 4, 2013, an additional 60 yearling LAT-SE and 60 yearling LAT-LS were collected from production raceways then analyzed for EEDv individually. All LAT-SE were negative and 2 of 60 LAT-LS were positive with titer levels being determined at this time.

Fry samples were also collected on March 4, 2013 were all negative for EEDV from LAT-SE (n-60, Lot Code P-LAT-SE-D-12-HI-MA) and LAT-LS (n=60, Lot Code P-LAT-LS-W-12-MA) to determine virus location and potential for issues with future production lots. All fry were tested for EEDv using 5 fish pools using real-time PCR. On March 22, 2013, MDNR received results for the fry lots and all lots were negative.

Analyses of archived 2001, 2003 and 2004 LAT-LS broodstock samples (2 5-fish pools per year) were negative for EEDv. It is likely that the infection is confined to production year 2012-2013 with additional analyses needed to confirm this conclusion.

Archived Cherry Creek Samples. All 2012 archived Cherry Creek brown trout (n=70), brook trout (n=70) and mottled sculpin (n=70) samples were tested and found to be negative for EEDv (Figure 7). Additional testing will be done for Cherry Creek samples from 2010 and 2011.

The Great Lake Fishery Commission objected to stocking lake trout in northern Lake Huron in the spring of 2013 even though the lot (Seneca Lake) and its companion lot of Lake Superior Leans had recovered and the virus could not be found any longer. The resulting surplus fish were spread across the remaining southern Lake Huron and southern Lake Michigan stocking sites.

As a result of the outbreak of EEDv in both production lots, a management decision was made to reduce densities by 25% by reducing the rearing assignment by 25%. This is really the only cultural measure we can take to reduce the risk of future EEDv outbreaks in the near-term. The best longer term measure we can take would be to install UV for production but the cost ($500,000) puts the project in the realm of capital outlay which has been difficult to get in recent years.

Two of the three Assinica brook trout upper production raceways had external parasite infections and required treatments with hydrogen peroxide this fiscal year. These treatments are now common place in that we expect one or two treatment per year in a prophylactic manner to prevent large scale progressive fish health problems in the future.

Fish Quality

Fish quality assessments (FQA) were performed on all production lots just prior to stocking. The results of the end of cycle FQA's are summarized in Table 10 below. Fin erosion, which is a constant occurrence each year, was hardly present in the fall fingerling brook trout and much less (25%) in the yearling brook trout stocked this fiscal year. Lake Superior lake trout had higher than normal fin erosion which may have been attributed to EEDv earlier in the rearing cycle. As in other years, short opercula occurred in brook trout and splake lots. Several years of selective broodstock removal, better starter food, and lower rearing densities have reduced its occurrence in these species. It could be that high inside tank densities contribute to some of this condition since the fall fingerlings brook trout are also affected. Short operculum are not a major health concern and it may be an inherent result of fish culture for these species, but a future goal is to see continued improvement in this area. Average fat levels were well over level 2.0 in all the species reared. The brook trout were again near record size and the splake were average when compared the previous three years. Lake Superior lake trout in FY2013 were some of the largest ever produced. This would have caused higher densities in outside upper raceways. The splake, in the second pass production area, likely lost some growth, due to EEDV in the lake trout and increased bacteria levels from larger brook trout and lake trout in the first pass. This may have also affected splake gill structure. Yearling stocking season started three weeks later than past years and struggled season long with colder spring temperatures and late melting of the snow pact in remote areas. No fish

health concerns occurred throughout the stocking season and noticeable fish growth occurred during this period. Overall, fish quality indices in FY2013 were excellent and consistent with recent years even showing small improvements in some species.

