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DEPARTMENT OF NATURAL RESOURCES

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ANNUAL FISH PRODUCTION ANALYSIS FOR FISCAL YEAR 2014

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TABLE OF CONTENTS

Michigan Department of Natural
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Annual Fish Production Analyses For Fiscal Year 2014

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INTRODUCTION

Michigan Department of Natural Resources (MDNR), Fish Production Section has produced separate annual reports detailing production statistics since the 1980s for each hatchery. The reports provide information related to expenditures; facility operation and maintenance; utility usage; fish production statistics; broodstock management; measures of fish health and quality; fish marking projects; and, ultimately, fish distribution for all Michigan fish production facilities. These reports are produced individually and annually for each unit. They are available to the public and some unit reports have been posted on the MDNR website periodically, but they have never been compiled into a Fish Production Section-wide report and published in a form that was widely available to the public or other agency personnel. This report marks the first year that these annual reports are being compiled into a comprehensive report. This summary is largely taken from the fiscal year 2014 (FY14) federal aid report used to document activities required under the Sport Fish Restoration Act reporting requirements. The summary is followed by individual chapters with analysis of production by each state fish hatchery: Marquette, Thompson, Oden, Platte River, Harrietta, and Wolf Lake.

FISH PRODUCTION SECTION-WIDE ANALYSIS

ADMINISTRATION

Fish Production Section full time equivalent (FTE) staffing levels have been relatively constant over the past five years. Wages, Contractual Services, Supplies and Material (CSS&M) costs, Vehicle and Travel Services (VTS) costs, and total weight produced in FY14 were similar to previous years while travel, fish food, and utility costs were higher than most previous years (Table 1).

TABLE 1. Fish Production Section fiscal and production information summary.

Item	2010	2011	2012	2013	2014
FTE	46	47	48	48	47
Wages	$4,021,994	$4,137,141	$4,582,291	$4,646,078	$4,580,666
CSS&M	$338,838	$311,465	$320,358	$324,859	$328,312
VTS	$101,697	$70,555	$86,683	$82,183	$80,200
Travel	$18,241	$17,780	$20,317	$16,653	$37,129
Fish food	$674,478	$602,562	$723,249	$694,613	$711,431
Utilities	$1,004,475	$1,061,868	$974,091	$988,532	$1,108,980
kg produced	314,430	305,051	310,609	322,179	269,578

HATCHERY FACILITIES

The funding source for major maintenance projects is a separate allocation of federal aid and is allocated by the division separately from individual hatchery budgets. Typically, this funding source supports large maintenance projects that are outside the scope of costs that could be borne by individual hatchery budgets (Table 2). The normal annual allocation is $200,000. Additional funding was available due to the use of Karn-Weadok (Consumers Power Company) settlement money for hatchery infrastructure improvements. This funding came in the form of energy credits for Wolf Lake, Harrietta and Oden state fish hatcheries. The savings in energy costs was used to fund additional maintenance projects across the hatchery system. Several projects planned for at the beginning of the year had to be delayed due to emergencies that arose during the fiscal year.

TABLE 2. Fish Production Section maintenance and improvements.

- FPS (Fish Production Section)
- HSFH (Harrietta State Fish Hatchery)
- MSFH (Marquette State Fish Hatchery)
- OSFH (Oden State Fish Hatchery)
- PRSFH (Platte River State Fish Hatchery)
- TSFH (Thompson State Fish Hatchery)
- WLSFH (Wolf Lake State Fish Hatchery)

Unit	Project description	Need	Final cost
FPS	Heavy equipment maintenance and repairs	Operational maintenance	$2,305
MSFH	Truck disinfection station	Biosecurity	$6,100
MSFH	Raceway enclosures	Biosecurity	$31,689
PRSFH	Replace UV bulbs	Biosecurity	$13,180
TSFH	High efficiency propane boiler	Energy efficiency	$16,934
TSFH	Raceway enclosures	Biosecurity	$104,000
HSFH	Replace well angle drives with generators	Operational maintenance	$97,820
HSFH	Hatchery building dehumidification	Operational maintenance	$41,191
WLSFH	Discharge ditch bank stabilization	Operational maintenance	$105,000
WLSFH	Emergency well repair to well #4, #6 and #7	Emergency repair	$16,839
WLSFH	Emergency residence #1 furnace replacement	Emergency repair	$2,950
WLSFH	Emergency repairs to well #6	Emergency repair	$26,695
OSFH	Well repair PW2, PW4	Emergency repair	$23,558
Annual expenditure			$488,261

FISH REARING

The number of coolwater fish produced was below requested levels due to lower production of Walleye fry than planned. The number of coldwater fish produced was very near planned production levels (Table 3).

TABLE 3. Fish production by species and age in FY14.

Species	Age	Number requested	Number stocked	Weight stocked (kg)
Coldwater				
Atlantic Salmon	Fall fingerling	30,000	49,853	686
Atlantic Salmon	Yearling	160,000	172,138	4,947
Brook Trout	Adult	0	548	219
Brook Trout	Fall fingerling	32,800	33,740	985
Brook Trout	Spring fingerling	8,000	2,450	33
Brook Trout	Yearling	66,000	62,019	5,207
Brown Trout	Adult	0	2,860	3,796
Brown Trout	Fall fingerling	30,000	38,211	1,358
Brown Trout	Yearling	1,420,000	1,324,857	77,367
Chinook Salmon	Spring fingerling	1,626,000	1,613,404	8,976
Coho Salmon	Yearling	1,570,000	1,570,200	100,995
Hybrid Sunfish	Adult	2,200	1,775	144
Lake Trout	Adult	0	179	908
Lake Trout	Yearling	322,500	336,652	5,817
Rainbow Trout	Adult	0	1,984	2,427
Rainbow Trout	Yearling	558,000	563,857	35,016
Steelhead	Fall fingerling	23,000	589,859	3,791
Steelhead	Yearling	1,215,000	1,218,700	86,795
Splake	Yearling	205,000	202,057	16,216
Total coldwater production		7,266,300	7,873,812	356,430
Coolwater				
Muskellunge	Fall fingerling	48,000	59,451	2,114
Northern Pike	Spring fingerling	2,562	107,605	177
Lake Sturgeon	Fall fingerling	15,500	2,761	50
Lake Sturgeon	Spring fingerling	0	2,300	74
Lake Sturgeon	Yearling	0	108	37
Walleye	Fall fingerling	87,370	6,302	220
Walleye	Spring fingerling	3,228,030	3,793,659	2,458
Walleye	Fry	17,519,000	10,225,600	61
Total coolwater production		20,902,662	14,199,561	5,335
Total production		28,168,962	22,073,373	361,765

EFFLUENT MANAGEMENT

Effluent monitoring and reporting were conducted at all six hatcheries according to National Pollutant Discharge Elimination System (NPDES) permit requirements. All parameters reported to the Michigan Department of Environmental Quality were within established limits. A highlight in the area is the achievement of 60 months of compliance with court-ordered effluent quality at Platte River State Fish Hatchery. Passing this milestone allows for reduced watershed sampling and associated costs in the future.

BROODSTOCK MANAGEMENT

Feral egg collections are used to support hatchery rearing programs (Table 4). Sufficient eggs were collected to meet all stocking requests with the exception of Walleye. Egg totals are estimates generated volumetrically (counting eggs in a known volume and measuring the total volume of eggs). Domestic egg collections are also used to support hatchery rearing programs and are performed at Marquette and Oden state fish hatcheries (Table 5).

TABLE 4. Feral egg collections used to support hatchery rearing programs.

Species, strain	Source	State fish hatchery			Total eggs
		Thompson	Platte	Wolf Lake	
Atlantic Salmon	Saint Mary's River	--	346,976	--	346,976
Chinook Salmon	Little Manistee Weir	868,268	1,766,536	840,756	3,475,560
Coho Salmon	Platte River Weir	--	2,859,077	--	2,859,077
Muskellunge, Great Lakes	Detroit River	--	--	429,545	429,545
Rainbow Trout, MI steelhead	Little Manistee Weir	1,654,960	--	3,172,254	4,827,214
Walleye, Bay De Noc	Little Bay De Noc	23,228,810	--	--	23,228,810
Walleye, Muskegon	Muskegon River	--	5,057,559	60,193,356	65,250,915

TABLE 5. Domestic egg collections at hatcheries used to support hatchery rearing programs.

Species, strain	Source	Total eggs
Brown Trout, Gilchrist Creek	Oden State Fish Hatchery	1,474,926
Brown Trout, Sturgeon River	Oden State Fish Hatchery	1,240,570
Brown Trout, Wild Rose	Oden State Fish Hatchery	3,471,702
Rainbow Trout, Eagle Lake	Oden State Fish Hatchery	1,276,704
Brook Trout	Marquette State Fish Hatchery	374,097
Lake Trout, Lake Superior	Marquette State Fish Hatchery	229,571
Lake Trout, Seneca Lake	Marquette State Fish Hatchery	337,920
Splake	Marquette State Fish Hatchery	554,899

FISH HEALTH

In FY14, staff from the Michigan State University (MSU) Aquatic Animal Health Laboratory provided fish health inspection and diagnostic services for all species and strains (lots) of salmonid and coolwater fish stocked. A lot of fish may be a few thousand to a few million fish of a specific species and strain at a particular hatchery. Lots are subsampled for inspection and diagnostic testing. Pre-stocking fish health inspections include assays to determine the presence or absence of seven reportable pathogens and are performed routinely on all lots of fish prior to stocking. A total of 56 pre-stocking fish health inspections were performed for production lots. Inspections are broken down by category:

- 35 full fish health hatchery salmonid inspections
- 2 full fish health hatchery coolwater inspections
- 7 hatchery Walleye inspections for viral hemorrhagic septicemia virus (VHSv) only
- 12 hatchery Muskellunge *Esox masquinongy* inspections for VHSv only

The pathogens of concern in these cases continue to be *Flavobacterium*, *Flexibacterium* spp. and infectious pancreatic necrosis virus (IPNv).

There were 16 lots of fish submitted for diagnostic testing from the six hatcheries in FY14. Diagnostic testing is only performed on lots when a disease outbreak is suspected. These included 13 cases for production lots and three for captive brood lots. Most cases submitted for testing in FY14 were for IPNv, bacterial gill disease (BGD) or bacterial coldwater disease (BCWD). The most significant finding in FY14 was the presence of IPNv in production and broodstock Brown Trout *Salmo trutta* at Oden State Fish Hatchery and production Brook Trout *Salvelinus fontinalis* at Marquette State Fish Hatchery. Infectious pancreatic necrosis virus had been found before in broodstock at Oden State Fish Hatchery but was never associated with any disease outbreak. Fingerlings of the Wild Rose and Sturgeon River strains of Brown Trout at Oden State Fish Hatchery experienced a clinical outbreak in FY14. Yearling Brook Trout at Marquette State Fish Hatchery were diagnosed with IPNv during a routine fish health inspection, but never exhibited clinical signs or experienced any unusual mortality. Both lots of Brown Trout at Oden State Fish Hatchery recovered and were retested and found to be free of IPNv and were stocked. The corresponding future broodstock lot was destroyed. Following the Great Lakes Fishery Commission's Model Program for Fish Health Management in the Great Lakes requirements (Phillips et al. 2014), the finding of IPNv in the Brook Trout prohibited us from stocking these fish in connected watersheds. They were stocked in a landlocked mine lake in Marquette County of Michigan's Upper Peninsula.

FISH QUALITY

Fish Quality Assessments (FQAs) following procedures defined by Goede and Barton (1990) were completed by hatchery personnel for all lots of salmonids reared and stocked out of the six state fish hatcheries in Michigan and fish released through cooperative rearing agreements. Assessments of fish quality were completed to document the condition of fish just prior to stocking. In FY14, a total of 48 FQAs were completed by hatchery and field personnel including 29 lots of fish at state hatcheries and 19 lots reared in net pens and cooperative rearing facilities throughout the state. Assessments showed that fish were in good condition at the time of stocking with minimal fish quality issues. When issues were documented, fin erosion, abnormal eyes and gills, and shortened opercula continued to be the most common negative quality criteria found in these lots.

FISH MARKING

All the Chinook Salmon *Oncorhynchus tshawytscha* and Lake Trout *Salvelinus namaycush* were marked within the Great Lakes Mass Marking Program using mass marking technology and United States

Fish and Wildlife Service (USFWS) personnel. All other marking was coordinated and carried out using Fisheries Division personnel and equipment (Table 6).

TABLE 6. Fish marking projects completed in FY14.

- AD (Adipose fin clip)
- ADCWT (Adipose coded wire tag)
- LV (Left ventral fin clip)
- OTC (Oxytetracycline)
- PIT (Passive Integrated Transponder)

Species, strain Age	Waterbody	Number marked fish Requested	 Stocked	Clip/Mark	Weight (lbs)
Atlantic Salmon, Landlocked					
Yearling	St. Mary's River	30,000	40,908	LV	5,788
Yearling	Lake Huron sites	130,000	131,230	ADCWT	5,095
Chinook Salmon, Michigan					
Spring fingerling	Lake Superior sites	375,000	392,590	AD	3,540
Spring fingerling	Lakes Michigan and Huron	1,251,000	1,220,814	ADCWT	16,206
Lake Trout, Seneca Lake					
Yearling	Lakes Michigan and Huron	215,000	212,714	ADCWT	6,699
Muskellunge, Great Lakes					
Fall fingerling	Big Bear Lake	1,650	1,800	PIT	177
Fall fingerling	Thornapple Lake	1,740	1,700	PIT	143
Rainbow Trout, MI steelhead					
Yearling	Au Sable River	20,000	17,368	ADCWT	2,581
Yearling	Manistee River	20,000	20,036	ADCWT	2,886
Yearling	Saint Joseph River	20,000	20,028	ADCWT	2,910
Walleye, Bay deNoc					
Swim-up fry	Portage Lake	1,100,000	1,100,000	OTC	15
Walleye, Nonspecific					
Fall fingerling	Various sites statewide	3,992	3,992	OTC	327
Spring fingerling	Various sites statewide	279,752	279,752	OTC	349
Total fin-clipped		2,061,606	2,056,294		45,719
Total coded-wire-tagged		1,671,606	1,624,912		36,724
Total oxytetracycline		1,383,744	1,383,744		690
Total coldwater fish marked		1,402,740	1,389,966		1,357
Total coolwater fish marked		2,061,000	2,055,688		45,706
Total fish marked		3,463,740	3,445,654		47,062

FISH DISTRIBUTION

Distribution of fish to stocking sites required 433 stocking trips from the six state fish hatcheries and 147 stocking trips by management unit personnel. A total of 837 sites were stocked by hatchery personnel and 186 sites by management unit personnel. Stocking vehicles logged approximately 115,751 miles stocking state hatchery fish and 8,220 miles stocking coolwater fish reared and transferred by management unit personnel. In summary, a total of 123,971 miles were driven stocking fish in FY14. A total of 580 trips

were made and 1,023 sites were stocked. A total of 3,072 person-hours were spent stocking fish in FY14. These metrics are relatively consistent year to year. Overall, there has been a slight decline in miles driven, number of trips, and hours spent stocking due to a gradual evolution to larger stocking vehicles. The number of stocking sites has not changed dramatically in recent years.

Modernization of the stocking fleet is an ongoing effort. Replacement rates for stocking vehicles is normally one vehicle every one or two years.

MARQUETTE STATE FISH HATCHERY PRODUCTION ANALYSIS

ADMINISTRATION

Full time equivalent count decreased slightly this year over fiscal year 2013 (FY13) due to the way the Research Section secretary's time was budgeted. In the past, one-third of wages and salaries were accounted to research and in this year one-half were accounted to research. This does not represent any change in work, but rather aligns with allocations of time used for the work plans. Wages increased slightly compared to FY13 but were below the previous four-year average due to a shift to fewer senior staff over that period. Contractual Supplies, Services, and Materials expenditures were significantly higher in FY14 compared to FY13 and the highest costs since fiscal year 2010 (FY10), but still only accounted for 82% of the allotment. The increase was due to relieving of spending restrictions and one large expenditure to CSS&M. Fish food expenditures were significantly lower in FY14 compared to FY13 and lower than the average of the previous four years. Approximately 58% of the fish food allotment was spent in FY14. Utility expenditures were significantly higher in FY14 compared to FY13 and higher than any year since FY10. Approximately 85% of the utility allotment was spent. The FY14 production weight was the highest weight produced in the past five years. Production weight was significantly higher in FY14 compared to FY13 because 25% mortality occurred in both Lake Trout strains due to epizootic epitheliotropic disease virus (EEDv) that previous year. Lower food expenditures were the result of lower feeding rates during the very cold winter months, lower rearing assignments, and greater feed conversion efficiency late in the growing season as temperatures increased before stocking (Table 7).

TABLE 7. Marquette State Fish Hatchery fiscal and production information summary.

Item	2010	2011	2012	2013	2014
FTE	7.1	7.2	6.9	7.2	7.1
Wages	$644,359	$626,432	$672,920	$599,972	$610,810
CSS&M	$68,982	$48,005	$42,327	$44,730	$49,242
VTS	Both combined with CSS&M above				$2,528
Travel					$10,727
Fish food	$71,397	$66,745	$56,665	$55,690	$42,445
Utilities	$51,402	$47,422	$42,816	$53,231	$59,144
kg produced	32,139	32,156	28,064	21,607	32,769

HATCHERY FACILITIES

Maintenance projects completed in FY14 include a broad array of medium to low-cost projects funded with unit budgets (Table 8). No major maintenance funding was available as Harrietta State Fish Hatchery used the majority of the annual fund for the installation of a liquid oxygen storage tank. The upstairs carpeting and vinyl flooring in the entrance was replaced. The cost was partially funded by Research Section with $2,000 from their major maintenance fund. The hatchery purchased one pneumatic Whisper Feeder™ using Fish Quality Unit and CSS&M monies. The intent is to see how the staff likes them with the goal being to replace existing electrical actuated feeders over time. Hatchery staff purchased and installed seven new flow meters and valves for the inside tanks. Hatchery staff began work on a disinfection station across Cherry Creek near deep well number 6. The remainder of the work for the disinfection station will be completed in fiscal year 2015 (FY15) using major maintenance funds. Hatchery staff coordinated with the mechanic from the Forest Resource Division's Marquette Repair Shop for the annual service for the emergency backup generator.

TABLE 8. Marquette State Fish Hatchery maintenance and improvements.

Item description	Contractor	Completion date	Final cost	Notes
Replace carpet	Tandus	June	$16,204	CSS&M
Whisper Feeder	EMF Metal	September	$2,100	Fish Quality
Seven flow meters	Midwest Instruments	May	$2,820	CSS&M
Disinfection station	In house	Ongoing	$530	CSS&M
Generator service	In house	May	$500	CSS&M
Sewage pump repair	Superior Electric	February	$1,015	CSS&M
Fish pump belt	Superior Electric	January	$562	CSS&M

Call Back Summary

Marquette State Fish Hatchery experienced two call back alarms in FY14. One was for a power outage and one was the watchdog alarm. The hatchery alarm and backup systems worked as intended with no fish lost as a result.

Utility Summary

Electrical usage (kw-hrs) in FY14 was very similar to FY13 and also similar to the previous four-year average. Electrical costs in FY14 were nearly identical to FY13. This year did not reflect a $2,266 earned credit which will be credited in FY15. Electrical costs in FY14 were slightly higher than the previous four-year average, as the unit costs have increased over that time period. Natural gas usage was slightly higher in FY14 compared to FY13 and slightly lower than the average of the previous four years. Natural gas usage is driven primarily by heating buildings and thus, winter severity. The unit cost of natural gas was slightly higher in FY14 compared to FY13, but similar to the previous four-year average. Liquid oxygen usage and cost are both up 70% compared to FY13 and at the highest level since FY10. The increase does not reflect an actual increase in use, but rather an artifact of billing cycles for the fiscal year. During the summer months, staff intentionally withheld delivery of liquid oxygen while hatchery demand was low to reduce the venting off of unused gas. Liquid oxygen annual use should balance out over time. Due to the size of the settling chambers and the cost of waste disposal, the hatchery has opted to pump the chambers on alternate years. The former land disposal site used

for hatchery waste was lost due to land transfer in FY13. A new site was established in FY14. The cost for waste disposal has remained static for the past five years (Table 9).

TABLE 9. Marquette State Fish Hatchery energy consumption history.

Category	2010	2011	2012	2013	2014
Electrical use (kw-hrs)	542,304	474,212	478,368	511,056	507,600
Electric costs	$40,729	$37,004	$39,355	$44,872	$44,826
Unit costs	$0.08	$0.08	$0.08	$0.09	$0.09
Natural gas use (ccf)	10,219	7,168	5,482	6,845	7,117
Natural gas cost	$8,176	$5,347	$3,819	$4,423	$5,043
Unit costs	$0.80	$0.75	$0.70	$0.65	$0.71
Liquid oxygen use (ccf)	4,319	5,247	4,031	4,525	7,704
Liquid oxygen cost	$3,779	$4,592	$3,527	$3,982	$6,779
Unit costs	$0.88	$0.88	$0.88	$0.88	$0.88
Waste disposal (gal)	31,200	0	42,000	0	31,200
Waste disposal cost	$2,496	$0	$2,496	$0	$2,496
Unit costs	$0.08	NA	$0.06	NA	$0.08

FISH REARING

The yearling Lake and Brook trout and splake *Salvelinus namaycush* × *S. fontinalis* reared outside benefited from warm summer temperatures in FY14 resulting in good growth. Growth was reduced in the winter due to early onset of cold temperatures and a late spring warm up. The late spring delayed stocking by two weeks and all of the growth potential lost in the winter was made up resulting in larger yearlings in all groups when compared to the past several years.

In FY14, Marquette State Fish Hatchery produced 32,769 kg of salmonids comprised of production and broodstock fish. The total weight produced in FY14 is 34% greater than in FY13, but lower than the previous four-year average. A total of 29,392 kg of Brook Trout, Lake Trout, and splake were stocked into public waters. The total number of these three species produced was 684,224 fish which is significantly lower than the previous four-year average. All production fish lots were started on BioOregon- BioVita™ starter and switched to Skretting™ Silver Cup steelhead diet.

The growth rates of fish in Brood Year 2013 (BY13) lots were similarly affected by a cool summer and early onset of cool fall temperatures that followed a moderately cold winter of 2014–15. Through the midwinter point of the rearing cycle, fish growth in all lots has been slow when compared to the last four years.

Brook Trout, Assinica

All the production and future brood lots were produced by crossing three-year-old females with two-year-old males. In October 2013, 33,740 fall fingerlings were stocked. This is within 3% of the rearing assignment. These brood year 2012 (BY12) fingerlings were 34 fish/kg, which is very close in size to the brood year 2011that exceeded all previous lot growth records. The average size of the BY12 yearling (Assinica) lot fell within the normal yearling range for Marquette State Fish Hatchery. Yearling Assinica production totaled 62,019 fish which was 10% below inventory. In the last several years Assinica yearlings have appeared to reach a growth ceiling for this genetic group. Significant growth improvement beyond

this mark is unlikely. Field survey reports indicate stocking is very successful at the current release size and condition.

Spring fingerling production BY13 met the 2,375 fish allocation which is below the rearing assignment number of 8,000 fish. Minimal effort is made to fine tune this number in this early life stage due to insignificant space and cost of holding the extra small fry. Inventory variations are always greatest in these small and later hatching fish. In the past, there have been attempts to correct overages early and the end result has been too few fish.