Table 10. Fish Quality Inspection Summary

Inspection Date	Species	Lot	Number Examined	Results
09/20/2012	Brook Trout Assinica	P-BKT-AS-D-2011-MA	60	Avg. Length 13.7 cm Avg. Weight 27.5 g Avg. no/kg 36.4 Avg. Fat 2.7 Normal Opercula 68% No Fin Erosion 98.3 %
03/07/2013	Lake Trout Seneca	P-LAT-SE-D-2011-HI-MA	60	Avg. Length 12.3 cm Avg. Weight 14.5 g Avg. no/kg 69 Avg. Fat 2.4 Normal Opercula 91 .7% No Fin Erosion 91.7 %
03/15/2013	Lake Trout L. Superior	P-LAT-LS-W-2011-MA	60	Avg. Length 14.2 cm Avg. Weight 21.1 g Avg. no/kg 47.3 Avg. Fat 2.6 Normal Opercula 95% No Fin Erosion 76.7 %
03/05/2013	Splake	P-SPL-MA-D-2011-MA	60	Avg. Length 18.9 cm Avg. Weight 63.8 g Avg. no/kg 15.7 Avg. Fat 3.7 Normal Opercula 80 % No Fin Erosion 98.3 %
03/29/2013	Brook Trout Assinica	P-BKT-AS-D-2011-MA	60	Avg. Length 17.3cm Avg. Weight 56 g Avg. no/kg 17.9 Avg. Fat 2.4 Normal Opercula 58.3 % No Fin Erosion 71.7 %

The rearing assignment for Seneca Lake yearlings was reduced by 25% in order to reduce the risk of another EEDv outbreak. The new rearing assignments is 210,000. All the Seneca Lake lake trout yearlings were marked using the USFWS's mass marking trailer in July. No fin-clipper wages were incurred. Use of the mass-marking trailer saved the Division approximately $7,800. This was the cost of hiring short term workers in FY2010 to manually clip the lake trout.

Table 11. Fish Marking Costs										
Location	Species	Strain	Age	Mark	Number Marked	Labor Costs-State worker	Labor Costs-Supervision	Marking Cost	Cost/Fish	Notes
MQT	LAT	SE	yearling	code wire	210,000	N/A	N/A	N/A	N/A	Auto trailer

Fish Distribution

Fish planting started on October 3, 2012 with fall fingerling Assinica brook trout and surplus adult brook trout broodstock. Spring yearling fish plants commenced in early April with southern Lake Michigan lake trout and splake plants. Northern Lake Michigan, Central Lake Michigan, and Northern Lake Huron Unit managers have been requesting plants early to minimize predation on their plants from fish and birds since 2005. Marquette Hatchery has been accommodating these requests as long as driving conditions are judged to be safe. Seneca Lake lake trout were not stocked off the Detour/Drummond Island Refuge as in past years due to concerns expressed by the Great Lakes Fishery Commission - Fish Health Committee. They were concerned about stocking recovered EEDv fish in the vicinity of a historical lake trout spawning reef. The fish normally stocked there were reallocated and an additional stocking site in Michigan City Indiana was added to accommodate these fish. The Tribal Fishery Committee and the USFWS agreed to stock federal fall fingerlings at the Drummond Island reef site in place of our yearlings Brook trout and splake plants in May concluded the spring stocking season. There were 166 plants made in 95 trips taking 648 hours (Table 12). The 3,200 gallon unit was used on a lake trout stocking trip to Harbor Beach with a relatively light load of 63,073 lake trout or 950 kg. The driver reported this stocking event a success with no major problems or mortalities. The numbers of stocking trips were less this year accounting for almost 100 fewer driving hours over the previous years. One significant change was the lower lake trout numbers. We also stocked less surplus lake trout and brook trout broodstock. In addition to the rearing assignments dropping, efficiency of larger trucks, even to some of the brook trout lakes, required fewer technician driving hours.