Lake Trout, Lake Superior

Brood year 2012 was the fifth production lot reared from a wild strain fish in the hatchery. A small aliquot of eggs was taken from each family to secure a second domestic future brood lot of Lake Superior Lake Trout by crossing 2001, 2003, and 2004 male and female brood lots. Egg eye-up rates from each broodstock lot used were within the normal range. The rearing assignment for this lot was reduced by 25% to 112,500 yearlings in order to reduce stress in hopes that this would reduce the risk of another EEDv outbreak. The 123,938 fish contributed 2,772 kgs to the total spring yearling production. They were slightly smaller in size (44.7 fish/kg) compared to previous lots but showed all the qualities in terms of health condition and vigor as the previous production lots of this strain. These fish were used to fill inland lake stocking requests.

The BY13 production lot of Lake Superior Lake Trout was established from crossing 2003 and 2004 male and female brood lots. The 112,500 yearlings rearing assignment was held static. This lot had normal eye-up rates with no disease concerns as of the end of the fiscal year. Summer 2014 water temperatures were cooler than normal. As a result, fish are smaller at age than previous lots. These fish will be used to fill inland lake stocking requests in the spring 2015. The final status of these fish will be summarized in next year's report.

Lake Trout, Seneca Lake

Approximately 337,000 eyed eggs were received from Sullivan Creek National Fish Hatchery to establish the yearling Seneca Lake lot of BY12. Yearling production from the BY12 totaled 212,714 fish which was 3% over the new reduced rearing assignment (Table 10). This new and lower rearing assignment was due to the EEDv outbreak last year which started in the Lake Superior strain and spread to the Seneca strain within weeks. Each year the Seneca strain Lake Trout lot struggle to put on growth after they are clipped, tagged, and moved to the outside raceways. This disturbance occurs in mid-July when growth rates should peak had they been put outside in early June. In addition, the move to 100-cubic-meter outside raceways lowers fish densities which creates a panic behavior in the population and further offsets growth. Additionally, in winter 2014, extreme, long-lasting cold conditions further slowed growth, such that this lot was smaller at release than normal. The BY12 lot was stocked into allocated waters in April 2014 at 72.3 fish/kg, whereas normal size from past lots has ranged 43.3 to 60.1 fish/kg.

In November 2013, approximately 337,000 eyed eggs were received to establish the BY13 lot. Marquette State Fish Hatchery stayed with the lower rearing assignment (210,000) for the BY13 lot because of a past disease outbreak. Hatching and early rearing mortality records were at normal rates and condition for age. Currently there are no disease concerns with this lot. Again, cool summer temperatures affected fish growth after the lot was clipped, tagged, and moved to outside raceways. They are scheduled for stocking in April 2015.

Both lots (BY12 and BY13) of Seneca strain yearlings are used to fill Great Lakes requests for Northern and Southern Lake Huron and Southern Lake Michigan. The Seneca strain appears to have difficulty adjusting to late transfer into outside raceways. Clipping and tagging activities, the low density in outside raceways, and the continual variations in water temperature later in the winter months all appear to affect growth and size at stocking. Future culture practices will be aimed at trying to improve early fish growth

that occurs in the inside tanks, under constant water temperature and when feed conversion rates are higher. This will hopefully allow tagging to occur several weeks earlier and allow the fish to take advantage of the short period of warmer creek temperatures in the summer.

TABLE 10. Marquette State Fish Hatchery production statistics.

Splake, Marquette

Species, strain Age	Number assigned	Number stocked	Mean length (cm)	Total weight (kg)	Reason for surplus (shortage)
Brook Trout, Assinica					
Spring fingerling	8,000	2,375	6	32	Low allocations
Fall fingerling	32,800	33,740	15	985	Normal variation
Yearling	66,000	62,019	22	5,207	Normal variation
Adult	0	548	40	219	Surplus product
Species total	106,800	98,134		6,224	
Lake Trout, Lake Superior					
Yearling	120,000	123,938	14	2,772	Normal variation
Adult	0	179	173	908	Surplus product
Species total	120,000	123,938		2,772	
Lake Trout, Seneca Lake					
Yearling	220,000	212,714	12.4	3,045	Normal variation
Species total	220,000	212,714		3,045	
Splake, Michigan					
Yearling	205,000	202,057	20.8	16,216	Normal variation
Species total	205,000	202,057		16,216	
Total	651,800	636,843		28,257	

The BY12 lot was established by crossing BY01 and BY03 Lake Trout with BY09 Assinica Brook Trout male lot. There has been a recent trend toward fewer stocking requests for splake. The 2013 rearing assignment has dropped to a new low of 205,000 fish. Eye-up and hatching rates were average in this BY12 lot. The fish were later transferred into raceways R-8 thru R-11. Marquette State Fish Hatchery produced 202,057 yearling splake which was within the 10% normal variation of the rearing assignment. Their total weight was 16,216 kgs. The total splake weight at stocking was increased slightly over past years in spite of the cool weather. This was made possible because yearling stocking occurred later than past years due to the late spring break up. Also, the splake targeted for Great Lakes stocking were held until the last few stocking trips of the season. The lower rearing assignment allowed for lower densities and continued fish growth in the inside tanks, thereby allowing for larger fish of better overall condition at transfer to the outdoor raceways and later in the rearing cycle to the stocking sites.

The BY13 lot was established by crossing BY01 and BY03 Lake Trout with brood year 2010 Assinica Brook Trout. The rearing assignment remained at 205,000 fish. The fish were reared inside then moved to outside raceways R-8 thru R-11 in excellent condition after spring clean-up in early June. Currently, there are no disease concerns with this lot. The current stocking plan is to hold inland lake fish longer into April and the Great Lakes targeted fish until the last two weeks in May and target a 10 fish per kg stocking size goal. Fisheries managers have the opinion that larger fish survive better.

Outside rearing water temperatures can vary considerably from year to year. This will affect growth but, given the fish quality observations each year and past improvements made in this strain, there still appears to be potential for increased growth before stocking if given optimal hatchery conditions.

Marquette State Fish Hatchery received a $1,000 gift of fish food from the Keweenaw splake Anglers in March of 2012, 2013, and 2014. Fish food was purchased directly by the group and shipped to the hatchery.

Marquette State Fish Hatchery transferred no fish to other facilities in FY14.

Cost per Species

The cost per fish of all species, strains, and ages was estimated using a spread sheet model (Table 11). 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 11. Marquette State Fish Hatchery cost per fish.

Species, strain	Age	Strain cost	Number produced	Cost/fish
Brook Trout, Assinica	Spring fingerling	$3,533	2,375	$1.48
	Fall fingerling	$100,615	33,740	$2.98
	Yearling	$284,485	62,019	$3.60
Lake Trout, Lake Superior	Yearling	$311,476	123,938	$2.51
Lake Trout, Seneca Lake	Yearling	$230,833	212,714	$1.09
Splake, Michigan	Yearling	$435,940	202,057	$2.16

EFFLUENT MANAGEMENT

Marquette State Fish Hatchery has no total phosphorus (TP) effluent limit established in its current NPDES permit (MI0035777). Net TP and total suspended solids (TSS) data are collected each month. Net values are calculated by subtracting the value of the sample collected upstream of the hatchery from the value of the sample collected downstream at the outfall. The permit only requires suspended solids to be reported each month which on occasion has a negative value. There is a 6 mg/l concentration limit for TSS. Occasional negative values are possible due to the high volume of natural silt that settles in the outside raceways and the method/timing of the sample collections. The raceways act as a sediment trap, allowing silt to settle between weekly cleanings. The raceways are brushed regularly, flushing this silt out of the hatchery. Water samples collected for effluent monitoring are collected once per month as grab samples and they don't capture these events. Composite sampling has been done in the past and the results are generally comparable to those from grab sampling. In FY14, there were no violations of the limits set for the facility (Table 12). Phosphorus (P) removal efficiency is the percentage of non-assimilated P removed by the effluent treatment system. Phosphorus removal efficiency is calculated as follows:

P removal efficiency = 1- (net effluent P loading / unused P), where

Unused P = P in from feed–Assimilated P, where

Assimilated P = Biomass produced x 0.004

This calculation assumes that the fish biomass produced is approximately 0.4% P, as is borne out by literature review.

The P removal efficiency calculation was modified in this report from the P use efficiency to more accurately reflect how efficient our system is in removing unused P. The calculation assumes 0.4% P content in the fish. This new calculation accounts for the P incorporated in the production weight of the fish. The rest of the calculations remain unchanged from previous reports.

TABLE 12. Marquette State Fish Hatchery effluent loading parameters.

Parameters	Fiscal year				
	2014	2013	2012	2011	2010
Fish weight produced (kg)	32,769	21,607	28,046	31,534	32,139
Average flow (L/minute)	31,387	31,387	31,387	31,387	31,387
Phosphorus					
From feed (kg)	299	337	318	414	472
Average concentration (mg/L)	0.008	0.0062	0.0123	0.0149	0.0112
Annual loading (kg)	132	102	203	246	185
Unused (kg)	161	246	200	282	337
Excess removal efficiency (%)	18	59	-1	13	45
TSS					
Average concentration (mg/L)	0.9	0.6	0.5	0.9	0.6
Annual loading (kg)	14,612	9,898	8,447	14,298	10,311

BROODSTOCK MANAGEMENT

Spawning operations started with the Lake Superior lean Lake Trout on October 8, 2013 and concluded with the Assinica Brook Trout egg take on November 24, 2013. All crosses were one male crossed with one female. There were four Lake Trout egg takes (81 pairs spawned), three splake egg takes (94 pairs spawned) and five Assinica Brook Trout egg takes (210 pairs spawned). A total of 1,248,211 eggs were collected from the three species: 319,219 Lake Trout (78% eye-up), 554,899 splake (percent eye-up), and 374,093 Brook Trout (73% eye-up). Aliquots from each Brook Trout mating were used to establish a future brood lot.

Brook Trout broodstock numbers were lowered in FY14. Lake Trout numbers were reduced temporarily with the retirement of the brood year 2001 fish in FY14. The BY12 Lake Trout will soon be taken out of isolation and placed into brood area. Brood food quantity and cost show a small adjustment down for the current year-classes on inventory. Food costs will likely stabilize given there is little room to adjust brood numbers further with the current rearing assignment.

FISH HEALTH

Broodstock

All broodstock lots were vaccinated with an oral vaccine against *Renibacterium salmoninarum* or bacterial kidney disease (BKD). The vaccine was obtained from the MSU Aquatic Animal Health Laboratory. The young-of-the-year Brook Trout broodstock received a commercially produced immersion furunculosis vaccine at the two-gram fingerling stage. In late March, the yearling Brook Trout broodstock received a commercial injectable furunculosis vaccine 60 days before being sent to outside raceways. All Brook Trout

broodstock received ten days of top-dressed erythromycin laced food to prophylactically combat BKD. No additional antibiotic treatments were required.

A total of 14 brood fish health cases were sent to MSU from Marquette State Fish Hatchery. Ten cases were to test for BKD in Brook Trout milt and ovarian fluids; no disease outbreaks occurred so no diagnostics tests were required. Four cases were full fish health inspections for pre-spawning approval with no diseases of concern detected.

Production

The delay in getting disease testing results and the extended egg disinfection process increases the handling time of each egg lot. Eye-up and hatching rates on all egg lots were still acceptable, ranging from 52 to 82%. Daily hydrogen peroxide treatments at 550ppm were used as a fungicide on all eggs in incubation. Eyed Seneca Lake Trout eggs from USFWS receive two iodophor treatments prior to entering the incubation units at Marquette State Fish Hatchery.

In late December and mid-January, the Brook Trout yearlings (BY12) became infected with an external parasite (*Gyrodactylus* spp). A series of hydrogen peroxide static bath treatments were completed halting further damage and disease progression. No additional disease treatments or antibiotic applications were required on any of the BY12 and BY13 production lots.

Both BY12 and BY13 production lots were vaccinated with an oral BKD vaccine (produced by the MSU Aquatic Animal Health laboratory) and a commercial immersion furunculosis vaccine as two-gram fingerlings and sent to outside raceways in early June.

Brook Trout yearlings in R-3A raceway tested a low positive result for IPNv after wild Brook Trout sampled above the hatchery the previous summer were found positive for IPNv. No mortalities were observed and by all accounts the fish appeared normal. Due to the positive results, the fish were required to be stocked into Lake Angeline in Marquette County which had no outlet to public waters. Additional and extensive testing occurred on fish from every individual raceway. All other production lots and brood trout raceways (R-1a, 1b, 2a, 2b and 3b) were fish health certified by the MSU Aquatic Animal Health Laboratory for stocking. Marquette State Fish Hatchery continues to IPNv test upstream fish populations and has expanded the testing within the hatchery by testing 60 Brook Trout per raceway rather than 60 brood trout per lot code.

A total of 14 production fish health cases were sent to the MSU Aquatic Animal Health Laboratory from Marquette State Fish Hatchery. Two cases were to test for IPNv in Brook Trout, no diagnostics tests were required and 12 were full fish health inspections for stocking approval.

FISH QUALITY

Fish Quality Assessments were performed on all production lots just prior to first scheduled stocking date. Fall fingerling Brook Trout condition was similar to previous years. All yearling Brook Trout showed reduced growth and lower visceral fat index resulting from cold winter conditions in 2013-2014. Fin erosion and opercula conditions varied from species to species but these measures of quality have changed little from year to year in the Lake Trout and splake. Adult Brook Trout broodstock with these conditions have been selectively culled for many years so it's persistence in the resulting production lots may be due to environmental or nutritional conditions rather than genetic characteristics of the adults. Using a better quality of starter food and lower rearing densities have reduced its occurrences compared to previous lots further supporting the hypothesis that the underlying cause is environmental or nutritional.

Noticeable yearling Brook Trout and splake growth occurred later in the spring season. As a result, these lots were comparable in size to the previous three years at stocking. The Lake Trout struggled with growth all season long due to colder water temperatures and they were stocked first into downstate sites. They

were noticeably smaller than past lots from Marquette State Fish Hatchery. Overall, the quality of the later stocked fish in FY14 was very acceptable and consistent across lots showing little area for improvement.

FISH MARKING

Before being transferred to outside raceways R-4A and B in early July, the BY13 Seneca Lake yearlings were inventoried, adipose fin clipped, and coded-wire-tagged using a mass marking trailer operated by the USFWS.

FISH DISTRIBUTION

Spring fish planting started on October 7, 2013 with fall fingerling Assinica Brook Trout and surplus adult Brook Trout broodstock. Spring stocking season started four weeks later than past years, in mid-April, with southern Lake Michigan and Lake Huron Lake Trout, followed by the inland Lake Trout sites. Seneca Lake Lake Trout stocking off the Detour/Drummond Island Refuge was again resumed following a one-year hiatus due to the EEDv outbreak. The 3,200-gallon Great Lake stocking unit was used on two Lake Trout stocking trips. The Harbor Beach stocking trip had a relatively light load of 62,700 Lake Trout weighing 939 kg. The second trip was to Detour/Drummond Island Refuge which had 100,714 fish weighing 1,393 kgs. The driver reported both stocking events a success with no major problems or mortalities. Splake and Brook Trout plants were held in the hatchery until late May to maximize their stocking size and allow snow melt to occur in the remote areas of the Upper Peninsula. Spring fingerling Brook Trout plants closed the stocking season in mid-June. There were 152 plants made in 81 trips over 21,234 miles taking 550.4 stocking effort hours.

A temporary employee was hired for spring stocking season to help with hatchery duties while the technicians were out stocking fish. Marquette State Fish Hatchery technicians completed 100% of the driving and stocking requirements. In addition, this temporary employee worked in the hatchery during the summer months allowing permanent technicians to help Research and Management Units on stream shocking surveys and Walleye pond work.

THOMPSON STATE FISH HATCHERY PRODUCTION ANALYSIS

ADMINISTRATION

Full time equivalent count decreased slightly from FY13 due to the way the Research Section secretary's time was budgeted. In the past, one-third of wages and salaries were accounted to research and in this year one-half were accounted to research. This does not represent any change in work but rather aligns with allocations of time used for the work plans. Wages and salaries and CSS&M expenditures were up slightly over FY13 and have generally been increasing every year since FY10. Approximately 73% of the combined CSS&M, Travel, and VTS allotment was spent in FY14. Efforts were continued to save money in these budget categories to compensate for other budget categories that were overspent. Fish food costs increased significantly over FY13 levels and were the highest since FY10. This budget category was overspent by 138%. Food expenditures are tied most closely to the cost of food used for steelhead and the steelhead stocked in FY14 were the largest since FY10. Steelhead production weight drove up the total production weight to the highest level since FY10. Utility expenditures were also significantly higher in FY14 compared to FY13 or any year since FY10. Energy costs were high due to high electrical, propane, and liquid oxygen use. Approximately 90% of the utility budget allotment was expended in FY14 (Table 13).

TABLE 13. Thompson State Fish Hatchery fiscal and production information summary.

Item	2010	2011	2012	2013	2014
FTE	6.9	7.2	6.9	6.9	6.5
Wages	$542,366	$615,821	$686,082	$723,001	$731,772
CSS&M	$57,176	$52,376	$51,347	$52,056	$40,472
VTS	Both combined with CSS&M above				$2,528
Travel					$10,727
Fish food	$113,175	$109,779	$125,174	$130,903	$163,008
Utilities	$123,384	$143,907	$121,205	$124,661	$139,196
kg produced	52,994	51,411	47,522	55,592	57,140

HATCHERY FACILITIES

Maintenance projects completed in FY14 include a broad array of projects funded with interpretive center major maintenance, hatchery major maintenance, and unit budgets. The three spring-water, long-shaft pumps were replaced with two submersible pumps controlled with variable frequency drives. The asphalt was crack sealed, seal coated, a curb drain was installed in the parking lot, and several areas where asphalt was crumbling were replaced with new asphalt. Staff requested removable screens in three outside raceways. After evaluation, more may be requested in the future. The hatchery purchased one pneumatic Whisper Feeder™ . The intent is to see how the staff like them with the goal being to replace existing electrically actuated feeders over time. Hatchery staff coordinated annual service for our emergency backup generator using the mechanic from the Marquette Repair Shop (Forest Resource Division). The hatchery fluorescent lighting is being upgraded to new high efficiency lighting. The hatchery purchased a set of forks for the John Deere tractor and a lawn vacuum. The staff has begun renovation of the break/conference room area to better use the space as a meeting room. Purchases for the new room include new counter tops and a multimedia projector. New tables and chairs will be purchased in FY15. Significant maintenance accomplishments and facility improvements occurred during FY14 (Table 14).

TABLE 14. Thompson State Fish Hatchery maintenance and improvements.

Item description	Contractor	Completion date	Final cost	Notes
Spring water pumps	L.W. Allen	August	$31,428	Major maintenance
Asphalt repair	Oberstar	July	$77,700	Major maintenance, Interpretive Center
Raceway screens	In house	August	$2,333	CSS&M
Whisper Feeder	EMF Metal	September	$1,751	Fish Quality
Generator service	In house	July	$500	CSS&M
Facility lighting	In house	Ongoing	$756	CSS&M
Forks–JD loader	Northgate	June	$1,125	CSS&M
Leaf vacuum	Sears	July	$1,400	CSS&M
Meeting room renovation	In house	Ongoing	$2,328	CSS&M

Electrical usage and unit cost in FY14 were very similar to FY13 and also similar to the previous four-year average. Propane gas use in FY14 corresponded to 120% of the FY13 use and 117% of the previous four-year average use. Cost per unit was 126% that of FY13 and 105% of the previous four-year average. Propane gas use is driven primarily by heating buildings and thus, winter severity. Liquid oxygen use and expenditure was 33% higher than FY13 and 43% higher than the previous four-year average. This is at its highest level since FY10. This increase is not normal and is being investigated. The cost per unit for liquid oxygen has remained static for the past five years. Waste disposal volume was 122% compared to FY13 and 113% compared to the previous four-year average. The cost per unit for waste disposal has remained static for the past four years (Table 15).

TABLE 15. Thompson State Fish Hatchery energy consumption history.

Category	2010	2011	2012	2013	2014
Electrical use (kw-hrs)	1,102,789	1,155,288	930,057	1,058,144	1,079,969
Electric costs	$96,774	$107,709	$91,610	$96,539	$99,062
Unit cost	$0.09	$0.09	$0.10	$0.09	$0.09
Propane gas use (gal)	10,591	13,326	14,113	12,211	14,646
Propane gas cost	$15,248	$24,556	$24,564	$16,263	$24,518
Unit cost	$1.44	$1.84	$1.74	$1.33	$1.67
Liquid oxygen use (ccf)	1,472,589	1,578,251	1,331,591	1,611,515	2,136,946
Liquid oxygen cost	$9,866	$10,574	$8,922	$10,797	$14,318
Unit cost	$0.01	$0.01	$0.01	$0.01	$0.01
Waste disposal (gal)	37,500	17,500	20,000	22,500	27,500
Waste disposal cost	$1,026	$840	$920	$1,062	$1,298
Unit cost	$0.03	$0.05	$0.05	$0.05	$0.05

Thompson State Fish Hatchery had four call back alarms in FY14: one for power outage, two for aeration pump failure, and one for spring water pump low flow. All necessary repairs were made. Hatchery alarm and backup systems worked as intended with no fish loss as a result.

FISH REARING

In FY14, Thompson State Fish Hatchery produced 57,090 kg of salmonids comprised of Gilchrist Creek Brown Trout, Michigan strain Chinook Salmon, and Michigan strain Rainbow Trout *Oncorhynchus mykiss* (steelhead). The total number of these species produced was 1,445,058. The weight produced in FY14 is 2.7% greater than in FY13 and the number produced is 4% lower than in FY13. When compared to the previous four-year average, FY14 weights were up 12.4% while numbers produced were down 13.7%. Annual weights produced are driven by the size of the fish produced in the spring while annual numbers produced are primarily driven by fall fingerling steelhead. Bay de Noc Walleye fry is the only other species produced at Thompson State Fish Hatchery. They are not included in the comparisons above due to numbers shipped varying by millions each year (Table 16).

TABLE 16. Thompson State Fish Hatchery production statistics.

Species, strain Age	Number assigned	Number stocked	Mean length (cm)	Total weight (kg)	Reason for surplus (shortage)
Brown Trout, Gilchrist Creek					
Fall fingerling	0	4,000	12	85	Specific fall site request
Spring yearling	200,000	172,110	19	13,756	Inventory adjustment
Species total	200,000	176,110		13,841	
Chinook Salmon, Michigan					
Spring fingerling	421,000	437,937	8	1,829	Inventory adjustment
Species total	421,000	437,937		1,829	
Rainbow Trout, MI steelhead					
Fall fingerling	0	153,909	8	798	Graded surplus
Spring yearling	465,000	474,721	21	41,312	Inventory adjustment
Species total	465,000	628,630		42,110	
Walleye, Bay de Noc					
Fry	2,500,000	6,700,000	0.3	40	Good survival
Species total	2,500,000	6,700,000		40	
Total	3,586,000	7,942,677		57,820	

Brown Trout, Gilchrist Creek

Photoperiod manipulation at Oden State Fish Hatchery produced BY12 eyed eggs for Thompson State Fish Hatchery nearly six and a half weeks earlier compared to previous years without photoperiod manipulation. To offset this gain of growing days, blended water near 11°C was used in early tank rearing rather than 13°C. The Ontonagon River was stocked with 4,000 fall fingerlings per request. In the spring of 2014, there were 172,110 yearlings stocked which was nearly 14% below the rearing assignment. The first two inventories performed on this lot indicated there were fewer fish started in the tanks than had been planned, leading to the shortfall in stocking numbers in the spring. With the earlier delivery of eggs and use of cool water for rearing, this created a spring yearling size that was nearly 76% larger than the target stocking size. All Brown Trout start feeding on BioOregon™ starter feed and are finished on SilverCup™ steelhead diet.

Photoperiod manipulation at Oden State Fish Hatchery produced BY13 eyed eggs for Thompson State Fish Hatchery nearly seven and a half weeks earlier compared to previous years without photoperiod manipulation. To offset this gain and reduce the size of the yearlings at the end of the growing cycle, early rearing was completed on cold water (8°C). At first inventory, it was found that this strategy had reduced growth significantly and that the lot would not meet the target size of 16 cm. Between the time the fish were moved outside in July and the end of the fiscal year this lot experienced over 44,000 mortalities. Details are outlined in the Fish Health section. In September, 35,000 fall fingerlings from the lot were transferred to Wolf Lake State Fish Hatchery to be used as forage for the musky program. At the time, it was believed that the transfer could be accommodated while still meeting the rearing assignment. However, after the lot was stocked out it was apparent that we should not have surplused so many of the lot as we ended up 14% short of our rearing assignment.

Chinook Salmon, Michigan

Brood year 2013 eggs were taken at the Little Manistee Weir in October 2013 and were incubated on 8°C. water. After the yolk sac was mostly absorbed these fish were moved to tanks with 13°C rearing water. The USFWS mass marking trailer arrived on April 22 and all Chinook Salmon allocated to Lake Michigan received an adipose fin clip and a coded wire tag (CWT), while all Chinook Salmon assigned to Lake Superior received only an adipose clip. The reduced Chinook Salmon rearing assignment implemented in fiscal year 2012 (FY12) continued due to decreased forage in Lake Michigan. Thompson State Fish Hatchery surpassed its rearing assignment by 4% in stocking 437,937 spring fingerlings. Stocking weight was 1,829 kg. The fish were 8.1% smaller than the target size. Three net pens were operated with cooperating sportsmen's groups at Lake Superior ports. Approximately 140,000 fingerlings were penned at these locations. Bio-Oregon™ was the only feed used in the rearing of this lot.

Rainbow Trout, Michigan (Steelhead)

Brood year 2013 steelhead had early rearing water temperatures of 13°C in tanks. After being graded twice, they were moved to outside raceways with water temperatures near 10.5°C. In FY14, 125,996 fall fingerlings were transferred to Wolf Lake State Fish Hatchery to help support the musky program. Another 153,909 fall fingerlings were stocked into public waters. In the spring of 2014, a total of 474,721 yearlings at a total weight of 41,312 kg were stocked. This was nearly 2% above the rearing assignment and the fish were 22% larger than the median target size (13.2 fish/kg). Two acclimation pens were used at Lake Huron ports. These were pens that were part of the pen acclimation study that concluded in 2013 but cooperators were allowed to pen until the study results could be fully evaluated. The pens were located at Van Etten Creek and Harrisville Mill Pond. Bio-Oregon™ was the only feed used in the rearing of this lot.

Brood year 2014 steelhead started with eggs coming from the Little Manistee Weir on April 21. With a long, cold winter, the timing of this egg take was a few weeks later than the previous few years. Eggs were incubated on 13°C water. New submersible spring water pumps with variable frequency drives were at the hatchery to replace old spring water pumps. With these new pumps and variable frequency drives, the staff had greater control of water temperatures. The lot was started in rearing tanks using 14.3°C water rather than 13°C water as in the past. This first-year trial of using warmer early rearing water appears to be beneficial for growth. This lot was graded twice to sort the lot by size. During FY14, 142,158 of the smallest graded steelhead were transferred to Wolf Lake State Fish Hatchery to help support the musky program.

Walleye, Little Bay de Noc

On April 29, 2014, the first of two egg takes was conducted at Rapid River, Michigan. Approximately 13 million green eggs were collected. The following day the second egg take was conducted yielding another 10 million green eggs. Saline solution was used for activation of the sperm. This was the second year in a row that the egg takes were conducted very late due to a cold spring. These dates represent the latest that egg takes have been conducted in the Little Bay de Noc since the inception of the egg collection efforts in the late 1970s. Air temperatures were in the 40s°F each day. Spawning occurred at the Rapid River Public Access site. Eggs were transferred to hatching jars each day using two methods to test efficiency and potential effects on egg viability. The methods used were to scoop eggs into the jars using one-liter sized wire colanders and to siphon the eggs into jars. It was found that siphoning is a little faster but increases the potential to spill eggs. Eggs put into jars using the siphoning method were also found to have an average of 6.3% lower fertility than scoop-filled jars. The green egg to fry ratio for the combined lots was 35.9%. This is 12.6% better than in 2013 and 6.7% better than the previous four-year average. Most of this improvement is attributed to being more selective with spawning females and rejecting females whose eggs did not flow freely or were watery or bloody. With better than anticipated egg survival, more fry were available than requested. Thompson State Fish Hatchery's assignment was to produce 4.13 million fry for direct plantings and transfers to ponds. All fry for pond rearing requests were met and the direct plant requests were exceeded. Three million surplus fry were stocked in Little Bay de Noc. A total of 1.25 million

Walleye fry were oxytetracycline (OTC) marked. The marked fry went to one pond and one direct plant site in the Lake Superior watershed. The total number of fry produced in 2014 was greater than in FY13 and greater than the previous four-year average. Fry requests vary annually. With reductions in the number of marked fry requested going forward, Thompson State Fish Hatchery will have additional capacity for fry production. Thompson State Fish Hatchery is currently able to meet all requests for marked and unmarked fry.

Cost Per Species

The cost of fish produced and stocked out of Thompson State Fish Hatchery in FY14 is derived from the fish production program that assigns operational costs based on the relative number of rearing units occupied during the rearing cycle for each species (Table 17). The first day of each month was used to determine space occupied. Operational costs used in the cost model include salaries and wages, CSS&M, utilities, fish food, fish health, fish transport, fish marking, major maintenance, and capital depreciation. Cost to produce Walleye fry was estimated by hours worked and associated expenses.

TABLE 17. Thompson State Fish Hatchery cost per fish.

Species, strain	Age	Strain cost	Number produced	Cost/fish
Brown Trout, Gilchrist Creek	Spring yearling	$322,982	172,110	$1.88
Chinook Salmon, Michigan	Spring fingerling	$115,586	437,937	$0.26
Rainbow Trout, MI steelhead	Spring yearling	$846,427	474,721	$1.78
Walleye, Bay de Noc	Fry	$5,879	8,330,000	$0.01

Effluent Management

Effluent grab samples for Thompson State Fish Hatchery are taken at the settling pond discharge on a monthly basis. The NPDES permit limit for TSS is 6.0 mg/L. The permit does not specify any effluent limit for TP. It should be noted that FY14 is the first full year that the Platte River State Fish Hatchery's water chemistry laboratory processed all the effluent samples. Total phosphorus concentrations are reported monthly. Effort is made to reduce the concentration of TP in the discharge including pumping of solids and using low P feed. No violations of the NPDES permit occurred in FY14. Phosphorus removal efficiency is a decimal expression of the percentage of non-assimilated P removed by the effluent treatment system. In other words, it's a measure of the efficiency of the hatchery system and operational practices in removing TP introduced into the hatchery via the fish feed (Table 18). Phosphorus removal efficiency is calculated as follows:

P removal efficiency = 1- (net effluent TP loading / unused TP), where

Unused P = TP in from feed–Assimilated TP, where

Assimilated TP = Biomass produced x 0.004Broodstock Management

All eggs at Thompson State Fish Hatchery come from either wild fish collections or from Oden State Fish Hatchery. No broodstock are kept on site.

TABLE 18. Thompson State Fish Hatchery effluent loading parameters.

Parameters	Fiscal year				
	2014	2013	2012	2011	2010
Fish weight produced (kg)	57,210	55,687	47,607	51,518	48,750
Average flow (L/minute)	9,463	9,726	9,200	9,726	9,989
Phosphorus					
From feed (kg)	502	436	441	466	465
Average concentration (mg/L)	0.0396	0.0321	0.0285	0.0303	0.0357
Annual loading (kg)	197	164	138	155	187
Unused (kg)	261	202	241	249	260
Excess removal efficiency (%)	25	19	43	38	28
TSS					
Average concentration (mg/L)	0.8	2.3	2.2	2.0	1.7
Annual loading (kg)	4,143	11,758	10,396	10,377	9,057

FISH HEALTH

All incoming eggs to Thompson State Fish Hatchery get two iodophor treatments prior to entering the incubation units. The first treatment is at 50 ppm for 30 minutes and the second is at 100 ppm for 10 minutes. Formalin is used to combat fungus in Walleye and steelhead eggs. Hydrogen peroxide is used as a fungicide with the Chinook Salmon and Brown Trout eggs.

Thompson State Fish Hatchery continued to experience most of the same fish health issues as in previous years. Some of the issues were more severe in FY14 than an average year. Thiamine Deficiency Complex (TDC) was more severe in the Chinook Salmon than in recent years. Chinook Salmon were treated in incubation with flow through thiamine treatments and again in static baths in the tanks. Severe Thiamine Deficiency Syndrome (TDS) is not normally seen in steelhead, but this past year Thompson State Fish Hatchery experienced higher losses in incubation trays and when fish first went into tanks. Discussions with other hatcheries indicated that thiamine greatly helps reduce such losses. Thompson State Fish Hatchery had surplus steelhead fry so no thiamine treatments were conducted for this species. Eventually steelhead mortalities dropped to normal levels. Staff still struggle with BCWD in steelhead and BGD problems in all lots while in the outside raceways. Chloramine T was used to treat these diseases in Chinook Salmon and steelhead under an Introductory New Animal Drug (INAD) treatment with good success.

The BY13 Gilchrist Brown Trout experienced an idiopathic fish health problem in FY14. A week after being transferred outside, daily mortalities began to rise. A few strands of flexibacteria were found on the gills, possibly indicating BGD, so a Chloramine T treatment, which recently became approved for use with BGD, was initiated. The treatment was unsuccessful and mortalities continued to rise. Diagnostic samples were sent to the MSU Aquatic Animal Health Laboratory in early August with no pathogens found. High mortalities continued and another diagnostic sample was sent to the MSU Animal Health Laboratory in early September. In the timeframe between when the fish went into the raceway and the end of the fiscal year, 44,000 fingerlings were lost. Diagnostic results, treatment, and additional details for this lot will be covered in next year's report.

A total of nine lots of fish were sent to MSU from Thompson State Fish Hatchery. Two were to test for VHSv in Walleye, two were for diagnostics for Brown Trout and five were full fish health inspections for stocking approval.

FISH QUALITY

Three FQAs were performed in the spring of 2014 before each of the lots were stocked. The BY12 Brown Trout had good fins and opercula and a visceral fat index of 3.7. The size of the fish was much greater than the previous brood year as noted in the fish rearing section. The BY13 Chinook Salmon showed no fin erosion or shortened opercula. They had a visceral fat index of 2.2 and were slightly smaller than the previous brood year. The BY13 steelhead had good fin and opercula condition with visceral fat indexes of 3.2. Their size was slightly larger than in the previous brood year. Additional abbreviated FQAs with parameters such as length, weight and smolting rates were done for the net pen fish. These are kept on file but not included in this report.

FISH MARKING

Two fish marking projects were carried out at Thompson State Fish Hatchery in FY14. The first fish marking project occurred in late April with the arrival of the USFWS mass marking trailer. All Chinook Salmon received an adipose clip and all fish from three groups to be stocked into Lake Michigan also received a CWT. This year was the fourth of five planned years where mass marking technology was employed to mark all the Chinook Salmon stocked by all agencies stocking this species in Lake Michigan and Lake Huron. Marking all the Chinook Salmon stocked will allow managers to quantify the hatchery contribution to the fishery and allow managers to make informed decisions related to stocking numbers and locations. The results of this Great Lakes basin-wide study will help determine future management of Chinook Salmon in the two lakes. The second marking activity was performed on 1.25 million Walleye fry. These fry were immersed in an OTC solution for at least eight hours prior to release into a rearing pond or public lake. Marking fry allows managers to determine contributions of hatchery fish to inland and Great Lakes fisheries.

FISH DISTRIBUTION

Fish stocking activities for FY14 began with fall fingerling distributions in October and November. The vast majority of fall stocking activity was to distribute graded steelhead that were not needed for spring production. A specific request for fall fingerling Brown Trout required one trip in November. Fall stocking activities were performed with four trips, driving 915 miles and 24 hours of personnel time. Spring stocking activities started on March 31, 2014. A long winter kept Upper Peninsula roads and stocking sites inaccessible longer than most years. The cold spring resulted in delayed completion of stocking activities with the last trip occurring on June 4. There were 62 spring trips made at 88 locations using specialized stocking trucks. These trips required 416 hours, driving 16,039 miles. Just over 75% of the stocking locations were within the Upper Peninsula.

ODEN STATE FISH HATCHERY PRODUCTION ANALYSIS

ADMINISTRATION

Fiscal Year 2014 staffing was similar to the previous year at Oden State Fish Hatchery. Ed Eisch began acting as the program manager for the Fish Production Section midway through the fiscal year. Aaron Switzer acted as the Natural Resource Manager 3 during the same time period and continued his duties as Natural Resource Manager 1 as well. Secretary Denise Kinsinger transferred to Forest Resource Division in July. Melinda (Mindi) Dean was hired as the new Secretary and began in mid-September.

The overall operational expenditures totaled $1,042,739 which is approximately a 1% decrease from the previous fiscal year. FY14 saw a continued annual increase in wages. Utility expenditures were 16% higher than FY13 due to a cold winter and the need to hold fish longer into the spring. The yearling Brown Trout had a delayed release due to health concerns from a possible IPNv break out earlier in the year. All other expenditures were consistent with the prior year (Table 19).

TABLE 19. Oden State Fish Hatchery fiscal and production information summary.

Item	2010	2011	2012	2013	2014
FTE	6.0	7.0	7.0	7.0	7.0
Wages	$551,107	$594,744	$659,936	$707,600	$664,354
CSS&M	$36,651	$36,788	$40,321	$35,981	$35,526
VTS	$10,632	$11,954	$11,072	$11,517	$12,478
Travel	$3,245	$3,391	$2,209	$1,862	$1,310
Fish food	$114,690	$97,336	$110,747	$108,395	$109,062
Utilities	$156,622	$194,950	$193,434	$189,220	$220,009
kg produced	58,921	57,285	55,186	51,570	55,651

Total expenditures were more than $48,000 over the allocated budget for FY14, due mainly to higher electricity cost. The managers will be revisiting allocations for all Fish Production Section facilities in the near future.

Overall production totaled 55,651 kg of Brown and Rainbow trout. This output corresponds to an 8% increase in comparison to FY13. This increase is a function of producing fish that are surplus to the rearing assignments.

HATCHERY FACILITIES

Oden State Fish Hatchery did not have a fully staffed maintenance crew in FY14. Maintenance staff included a full-time maintenance mechanic, an equipment operator for roughly seven months of the year, and a trades helper that travelled from Charlevoix Research Station about once per week. The equipment operator spent approximately five months working at the Black River Sturgeon Hatchery, a joint operation between the MDNR and MSU, leaving Oden State Fish Hatchery short staffed over the busy late spring and summer months. The Fish Production Section's statewide equipment technician began to be stationed at Oden State Fish Hatchery and his activities will be covered in this report.

In spite of being short staffed, many projects were completed and the facility was kept aesthetically pleasing for the visiting public. Larger projects completed by the staff included coordination of annual well testing and upgrades for the automatic production raceway feeders (Table 20). Flow testing revealed wells 1, 3, 4 and 5 producing at or near rated capacities and well 2 in need of a new pump, motor, and cleaning. Staff also made several significant improvements including:

- maintenance and repairs to the boiler
    - replacement of two flow meter circuit boards
    - the sewer lift pump
    - the drum filter backwash pump
    - and the hopper pump stator

- drainage improvements for the visitor center
- visitor center ceiling and drywall repair
- train car roof repairs
- and addition of light-blocking mesh to B-Race

TABLE 20. Oden State Fish Hatchery maintenance and improvements.

Item description	Contractor	Completion date	Final cost	Notes
Annual well/pump testing	Peerless Midwest, Inc.	October 2013	$1,375	PW-2 needs work
Feeder upgrades	Logic Plus	December 2013	$1,238	Production Raceways
Viewing chamber glass	Fishbeck, Thompson, Carr, & Huber, Inc.	September 2014	$37,270	Engineering costs

Major Maintenance funds were used to complete engineering work required for replacement of the larger pane of glass in the Viewing Chamber which had been broken by vandals. This project required diverting the stream for an extended period, heavy equipment for excavating a bypass around the Viewing Chamber, and a crane to sling in the new custom-made window. As a result of the complexity, this project was not fully completed until after FY14 and all other costs associated with it will be paid from the FY15 major maintenance budget.

Additionally, the fishing pier project for Big-A and Little-A shows that ponds moved into the installation phase, but the project was not fully completed by the end of FY14. This $300,000 project was funded by grant money from the Natural Resource Trust Fund.

Call Back Summary

During FY14 there were a total of three call backs compared to eight in FY13, with two caused by weather-related power interruptions. The only other call back was due to human error, with a set point not being properly reset after a flow adjustment occurred while stocking from the brood building. No loss of fish occurred during any of the emergency alarms.

Utility Summary

In a year-to-year comparison, FY14 electricity usage increased from the previous year but was almost identical to the four-year average (Table 21). The increased usage is directly attributable to significantly delayed stocking of yearling Brown Trout in order to complete additional necessary fish health testing for possible IPNv. The unit cost of electricity increased making FY14 electricity expenditures significantly higher than the previous four years.

TABLE 21. Oden State Fish Hatchery energy consumption history.

Category	2010	2011	2012	2013	2014
Electrical use (kw-hrs)	1,458,441	1,757,655	1,765,070	1,572,818	1,663,500
Electric costs	$131,245	$157,793	$168,469	$163,105	$187,289
Unit costs	$0.09	$0.09	$0.10	$0.10	$0.11
Natural gas use (ccf)	11,236	21,880	17,211	18,945	19,968
Natural gas cost	$12,286	$18,620	$14,007	$14,531	$14,783
Unit costs	$1.09	$0.85	$0.81	$0.77	$0.74
Liquid oxygen use (ccf)	26,090	27,276	24,793	24,665	26,383
Liquid oxygen cost	$12,627	$13,587	$13,463	$12,939	$13,851
Unit costs	$0.48	$0.50	$0.54	$0.52	$0.52
Waste disposal (gal)	0	48,000	0	0	48,880
Waste disposal cost	$0	$4,100	$0	$0	$4,880
Unit costs	--	$0.09	--	--	$0.10

Natural gas costs in FY14 were almost identical to the previous four-year average, despite using over 2,000 hundred cubic feet more than the four-year average. However, overall costs were very similar to average, due to favorable lower unit costs and proper budget management. This higher volume used is attributed to colder winter weather than the past few years and because the heated water rearing time was extended for Sturgeon River Brown Trout to increase growth.

FISH REARING

Overall production for Oden State Fish Hatchery in FY14 included 729,042 Brown Trout and Rainbow Trout, totaling 55,651 kg (Table 22). When compared to FY13 production levels, this was a 13% decrease in the number of fish produced but almost 8% more biomass produced. The decrease in the number of fish was mostly due to fewer fall fingerling Brown Trout produced, while the increase in weight was due to increased size of production Brown Trout yearlings stocked related to delayed stocking. Overall, the total weight produced was within 0.1% of the five-year average.

Brown Trout, Gilchrist Creek

In FY14, no yearling Gilchrist Creek Brown Trout were stocked. Oden State Fish Hatchery stocked only adults, with a total of 1,200 fish stocked, weighing a total of 992 kg, averaging 1.2 fish per kg that were 42 cm (16.6”) long. These were retired brood fish that had served their reproductive purpose at Oden State Fish Hatchery and were stocked into put-and-take fisheries.

Brown Trout, Sturgeon River

Fiscal year 2014 Sturgeon River Brown Trout stocking from Oden State Fish Hatchery included only yearlings. A total of 54,867 fish were stocked, weighing 1,428 kgs, and averaging 38.4 fish per kg. This is substantially larger than the 48.1 fish per kg yearlings stocked from Oden State Fish Hatchery in FY13 and larger than any Sturgeon River Brown Trout stocked from any facility to date. The larger size was due to a combination of manipulating the photoperiod of brood fish to have spawning occur six weeks earlier, increasing heated water rearing time, and staff making cultural improvements in the production raceways. The actual number of Sturgeon River Brown Trout stocked was lower than planned due to cannibalism problems in the production raceways.

Brown Trout, Wild Rose

The Wild Rose Brown Trout stocked from Oden State Fish Hatchery during FY14 included both yearlings and adults. For yearlings, a total of 285,730 fish weighing 28,736 kg and averaging 9.9 fish per kg were stocked. This was 4.8% lower than the rearing assignment, which can be attributed to efforts to keep final populations from being in surplus of the rearing assignment and a late season fish loss associated with disturbing the fish in the middle of the night while gathering samples for additional IPNv testing. Stocking of adult Wild Rose Brown Trout included fish from two year-classes totaling 1,660 fish and weighing a total of 2,803 kg. Wild Rose Brown Trout adults from one year-class averaged 52 cm (20.5") in length and were 0.5 fish per kg, while the other lot averaged 44 cm (17.5") in length and were 0.8 fish per kg.

Rainbow Trout, Eagle Lake

Fiscal year 2014 Eagle Lake Rainbow Trout stocking from Oden State Fish Hatchery included yearlings, fall fingerlings, and adults. A total of 293,357 yearlings were stocked, weighing 18,372 kg and averaging just under 16.0 fish per kg. The fall fingerlings consisted of small grade fish which were a byproduct of grading. Over half of the small grade fish were transferred to Wolf Lake State Fish Hatchery for Muskellunge forage, including 106,242 small Eagle Lake Rainbow Trout weighing 606.6 kg. Oden State Fish Hatchery stocked the remaining 90,244 fall fingerlings, weighing 892 kg. Stocking of adult Eagle Lake Rainbow Trout included fish from two year-classes totaling 1,984 fish, weighing 2,427 kg. Eagle Lake Rainbow Trout adults from one year-class averaged 48 cm (18.9") in length and were 0.7 fish per kg, while the other group averaged 40 cm (15.8") in length and were 1.04 fish per kg.

TABLE 22. Oden State Fish Hatchery production statistics.

Species, strain Age	Number assigned	Number stocked	Mean length (cm)	Total weight (kg)	Reason for surplus (shortage)
Brown Trout, Gilchrist Creek					
Adult	0	1,200	42	992	
Brown Trout, Sturgeon River & Wild Rose					
Yearling	90,000	54,867	13	1,428	Cannibalism
Adult	0	830	52	1,766	
Adult	0	830	44	1,038	
Yearling	300,000	285,730	20	28,736	-4.8% short of assignment
Species total	390,000	343,457		33,960	
Rainbow Trout, Eagle Lake					
Adult	0	1,334	48	1,803	
Adult	0	650	40	624	
Fall fingerling	0	90,244	10	892	Grading
Yearling	286,000	293,357	18	18,372	2.6% over assignment
Species total	286,000	385,585		21,691	

Cost per Species

Cost per fish estimates for production lots are outlined in Table 23. The cost for producing Sturgeon River Brown Trout was $4.26 per fish, for Wild Rose Brown Trout was $1.56 per fish, and for Eagle Lake Rainbow Trout was $1.76. Both lots of Brown Trout were more expensive per fish than last year, but Eagle Lake Rainbow Trout costs per fish were almost identical to the previous year. Sturgeon River Brown Trout cost per fish was affected significantly by the small number produced and because they were reared three extra months in multiple nursery tanks instead of a single production raceway. The model used to calculate

cost treats each rearing unit as if it costs the same to operate, inflating the price per fish when they are held in multiple tanks. Had Sturgeon River Brown Trout been reared in a single raceway over this period, the price estimate would have been $3.25. Additionally, it is important to note that Wild Rose Brown Trout saw a 20% increase over the previous year, occurring mostly because stocking was significantly delayed due to IPNv testing and an overall reduction in inventories.