Table 12. Fish Transport Costs									
Species	Strain	Number Planted	Total Weight	Number of Trips	Total Effort	Age	Stocking Miles	Cost per Mile	Stocking Cost
BKT	AS	1,042	781	6	28	A	1,025	4.48	$4,592
BKT	AS	32,793	1,091	15	84	FF	2,709	4.48	$12,136
BKT	AS	15,175	32	3	13	SF	32	4.48	$145
BKT	AS	66,565	5,877	29	144	YR	5,164	4.48	$23,135
LAT	SE	48,852	414	1	2	SF	30	4.48	$134
LAT	SE	229,808	3,604	11	129	YR	6,515	4.48	$29,187
LAT	LS	128	800	1	5	AD	167	4.48	$748
LAT	LS	111,480	2,720	5	67	YR	3,061	4.48	$13,713
SPL	MA	229,228	17,262	30	184	YR	7,408	4.48	$33,188

Appendix 1. Hatchery fiscal and production data		
A. FISCAL EXPENDITURES		
	Actual	**Allotted**
1. Salaries, wages, & fringes (permanent)		
a. Total hatchery	$609,226	$609,226
b. Less stocking labor	$37,479	$37,479
c. Non Fish Production Charges	$0	$0
d. Plus labor in from other units	$0	$0
Net Payroll	$571,748	$571,748
2. Salaries, wages, & fringes (temporary)	$28,225	$18,158
3. CSS&M		
a. Administration	$31,011	$59,019
b. Misc		
c. Fish Rearing		
d. Hatchery Facilities (maintenance)		
Total	$31,011	$59,019
4. Travel	$1,540	$4,228
5. VTS	$10,270	$13,000
6. Utilities		
a. Electric	$44,872	
b. Natural gas	$4,377	
c. Fuel oil		
d. Fish Waste Disposal		
e. Sewer		
f. Liquid Oxygen	$3,982	
Total	$53,231	$69,182
7. Feed		
a. Production (ref. page 2a)	$46,928	
b. Broodstock (ref. page 2b)	$8,763	
Total	$55,690	$72,971
8. Encumbrance Carry forwards		
TOTAL HATCHERY BUDGET	$723,490	$808,306
Interpretive Center Costs	$1,909	$5,000

B. FEED – PRODUCTION				
	Production Food Names		**Totals**	**Cost**
1. Kg. food on hand B.O.Y.	BioVita Starter			
	BioDry 1000 LP		318	$707
	SilverCup		8,165	$11,140
	Bio Grower			
	Atlantic Salmon Diet			
		TOTAL KG	8,482	$11,847
2. Kg. food received	BioVita Starter		1,537	$4,712
	BioVita Fry			
	BioDry 1000 LP		-	$0
	Silvercup		25,560	$35,227
	Treated Food		544	$904
	Atlantic Salmon Diet		-	$0
	Freight		-	$963
	Forage		-	$0
		TOTAL KG	27,641	$41,807
3. Kg. food shipped to others	BioDiet Starter		-	$0
	SilverCup		1,000	$1,364
	Bio-Oregon 1000			
	Atlantic Salmon Diet		-	$0
		TOTAL KG	1,000	$1,364
4. Kg. food on hand E.O.Y.	BioVita			
	BioDry 1000 LP			
	SilverCup		1,700	$5,362
	BioDiet Grower		-	
	Atlantic Salmon Diet		-	
		TOTAL KG	1,700	$5,362
5. Cost and food used		**TOTAL KG**	33,423	$46,928

NOTE: Cost & food used = beginning + received - shipped - ending

C. FEED – BROODSTOCK			
	Broodstock Food Names	**Totals**	**Cost**
1. Kg. food on hand B.O.Y.			
	Vitalis SA 4.0mm	-	$0
	Vitalis SA 6.0mm	280	$765
	Vitalis SA 9.0mm	1,500	$4,101
	TOTAL KG	1,780	$4,866
2. Kg. food received			
	Vitalis SA 4.0, 6.0 & 9.0mm	2,295	$7,064
	Biodiet Grower 2.5, 3.0mm	180	$513
	8.0mmBioDiet Grower (6% TM-100)		
	5.0mm BioDiet Grower (4% TM-100)		
	2.5mm BioDiet Grower (4.5% Aqua-100)		
	Freight		$1,681
	TOTAL KG	2,475	$9,258
3. Kg. food shipped to others		-	$0
	TOTAL KG	-	$0
4. Kg. food on hand E.O.Y.			
	Vitalis SA 4.0 mm	-	$0
	Vitalis SA 6.0 mm	700	$2,142
	Vitalis SA 9.0 mm	1,000	$3,220
	TOTAL KG	1,700	$5,362
5. Cost and food used	**TOTAL KG**	2,555	$8,763

D. INVENTORY WT.	Salmonids	Coolwater	Warmwater	Total
1. Kg. on hand B.O.Y.	22,617	0	0	22,617
2. Kg. planted	32,581	0	0	32,581
3. Kg. transferred	42.1	0	0	42.1
4. Kg. received	0	0	0	0
5. Kg. on hand E.O.Y.	11,601	0	0	11,601
6. Weight produced	21,607	0	0	21,607

NOTE: Wt. produced =- Kg. EOY + planted + transferred - received - BOY

E. INVENTORY NOS.	Salmonids	Coolwater	Warmwater	Total
1. No. on hand B.O.Y.	748,220	0	0	748,220
2. No. planted	735,071	0	0	735,071
3. No. transferred	9,650	0	0	9650
4. No. received	0	0	0	0
5. No. on hand E.O.Y.	618,518	0	0	618,518
6. No. fish produced	615,019	0	0	615,019

NOTE: No. produced = No. EOY + planted + transferred - received – BOY

F. ACTUAL PLANTS & TRANSFERS

Species	Age	Number	Weight	No./Kg.	Document
BKT(as)	AD	1,042	781	1	FSIS
BKT(as)	SF	15,175	32	474	FSIS
BKT(as)	FF	32,793	1,090.00	30	FSIS
BKT(as)	YRG	66,565	5,877	11	FSIS
LAT(ls)	AD	128	800	0	FSIS
LAT(spp)	sf	48,852	414	118	FSIS
LAT(ls)	YRG	111,480	2,720	41	FSIS
LAT(se)	YRG	229,808	3,604	64	FSIS
SPL( )	FF	0	0	0	FSIS
SPL( )	YRG	229,228	17,263	13	FSIS
		735,071	32,581		

G. ASSIGNED PLANTS AND TRANSFERS

Species	Age	Number	Weight	No./Kg.	Document
BKT(as)	AD	N/A			HRA
BKT(as)	SF	8,000	28	286	HRA
BKT(as)	FF	32,800	890	37	HRA
BKT(as)	YRG	66,800	1,937	34	HRA
LAT	AD	N/A			HRA
LAT(ls)	YRG	150,000	4,000	38	HRA
LAT(se)	YRG	300,000	5,500	55	HRA
SPL( )	YRG	235,000	14,090	17	HRA
		792,600	26,445		

H. PRICE PER KG AND LB.

1. Total Operating Hatchery Cost (per Section A)	$723,490
2. Divide by Weight Produced in Kg.	21,607
3. Cost per Kg.	$33.48
4. Conversion rate to lbs.	2.2
5. Cost per Lb.	$15.22

Appendix 2. Hatchery breeding summary								
Species	**Strain**	**Date**	**Number Used**	♂	♀	**# of Eggs**	**% Eyed**	**Notes**
BKT	AS	10/25/2012	33	2010	2009	90,360	40%	2st year 2X3
BKT	AS	11/01/2012	30	2010	2009	67,770	66%	2st year 2X3
BKT	AS	11/08/2012	54	2010	2009	108,000	75%	2st year 2X3
BKT	AS	11/19/2012	53	2010	2009	78,300	74%	2st year 2X3
BKT	AS	11/29/2012	54	2010	2009	85,842	68%	2st year 2X3
LAT	LS	09/27/2012	58	2001,03,04	2001,03,04	148,356	47%	Cross lot
LAT	LS	10/04/2011	52	2001,03,04	2001,03,04	166,651	25%	breeding
LAT	LS	10/11/2012	42	2001,03,04	2001,03,04	65,938	34%	proportional
LAT	LS	10/18/2012	79	2001,03,04	2001,03,04	140,625	22%	to founding
SPL	MA	10/09/2012	81	2009	2001	397,944	62%	
SPL	MA	10/09/2012	59	2009	2003	261,416	62%	
Total			595			1,611,202		