TABLE 23. Oden State Fish Hatchery cost per fish.

Species, strain	Age	Strain cost	Number produced	Cost/fish
Brown Trout, Sturgeon River	Yearling	$233,915	54,867	$4.26
Brown Trout, Wild Rose	Yearling	$444,841	285,730	$1.56
Rainbow Trout, Eagle Lake	Yearling	$515,215	293,357	$1.76

Egg Production

Oden State Fish Hatchery's FY14 egg production included fertilizing 3.1 million Brown Trout eggs to produce 2.2 million eyed eggs and 1.3 million Rainbow Trout eggs to produce 1.2 million eyed eggs. These eggs will be distributed to Harrietta and Oden state fish hatcheries production programs for yearling production in 2016. The cost per egg (Table 24) was very similar to the previous year, with a very slight increase in all lots, increasing the average price to produce an eyed egg by $0.002. More detail about egg production can be found in the Broodstock Management section of this report.

TABLE 24. Oden State Fish Hatchery egg costs.

Species, strain	Cost per egg	
	Green	Eyed
Brown Trout, Gilchrist Creek	$0.12	$0.15
Brown Trout, Sturgeon River	$0.16	$0.20
Brown Trout, Wild Rose	$0.12	$0.19
Rainbow Trout, Eagle Lake	$0.15	$0.18
Average	$0.14	$0.18

EFFLUENT MANAGEMENT

Oden State Fish Hatchery's annual P loading and daily suspended solids concentrations are well within the effluent limits defined by the NPDES permit (Table 25). The twelve-month rolling P limit is 800 pounds and Oden State Fish Hatchery's discharge ranged from 427 to 550 pounds of P during FY14. Oden State Fish Hatchery's limit for TSS is 100 pounds per day, which was exceeded once in FY14, caused by waterfowl activity on the settling pond in January. Extended periods of extremely cold weather caused normally open bodies of water in the vicinity to freeze, driving waterfowl to the open water settling pond.

Phosphorus removal efficiency is a decimal expression of the percentage of non-assimilated P removed by the effluent treatment system. Phosphorus removal efficiency is calculated as follows:

P removal efficiency = 1- (net effluent P loading / unused P), where

Unused P = P in from feed–Assimilated P, where

Assimilated P = Biomass produced x 0.004

This calculation assumes that the fish biomass produced is approximately 0.4% P, as is borne out by literature review. During FY14, nearly 73% of the P that was not converted into fish biomass was removed by the treatment system. Results were near the five-year average, but slightly less than in FY13.

TABLE 25. Oden State Fish Hatchery effluent loading parameters.

Parameters	Fiscal year				
	2014	2013	2012	2011	2010
Fish weight produced (kg)	58,492	51,462	55,070	57,165	58,797
Average flow (L/minute)	12,188	11,586	12,745	12,322	10,527
Phosphorus					
From feed (kg)	640	607	627	710	730
Average concentration (mg/L)	0.036	0.033	0.068	0.037	0.056
Annual loading (kg)	232	199	456	236	308
Unused (kg)	394	391	396	470	483
Excess removal efficiency (%)	41	49	-15	50	36
TSS					
Average concentration (mg/L)	0.92	0.92	0.68	0.33	0.48
Annual loading (kg)	5,894	5,602	4,555	2,137	2,656

BROODSTOCK MANAGEMENT

Immediately after 2013 spawning was complete, the photoperiod control for brood lots of Gilchrist Creek Brown Trout and Sturgeon River Brown Trout was advanced from six weeks to thirteen weeks, which resulted in spawning twice in this period for both lots, occurring at both the beginning and ending of FY14. Brood lots of Wild Rose Brown Trout and Eagle Lake Rainbow Trout were kept on natural light, with normal spawning patterns occurring.

Spawning consisted of a 1:1 spawning ratio, using a 0.7% saline solution for milt activation. New brood lots were obtained by collecting a random aliquot (approximately one tablespoon) of eggs from each cross before fertilized eggs were rinsed. In the beginning of FY14, before February, all eggs were water hardened for one hour in a 2.0 ppm Erythromycin solution, followed by a thirty-minute bath of 100 ppm buffered iodine. Due to concerns with IPNv, a new strategy was implemented and after September of FY14, a 0.9% saline rinse of eggs occurred prior to fertilization, followed by multiple rinses of 0.9% saline after fertilization and an immediate thirty-minute 100 ppm iodine bath. Air stones were used to ensure continuous mixing of the solution while iodine disinfection occurred.

For Gilchrist Creek Brown Trout, all eggs taken at the beginning of the fiscal year were for production, spawned with six weeks of photoperiod advancement. Spawning began on October 8, 2013 and continued until October 29, 2013 when enough eggs were taken to reach rearing assignments. There was a total of three egg takes in this period, producing 1,060,761 green eggs. Fertility rates averaged 87% and survival to the eyed stage was 86%. A total of 475,603 eyed eggs were transferred to Harrietta State Fish Hatchery on November 20, 2013 and December 5, 2013, while 435,336 were transferred to Thompson State Fish Hatchery on December 5 and 10, 2013 (Table 26).

TABLE 26. Oden State Fish Hatchery eyed egg transfers. TSFH = Thompson State Fish Hatchery, HSFH = Harrietta State Fish Hatchery.

Notice number	Species, strain	Lot	Date	Number	Volume (L)	Destination
OD-2014-05	Brown Trout, Gilchrist Creek	P-BNT-GC-D-13-OD-HA	11/20/13	392,270	20.3	HSFH
OD-2014-07	Brown Trout, Gilchrist Creek	P-BNT-GC-D-13-OD-HA	12/05/13	83,333	4.5	HSFH
OD-2014-08	Brown Trout, Gilchrist Creek	P-BNT-GC-D-13-OD-TH	12/05/13	259,259	14.0	TSFH
OD-2014-09	Brown Trout, Gilchrist Creek	P-BNT-GC-D-13-OD-TH	12/10/13	176,077	9.2	TSFH
OD-2014-07	Brown Trout, Sturgeon River	P-BNT-SR-D-13-OD-HA	12/05/13	217,608	13.1	HSFH
OD-2014-10	Brown Trout, Wild Rose	P-BNT-WR-D-13-OD-HA	01/07/14	495,327	26.5	HSFH
OD-2014-11	Rainbow Trout, Eagle Lake	P-RBT-EL-D-13-OD-HA	02/24/14	400,000	23.0	HSFH
Totals				2,023,874	110.6	

The second spawning cycle for Gilchrist Creek Brown Trout included both production and brood eggs, which started on September 3, 2014 and extended into the next fiscal year, ending on October 13, 2014. In FY14, 399,647 eggs were spawned from 189 pairs in two egg takes for production, while 14,519 eggs were spawned from 189 pairs for brood. Survival to the eyed stage was 85% for the production eggs and 77% for the brood eggs. No transfer activity occurred from these lots in FY14, simply because the eggs had not yet developed enough.

For Sturgeon River Brown Trout in the beginning of the fiscal year, both production and brood eggs were spawned with six weeks of photoperiod advancement. Spawning took place on three dates between October 9, 2013 and November 6, 2013. There was a total of 692,302 eggs spawned from 377 pairs of fish for production and 33,672 eggs spawned from 377 pairs for brood. Survival to eyed stage averaged 85% for production and 86% for brood. A total of 217,608 eyed Sturgeon River Brown Trout eggs were transferred to Harrietta State Fish Hatchery on December 5, 2013.

At the end of FY14, Sturgeon River Brown Trout began spawning a second time with the goal of photoperiod control causing spawning to occur thirteen weeks ahead of natural timing. This did not work out to be quite thirteen weeks but was still a significant advancement of about nine weeks. All Sturgeon River Brown Trout eggs fertilized this autumn were strictly for production lots so spawning ceased as soon as egg goals were met. Only two spawning dates occurred, using females from two different brood lots, starting on September 24, 2014 and ending on October 8, 2014, which spanned into the next fiscal year. In FY14, 514,596 eggs were spawned from 303 pairs of fish, yielding 355,045 eyed eggs, for a survival of 69% to the eyed stage. None of these eggs were transferred in FY14 due to insufficient development before the end of the fiscal year.

For Wild Rose Brown Trout, both production and brood eggs were spawned from four-year-old females and timing was very typical. Spawning occurred on three dates, beginning just prior to the start of FY14, on September 30, 2013 and ending on October 30, 2013. For production, a total of 2,379,957 eggs were spawned on three dates from 581 pairs, yielding 1,290,958 eyed eggs, for a survival of 54% to the eyed stage. It should be noted that all eyed egg requests were met before the October 30, 2013 eggs had developed to the eyed stage so these eggs were discarded before picking. Survival to eyed stage for the first

two dates averaged 65.5%. For brood, a total of 54,574 eggs were spawned on three dates from 481 pairs, yielding 38,423 eyed eggs, for an average survival of 70% to the eyed stage. Wild Rose Brown Trout eggs for Harrietta State Fish Hatchery were chilled to slow development and a total of 495,327 eyed eggs were transferred on January 7, 2014.

For Eagle Lake Rainbow Trout, both production and brood eggs were spawned from four-year-old females and crossed with three-year-old males. Spawning occurred on three dates between December 13, 2013 and January 21, 2014. For production, a total of 1,239,576 eggs were spawned on three dates from 452 pairs of adults, yielding 1,149,002 eyed eggs, for an average survival rate of 93% to the eyed stage. For brood, a total of 37,128 eggs were spawned on three dates from 452 pairs of adults, yielding 28,434 eyed eggs, for a survival of 76% to the eyed stage. A total of 400,000 eyed Eagle Lake Rainbow Trout eggs were transferred to Harrietta State Fish Hatchery on February 24, 2014.

FISH HEALTH

During FY14, scheduled health inspections at Oden State Fish Hatchery occurred for several brood and production lots in both spring and autumn. Additionally, there were seven unplanned diagnostic cases, several planned vaccinations and antibiotic treatments, and four unplanned disease treatments recommended from diagnostic testing.

Brood health inspections did not detect anything of concern. This included necropsies of ten fish from eight separate brood lots and reproductive fluid testing from 60 fish per lot in five fish pooled samples for all lots with spawning adults.

Production fish health inspections of 60 fish per lot were completed in February prior to stocking. Polymerase Chain Reaction (PCR) tests detected IPNv in the yearlings to be stocked (lot P-BNT-WR-D-12-OD). Additional inspections of this lot occurred in March, which included sampling of 60 fish per raceway from each of the six raceways. Polymerase Chain Reaction testing was again used and did not detect IPNv from these additional samples. It is believed that earlier PCR tests magnified viral artifacts found because of an acute outbreak upstream, in the nursery, but the disease was not actually in the yearlings. Additional inspections occurring in FY14 included two fall fingerling inspections of production fish in August, neither finding anything of concern.

Diagnostic testing included four separate tests of three production lots, spread over the year, which found *Flavobacter* spp. as the causative agent. Each diagnosis of Flavobacteriosis required an hour bath of 15 mg/L Chloramine-T, under the INAD program. Additionally, three diagnostic tests in February found acute IPNv in the nursery, in lots P-BNT-WR-13-OD, P-BNT-SR-D-13-OD, and B-BNT-WR-D-13-OD. The brood lot was euthanized, but both production lots were kept and later found to be virus free.

Planned vaccinations and treatments included administering two *Aeromonas salmonicida* (furunculosis) dip vaccine treatments, spaced two weeks apart, to all lots of production fish when they reached 2.0 grams; administering 0.2 ml of a water based injectable *A. salmonicida* vaccine to each brood fish; and injecting 0.1 ml of Erythromycin-100 into each brood fish three times per year to fight BKD. Additionally, twenty-one-day oral Gallimycin PFC™ treatments were administered to all production lots, soon after transition from starter feeds to pellets, to prophylactically fight BKD. These treatments have all been highly successful, with furunculosis undetected since 2004 and BKD drastically reduced from being commonly detected to being only sporadically detected in all brood and production lots.

FISH QUALITY

Nine different FQAs were performed by Oden State Fish Hatchery staff during FY14. They included three FQAs just prior to stocking at Oden State Fish Hatchery, two for Chinook Salmon releases at Medusa and Cheboygan net pens, one just prior to Lake Sturgeon stocking at Black River Sturgeon Hatchery, and three routine FQAs of Oden State Fish Hatchery's production fish after transfer from the nursery.

Noteworthy findings include moderate fin erosion in 13.3% of the production Wild Rose Brown Trout just before stocking, ample fat supplies in all trout, and smolting occurring in 85–95% of the Chinook Salmon. No other remarkable findings were noted.

FISH MARKING

No fish marking occurred during FY14.

FISH DISTRIBUTION

A total of 21,761 miles were traveled for stocking in FY14 to stock a total of 729,042 Rainbow and Brown Trout weighing 55,651 kg. The majority of effort occurred between March 31, 2014 and June 12, 2014. There were 77 trips to 91 sites, which took a total of 566 person-hours to complete. Yearling Wild Rose Brown Trout were held much later than normal until IPNv results were received, which were determined to be negative. No other problems occurred during the stocking season.

PLATTE RIVER STATE FISH HATCHERY PRODUCTION ANALYSIS

ADMINISTRATION

Fiscal Year 2014 staffing was similar to the previous year at Platte River State Fish Hatchery. Personnel changes included the addition of Equipment Technician, Nicolas Merchant. Nicolas is supervised by the Natural Resource Manager 3 at Wolf Lake State Fish Hatchery but is stationed at Platte River State Fish Hatchery. Ed Eisch began acting as the program manager for the Fish Production Section midway through the fiscal year. Aaron Switzer acted as the Natural Resource Manager 3 during the same period as well as continuing his duties as Natural Resource Manager 1. Secretary Denise Kinsinger transferred to Forest Resource Division in July. Melinda (Mindi) Dean was hired as the new Secretary and began in mid-September.

The overall operation expenditures totaled $1.62 million which is a 2% increase from the previous fiscal year. Expenditure decreases were seen across the board, except utilities and wages. Utilities increased 26% from the prior fiscal year and wages were stable (Table 27). Extreme cold temperatures combined with increased energy unit costs contributed to the substantial increase in utility expenditures. The long-term decrease in utility expenditures for natural gas was interrupted with this year's expenditure due to a change in rate structure.

TABLE 27. Platte River State Fish Hatchery fiscal and production information summary.

Item	2010	2011	2012	2013	2014
FTE	9.2	9.2	9.7	9.7	9.7
Wages	$777,530	$768,150	$827,959	$875,189	$874,175
CSS&M	$81,256	$64,029	$71,350	$65,078	$62,545
VTS	$19,463	$27,823	$38,915	$37,014	$27,571
Travel	$4,984	$8,856	$8,974	$9,086	$9,501
Fish food	$132,422	$121,033	$160,185	$165,113	$160,657
Utilities	$321,702	$277,741	$236,902	$237,938	$322,255
kg produced	54,428	61,775	62,669	60,965	59,370

Water sampling expenditures, not included in this table, stayed on par with the prior year and continued downward in comparison to the previous four-year average. The general decrease in water sampling expenditures is directly related to conducting all P analysis in Platte River State Fish Hatchery's in-house laboratory. Despite the downward trend, water sampling was still more than $75,000 over budget for FY14. This overage combined with the overage in utilities put Platte River State Fish Hatchery nearly $97,000 over the allocated budget. The sixty consecutive month compliance period associated with the consent judgment between Platte River State Fish Hatchery and the Platte Lake Improvement Association is nearly met. Upon completion of the compliance period, there will be a significant reduction in the water sampling budget for FY15.

Overall production totaled 59,370 kg of Chinook, Coho *Oncorhynchus kisutch* and Atlantic salmon *Salmo salar*. This corresponds to a 2.61% decrease in comparison to FY13. This decrease is a function of being on target with rearing assignments. Meeting rearing assignments resulted in being in close alignment with the four-year average. The unit cost to produce fish at Platte River State Fish Hatchery during FY14 was $11.67 per pound of fish produced. This is one cent less than FY13 and continues on a slight downward trend over the four-year average.

HATCHERY FACILITIES

Platte River State Fish Hatchery had a fully staffed maintenance crew which allowed several projects to be completed in FY14 (Table 28). Maintenance staff coordinated the controls and safety devices certification annual boiler inspections and repair of the computer controller for the automated fish feeders in the outdoor raceway complex. They removed and replaced a broken valve on the spring line to the hatchery. The most noteworthy accomplishment was relocating Walleye incubation to the Service Building. A new hatching trough and head tank were fabricated. Hatching tanks and plumbing throughout the system were installed. Installation of an ultraviolet unit, water heater, pump with a variable speed control, and a sand filter were also part of the relocation project. The entire system can also use gravity feed spring water in an emergency.

TABLE 28. Platte River State Fish Hatchery maintenance and improvements.

Item description	Contractor	Completion date	Final cost	Notes
Fish feeder controller	Logic Plus	December 2013	$2,462	
Controls and safety devices certification–boiler inspections	Temperature Control, Inc.	December 2013	$930	
Pipes and valves	Fastenal, Inc.	January 2014	$1,863	Walleye incubation
Water heater	In the Swim	April 2014	$1,791	Walleye incubation
Replaced 12" gate valve	Michigan Pipe and Valve	September 2014	$1,654	Spring line to building

The maintenance staff assisted with various projects at the weirs, including an emergency steelhead egg take at the Little Manistee Weir due to a breach caused by flooding. Staff assisted in coordination of the repairs for the breach and installed new lighting on the weir.

Call Back Summary

During FY14, there were a total of six call backs, an increase from four in FY13. Two were caused by weather related power interruptions. Two other call backs were due to human error, with a ring left off the standpipe of a rearing tank causing a low tank alarm and a float switch accidently being knocked off. The other two were related to an algae bloom on our spring pond which plugged our tank screens and a spring pump electrical failure. No loss of fish occurred during any of the emergency alarms.

Utility Summary

The downward trend in electrical usage seen in FY13 continued into FY14. Usage fell by a modest 2.9% in the year-to-year comparison. Electricity usage has stabilized and until such time as production levels change significantly, it is likely that electricity usage will hover in the 1.25–1.35 million kilowatt-hour range.

Natural gas usage was up from FY13 usage by more than 10% in the year-to-year comparison. This is the result of a colder and longer winter than the previous year. Unit cost was up by 28% which inflated the increase in expenditures by 51%. Natural gas usage is much less predictable than electricity because of the fluctuations in severity of winter conditions from year to year (Table 29).

TABLE 29. Platte River State Fish Hatchery energy consumption history.

Category	2010	2011	2012	2013	2014
Electrical use (kw-hrs)	1,252,200	1,443,000	1,332,600	1,316,400	1,279,500
Electric costs	$87,200	$101,337	$104,295	$96,801	$108,127
Unit costs	$0.07	$0.07	$0.08	$0.07	$0.08
Natural gas use (ccf)	185,954	268,299	194,030	240,817	265,287
Natural gas cost	$199,278	$166,111	$115,702	$137,733	$208,804
Unit costs	$1.07	$0.62	$0.60	$0.57	$0.79
Liquid oxygen use (ccf)	8,589	8,765	10,111	6,486	10,681
Liquid oxygen cost	$4,724	$5,175	$5,506	$3,405	$5,324
Unit costs	$0.55	$0.59	$0.54	$0.53	$0.50
Waste disposal (gal)	115,000	106,000	96,000	112,000	0
Waste disposal cost	$13,651	$12,820	$11,395	$13,294	$0.00
Unit costs	$0.12	$0.12	$0.12	$0.12	$0.00

Liquid oxygen usage was up by nearly 56% in the year-to-year comparison. The unit cost should remain quite stable because there is a multiyear contract in place for liquid oxygen. Liquid oxygen usage may be skewed a bit by the filling cycle.

Waste hauling did not occur in FY14. Increased costs may be incurred in FY15.

FISH REARING

Salmon production during FY14 was 2% below FY13 production. A total of 59,370 kgs of Atlantic, Chinook, and Coho salmon were produced compared to 60,670 kg produced during FY13. The decrease in production was a function of the rearing assignment and meeting allocations. The prevalence of TDS at the beginning of the Coho Salmon rearing cycle was extremely low. There were no violations in the net discharge therefore, the Atlantic, Chinook, and Coho salmon were fed at normal rates resulting in average size at stocking. Atlantic Salmon were stocked at a much smaller size, largely due to surface water rearing conditions. Stocking size for Chinook and Coho salmon in FY14 were similar to FY13 (Table 30).

TABLE 30. Platte River State Fish Hatchery production statistics.

Species, strain Age	Number assigned	Number stocked	Mean length (cm)	Total weight (kg)	Reason for surplus (shortage)
Atlantic Salmon, landlocked					
Fall fingerling	0	36,453	10.7	458.40	Experimental rearing program
Spring yearling	0	131,230	12.0	2,315.70	
Species total	0	167,683		2,774.10	
Chinook Salmon, Michigan					
Spring fingerling	994,000	956,071	8.5	4,860.70	
Species total	994,000	956,071		4,860.70	
Coho Salmon, Michigan					
Spring yearling	1,570,000	1,570,200	13.6	51,732.97	
Species total	1,570,000	1,570,200		51,732.97	
Walleye, Muskegon River					
Fry	0	286,027	0.5	2.00	Experimental rearing program
Species total	0	286,027		2.00	
Total		2,979,981		59,369.77	

Atlantic Salmon, landlocked

Atlantic Salmon production in FY14 continued on an experimental basis. Platte River State Fish Hatchery stocked 131,230 yearling Atlantic Salmon at 2315.7 kg (57 fish/kg). There were also 36,453 fall fingerlings stocked at 458.4 kg (80 fish/kg). This group marked the second lot of Atlantic Salmon successfully reared from eyed eggs at Platte River State Fish Hatchery. Atlantic Salmon begin the rearing cycle on ultraviolet treated Brundage Spring water, lowering the presence of the pathogens that cause whirling disease. In August they are mass marked with CWTs, adipose clipped, and moved to Brundage Creek water for the remainder of the rearing cycle. The extremely cold winter did not allow much additional growth from fall to spring and resulted in smaller fish than in FY13. The changes in rearing conditions,

early plant out, and a dedicated staff made certain the Atlantic Salmon program can continue. No other issues were encountered and the rearing season was relatively unremarkable.

In late December 2013, Platte River State Fish Hatchery received 254,000 eyed Atlantic eggs from Lake Superior State University (LSSU). The eggs, representing the 2013 year-class, were taken and incubated to the eyed stage at the LSSU Aquatic Research Laboratory. The eggs were treated with an iodophor bath upon arrival. A one hour, 1000 ppm thiamine mononitrate bath treatment was administered to the fry just after tanking to control losses due to TDS. Early rearing of these fish was done using ultraviolet-treated, first-pass water. They remained on this water source for the first seven months of the rearing cycle in an effort to control whirling disease. In August, they were moved from the starter tanks to the rearing tanks. Shortly after being transferred, the rearing water was switched slowly from spring water to creek water. By the end of FY14, this lot had experienced two outbreaks of Flavobacteriosis and had been diagnosed with furunculosis. These disease outbreaks will be discussed in the Fish Health section.

Chinook Salmon, Michigan

Michigan strain Chinook Salmon production in FY14 was minimally affected by early losses due to TDS. Hatch rates and eye-up exceeded the five-year average. The rearing assignment called for stocking or net penning of 994,000 spring fingerling Chinook Salmon (Table 31). By the end of the stocking season, Platte River State Fish Hatchery had stocked or transferred to net pens a total of 956,071 spring fingerlings weighing 4860.7 kg (197/kg). The Swan River direct plant was postponed until early June to minimize predation by Lake Trout in Swan Bay. Included in the total were 756,973 fish weighing 3592.1 kg (211/kg) in direct plants, and 199,098 fish weighing 1268.6 kg (157/kg) transferred to net pens.

TABLE 31. Platte River State Fish Hatchery cost per fish.

Species, strain	Age	Strain cost	Number produced	Cost/fish
Atlantic Salmon, landlocked	Fall fingerling	$65,325	36,453	$1.79
Atlantic Salmon, landlocked	Spring yearling	$241,651	131,230	$1.84
Chinook Salmon, Michigan	Spring fingerling	$466,752	956,071	$0.49
Coho Salmon, Michigan	Spring yearling	$1,351,592	1,570,200	$0.86

Gametes for the 2013 year-class of Chinook Salmon were collected during the first week of October 2013. Platte River State Fish Hatchery received approximately 1.6 million eggs from the Little Manistee River Weir egg harvest on October 2nd and 3rd, 2013. These were collected from a total of 436 females. Eye-up rates were 85%, well above the five-year average of 75%. Hatch rates were good for this year-class averaging 80% of the total eyed eggs. A one hour, 1000 ppm thiamine mononitrate treatment was administered to the eggs during water hardening. The treatment was concurrent with the erythromycin treatment, to minimize losses due to TDS. This operational change is outlined in the 2013 Little Manistee Weir Standard Operating Procedures (internal department document). Mortality just after tanking the fry was minimal. The treatment is viewed as successful because it resulted in minimal losses. No other disease issues were encountered and the rearing season was relatively unremarkable.

Coho Salmon, Michigan

Michigan strain Coho Salmon production totaled 1,570,200 yearling smolts stocked out, weighing 51,733 kg. At an average of 30.35 fish per kg, this year-class was slightly smaller than that stocked during

FY13 (29.29/kg). The size of the 2012 year-class of Coho Salmon is the result of a conscious effort to find optimum feeding rates throughout the entire rearing cycle, while remaining below the net P discharge limit. This is discussed further in the effluent management section of this report.

Gametes for the 2013 year-class of Coho Salmon were collected during the third week of October 2013. Coho Salmon egg take will be covered in detail under Broodstock Management. A one hour, 1000 ppm thiamine mononitrate treatment was administered to the eggs during water hardening. The treatment was concurrent with the erythromycin treatment, to minimize losses due to TDS. This operational change is outlined in the 2013 Platte River Weir Standard Operating Procedures. Early losses to spinning mortality were extremely high. A complete inventory was completed in July 2014 when the fish were moved to the outside raceway complex for final rearing. Major rearing losses resulted in the inventory being 12% below the rearing assignment. Since the move outside, their rearing has been unremarkable.

A feeding model designed by the Settlement Agreement Implementation Coordinator, Dr. Ray Canale, was applied to two raceways of fish in C series. Dr. Canale designed a model for optimum feeding rates at Platte River State Fish Hatchery. The model attempts to address variables, such as fluctuating water temperatures and TP limitations that are specific to Platte River State Fish Hatchery. The purpose of this study is to compare Dr. Canale's feeding model and traditional feeding methods. Results of the study will be further documented in the FY15 Production Analysis Report.

Walleye, Muskegon

Walleye production in FY14 continued on an experimental basis. Major renovations took place, including redesigning and relocating our incubation area to the service building. The change isolates coolwater incubation from coldwater incubation. There was increased awareness and monitoring with the changes to the system. Gamete collection for the 2014 year-class occurred during the first week of April. Platte River State Fish Hatchery received approximately 5.0 million green eggs from the Muskegon River on April 3, 2014. Fry began hatching on April 25, 2014. Only 200,000 of the targeted 2.5 million fry were hatched out and split between the Beaver Island Pond and Mason County rearing pond. The low hatch rates, similar to those for Wolf Lake State Fish Hatchery's eggs which were taken on the same date, appear to be due to poor egg quality on that date. Reasons for the poor quality are not known but are generally understood to reflect the condition of the brood on that day (either too ripe or too green).

Cost per Species

The cost of producing Atlantic, Chinook, and Coho salmon is derived from an Excel spreadsheet model that was designed for all state-run fish hatcheries and modified in specific areas for Platte River State Fish Hatchery. In this model, all natural gas costs associated with heating rearing water are attributed to Chinook Salmon rearing. Other costs, including labor, utilities, feed, maintenance, fish health, and transportation are apportioned to individual species based on the relative number of rearing units occupied by a given lot of fish.

Atlantic Salmon spring yearling costs decreased significantly (nearly 25%) compared to FY13. The decrease in cost per fish was driven by fall fingerling plants and higher rearing densities. At $0.49 per fish, the FY14 cost per Chinook Salmon (2013 year-class) reared at Platte River State Fish Hatchery was higher than the cost of $0.34 per fish calculated for FY13 (2012 year-class). The cost differential is directly related to the surplus fish produced during the 2012 year-class. Rearing nearly 400,000 fewer fish in the same rearing space drives the cost per fish upward. The cost per Coho Salmon yearling reared at Platte River State Fish Hatchery decreased from $0.94 for the fish stocked during FY13 (2011 year-class) to $0.86 per fish for those stocked during FY14 (2012 year-class). Achieving the rearing assignment and carrying higher densities in the same amount of rearing space attributed to the decrease in cost per fish.

EFFLUENT MANAGEMENT

Platte River State Fish Hatchery is bound by effluent limitations for TP that were set forth in a consent agreement with the Platte Lake Improvement Association, signed in March of 2000. The limitations associated with this agreement are as follows:

- Daily flows cannot exceed 20 million gallons per day
- Rolling three-month net TP loading cannot exceed 55 pounds
- Net TP loading cannot exceed 175 pounds in a calendar year

The NPDES permit reflects the same limitations, except the calendar year limitation is replaced with a rolling 12 month loading limit of 175 pounds. The NPDES permit also limits net TSS loading to an average daily limit of 500 pounds with a maximum daily limit of 750 pounds. The net TSS concentration is limited to 6.0 ppm.

The net TSS loading was zero for the entire fiscal year. This is not uncommon as the prior four years have produced the same result. This is because of the relatively high TSS concentration in Platte River State Fish Hatchery's surface water sources. The disc filters and the large settling pond are very efficient at removing solids prior to discharging back into the Platte River

For the fiscal year, Platte River State Fish Hatchery was significantly under the twelve-month limit for net TP loading. The actual twelve-month net TP loading was 37 pounds (Table 32). The calendar year limit of 175 pounds net TP loading as set forth in the Settlement Agreement was not violated, resulting in zero monetary fines. The low values for TSS are a function of the disk filtering system at the hatchery. Values reported are net (effluent concentration–incoming concentration). The filters are removing more TSS from the incoming water than the hatchery produces and since the MDEQ does not allow reporting of negative values the reported value is zero. Platte River State Fish Hatchery's waste management protocols continue to function very well, with excess P removal efficiency exceeding an average of 96% over the past four years.

Phosphorus removal efficiency is the percentage of non-assimilated P removed by the effluent treatment system. Phosphorus removal efficiency is calculated as follows:

P removal efficiency = 1- (net effluent P loading / unused P), where

Unused P = P in from feed–Assimilated P, where

Assimilated P = Biomass produced x 0.004

This calculation assumes that the fish biomass produced is approximately 0.4% P, as is borne out by literature review.

TABLE 32. Platte River State Fish Hatchery effluent loading parameters.

Parameters	Fiscal year				
	2014	2013	2012	2011	2010
Fish weight produced (kg)	50,399	63,050	66,949	58,210	54,258
Average flow (L/minute)	14,194	19,267	18,189	17,926	18,110
Phosphorus					
From feed (kg)	456	472	566	485	423
Average concentration (mg/L)	0.005	0.002	0.001	0.002	0.007
Annual loading (kg)	37	15	11	16	69
Unused (kg)	244	207	285	241	195
Excess removal efficiency (%)	85	93	96	93	65
TSS					
Average concentration (mg/L)	0	0	0	0	0
Annual Loading (kg)	0	0	0	0	0

The changes in management practices combined with on-site, real time TP monitoring made FY14 another banner fiscal year for net TP loading. The highest net TP load during the period was 14.74 pounds in March. Neither the Settlement Agreement nor the NPDES permit allows the reporting of negative numbers.

The sixty-month compliance period will be met in FY15 with continued diligence and sound effluent management. Achieving this goal will result in changes to the watershed sampling and monitoring requirements set forth by the Consent Agreement.

BROODSTOCK MANAGEMENT

The Coho Salmon run during the fall of 2013 was equivalent to the state average, providing ample numbers of mature adults for egg take and the Platte River sport fishery. The run totaled 31,417 adult and 2,496 jack Coho Salmon. This mirrors the adult Coho Salmon passed during the 2012 weir season in FY13. Included in this number were 17,859 adults passed above and 13,558 adults harvested at the lower Platte River Weir. Sixty-eight percent of the adults passed above the lower Platte River Weir reached the upper Platte River Weir.

During FY14, Coho Salmon gametes were collected on six separate dates beginning on October 15, 2013. Eggs for Platte River State Fish Hatchery were collected on days one, two, and four of the gamete collection operation. Slightly more than 2.8 million green eggs were kept for incubation at Platte River State Fish Hatchery. The desired 1:1 spawning ratio was achieved over the first four days of egg take, which was the majority of the eggs kept for Platte River State Fish Hatchery. Over the final two days the supply of males decreased slightly. All ponds were opened every morning to attempt to get fish from across the run for genetic diversity. Eye-up rates were equivalent to the state average. On October 21, 2013, just fewer than one million green eggs were collected for Bodine State Fish Hatchery in Indiana (Table 33). On October 17, 2012, just over one million green eggs were taken for Jake Wolf State Fish Hatchery in Illinois. Both out-of-state hatcheries provided additional personnel and transported the eggs back to their respective hatcheries. There were also 80,000 green eggs taken for the continuing TDS Study at Wolf Lake State Fish Hatchery on October 22, 2012.

TABLE 33. Platte River State Fish Hatchery eyed egg transfers.

Notice number	Species, strain	Lot	Date	Number	Volume (L)	Destination
PL-13-08	Coho Salmon, Michigan	P-COS-MI-W-13-PL	10/17/13	1,014,390	270.0	Jake Wolf Fish Hatchery, Illinois
PL-13-09	Coho Salmon, Michigan	P-COS-MI-W-13-PL	10/21//13	912,951	243.0	Bodine Fish Hatchery, Indiana
Totals				1,927,341	513.0	

FISH HEALTH

Annual health inspections were conducted on all production lots of Coho and Chinook salmon prior to stocking and on the feral, Michigan strain, Coho Salmon spawning adults. There were no fish that tested positive (low) for *R. salmoninarum*, the causative bacteria for BKD. There were seven out of sixty that tested positive for *A. salmonicida,* the causative bacteria for furunculosis. Production lots of yearling Coho and Atlantic salmon and spring fingerling Chinook Salmon had a fish health inspection prior to plant out. The results for all production lots were negative for all pathogens of concern.

Chemical treatments administered during FY14 included Chloramine-T and Terramycin 200™. Chloramine-T (CHL-T) was used three times for cases of *Flavobacterium branchiophila*, the causative agent for BGD. All BGD outbreaks were confirmed by hatchery staff. Chloramine-T was also used twice for external flavobacteriosis. Each of these cases was treated with a 15 ppm, one-hour, static bath, CHL-T treatment administered under the CHL-T INAD. Staff at the MSU Aquatic Animal Health Laboratory isolated *A. salmonicida* in the Atlantic Salmon, and they were treated with Terramycin 200™ laced feed at 0.5% total biomass for ten days. All treatments were deemed successful as they all resulted in decreased mortalities and/or return to normal fish behavior.

FISH QUALITY

Several FQAs were completed during FY14. Six were completed on Chinook Salmon prior to stocking and resulted in no remarkable findings. There were five other Chinook Salmon assessments done on net-penned fish, all of which showed the fish to be smolting and ready for release. The 2012 year-class of Coho Salmon had an FQA prior to stocking and the 2013 year-class of Coho Salmon had an FQA before being transferred to the outdoor raceway complex. Both assessments resulted in no remarkable findings. The 2012 Atlantic Salmon had an FQA prior to stocking and had no remarkable findings.

FISH MARKING

The entire 2013 Chinook Salmon year-class was marked and tagged using automated tagging trailers owned and operated by the USFWS. All fish received an adipose fin clip and a CWT that is specific to the general area of the lake, if not the specific site, where they were stocked. The fish handled well and mortalities were minimal.

Similarly, all of the 180,000 2012 year-class spring yearling Atlantic Salmon were marked and tagged using automated tagging trailers owned and operated by the USFWS. Fish destined for each of the four stocking locations were given a CWT that is unique to their specific stocking location. The fish handled

well, but unlike Chinook Salmon, exhibited above normal mortalities for the remainder of the rearing cycle. The difference is attributed to greater sensitivity to handling, which is normal for Atlantic Salmon.

FISH DISTRIBUTION

Atlantic Salmon stocking during FY14 included one stocking trip of 36,453 fall fingerlings weighing 458.4 kg (79.5/kg) and five stocking trips to plant 131,320 spring fingerlings weighing 2,315.7 kg (56.3/kg). The trips took 44 person-hours and covered 1,936 miles.

Chinook Salmon stocking during FY14 included four trips where 756,973 spring fingerlings weighing 3,592.2 kg (218.7/kg) were direct planted into three different receiving waters. These trips covered 1,035 miles and required nearly 27 person-hours. There were three net pen transfers of 199,098 spring fingerlings, totaling 1,268.5 kg (157.1/kg). These trips required 462 miles and 15.5 person-hours.

Coho Salmon stocking during FY14 began on April 2, 2014. The Platte River received 797,972 yearling Coho Salmon totaling 25,820.6 kg (30.9/kg), stocked directly into the Platte River at the upper weir. An additional 777,238 yearlings weighing 25,912.4 kg (30.0/kg) were stocked off-site, including 20 trips to nine different receiving waters. One hundred thirteen person-hours were spent on these trips, which totaled 4,945 miles driven. The off-site distribution activities during FY14 were increased compared to those in FY13 due to changes in stocking locations and stocking unit availability.

Walleye stocking included three transfers for a total of 186,060 fry to ponds.

HARRIETTA STATE FISH HATCHERY PRODUCTION ANALYSIS

ADMINISTRATION

Fiscal Year 2014 staffing was similar to the previous year at Harrietta State Fish Hatchery. Ed Eisch began acting as the program manager for the Fish Production Section midway through the fiscal year. Aaron Switzer acted as the Natural Resource Manager 3 during the same period as well as continuing his duties as Natural Resource Manager 1. Secretary Denise Kinsinger transferred to Forest Resource Division in July. Melinda (Mindi) Dean was hired as the new Secretary and began in mid-September.

The overall operation expenditures totaled $971,530, which is an increase of less than 1% above the previous fiscal year. Expenditures varied slightly across the board with no significant changes (Table 34).

TABLE 34. Harrietta State Fish Hatchery fiscal and production information summary.

Item	2010	2011	2012	2013	2014
FTE	7.0	7.0	6.9	6.9	6.9
Wages	$611,799	$631,384	$689,309	$700,418	$703,567
CSS&M	$31,995	$32,738	$34,160	$33,330	$28,780
VTS	$4,887	$5,998	$7,294	$9,933	$10,576
Travel	$508	$775	$934	$1,642	$1,426
Fish food	$63,952	$59,683	$77,022	$66,855	$67,984
Utilities	$152,191	$168,540	$141,814	$157,749	$159,197
kg produced	58,314	48,738	61,140	53,152	60,437

Total expenditures were $15,000 under the allocated budget for FY14. There were significant savings in utilities, specifically propane, and CSS&M. These savings offset the slight overages in most of the other line items in the budget.

Overall production totaled 60,473 kg of Brown and Rainbow trout. This corresponds to a 13.7% increase in comparison to FY13. This increase is a function of being above the rearing assignments and having program overages.

HATCHERY FACILITIES

The hatchery had a fully staffed maintenance crew which allowed several projects to be completed in FY14. The staff coordinated the annual flow testing of the wells. The water production from all four wells looked good with all being close to designed capacities. Staff also made several improvements to the facility including the conversion to high-efficiency compact fluorescent lighting. Staff changed an aeration pit pump due to failure and coordinated the repair of the pump. Staff coordinated the removal of several large white pines that presented a hazard to one of the hatchery residences (Table 35).

TABLE 35. Harrietta State Fish Hatchery maintenance and improvements.

Item description	Contractor	Completion date	Final cost	Notes
Liquid oxygen system	Johnson Wood, LLC	September 2014	$126,879	Phase 1 complete; phase 2 to be completed in FY15
Annual well testing	Peerless Midwest	November 2013	$1,100	
Aeration pump repair	Standard Electric	January 2014	$2,460	
Tree removal	Helsel Tree Service	August 2014	$2,000	

Major maintenance money funded Phase 1 of the Liquid Oxygen/Dehumidification Project at the hatchery. In June, Johnson Wood, Inc. was awarded the contract to replace the old Xorbox™ oxygenation system with a new liquid oxygen system. The project was started in July with the pouring of the concrete pad for the bulk oxygen tank. The tank was purchased from Purity Gas and was listed as a line item in the original contract. The tank and vaporizer were installed in August by Purity Gas with Johnson Wood, Inc. coordinating the connection between the tank and the hatchery. The transition went smoothly and

was a much-needed improvement for the aging facility. Replacement of the Xorbox™ system will reduce the risk of catastrophic fish loss due to mechanical failure and will result in lower annual maintenance costs and fewer call backs. It is expected that there will also be savings in the overall utility costs for the facility. Phase 2 of the Liquid Oxygen/Dehumidification Project will be completed in FY15 and will include installation of a geothermal heating unit to replace the heat that was a byproduct of the air compressors. The heat from the compressors was used to dehumidify the tank room. Funding will come from the major maintenance budget.

Maintenance staff assisted with various projects at the weirs including an emergency steelhead egg take at the Little Manistee Weir due to a breach caused by flooding. Staff also coordinated repairs for the breach which included new lighting on the weir as the old lighting was swept away during the flood.

Call Back Summary

During FY14, there were a total of nine call backs, with five of them being caused by main power bumps. Other call backs were caused by aeration pump failure, a smoke alarm, and boiler safeties. No loss of fish occurred during any of the emergency alarms.

Utility Summary

In a year-to-year comparison, electricity usage was slightly higher in FY14 compared to FY13. This increase in cost and usage was attributed to needing to hold on to the Wild Rose Brown Trout later into the spring due to testing fish at Oden State Fish Hatchery for IPNv. Even with the increased time running wells and aeration pumps in FY14, usage was virtually identical to the average usage over the past five fiscal years. There was a slight decrease of 2% in electricity unit cost in FY14 compared to FY13.

Propane usage in FY14 was below the five-year average despite having another colder than average winter. The winter in FY12 was very mild and the winter in FY13 was extremely cold and long. The winter of FY14 was cold, though not as lengthy as FY13 and the propane usage follows that pattern. Overall, propane unit costs are more volatile than electricity unit costs. Propane unit cost was up over 25% in FY14 compared to the previous year, but only an increase of slightly more than 3% when looking at the five-year comparison (Table 36).

TABLE 36. Harrietta State Fish Hatchery energy consumption history.

Category	2010	2011	2012	2013	2014
Electrical use (kw-hrs)	1,710,190	1,705,555	1,474,400	1,437,817	1,536,213
Electric costs	$142,744	$157,379	$139,457	$143,238	$149,057
Unit costs	$0.08	$0.09	$0.09	$0.10	$0.10
Propane use (gal)	5,358	5,389	2,967	10,089	5,004
Propane cost	$7,788	$9,916	$5,245	$13,311	$8,309
Unit costs	$1.45	$1.84	$1.77	$1.32	$1.66
Liquid oxygen use (ccf)	0	0	0	0	335,376
Liquid oxygen cost	$0.00	$0.00	$0.00	$0.00	$1,854
Unit costs	$0.00	$0.00	$0.00	$0.00	$0.01
Waste disposal (gal)	22,000	20,000	29,000	20,000	24,000
Waste disposal cost	$660	$800	$1,163	$1,200	$1,050
Unit costs	$0.03	$0.04	$0.04	$0.06	$0.04

FISH REARING

Overall production for Harrietta State Fish Hatchery in FY14 was 1.303 million Brown Trout and Rainbow Trout, totaling 60,437 kg. When compared to FY13 production levels, this was a 7% decrease in the number of fish produced, and a 23% decrease in the weight produced. This large decrease in number and weight produced was attributed to requesting fewer eyed eggs to get final production numbers more closely aligned with the rearing assignment, thereby eliminating fall fingerling plants that result from surplus fish.

Brown Trout, Gilchrist Creek

In FY14, there were 392,448 yearling Gilchrist Creek Brown Trout stocked, weighing a total of 10,829 kg and averaging 36.2 fish per kg, compared to 35.5 fish per kg in FY13. The number stocked was 6% above the rearing assignment. The surplus was due to adding more Gilchrist Creek Brown Trout to the total number to replace the shortage in Wild Rose Brown Trout. The per-fish cost for this strain during FY14 was $0.85. This is an increase of slightly more than 10% compared to the five-year average. This increase was mainly due to raising fewer Gilchrist Creek Brown Trout in an effort to be more in line with requests.

Brown Trout, Sturgeon River

The Sturgeon River Brown Trout stocked during FY14 averaged 41.7 fish per kg, which is substantially larger than the 57.9 fish per kg in FY13. These are the largest Sturgeon River Brown Trout stocked to date. The larger size was due to photoperiod manipulation at Oden State Fish Hatchery resulting in spawning six weeks earlier. Harrietta State Fish Hatchery stocked a total of 148,542 Sturgeon River Brown Trout weighing 3,560 kgs. The number of Sturgeon River Brown Trout stocked was just 2.5% over the rearing assignment. The cost per fish stocked during FY14 was $0.89. This was similar to the five-year average.

Brown Trout, Wild Rose

The total number of Wild Rose Brown Trout stocked during FY14 was 290,510 which was 8% below the rearing assignment. The shortfall was replaced with additional Gilchrist Creek Brown Trout. A total of 20,137 kgs of yearling Wild Rose Brown Trout were stocked in FY14, averaging 14.4 fish per kg compared to 15.1 fish per kg in the previous fiscal year. The cost per Wild Rose Brown Trout stocked during FY14 was $1.53. This was almost a 20% increase compared to the five-year average. This increase was mainly due to raising fewer Wild Rose Brown Trout which used more rearing space than any other species.

Rainbow Trout, Eagle Lake

Eagle Lake Rainbow Trout production included 270,500 yearlings stocked which was 3% short of the rearing assignment of 279,000 yearlings. This minor shortage is attributed to sampling error while moving fish from inside tanks to the outside raceways and/or during the loading process during fish stocking. Total weight produced was 14,844 kg. The average size at stocking was 18.2/kg, which is 13% smaller than FY13, but well within the targeted size range. The cost to raise each fish stocked during FY14 was $1.42. This was a 40% increase compared to the five-year average. This increase was mainly due to shifting Rainbow Trout production from three rearing units to the current four units (Table 37).