Appendix 3. Fish Health Inspection Summary for Marquette State Fish Hatchery										
		Results								
Inspection Date	**Lot**	**Number Examined**	**VHS**	**IHN**	**IPN**	**WD**	**OmV**	***Renibacterium salmoninarum***	***Aeromonas salmonicida***	***Yersinia ruckeri***
09/28/2012	B-LAT-LS-W-04-MS-MA	56	0	0	0	NR	0	Rs (0)	0	0
09/28/2012	B-LAT-LS-W-03-MS-MA	69	0	0	0	NR	0	Rs (0)	0	0
09/28/2012	B-LAT-LS-W-01-MS-MA	72	0	0	0	NR	0	Rs (0)	0	0
10/24-11/12	B-BKT-AS-D-09-MA	245	0	0	0	NR	0	Rs (3:1H,1M,1L)	0	0
10/24-11/12	B-BKT-AS-D-2010-MA	245	0	0	0	NR	0	Rs (15:3H,6M,6L)	0	0
01/22/2013	P-LAT-LS-W-11-MA	60	0	0	0	NR	0	Rs (0)	0	0
01/22/2013	P-SPL-MA-D-11-MA	60	0	0	0	NR	0	Rs (0)	0	0
01/22/2013	P-LAT-SE-D-11-HI-MA	60	0	0	0	NR	0	Rs (0)	0	0
03/05/2013	P-BKT-AS-D-11-MA	60	0	0	0	NR	0	Rs (0)	0	0
05/23/2013	P-LAT-SE-D-11-HI-MA	60	0	0	0	NR	0	Rs (0)	0	0
03/05/2013	P-BKT-AS-D-12-MA	60	0	0	0	NR	0	Rs (0)	0	0
08/27/2013	Wild brook trout Cherry Creek	60	0	0	0	0	0	Rs (1:1L)	0	0
08/27/2013	Wild brook trout Cherry Creek	60	0	0	POS low PCR	0	0	Rs (15:1H-11M-1L)	0	0
08/27/2013	Wild sculpin Cherry Creek	60*	0	0	0	NR	0	NR	0	0
08/20/2013	B-LAT-LS-W-04-MS-MA	10	0	0	0	NR	0	Rs (0)	0	0
08/20/2013	B-LAT-LS-W-03-MS-MA	10	0	0	0	NR	0	Rs (0)	0	0
08/20/2013	B-LAT-LS-W-01-MS-MA	10	0	0	0	NR	0	Rs (0)	0	0
08/20/2013	P-BKT-AS-D-11-MA	55	0	0	0	NR	0	Rs (0)	0	0
08/20/2013	B-BKT-AS-D-10-MA	60	0	0	0	NR	0	Rs (0)	0	0
08/20/2013	B-BKT-AS-D-11-MA	60	0	0	0	NR	0	Rs (0)	0	0

* EEDv was detected in 4 of 12 pools of gill tissue and 2 out of 12 pools kidney/spleen/heart tissue by PCR, confirmed by gene sequencing