TABLE 37. Harrietta State Fish Hatchery production statistics.

Species, strain Age	Number assigned	Number stocked	Mean length (cm)	Total weight (kg)	Reason for surplus (shortage)
Brown Trout, Gilchrist Creek Yearling	370,000	392,448	14	10,829	Replaced surplus for shortage on Wild Rose
Brown Trout, Sturgeon River Yearling	145,000	148,542	13	3,560	Sampling error
Brown Trout, Wild Rose Yearling	315,000	290,510	18	20,137	Shortage replaced with Gilchrist Creek
Species total	830,000	831,500		34,526	
Rainbow Trout, Eagle Lake Yearling	279,000	270,500	17	14,844	Sampling error
Species total	279,000	270,500		14,844	
Total	1,109,000	1,102,000		49,370	

Cost per Species

An Excel spreadsheet model was used as a basis for an algorithm within the fish production program to calculate the total cost to rear a given species. In this model, total cost per species was calculated based on relative number of rearing units occupied by a given lot of fish to give a percentage of rearing space used at the beginning of each month. This total cost includes labor, utilities, feed, maintenance, fish health, and transportation. The total cost is then divided by the total number of fish produced to give the cost per fish for each individual strain (Table 38).

TABLE 38. Harrietta State Fish Hatchery cost per fish.

Species, strain	Age	Strain cost	Number produced	Cost/fish
Brown Trout, Gilchrist Creek	Yearling	$337,752	398,748	$0.85
Brown Trout, Sturgeon River	Yearling	$131,927	148,527	$0.89
Brown Trout, Wild Rose	Yearling	$445,398	290,510	$1.53
Rainbow Trout, Eagle Lake	Yearling	$384,342	270,500	$1.42

The Gilchrist Creek Brown Trout yearling costs decreased 10% compared to FY13. The decrease in cost per Gilchrist Creek yearling was driven by raising more fish in the same rearing space compared to FY13. At $0.89 per fish, the Sturgeon River Brown Trout were the identical price as in FY13. The cost per Wild Rose Brown Trout yearling reared increased from $1.32 during FY13 compared to $1.53 per fish in FY14. This increase is due to raising fewer Wild Rose Brown Trout per the same rearing space

resulting in an increase in price per fish. Eagle Lake Rainbow Trout increased in price from $1.28 to $1.42 comparing FY13 to FY14. Again, this increase is due to raising fewer fish in the same amount of rearing space compared to the previous year.

EFFLUENT MANAGEMENT

Annual net P loading and daily suspended solids concentrations are well within the effluent limits defined in Harrietta State Fish Hatchery's NPDES permit. The twelve-month rolling net P limit is set at 600 pounds and Harrietta State Fish Hatchery never exceeded 400 pounds for any month during FY14. Harrietta State Fish Hatchery does not have a TSS loading limit as part of its NPDES permit, but rather has a TSS concentration limit of 6.0 mg/L. During FY14, Harrietta State Fish Hatchery never exceeded the limit of 6.0 mg/L.

Phosphorus removal efficiency is a decimal expression of the percentage of non-assimilated P removed by the effluent treatment system. Phosphorus removal efficiency is calculated as follows:

P removal efficiency = 1- (net effluent P loading / unused P), where

Unused P = P in from feed–Assimilated P, where

Assimilated P = Biomass produced x 0.004

This calculation assumes that the fish biomass produced is approximately 0.4% P, as is borne out by literature review. During FY14, nearly 45% of the P that was not converted into fish biomass was removed by the treatment system. This is a 19% improvement over removal estimated for FY13 (Table 39).

TABLE 39. Harrietta State Fish Hatchery effluent loading parameters.

Parameters	Fiscal year				
	2014	2013	2012	2011	2010
Fish weight produced (kg)	40,552	53,040	61,139	40,396	63,503
Average flow (L/minute)	8,122	7,675	7,517	9,646	8,858
Phosphorus					
From feed (kg)	410	408	463	370	369
Average concentration (mg/L)	0.031	0.034	0.039	0.032	0.038
Annual loading (kg)	132	137	154	162	177
Unused (kg)	240	185	206	200	102
Excess removal efficiency (%)	45	26	25	19	-73
TSS					
Average concentration (mg/L)	0.77	1.29	1.47	1.15	1.04
Annual loading (kg)	3,287	5,204	5,808	5,830	4,842

FISH HEALTH

During FY14, there were no disease treatments. A prophylactic treatment of erythromycin was given to the 2013 year-class of Wild Rose Brown Trout as spring fingerling at a concentration of 0.43 grams of erythromycin per kg of biomass. The annual pre-stocking health inspections were done on all four lots of fish with no negative findings. The 2013 year-class of Wild Rose Brown Trout were also tested for IPNv when the corresponding lot at Oden State Fish Hatchery was found positive for IPNv. Since the eggs

originated from Oden State Fish Hatchery, testing was done to see if the IPNv was transferred with the eggs or if this was an isolated incident. All samples came back negative for the IPNv.

FISH QUALITY

Five different FQAs were conducted by Harrietta State Fish Hatchery staff during FY14. Included among these FQAs was one assessment for the Wild Rose Brown Trout being finished at Walton Junction Pond just prior to their release into the Manistee River. Fish Quality Assessments indicated moderate fin erosion problems in the Wild Rose Brown Trout (31.0%), the Walton Junction Wild Rose Brown Trout (16.0%), and Eagle Lake Rainbow Trout (23.7%). There was mild active erosion in the Walton Junction Wild Rose Brown Trout (11.7%) and moderate active erosion in the Wild Rose Brown Trout (17.1%) at the time of the assessment. No other remarkable findings were noted.

FISH MARKING

No fish marking occurred during FY14.

FISH DISTRIBUTION

A total of 25,953 miles were traveled between April 2, 2014 and June 25, 2014 to stock 1,102,000 yearling Rainbow and Brown Trout. There were 98 trips to 279 sites that took a total of 657.5 person-hours to complete. All Wild Rose Brown Trout were held until the results of the Oden State Fish Hatchery's Wild Rose Brown Trout test for IPNv were known. This resulted in a longer than anticipated stocking season. No other problems occurred during the stocking season.

WOLF LAKE STATE FISH HATCHERY PRODUCTION ANALYSIS

ADMINISTRATION

The number of FTEs and the salary and wage costs in FY14 were both lower than FY13. The secretarial position for the Lower Peninsula was vacant for two months and the FTE (1.0) for the statewide electronics unit was not included with Wolf Lake State Fish Hatchery in FY14, as it had been in previous years because these positions are now reported in a separate Electronics Unit report. The overall salary and wage costs were lower, but both overtime and costs for state workers were higher due to travel for training/meetings (overtime costs) and two fish culture staff being on extended leave (state worker costs). Expenditures in FY14 for CSS&M were significantly higher than FY13 due to increased costs for network services ($19,100 per year in FY14 compared to $9,500 per year prior to FY14), settlement for tree loss on 25th Street ditch ($5,800), and large equipment and facility repairs ($18,000) not covered with major maintenance funding. Vehicle and Travel Services costs in FY14 were lower than FY13 due to the lower leasing costs of older vehicles. Travel costs in FY14 were higher than FY13 due to hatchery staff attending fish health training in La Crosse, Wisconsin, team building, and the Cool Water Fish Culture Workshop in Syracuse, New York. Fish food expenditures in FY14 were similar to FY13 but with a slight decrease in usage and slight increase in unit cost and shows a similar trend when compared to the previous four-year average. Expenditures for pelleted food followed the same trend as overall food expenditures. Expenditures on pelleted food are dictated by the size of yearling steelhead, with larger yearlings requiring more food. Expenditures for minnows, both for the amount needed and unit cost, increased significantly when compared to FY13 and the previous four-year average. The amount expended for minnows depends on the number of fall fingerling

Muskellunge produced and the amount of small grade minnows purchased, which was higher in FY14 than in other years. Utility expenditures were lower in FY14 compared to FY13 and also compared to the previous four-year average. This decrease can be attributed to lower natural gas usage and unit cost (Table 40).

TABLE 40. Wolf Lake State Fish Hatchery fiscal and production information summary.

Item	2010	2011	2012	2013	2014
FTE	10.2	9.0	10.6	10.4	9.8
Wages	$894,833	$900,610	$1,046,085	$1,039,898	$995,987
CSS&M	$62,778	$77,529	$80,853	$93,684	$111,747
VTS	$19,550	$21,389	$27,193	$21,457	$16,077
Travel	$12,749	$8,149	$10,409	$5,925	$8,775
Fish food	$178,842	$147,986	$193,456	$167,657	$168,275
Utilities	$199,174	$229,308	$237,920	$225,733	$209,179
kg produced	57,634	53,686	56,028	79,293	59,862

HATCHERY FACILITIES

Facility maintenance and repairs at Wolf Lake State Fish Hatchery remain a large part of CSS&M and major maintenance expenditures due to facility age (Table 41). Sadie Hallock took over responsibility for Wolf Lake State Fish Hatchery's safety program. Annual facility inspections were completed as required. Sadie attended safety meetings, safety conferences, and organized safety meetings and training for hatchery staff. Additionally, training continued for call back procedures, equipment start-up, and the Opto computer system for all on-call and weekend staff. An aggressive preventative maintenance program continues to be a priority and focuses on preventing equipment failures by tracking performance and age to determine when replacement should occur and thereby reducing call backs incurred due to mechanical failures. Additionally, alarms are locked out for equipment or buildings not in use to prevent unnecessary call backs. The following are some of the more significant facility maintenance, improvement, and repair projects completed in FY14:

- Installed new variable frequency drive on newer fish pump
- Fabricated new raceway and tank room screens
- Installed life support systems on refurbished stocking units
- Repairs to various equipment including gators and backhoes
- Compressors for lined ponds and aeration lift pumps
- Replaced heaters in well houses
- Installed new formalin pump in incubation
- Repaired liners in ponds,
- Repaired facility roads
- Installed drainage around the fish health building

TABLE 41. Wolf Lake State Fish Hatchery maintenance and improvements.

Item description	Contractor(s)	Completion date	Final cost	Notes
Water damage repairs at health laboratory	Staff, Great Lakes Insulation Northern A-1	August	$9,344	Includes asbestos removal, spray in insulation, drywall, rehanging pipes, carpet removed
Water supply renovation at laboratory	Staff, C.L. Mahoney	February	$2,460	Added valve to incoming spring water, abandoned old iron pipe, repiped in pvc
New heated water system for muskie culture	Staff, W. Soule	August	$21,206	New high-efficiency boiler provides twice the amount of heated water previously available
Alarm system for heated water in laboratory	Staff	June		As new system is pumped, it was necessary to add alarms in addition to sounding alarm. System reverts to gravity fed, cold water, in a no-power situation
DEQ dam inspection and dam maintenance	Staff	Ongoing		Clearing brush from outer perimeter of ponds
Pump settling basin	Liquid Industrial Waste, Inc.	July	$6,600	
Fabricate screens for round tanks	Staff	June	$1,980	Better selection of hole sizes allows more efficient tank cleaning, stainless steel is more durable
Tree removal	Staff, J & S Tree Service	September	$1,600	Removed dangerous dead branches above visitor center parking lot and 25th Street ditch, removed ash trees killed by emerald ash borer
Repair broken domestic water line at visitor center	Staff, W Soule	September	$2,069	Emergency repair of broken water line

Call Back Summary

The number of call backs in FY14 was 13, down from 20 in FY13. This low number of call backs can be attributed to the upgrade of the Opto hardware and software which eliminated the “watchdog” call backs experienced in previous years. All of the call backs in FY14 were related to weather in one way or another. There were some growing pains experienced with various components of the new heated water system in the wet laboratory that were corrected with reset parameters on the variable frequency drive supplying the water to the tanks in order to have it restart after power interruptions. This accounted for three weather-related call backs that might have been avoided had these parameters been set when the boiler was installed. One call back was a low temperature alarm caused by the failure of the unit heater in the Well 4 building during a very cold period. The thirty-year-old unit heater was replaced. Two alarms were for primary power fail and flow fail in Well 6. Both were restored to normal by the time the on-call staff responded to them. This alarm has occurred infrequently over the years. It is thought that Well 6 is more sensitive to spikes or drops in voltage because it is at the end of the primary power line. In a very short power blip, it will be the

only monitoring point that comes into alarm. The power monitor was replaced but the alarm recurred after this change. The remaining seven alarms were all storm-related power outages, either momentary blips, or extended outages.

Utility Summary

Electrical usage and unit cost in FY14 were similar to FY13 but both usage and unit cost were higher in FY14 when compared to previous four-year average. Costs for electricity represent 72% of the annual utility budget so increases in either usage or unit cost can significantly affect utility expenditures for the year. Natural gas usage and unit cost in FY14 were lower than FY13 and much lower when compared to the previous four-year average. Costs for natural gas represent only 20% of the annual utility budget so changes in usage or unit cost have less effect on overall expenditures for utilities. Liquid oxygen usage decreased while unit cost increased in FY14 when compared to FY13. However, both usage and unit cost were much lower in FY14 when compared to the previous four-year average. Costs for liquid oxygen represent 5% of the annual utility budget. Waste disposal amounts and unit costs were higher in FY14 compared to FY13. When compared to the previous four-year average, the disposal amount was higher but the unit cost was similar. Costs for waste disposal represent 3% of the annual utility budget. There are years with no cost for waste disposal as it was done early in the subsequent fiscal year. Table 42 below summarizes utility cost and usage for the last five years.

TABLE 42. Wolf Lake State Fish Hatchery energy consumption history.

FISH REARING

Category	2010	2011	2012	2013	2014
Electrical use (kw-hrs)	1,300,320	1,246,320	1,366,260	1,470,087	1,458,184
Electric costs	$115,710	$121,967	$137,707	$145,896	$145,598
Unit costs	$0.09	$0.10	$0.10	$0.10	$0.10
Natural gas use (ccf)	89,630	112,980	117,070	97,620	67,750
Natural gas cost	$73,650	$98,840	$91,776	$67,472	$40,179
Unit costs	$0.82	$0.87	$0.78	$0.69	$0.59
Liquid oxygen use (ccf)	20,748	26,728	24,774	32,739	26,602
Liquid oxygen cost	$9,814	$12,642	$9,668	$12,365	$10,589
Unit costs	$0.47	$0.47	$0.39	$0.38	$0.40
Waste disposal (gal)	0	9,700	8,400	0	25,800
Waste disposal cost	$0.00	$2,149	$2,082	$0.00	$6,355
Unit costs	$0.00	$0.22	$0.25	$0.00	$0.25

In FY14, Wolf Lake State Fish Hatchery produced a total of 57,049 kgs of salmonids comprised of Michigan strain Chinook Salmon and Michigan strain Rainbow Trout (steelhead). The total number produced was 2,809,734. The FY14 weight for salmonids is 25.6% lower and the number produced is 15.4% lower than FY13. When compared to the previous four-year average, FY14 salmonid production weights were down 3.8% and numbers produced were down 15.4%. Annual weights of salmonids produced are driven by the size of yearling steelhead, while annual numbers produced reflect the number of small grade fall fingerling steelhead produced.

Wolf Lake State Fish Hatchery produced a total of 2,813 kg of coolwater species including Muskegon River strain Walleye and Great Lakes strain Muskellunge. The total number produced was 13,235,000.

The production of coolwater species increased 46.6% by weight and 8% by number when compared to the previous year. The weight produced for coolwater fish is dependent on the number of fall fingerling Muskellunge produced while numbers produced are driven by Walleye production and more specifically by requests for direct plant Walleye fry. Walleye fry production for transfer to rearing ponds is relatively stable while requests for Walleye fry to stock typically occur every other year, resulting in high variability of Walleye fry production when comparing to the previous year (Table 43).

TABLE 43. Wolf Lake State Fish Hatchery production statistics.

Chinook Salmon, Michigan

Species, strain Age	Number assigned	Number stocked	Mean length (cm)	Total weight (kg)	Reason for surplus (shortage)
Chinook Salmon, Michigan					
Spring fingerling	231,000	234,477	10	2,445	Minimal loss in net pens
Species total	231,000	234,477		2,445	
Muskellunge, Great Lakes					
Fall fingerling	48,000	53,145	21	2,081	High survival
Spring fingerling	0	6,306	11	388	High survival
Species total	48,000	59,451		2,469	
Rainbow Trout, MI steelhead					
Fall fingerling	23,000	459,062	9	3,170	Result of grading
Yearling	750,000	760,993	17	46,989	Fish counter error
Species total	773,000	1,220,055		50,159	
Walleye, Muskegon River					
Fry	16,017,000	13,155,600	0.3	76	Low fertilities/eye-up
Species total	16,017,000	13,155,600		76	
Total	17,069,000	14,669,583		55,149	

Wolf Lake State Fish Hatchery transferred 235,655 Michigan strain Chinook Salmon fingerlings weighing 2,423 kg to eight net pens in the spring of 2014. The rearing assignment was 231,000. All net pen transfers were at or slightly above the assigned number. Prior to transfer, all fingerlings were adipose clipped and coded-wire-tagged by the USFWS AutoFish System mass marking trailer. The net pen locations in FY14 were St. Joseph, South Haven, Holland, Saugatuck, Grand Haven, Manistee, Muskegon, and Ludington.

Muskellunge, Great Lakes

Eggs for the Great Lakes Muskellunge program were collected from wild fish in the Detroit River with electrofishing boats from May 21 through June 3. Wolf Lake State Fish Hatchery received 430,000 fertilized eggs representing nine females and 13 males which produced 350,000 fry. A new heated water system, including a high-efficiency boiler and mixing tank, were installed for musky rearing in spring of 2014. The new boiler has the ability to heat 120 gallons of water up to 72°F, approximately double what the old boiler could produce. This increase in the amount of heated water provided the ability to add five

additional rearing tanks and increase water flows. The mixing tank provided the ability to have all rearing tanks at the same temperature. The old heated-water system required mixing cold, spring water and heated water with individual valves at the head of each row of tanks. This often resulted in slightly different water temperature for each row of tanks making growth rates highly variable. There were no significant disease outbreaks during intensive culture. Just over 65,000 fingerlings were transferred to lined ponds and an additional 80,000 were transferred to two earthen ponds. Due to high survival in early rearing, 20,000, three-inch fingerlings were transferred to one lined pond to reduce tank densities. The normal stocking rate for the lined ponds is 15,000 four-to-five-inch fingerlings per lined pond, but the stocking rate was increased due to smaller size of fish. The need to reduce densities in tanks, as well as the presence of abundant minnow fry in the pond provided an opportunity to see if this option would work in the future. Wolf Lake State Fish Hatchery was also able to provide the State of Indiana with 20,000 three-inch fingerlings when their production fell short and also provided 13,000 fingerlings to the State of Wisconsin. A trade agreement with the State of Wisconsin provides 3,000 Great Lakes strain Muskellunge in exchange for 3,000 northern strain Muskellunge but high survival allowed for the additional 10,000 to be transferred in FY14. In addition to transfers to ponds and other states, 6,300 surplus spring fingerlings were stocked into the Grand River. A total of 36,228 fall fingerlings totaling 1,650 kg were harvested from six ponds at Wolf Lake State Fish Hatchery and stocked into 21 bodies of water throughout Michigan in the fall of 2014. Return rates for all ponds (lined and earthen) was 25%. Returns from lined ponds averaged 48% which is lower than the expected return rate of 60–70%. All fingerlings stocked in future broodstock lakes were marked with Passive Integrated Transponders (PIT) tags prior to stocking. Substantial mortality was experienced in three of the four lined ponds and this will be explained in greater detail in the Fish Health section of this document. The number of fall fingerlings from BY14 will be documented in the FY15 Production Analysis Report as they were harvested and stocked in FY15.

Rainbow Trout, Michigan (Steelhead)

Brood year 2013 yearling steelhead were stocked from April 7th to May 15th. The total number of yearlings stocked was 720,983, collectively weighing 44,685 kg. Yearlings averaged 16.13 fish/kg which was smaller than the target size of 13.4 fish/kg. The smaller than average yearlings can partially be attributed to an unusually cold winter, late spring thaw, and later egg take which resulted in fewer rearing days in their rearing cycle. This lot also contracted BCWD in October of 2013 which likely contributed to smaller size yearlings. An additional 40,010 yearlings were transferred to the State of Indiana per trade agreement and were stocked in Indiana waters of the St. Joseph River.

Brood year 2014 eggs were collected from wild fish at the Little Manistee Weir on April 21st. Due to a high-water event that compromised the weir, all eggs for the state were taken in one day. Wolf Lake State Fish Hatchery received 2.6 million eggs and an additional 400,000 green eggs were provided to the State of Indiana per the trade agreement. An operational change for BY14 was heating water during the incubation period (six weeks) from 11°C to 14–15°C. This was done to determine if fish could be moved to tanks and started on feed sooner with the warmer incubation temperatures. This would provide extra time for growth by reducing incubation time and potentially eliminate the need to heat water during the four months of tank rearing. The result of increased temperatures was that the incubation period was shortened by six days when compared to the previous five-year average. The fertilization rate was 92% which indicated that the increased incubation temperature did not affect egg survival. Wolf Lake State Fish Hatchery provided Castalia State Fish Hatchery in Ohio with 600,000 eyed eggs per a trade agreement with the State of Ohio.

In 2013, a growth comparison was performed on steelhead reared at high densities on heated water versus fry reared at lower densities on base temperature (11°C) water. Results showed comparable growth of fish if rearing densities were reduced. Based on that finding, all 1.9 million fry were transferred to 15 concrete and five round tanks on June 4 and reared on base temperature (11°C) water. Standard procedure previously was to transfer all fry to ten tanks and rear at high densities to use the limited heated water. The goal with BY14 fish was to evaluate the combined benefit of both a shortened incubation period and reduced

densities to obtain comparable sized yearling fish while reducing natural gas usage for heating water during the four months of early rearing. Initial cleanup totaled just less than 20% loss. This is unusually high compared to previous years. The majority of fry removed exhibited signs of TDS. Fry from eggs provided to Ohio and Indiana also had abnormally high mortality. Based on positive results of thiamine treatments administered by Indiana, all production tanks were given a one-hour thiamine static bath treatment at 750 ppm. This treatment was very beneficial as daily mortality was reduced significantly after the treatment. An added benefit of reduced densities was that grading was delayed until mid-September. During the first grade, the smallest fish were transferred to 6-foot diameter circular tanks on the north end of the tank room. These graded smalls were set aside to be used as Muskellunge forage. As densities increased, the largest fish were graded out and transferred to raceways. As was done in the previous year, the largest fish were placed in the third series raceways with the next largest fish going to the second series and finally the smallest fish in the first series. Wolf Lake State Fish Hatchery also provided 23,000 fall fingerlings to Arden Pond, Berrien Springs Sportsman's Club as part of a cooperative rearing agreement that raises fish and stocks them directly into the St. Joseph River as yearlings

Walleye, Muskegon

Wolf Lake State Fish Hatchery conducted the Walleye egg take at the Pine Street public access site on the Muskegon River in FY14. Just over 60 million eggs were collected over five egg take days. Eggs were fertilized and water hardened using river water. Once water hardened, eggs were topically disinfected with a 50 ppm iodine solution for thirty minutes, rinsed, and transported to Wolf Lake State Fish Hatchery in hatchery water. Eggs were again disinfected with 100 ppm iodine solution for ten minutes upon arrival at Wolf Lake State Fish Hatchery. Fertilization rates averaged 49.3%, which is lower than the expected fertility rate of 70%. All assigned fry transfers to rearing ponds were met. A total of 9.63 million fry were transferred to management units, of which 1.8 million were marked with OTC. Due to the lower-than-average fertilization rates, Wolf Lake State Fish Hatchery fell short of its assignment of direct plant fry. Wolf Lake State Fish Hatchery planted just over 3.5 million fry at six different locations on the Grand River and one location on Thornapple Lake. The total number of fry assigned to be direct planted was 6,074,000.

Cost per Species

The cost per species for fish produced and stocked from Wolf Lake State Fish Hatchery is derived from the fish production program. The program assigns operational costs based on the space occupied during the rearing cycle for each species. The first day of each month was used to determine space occupied. Operational costs used in the cost model include salaries and wages, CSS&M, utilities, fish food, fish health, fish transport, fish marking, major maintenance, and capital depreciation. Cost to produce Walleye and Muskellunge was estimated by hours worked and associated expenses (Table 44).

TABLE 44. Wolf Lake State Fish Hatchery cost per fish.

Species, strain	Age	Strain cost	Number produced	Cost/fish
Rainbow Trout, Michigan (steelhead)	Yearling	$1,089,825	784,785	$1.39
Chinook Salmon, Michigan	Spring fingerling	$201,373	219,396	$0.92
Muskellunge, Great Lakes	Fall fingerling	$330,442	53,145	$6.22
Walleye, Muskegon River	Fry	$15,616	12,255,600	$0.0013

EFFLUENT MANAGEMENT

Effluent samples for Wolf Lake State Fish Hatchery are taken using a grab sample at the hatchery discharge from Pond 24 on a monthly basis. Water used for fish production travels through three earthen ponds prior to discharge from Pond 24. Concentrations of TSS and TP in hatchery effluent are permitted under a NPDES permit No. MI0035734. The limits in this permit are 6.0 mg/L TSS and 0.05 mg/L TP. Biological activity (waterfowl, muskrats, growth/decay of aquatic vegetation) in the three earthen ponds upstream of the discharge point can affect TSS and TP in effluent samples. Wolf Lake State Fish Hatchery had one TSS discharge violation of the NPDES permit limits which occurred in May 2014. When the sample was taken, nothing out of the ordinary was noted. There have been instances in the past where large numbers of waterfowl have been documented on the pond, upstream of the sample location, and TSS discharge levels were elevated due to their activity. The continued use of low P feeds and removal of solids are ways that both TSS and TP can be reduced in water discharged from the hatchery (Table 45).

Phosphorus removal efficiency is the percentage of non-assimilated P removed by the effluent treatment system. Phosphorus removal efficiency is calculated as follows:

P removal efficiency = 1- (net effluent P loading / unused P), where

Unused P = P in from feed–Assimilated P, where

Assimilated P = Biomass produced x 0.004

This calculation assumes that the fish biomass produced is approximately 0.4% P, as is borne out by literature review.

TABLE 45. Wolf Lake State Fish Hatchery effluent loading parameters.

BROODSTOCK MANAGEMENT

Parameters	Fiscal year				
	2014	2013	2012	2011	2010
Fish weight produced (kg)	59,856	79,293	56,028	53,686	57,634
Average flow (L/minute)	10,488	10,488	9,173	8,727	10,672
Phosphorus					
From feed (kg)	490	603	592	512	566
Average concentration (mg/L)	0.026	0.019	0.008	0.015	0.013
Annual loading (kg)	145	107	39	67	76
Unused (kg)	238	270	357	287	324
Excess removal efficiency (%)	39	60	89	77	77
TSS					
Average concentration (mg/L)	2.0	3.4	1.0	1.9	2.03
Annual loading (kg)	11,025	18,742	4,822	8,715	11,358

All eggs at Wolf Lake State Fish Hatchery come from feral egg take operations. Steelhead and Chinook Salmon eggs were received from the Little Manistee River Weir; Walleye eggs were collected from fish in the Muskegon River; and Great Lakes Muskellunge eggs were collected from fish in the Detroit River. No broodstock are kept on site.

FISH HEALTH

All incoming eggs to Wolf Lake State Fish Hatchery receive two iodophor disinfection treatments prior to entering the incubation units. Formalin is used daily (1,667 ppm for 15 minutes) to prevent egg fungus on Walleye, Chinook Salmon, steelhead, and Muskellunge eggs up until hatch. Chinook Salmon eggs were water hardened for 60 minutes in a solution containing 2.0 ppm erythromycin and 1,000 ppm thiamine mononitrate at Little Manistee Weir prior to transfer to Wolf Lake State Fish Hatchery. Water hardening eggs in erythromycin has been standard protocol for many years to reduce the incidence of BKD in the hatchery. Thiamine has been used in the hatchery on swim-up fry to reduce the incidence of TDS but a bath treatment at this stage may not be as effective as treating green eggs during water hardening. In FY14, an evaluation of the effectiveness of a combined treatment of erythromycin and thiamine during water hardening was completed for Chinook Salmon eggs. This new protocol was considered very successful as the incidence of TDS was very low and groups were negative for BKD. Steelhead eggs were water hardened in an erythromycin solution only because TDS is usually not an issue in steelhead. However, the incidence of TDS was abnormally high in steelhead fry from the 2014 production lot. All fry received a thiamine bath at 750 ppm for a minimum of one hour or until dissolved oxygen levels required flow to be restored. This treatment was considered successful. Wolf Lake State Fish Hatchery continues to have problems with external flavobacteriosis and BCWD. Chloramine-T was used to treat steelhead under an INAD program with good success.

A total of 32 fish health exams were completed at Wolf Lake State Fish Hatchery in FY14. This included three diagnostics and 29 inspections. Diagnostics were completed for one lot of steelhead with flavobacteriosis and two lots of Muskellunge, one for evaluation of Piscirickettsia-like organisms (no symptoms or mortality) and one associated with a mortality event in the ponds that was attributed to copper toxicity. Inspections were completed on all lots prior to stocking, including two inspections of steelhead (fall fingerlings and yearlings), eight inspections of Chinook Salmon (one full inspection and seven groups tested for BKD only as part of the evaluation of water hardening in a combination treatment discussed above), five inspections of Walleye fry for VHSv only and 14 inspections of Muskellunge (two full inspections and 12 inspections for VHSv only). All inspection results were negative for reportable diseases.

FISH QUALITY

Fish Quality Assessments were performed on steelhead and Chinook Salmon in FY14. Quality parameters for steelhead were assessed three times throughout their rearing cycle including just after fish were transferred to outdoor rearing units, midway through the rearing cycle, and just prior to stocking. Chinook Salmon were assessed once during rearing, just prior to transfer to net pens. The BY13 steelhead had good fins and a visceral fat index of 3.1. There were shortened or deformed opercles observed in 27% of the fish sampled and fish were 13% smaller than fish in the previous year-class. The BY13 Chinook Salmon were in good condition with a visceral fat index of 2.5 and were slightly larger than the previous year-class. Additionally, Wolf Lake State Fish Hatchery personnel conducted FQAs for six groups of Chinook Salmon in net pens at the following locations: Holland, Saugatuck, South Haven, St. Joseph, Grand Haven and Muskegon. An FQA was not performed on steelhead at Berrien Springs Sportsman's Club due to dam boards failing and fish being released before samples could be collected.

FISH MARKING

There were four marking events at Wolf Lake State Fish Hatchery during FY14. Fall fingerling Muskellunge stocked in the two future broodstock lakes, Thornapple and Big Bear, received PIT tags just prior to stocking in November 2013. Steelhead yearlings that were stocked at three index port sites required two marking processes. Fall fingerling steelhead were adipose clipped in October 2013 as fish were

transferred to the raceway and yearling fish received CWTs just prior to stocking in April 2014. The fish were marked in two separate events due to the small number of fish needed for each of the three sites and the inability to hold these three small groups separately for six months at the hatchery. All Chinook Salmon were adipose clipped and coded-wire-tagged in March 2014 by USFWS personnel using the AutoFish System mass marking trailer. A total of 1.8 million Walleye fry were marked with OTC for approved marking studies and stocking in treaty waters (Table 46).

TABLE 46. Wolf Lake State Fish Hatchery fish marking summary.

- AD (Adipose fin clip)
- ADCWT (Adipose coded wire tag)
- CWT (Coded wire tag)
- PIT (Passive Integrated Transponder)
- SW (State worker)
- S (Supervision)
- USFWS (US Fish & Wildlife Service)

Species, strain Age	Mark	Number marked	Labor costs SW	Labor costs S	Marking cost	Cost/fish	Notes
Muskellunge, Great Lakes							
Fall fingerling	PIT	3,500	$0.00	$3,141	$5,915	$1.69	
Rainbow Trout, MI steelhead							
Fall fingerling	AD	60,371	$1,307	$0.00	$0.00	$0.02	
Yearling	CWT	57,476	$1,769	$4,146	$5,173	$0.19	
Chinook Salmon, Michigan							
Spring fingerling	ADCWT	236,178	$0.00	$0.00	$0.00	$0.00	USFWS

FISH DISTRIBUTION

A total of 69 trips were completed in FY14 to stock and transfer fish. Drivers traveled 19,872 miles to 104 sites, which took 446 hours to complete. The stocking season for FY14 began on October 23, 2013 with fall fingerling Muskellunge and was not completed until August 28, 2014. Unlike other Michigan facilities, Wolf Lake State Fish Hatchery produces coldwater and coolwater species which are stocked at various times throughout the year. Wolf Lake State Fish Hatchery also coordinates the stocking of Skamania steelhead from Indiana and Channel Catfish from Ohio. Of the 69 trips in FY14, 48 trips were made to stock coldwater fish (steelhead and Chinook Salmon), 18 trips were made to stock coolwater fish (Muskellunge and Walleye) and three trips were made to stock warmwater fish (Channel Catfish).

ELECTRONICS UNIT

In FY14, the electronics unit worked to maintain, upgrade, and improve alarm systems and related equipment at the six main fish production facilities as well as the seasonally operated Black River Streamside Sturgeon Facility. Electronics Unit staff also assisted other Fisheries Division units, making repairs to various electronic equipment and researching options to meet work needs and improve operations.

ADMINISTRATION

In FY14, a second electronics technician, Nick Merchant was hired and he started in April of 2014. The increases to FTEs, wages, and travel allotments in FY14 compared to previous years are the result of the change to staffing in this unit (Table 47).

TABLE 47. Electronics Unit fiscal summary.

Item	2010	2011	2012	2013	2014
FTE	1.0	1.0	1.0	1.0	1.4
Wages	$104,239	$120,686	$129,548	$112,191	$150,242
CSS&M	$17,725	$22,406	$19,458	$15,996	$21,153
VTS	$11,440	$9,592	$8,792	$5,367	$3,166
Travel	$1,612	$1,484	$1,173	$1,675	$3,508

Projects

Below is a description of significant work and projects completed by the electronics unit (Table 48).

- Staff installed a liquid oxygen pressure switch and display at Harrietta State Fish Hatchery. The pressure switch was installed to give an alarm point for Opto 22™ in case of a high or low level of pressure in the system. The display at point of use and in Opto 22™ was put in place to give a visual aid for quick reading of pressure in the system.
- The fish waste pumps at Platte River State Fish Hatchery are vital to the fish waste management system. The controls were very outdated and required constant maintenance. A new control system was designed to reduce maintenance time and repair costs. After design was complete and tested to include software and hardware, the new controls have been implemented. A total of 10 fish waste pumps are at Platte River State Fish Hatchery and eight have been upgraded thus far. All wiring and controls haven been changed.
- Due to age and reparability, flow switches were replaced with the new Fluid Components International (FCI) switch to increase reliability and reduce the number of unnecessary call backs.
- Staff upgraded Opto 22 alarm system software and hardware to the newest version, Programmable Access Control (PAC). This was completed at all of the Upper Peninsula hatcheries. These systems are vital to the hatcheries in providing reliable notification of failures to the staff.
- Staff repaired and improved drum filter control system at Oden State Fish Hatchery to improve effluent management.
- Staff repaired various electronic devices for the Fish Production Section as well as field units.

TABLE 48. Electronics Unit maintenance and improvement projects.

Facility	Project	Hours	Cost
Harrietta State Fish Hatchery	Flow switch	24.0	$1,050
Harrietta State Fish Hatchery	Liquid oxygen pressure display and switch	75.0	$1,500
Marquette State Fish Hatchery	Opto 22 upgrade	70.0	$9,000
Oden State Fish Hatchery	Drum filter	45.0	$600
Platte River State Fish Hatchery	Fish waste pump upgrade	100.0	$1,000
Thompson State Fish Hatchery	Alarm points and variable frequency drives setup	60.0	$2,000
Thompson State Fish Hatchery	Opto 22 upgrade	60.0	$12,000

FISH HEALTH UNIT

ADMINISTRATION

The FY14 allotment for fish health was $231,766. Expenditures for FY14 were $220,031 and underspent the allotment by $11,735. The only budget category that was overspent was travel because of expenses associated with on-site fish health inspections by the MSU Aquatic Animal Health Laboratory staff. The CSS&M and vaccine allotments were both underspent. Expenditures for CSS&M included medicated feed, drugs/chemicals associated with disease treatments, INAD fees, sample shipment, and BKD screening costs at LSSU. Vaccine expenditures vary each year because larger purchases are made approximately every other year that cover more than one year of vaccinations. The MSU Aquatic Animal Health Laboratory contract cost was increased in FY14 from $177,222 to $180,766 to cover increased costs associated with this contract. The cost per case has varied over the last five years with the MSU Aquatic Animal Health Laboratory contract cost and the number of cases submitted having the greatest effect on this value. The cost per case in FY14, $1,111, is slightly lower than the five-year average cost per case of $1,248 (Table 49).

TABLE 49. Fish Health Unit fiscal and case information summary.

Item	2010	2011	2012	2013	2014
CSS&M	$23,007	$27,697	$23,759	$53,905	$24,983
VTS	$3,149	$3,212	$5,193	$7,099	$5,671
Travel	$984	$1,030	$1,274	$2,146	$1,487
Vaccine	$13,552	$5,366	$14,796	$9,943	$7,124
VHS	$0	$0	$0	$5,000	$0
MSU contract	$167,000	$170,340	$173,747	$177,222	$180,766
Number of cases	173	145	146	256	198
Cost per case[a]	$1,201	$1,432	$1,498	$997	$1,111

[a] Cost per case is determined by dividing expenditures for the FY by the total number of cases.

In FY14, the MDNR continued the partnership with the MSU Aquatic Animal Health Laboratory to provide aquatic animal health services. Fish health inspections and other diagnostic services were performed for state hatcheries on captive broodstock, production fish, wild broodstock, and wild fish stocks. In FY14, the total number of cases was lower than FY13 when there was extensive testing for EEDv at Marquette State Fish Hatchery. The number of cases in FY14 was slightly higher than the other three years with production inspections related to IPNv testing by rearing unit at Oden, Marquette, and Harrietta state fish hatcheries, and annual testing of wild fish in source waters at Marquette, Platte, and Harrietta state fish hatcheries (Table 50).

TABLE 50. Fish Health Unit case summary.

Case type	2010	2011	2012	2013	2014
Inspection-Broodstock-Wild	22	21	16	17	15
Inspection-Broodstock-Captive	73	41	42	63	51
Diagnostic-Broodstock-Captive	0	0	1	1	3
Inspection-Fish Production	33	42	35	74	87
Diagnostic-Fish Production	16	16	20	18	13
Diagnostic-Fish Production-EEDv	0	0	0	45	0
Diagnostic-Wild-Clinical	0	0	1	2	0
Diagnostic-Wild-VHS	20	0	0	0	0
Diagnostic-Wild-Fish Kills	1	9	0	0	0
Inspection-Wild	7	7	26	35	29
Inspection-Wild-EEDv	0	0	0	1	0
Diagnostic-Wild-Transfers	0	9	5	0	0
Diagnostic-Wild-Future Broodstock	1	0	0	0	0
Total	173	145	146	256	198

The fish health costs associated with Marquette and Oden state fish hatcheries are typically higher than the other facilities due to captive broodstock maintained at both of these hatcheries. In FY14, fish health costs at Oden State Fish Hatchery were significantly higher than past years due to an outbreak of IPNv disease which required extensive testing. The number of Chinook Salmon cases at both Wolf Lake and Platte River state fish hatcheries increased due to a study related to TDC that was an additional 12 cases (6 at each facility). Facility costs for production fish include both inspection and diagnostic cases. While the number of inspections per facility remains relatively constant over time, the number of diagnostic cases submitted each year varies and therefore has the greatest potential to effect annual health costs related to a facility (Tables 51, 52, and 53).

TABLE 51. Fish Health Unit cost summary by case type[a].

Case type	2010	2011	2012	2013	2014
Inspection-Broodstock-Wild	$26,412	$30,073	$23,975	$16,955	$16,669
Inspection-Broodstock-Captive	$87,639	$58,713	$62,934	$62,831	$56,675
Diagnostic-Broodstock-Captive	--	--	$1,498	$997	$3,334
Inspection-Fish Production	$39,617	$60,145	$52,445	$73,802	$96,680
Diagnostic-Fish Production	$19,208	$22,912	$29,968	$17,952	$14,446
Diagnostic-Fish Production-EEDv	--	--	--	$44,880	$0
Diagnostic-Wild-Clinical	--	--	$1,498	$1,995	$0
Diagnostic-Wild-VHS	$24,010	$0	$0	$0	$0
Diagnostic-Wild-Fish Kills	$1,201	$12,888	$0	$0	$0
Inspection-Wild	$8,404	$10,024	$38,959	$34,906	$32,227
Inspection-Wild-EEDv	--	--	--	$997	$0
Diagnostic-Wild-Transfers	$0	$12,888	$7,492	$0	$0
Diagnostic-Wild-Future Broodstock	$1,201	$0	$0	$0	$0
Total	$207,692	$207,645	$218,769	$255,315	$220,031

[a] Costs by case type are determined using the cost per case for the FY (found in Table 49) multiplied by the number of each type of case.

TABLE 52. Fish Health Unit cost summary by facility[a].

Facility	2010	2011	2012	2013	2014
Harrietta State Fish Hatchery	$7,203	$12,888	$13,486	$5,984	$7,779
Marquette State Fish Hatchery	$63,628	$41,529	$53,943	$105,716	$31,115
Oden State Fish Hatchery	$46,821	$42,961	$34,464	$24,933	$62,231
Platte River State Fish Hatchery	$8,404	$12,888	$10,489	$10,971	$14,446
Thompson State Fish Hatchery	$6,003	$11,456	$10,489	$5,984	$10,001
Wolf Lake State Fish Hatchery	$9,604	$10,024	$16,483	$37,898	$35,561
LSSU	$2,401	$2,864	$2,997	$1,995	$2,223
Other (Walleye rearing)	$0	$0	$2,997	$6,981	$7,779
Other (Channel Catfish)	$2,401	$2,864	$1,498	$0	$0
Other (Streamside)	$0	$4,296	$0	$0	$0
Total	$146,064	$141,771	$146,845	$200,462	$171,135

[a] Costs by facility using the cost per case for the FY (found in Table 49) multiplied by the total number of production and broodstock cases associated with each facility in that year.

TABLE 53. Fish Health Unit cost summary by species-strain for production and captive broodstock. Prod = Production; Brood = Broodstock.

Species, strain	2012		2013		2014	
	Prod	Brood	Prod	Brood	Prod	Brood
Atlantic Salmon, landlocked	$7,492	--	$1,995	--	$6,668	--
Brook Trout, Assinica	$4,495	$14,984	$13,963	$11,968	$10,001	$13,335
Brook Trout, Iron River	--	--	--	--	--	--
Brown Trout, Gilchrist Creek	$7,492	$4,495	$4,987	$1,995	$5,556	$11,113
Brown Trout, Sturgeon River	$7,492	$5,994	$4,987	$4,987	$6,668	$10,001
Brown Trout, Wild Rose	$7,492	$4,495	$4,987	$3,989	$14,446	$1,446
Chinook Salmon, Michigan	$7,492	--	$14,960	--	$21,114	--
Coho Salmon, Michigan	$1,498	--	$1,995	--	$1,111	--
Lake Trout, Lake Superior	$1,498	--	$23,936	$36,901	$1,111	$11,113
Lake Trout, Seneca Lake	$4,495	$26,972	$13,963	--	$3,334	--
Lake Herring	--	--	--	--	--	--
Muskellunge, Great Lakes	$4,495	--	$21,941	--	$17,780	--
Muskellunge, Northern	--	--	$997	--	--	--
Rainbow Trout, Eagle Lake	$5,994	$7,492	$3,989	$3,989	$1,111	$0
Rainbow Trout, MI steelhead	$13,486	--	$5,984	--	$5,556	--
Splake, Michigan	$1,498	--	$4,987	--	$1,111	--
Walleye	--	--	$3,989	--	$7,779	--

Fish Health Summaries

All fish lots to be stocked by MDNR in Michigan public waters were examined and tested for emergency and restricted fish pathogens as outlined in the Great Lakes Fishery Commission, Great Lakes Fish Health Committee's Model Program for Fish Health Management in the Great Lakes (Phillips et al. 2014) and guided by the laboratory protocols of the American Fishery Society–Fish Health Section Blue Book (AFS-FHS 2014) and the World Organization for Animal Health. Selected public waters were also evaluated for emergency and restricted fish pathogens.

BROODSTOCK INSPECTIONS–WILD BROODSTOCKS

Chinook and Coho Salmon

Thirty pairs of Michigan strain Chinook Salmon that returned to the Little Manistee River and Swan River weirs and thirty pairs of Michigan strain Coho Salmon that returned to the Platte River Weir were examined. *R. salmoninarum* was not detected in any of the tested samples. Prevalence for *A. salmonicida* was 20% in the Little Manistee River Weir, 2% in the Platte River Weir, and was not detected at the Swan River Weir. *Y. ruckeri* was not detected. The following nonreportable bacteria were detected: *F. psychrophilum* (prevalence of 17% in Swan River Weir and 57% in Little Manistee River Weir); *F. columnare* (prevalence

of 43% in Swan River Weir, 2% in Little Manistee River Weir, and 25% in Platte River Weir); and motile *Aeromonas* spp. (prevalence of 20% in Little Manistee River Weir and 2% in Platte River Weir). No viruses were detected.

Atlantic Salmon, landlocked

Thirty pairs of Atlantic Salmon returned to the St. Mary's River, LSSU Aquatic Research Laboratory and were examined. Bacteria isolated included reportable *A. salmonicida* (prevalence of 2%) and nonreportable *F. psychrophilum* (prevalence of 63%). No other reportable bacterial or viral pathogens were detected in the 30 pairs of fish examined. Other isolated nonreportable bacteria included motile *Aeromonas* spp. (prevalence of 25%).

Rainbow Trout, Michigan (Steelhead)

Thirty pairs of steelhead returned to the Little Manistee River Weir and were examined. No *A. salmonicida*, *R. salmoninarum* or *Y. ruckeri* were detected. The nonreportable bacterium, *F.psychrophilum,* was detected in kidney cultures at a prevalence of 7%. Other nonreportable bacteria that were isolated included motile *Aeromonas* spp. (prevalence of 3%) and *Providencia* sp. (prevalence of 2%). No viruses were detected. Skin and gill scrapings revealed the presence of *Gyrodactylus* sp., *Trichodina* sp., and *Tetrahymena* sp.