Appendix 4. Vaccination Summary

Vaccination Date	Species/strain	Lot Number	Vaccine applied	Application method	Notes Totals
02/02/2013	BKT / AS	B-BKT-AS-D-11-MA	BKD	Food	1ml / vaccine per 50lbs./fish
02/02/2013	BKT / AS	B-BKT-AS-D-10-MA	BKD	Food	1ml / vaccine per 50lbs./fish
02/09/2013	LAT-LS	B-LAT-LS-D-09-MA	BKD	Food	1ml / vaccine per 50lbs./fish
02/09/2013	LAT-LS	B-LAT-LS-W-04-MS-MA	BKD	Food	1ml / vaccine per 50lbs./fish
02/11-13/2013	LAT / LS	B-LAT-LS-W-03-KB-MA	BKD	Food	1ml / vaccine per 50lbs./fish
02/12-14/2013	BKT / AS	B-BKT-AS-D-2011-MA	BKD	Food	1ml / vaccine per 50lbs./fish
04/10/2013	LAT / LS	P-LAT-LS-D-2012-MA	Furogen	(One Dip) - 60 seconds	1.0L/100kg. of Fish
04/09/2013	Splake	P-SPL-MA-D-12-MA	Furogen	(One Dip) - 60 seconds	1.0L/100kg. of Fish
04/11/2013	LAT / SE	P-LAT-SE-D-12-HI-MA	Furogen	(One Dip) - 60 seconds	1.0L/100kg. of Fish
05/06/2013	BKT / AS	P-BKT-AS-D-12-MA	Furogen	(One Dip) - 60 seconds	1.0L/100kg. of Fish
05/06/2013	BKT / AS	B-BKT-AS-D-12-MA	Furogen	(One Dip) - 60 seconds	1.0L/100kg. of Fish
03/23/2013	BKT / AS	B-BKT-AS-D-11-MA	Erythromycin	Injection	Prevention
04/15/2013	LAT / LS	P-LAT-LS-D-2012-MA	BKD	Food	1ml / vaccine per 50lbs./fish
04/17/2012	LAT / SE	P-LAT-SE-D-12-HI-MA	BKD	Food	1ml / vaccine per 50lbs./fish
05/07/2013	BKT / AS	P-BKT-AS-D-2012-MA	BKD	Food	1ml / vaccine per 50lbs./fish
04/22/2013	Splake	P-SPL-MA-D-12-MA	BKD	Food	1ml / vaccine per 50lbs./fish
05/14/2013	BKT / AS	B-BKT-AS-D-12-MA	Furogen	(Second Dip) - 60 seconds	1.0L/100kg. of Fish
05/14/2013	BKT / AS	P-BKT-AS-D-12-MA	Furogen	(Second Dip) - 60 seconds	1.0L/100kg. of Fish

Appendix 5. Fish Disease Treatment Summary

Date	Lot	Disease or Treatment Reason	Treatment	Concentration	Results
9/30-11/29	All egg lots; Spawning	BKD	Erythromycin	0.38g/50gallons H2O 1hr. bath	Good
9/30-11/29	All egg lots; Spawning	Disinfectant (2 separate treatments)	Argentine	90ml/30min. 50ppm 189ml/10min. 100ppm	Good
9/30-12/31	All egg lots	Fungus treatment	Hydrogen peroxide	15 min. flow through treatment. 550ppm	Good
09/23/2013	P-LAT-LS-2011-MA R-05	External parasites	Hydrogen peroxide	1 hr. bath / 80ppm	not effective
09/25/2013	P-LAT-LS-2011-MA R-05	External parasites	Hydrogen peroxide	1 hr. bath / 80ppm	not effective
10/10-10/20	P-LAT-LS-2011-MA R-05	Coldwater Disease	Aqua Flora	908g/ton; (1% BW); 10mg food / kg fish	Not working
10/10-10/20	P-LAT-SE-D-2011-SE-MA R-06	Coldwater Disease	Aqua Flora	908g/ton; (1% BW); 10mg food / kg fish	Not working
10/26-11/4	P-LAT-LS-2011-MA R-05	Coldwater Disease	Aqua Flora	908g/ton; (1% BW); 10mg food / kg fish	Not working
10/26-11/4	P-LAT-SE-D-2011-SE-MA R-06	Coldwater Disease	Aqua Flora	908g/ton; (1% BW); 10mg food / kg fish	Not working
11/05-11/15	P-LAT-SE-D-2011-SE-MA R-04A&B	Coldwater Disease	Aqua Flora	908g/ton; (1% BW); 10mg food / kg fish	Not working
02/28/2013	P-BKT-AS-D-2011-MA R-02	Parasites	Hydrogen peroxide	1 hr. bath / 100ppm	Good
02/28/2013	P-BKT-AS-D-2011-MA R-01	Parasites	Hydrogen peroxide	1 hr. bath / 100ppm	Good