Coolwater species

Inspections were conducted on all coolwater broodstock populations in the spring of 2014 (242 fish). These included full examinations of Walleye from the Tittabawassee River (n = 60), Muskegon River (n = 60), and Little Bay de Noc (n = 60); examinations on Muskellunge from the Detroit River (full = 10 and nonlethal = 28); and nonlethal inspections of Lake Sturgeon from Black Lake (n = 21) and the Menominee River (n = 3). No reportable pathogens or *Heterosporis* sp. were detected. The following nonreportable bacteria were isolated: *Klebsiella* sp. (Walleye, Muskegon River, 2% prevalence); motile *Aeromonas* spp. (Walleye, Muskegon River, 2% prevalence); nonmotile *Aeromonas* spp. (Walleye, Little Bay de Noc, 2% prevalence); and *Providencia* sp. (Muskellunge, Detroit River, 20% prevalence). The following parasites were revealed by skin and gill scrapings: monogeneans (e.g., *Gyrodactylus* spp. in Walleye from Tittabawassee River and Little Bay de Noc); sessile ciliates (e.g., *Apiosoma* spp., *Epistylis* spp. and/or *Ambiphrya* spp. in Walleye from Muskegon River and Little Bay de Noc, and Muskellunge from the Detroit River); protozoans (e.g., *Trichodina* spp. in Walleye from the Tittabawassee River, Muskegon River and Little Bay de Noc); *Henneguya* spp. in Muskellunge, Detroit River); and crustaceans (e.g., *Argulus* spp. in Walleye from the Tittabawassee River and Little Bay de Noc).

Inspections

The *A. salmonicida* vaccine was administered to fish to prevent infections caused by *A. salmonicida*. Fourteen lots of captive broodstock were inspected in fall 2014. Two lots of Assinica strain Brook Trout and two lots of Lake Superior strain lean Lake Trout were inspected in August at Marquette State Fish Hatchery. Two lots of Gilchrist Creek strain Brown Trout, three lots of Sturgeon River strain Brown Trout, three lots of Wild Rose strain Brown Trout, and two lots of Eagle Lake strain Rainbow Trout were inspected in September at Oden State Fish Hatchery. *R. salmoninarum* was detected in two lots of fish from Oden State Fish Hatchery at 2% prevalence (medium titer in Eagle Lake strain Rainbow Trout and low titer in Sturgeon River strain Brown Trout). No other reportable pathogens were detected. Skin and gill scrapings revealed monogeneans (e.g., *Gyrodactylus* sp.), and ciliated protozoans in some lots.

Preventative measures to minimize the vertical transmission of R. salmoninarum

Gametes were collected in the fall of 2014 from 10 lots of salmonid broodstock at Oden and Marquette state fish hatcheries. Gametes from 60 fish each were collected from six lots of Brown Trout (Gilchrist, Sturgeon River, and Wild Rose strains) and two lots of Eagle Lake strain Rainbow Trout at Oden State Fish Hatchery. *R. salmoninarum* was detected by quantitative enzyme linked immunosorbent assay (QELISA) in one pool (five fish per pool) of ovarian fluid from Eagle Lake strain Rainbow Trout (high titer level). Post-spawn gametes from 364 Assinica strain Brook Trout at Marquette State Fish Hatchery were held in isolation for 24 hours pending laboratory results while milt or ovarian fluid samples from each fish were tested for the presence of *R. salmoninarum* using Q-ELISA in order to minimize vertical transmission and incidence of *R. salmoninarum* in hatchery stocks. *R. salmoninarum* was not detected in any of the Brook Trout gametes tested.

Additionally, all gametes were tested for the presence of VHSv, IPNv, and Infectious Hematopoietic Necrosis (IHNv). All completed test results were negative for viruses.

PRODUCTION INSPECTIONS

Twenty-one lots (60 fish per lot) of eight salmonid species from six State of Michigan hatcheries and the LSSU Aquatic Research Laboratory were tested for emergency and restricted fish pathogens prior to stocking in spring 2014. This included six lots of Brown Trout (three strains), four lots of Rainbow Trout (steelhead and Eagle Lake strains), three lots of Chinook Salmon, two lots of Atlantic Salmon, one lot of Coho Salmon, two lots of Lake Trout (two strains), two lots of Brook Trout, and one lot of splake.

R. salmoninarum, the causative agent of BKD, was detected using Q-ELISA in one lot of splake from Marquette State Fish Hatchery at low antigen levels at a prevalence of 10%. Additionally, 60 Chinook Salmon per rearing unit from two hatcheries were tested as part of a study examining the efficacy of thiamine treatments for combatting TDC. All were found to be negative for *R. salmoninarum* by Q-ELISA, including 360 Chinook Salmon from six rearing units at Platte River State Fish Hatchery and 420 Chinook Salmon from seven rearing units at Wolf Lake State Fish Hatchery.

The *Aeromonas salmonicida* vaccine (AquaTactics Fish Health, Washington, USA) was administered to fish to prevent infections caused by *A. salmonicida salmonicida* (furunculosis agent). Neither *A. salmonicida salmonicida* nor *Yersinia ruckeri* (enteric redmouth disease agent) were isolated during spring production inspections in 2014. The following nonreportable bacteria were isolated during these inspections: *Serratia* sp.; motile *Aeromonas* spp.; *Shewanella* sp.; and *Y. intermedia*. In addition, seven representative lots from these hatcheries were examined and found to be negative for *Myxobolus cerebralis*, the causative agent of whirling disease. *Nucleospora salmonis* was detected in kidney and/or gill samples from Marquette, Wolf Lake, Platte River, Thompson, Oden, and Harrietta state fish hatcheries at a prevalence ranging from one to twelve out of twelve pools (five fish per pool). The following parasites were revealed by skin and gill scrapings: monogeneans (e.g., *Gyrodactylus* spp. in Marquette State Fish Hatchery Brook Trout, splake and Lake Trout and in Thompson State Fish Hatchery steelhead and Brown Trout); sessile ciliates (e.g., *Apiosoma* spp. and/or *Ambiphrya* spp. in Marquette State Fish Hatchery Brook Trout and Oden State Fish Hatchery Rainbow Trout); and protozoans (e.g., *Trichodina* spp. in Marquette State Fish Hatchery Brook Trout). EEDv was not detected at Marquette State Fish Hatchery in any lots, despite its confirmed presence in two strains of Lake Trout in 2013 via quantitative PCR tests. Infectious pancreatic necrosis virus was detected in Marquette State Fish Hatchery Brook Trout and in Oden State Fish Hatchery Brown Trout. No other viruses were detected in fish sampled from these lots, including negative results for VHSv, IPNv, and IHNv.

Nine lots of production fish (60 fish per lot) from MDNR hatcheries were inspected prior to stocking in summer and fall 2014. These included steelhead and Muskellunge at Wolf Lake State Fish Hatchery; Assinica strain Brook Trout and Seneca strain Lake Trout at Marquette State Fish Hatchery; steelhead and Gilchrist strain Brown Trout at Thompson State Fish Hatchery; Eagle Lake strain Rainbow Trout at Oden

State Fish Hatchery; Atlantic Salmon at Platte River State Fish Hatchery; and Atlantic Salmon at LSSU Aquatic Research Laboratory. *R. salmoninarum* was detected in 2% of Thompson State Fish Hatchery steelhead at low titers. No other reportable pathogens were detected.

Diagnostics

The MSU Aquatic Animal Health Laboratory provided diagnostic services for MDNR on 68 cases from fish production facilities and wild populations, including fish kills, wild fish surveys/inspections, and transfers.

Fish Production Facilities

Fish were submitted by MDNR hatcheries for thirteen clinical cases from production lots and three clinical cases from broodstock lots for laboratory diagnoses following episodes of elevated mortality and/or morbidity. *Flavobacterium* spp. were the most commonly associated pathogen with these disease events. Other pathogens associated with mortality included *R. salmoninarum,* which was detected in two diagnostic cases at 5–10% prevalence, as well as IPNv and motile *Aeromonas* spp. Antibiotic sensitivity testing was performed as appropriate, investigational INAD or other approved Food and Drug Administration (FDA) treatments were recommended, and fish were treated following INAD or label requirements.

Infectious pancreatic necrosis virus was detected in February and March in three Oden State Fish Hatchery lots of production Brown Trout (Wild Rose and Sturgeon River strains), including at least one lot of fry that experienced mortality and disease signs associated with IPNv infection. Additional sample collections and subsequent testing of Brown Trout fingerlings (no signs of disease) by rearing unit failed to yield any cytopathic effect (CPE) on cell culture or to detect the virus via PCR, thereby confirming initial suspicions that viral titers were extremely low in these fish. During the same period, one lot of Brown Trout future broodstock (Wild Rose strain) reared at Oden State Fish Hatchery also experienced a mortality event associated with IPNv and was eventually destroyed. In 2014, IPNv was also detected in Marquette State Fish Hatchery, a facility that had never tested positive for IPNv from 1970–2013, though sampling of wild Brook Trout inhabiting Cherry Creek, the main hatchery water source, detected IPNv in 2013. For this reason, production Brook Trout were sampled by rearing unit (60 fish per rearing unit, 6 rearing units) in order to detect IPNv if present at a low prevalence. The results from this testing revealed that one of the six rearing units was positive for IPNv at detectable levels (CPE within 28 days on cell culture and positive via PCR) despite the absence of disease signs in the sampled fish. Additionally, 720 fish from Oden, Marquette, and Harrietta state fish hatcheries were tested specifically for IPNv, all of which were negative.

Wild Fish

VHSv Surveillance and Monitoring - The Michigan MDNR VHSv surveillance was initiated in 2006. A total of 26 cases of Walleye fry and fingerlings and Muskellunge fry were submitted from Wolf Lake and Thompson state fish hatcheries and various Walleye rearing ponds throughout the state for VHSv testing. A total of 11,639 fry/fingerlings were tested and no VHSv was detected. No VHSv surveillance of wild fish was done in FY14.

Fish Kills - No fish were submitted for testing in FY14 due to wild fish kills. Fish kills were rare, other than a few winterkill mortalities.

Wild Fish Surveys/Inspections – Ten cases (383 fish) were submitted for examination from surface water supplies for Platte River and Marquette state fish hatcheries. The fish species tested included Brown Trout, Brook Trout, Rainbow Trout, and Mottled Sculpin (*Cottus bairdii*). All submitted fish were tested for the presence of IPNv, VHSv, and IHNv. Additionally, submitted salmonids were tested for the presence of *R. salmoninarum* and *M. cerebralis*. *R. salmoninarum* was detected in Brown and Brook Trout from the Cherry Creek at a prevalence of 1–2%. *M. cerebralis* was not detected in any of the sites tested in 2014.

Epizootic epitheliotropic disease virus was not detected in wild fish in 2014, despite its detection during 2013 in Mottled Sculpin from Cherry Creek.

Seven species (Rock Bass, Bluegill, Largemouth Bass, Brown Trout, Brook Trout, Yellow Perch, and Brook Silversides) were inspected from multiple sites in six inland lakes and rivers (960 total fish) and examined for viruses (IPNv, VHSv, IHNv, and/or Largemouth Bass Virus or LMBv), *R. salmoninarum*, *M. cerebralis*, and *Heterosporis* sp. None of the aforementioned viruses were detected at 15°C or 25°C. *R. salmoninarum* and *M. cerebralis* were detected in Brown and Brook Trout collected from multiple Au Sable River sites. *R. salmoninarum* prevalence ranged from 2–17% in the six Au Sable River sites that were positive. *M. cerebralis* was detected at two sites in the Au Sable River, with prevalence ranging from one out of three pools to two out of four pools (n=5 fish per pool). *Heterosporis* sp. was not detected in any waterbody.

Potential Broodstock **-** No fish were collected and tested as potential new broodstock in FY14.

FISH HEALTH RESEARCH

Dr. Mohamed Faisal and staff from the MSU Aquatic Animal Health Laboratory continue to investigate various fish health issues as they arise including, working with strains of *Flavobacter sp*. causing disease outbreaks in hatcheries. Research projects and subsequent publications are provided to MDNR staff as they become available. Significant findings and research are presented by the MSU Aquatic Animal Health Laboratory staff at annual MDNR Fish Production Section meetings.

FISH QUALITY UNIT

ADMINISTRATION

To ensure that all fish produced for stocking are of high quality, the following work was performed:

- Inspect all production lots of fish, including partnership-reared salmonids within one month of the proposed stocking date using Utah's Fish Health/Condition Assessment procedure revised for Michigan
- Conduct regular FQAs on each lot during the production cycle
- Standardize procedures and gather data at all fish production facilities to develop food schedules, condition factors, and data required to produce a quality product
- Conduct annual assessments of the genetic diversity of captive broodstocks
- Conduct studies to improve quality and growth of fish produced for stocking

The FY14 budget allotment for fish quality was $11,300 and was overspent by $485. Purchases in FY14 included equipment (Whisper feeders, microscopes, pH probes), thiamine to treat for TDC, and an analysis of egg thiamine levels by LSSU. The overtime, VTS, Travel, and Fish Food categories had no expenditures for FY14 due to limited research done through the fish quality unit. A summary of Fish Quality Unit expenditures is provided in Table 54.

TABLE 54. Fish Quality Unit fiscal information.

Item	2010	2011	2012	2013	2014
CSS&M	$3,931	$7,872	$13,496	$10,773	$11,785
Overtime	$0	$0	$0	$0	$0
VTS	$0	$0	$0	$0	$0
Travel	$0	$0	$0	$0	$0
Fish Food	$0	$0	$0	$0	$0

FISH QUALITY ASSESSMENTS

Fish Quality Assessments were completed by hatchery personnel for all lots of salmonids reared and stocked out of the six state fish production facilities in Michigan and fish released through cooperative rearing agreements. Assessments of fish quality are completed to document the condition of fish immediately prior to stocking. In FY14, a total of 48 FQAs were completed by hatchery and field personnel including 29 lots of fish at state hatcheries and 19 lots reared in net pens and cooperative rearing facilities throughout the state. Assessments showed that fish were in good condition at the time of stocking with minimal fish quality issues. When issues were documented, fin erosion, abnormal eyes and gills, and shortened opercula continued to be the most common negative quality criteria found in these lots.

FISH QUALITY RESEARCH

Thiamine Deficiency Complex (TDC)

Thiamine deficiency complex (formerly known as early mortality syndrome) continues to be a concern for Great Lakes salmonids. In FY14, eggs from 30 fish were collected and reared for thiamine analysis from two Lake Michigan tributaries: Chinook Salmon (Michigan strain) from the Little Manistee River and Coho Salmon (Michigan strain) from the Platte River. Egg samples for thiamine analysis were also collected from 30 fish from Swan River, a Lake Huron tributary. However, no fish were reared from these adults due to low numbers of returning adults at this location. All egg samples were analyzed by staff at LSSU. Ongoing research, as part of a Great Lakes Trust Fund study looking at TDC in Lake Michigan, may help to clarify the role of thiamine in the development of TDC, as well as explain and predict when TDC will occur more accurately. There are currently plans to continue to monitor and document the incidence of TDC in Little Manistee Chinook Salmon, Swan River Chinook Salmon, and Platte River Coho Salmon in FY15 (Table 55).

TABLE 55. Comparison of percent incidence and mortality and average thiamine levels related to TDC.

		Species and location		
		Chinook Salmon		Coho Salmon
Year	Thiamine variables	Little Manistee	Swan River	Platte River
2012	Incidence of TDC (%)	All eggs died during incubation	No eggs collected or reared	All eggs died during incubation
	Mortality due to TDC (%)			
	Average thiamine level (nmol/g)	4.08	N/A	3.66
2013	Incidence of TDC (%)	10	No eggs reared	0
	Mortality due to TDC (%)	70.3	No eggs reared	0
	Average thiamine level (nmol/g)	N/A	5.23	6.01
2014	Incidence of TDC (%)	44	No eggs reared	100
	Mortality due to TDC (%)	68.8	No eggs reared	98.9
	Average thiamine level (nmol/g)	N/A	4.33	6.011

Thiamine Deficiency Complex/Bacterial Kidney Disease Egg Treatment Study

This study was continued in FY14 (second year of a three-year study) to determine the effects of a combined treatment of erythromycin and thiamine mononitrate during egg water hardening on the incidence of TDC symptoms and related mortality and incidence of BKD. The experiment was duplicated at both Platte and Wolf Lake state fish hatcheries with three treatment groups and one control group. In FY14, the incidence of TDC was higher in groups that received no thiamine treatment at the egg or fry stage, compared to those groups that received a thiamine treatment either during water hardening or as swim-up fry. The incidence of BKD was very low, so based on the results, it can be concluded that thiamine administered during water hardening along with erythromycin significantly reduced the incidence of TDC. The effect of thiamine on the efficacy of erythromycin during water hardening is not yet known. The plan is to repeat this experiment in FY15 to determine if the combined treatment is effective at reducing both the incidence of TDC and BKD.

Broodstock Genetics Analysis

All of the major broodstock lines have had baseline genetics information completed on them by Dr. Kim Scribner (MSU-PERM). Long-term monitoring of broodstocks was deferred because of budget shortfalls and the lack of a funded shared genetics technician position in Dr. Scribner's laboratory. This long-term analysis work will examine how well production fish match broodstock sources with respect to genetic diversity and will be restarted as soon as funding permits.

By providing key assistance in the development of the Esocid Management Plan, having students continue research on Lake Sturgeon breeding strategies and propagation methods, and providing consultation on the genetics management in the hatchery system, Dr. Kim Scribner has continued to assist the Fish Production Section in the development of a new Broodstock Management Plan. Samples continued to be added to the genetic sample depository at Dr. Kim Scribner's laboratory at MSU. Samples were taken from all hatchery production strains, available wild fish from the status and trends efforts, and all wild broodstock lines. This will be a rich depository of information for future genetics work.

Other Projects

The fish quality laboratory facilities were used by Wolf Lake State Fish Hatchery to rear spring fingerling Great Lakes Muskellunge. Also, subsamples of all production lots of fish from all six hatcheries were submitted for contaminant analysis. Analysis was performed by Michigan Department of Environmental Quality personnel. Findings were not available at the time this report was in preparation.

FISH HEALTH AND QUALITY FACILITIES

Fish Health and Quality facilities summaries for FY14 are included in the FY14 Production Analysis Report for Wolf Lake State Fish Hatchery.

FISH TRANSPORTATION UNIT

ADMINISTRATION

In FY14 the Fish Transportation Unit (FTU) budget allotment was $320,146. Total expenditures for the year were $244,758 leaving a final overall balance of $75,388 (23.54% under the budgeted allotment). The individual transportation budget subcomponents of overtime and travel were overspent by $481 (2.7%) and $222 (1.7%) respectively. Both VTS and CSS&M subcomponents however were underspent by $41,191 (27.5%) and $35,164 (25.3%) respectively which offset the overspending. Spending activity in FY14 was, in general, restricted to items legally mandated, safety related, preventative, or repairs deemed essential for operations.

In the last fiscal year, the FTU, by hours charged to the budget, was staffed by 0.7 FTEs. Fully staffed, the unit is comprised of a stocking biologist (0.7 FTE) and a diesel mechanic (1.0 FTE). The staff reduction from 1.7 FTE to the current 0.9 FTEs has significantly changed unit operations. The mechanic vacancy has reduced the unit's ability to perform preventive maintenance activity and has hindered the unit's ability to respond to mechanical breakdowns of various types and situations. Basic fleet maintenance activities have, by necessity, become more reactive and delayed in nature as compared to a preventive-type maintenance that was done with a staffed mechanic position. Maintenance activity has been reprioritized to these categories: as soon as possible, time permitting, or not currently being done. Any work on stocking vehicles is currently performed by hatchery maintenance staff, time permitting, or increasingly by a variety of private vendors. The mechanic provided some banked savings to the unit in terms of preventative work completed however it is apparent those savings have been used up based on the back log of work currently needing to be done.

Spending in the CSS&M category has been fairly consistent over the past several years but declined in FY14. The vacant diesel mechanic position and limited maintenance staff in hatcheries may have resulted in declined maintenance spending due to less preventative maintenance being done. Vehicle maintenance activities are currently limited to the known/reported mechanical issues and items identified during the annual federally mandated Department of Transportation vehicle inspections. It is highly desirable to hire a diesel mechanic as soon as possible to help reduce steadily increasing vendor expenses and to manage the stocking fleet more efficiently.

Vehicle and Travel Services expenditures appear to be up and down over the past five years but have remained fairly stable. The FY14 VTS expenditures appear to be down slightly from FY13. This is most likely the case because the expense of two stocking units (one new and one refurbished) were not fully integrated into fleet lease fees until FY15. Unit refurbishing has helped to significantly reduce VTS costs, or at least slowed the rate of increase, for the stocking fleet and will continue to play a role in fleet management for the foreseeable future.

Overtime expenses have remained fairly consistent over the past three fiscal years. Hopefully, this trend will continue going forward into FY15. There has been a concerted effort by hatchery staff to reduce or eliminate overtime by improving our driver's scheduling efficiency along with better fish inventory control techniques that help eliminate the need for additional stocking trips due to inventory overages (Table 56).

TABLE 56. Five-year comparison of fish transportation costs.

Item	2010	2011	2012	2013	2014
FTE	1.4	0.7	0.9	0.8	0.7
Wages	$129,980	$271,010	$343,285	$335,776	$320,717
CSS&M	$85,655	$136,648	$140,679	$136,651	$104,020
VTS	$116,606	$45,041	$117,201	$117,036	$108,809
Travel	$10,482	$14,065	$14,674	$14,681	$13,184
State workers	$0	$0	$0	$301	$0
Overtime	$14,661	$17,851	$19,732	$18,053	$18,481
Number stocked	10,099,297	15,778,502	18,857,551	22,266,668	22,056,227
kg stocked	319,873	300,972	337,389	320,101	341,455
Stocking miles	128,211	131,892	137,965	134,991	123,290
Number of trips	450	580	585	457	584
Stocking effort (hours)	3,066	3,100	3,473	3,140	5,984
Cost/kg	$1.12	$1.61	$1.88	$1.94	$1.66
Cost/mile	$2.79	$3.67	$4.61	$4.60	$4.58

FACILITIES AND EQUIPMENT

In February of FY14 the process of moving the heavy truck lift from the lower hatchery building to the Fish Transport Unit building was completed. After investigation and research, it was determined that the lift could be refurbished, repaired, and reinstalled at the new location in the transport building. The lift was repaired (small hydraulic oil leak) and both rusty lift planks were sand blasted and powder coated to eliminate and prevent future oxidation issues. The lift was inspected by Grand Traverse Crane Company and approved as safe to use, and an inspection certificate was issued. A physical paper file of pictures pertinent to the move and installation process will be housed at the Platte River State Fish Hatchery for future reference.

To complement and enhance the existing transport facility, a future parts storage room should be added to the west gable end of the FTU building. In rough terms, this addition should be 20 feet wide and extend 50 feet along the length of the west wall of the building. Progress on this suggested room will be reported if and when progress is made.

Any list of future projects would be incomplete without including dedicated stocking vehicle storage facilities located at each hatchery. Pole style storage buildings would provide protected storage, a location for vehicle disinfection, and a suitable location for maintaining the electrical charge on stocking vehicle batteries. The biggest obstacles to accomplishing this and other goals are existing workload, short staffing, and funding.

STOCKING UNITS

Transporting water and fish is expensive, and the need for efficiency and cost reduction measures are an ongoing operational mandate. One way to accomplish this task is to increase the hauling capacity of fish transport vehicles while carrying less water. In the future, as the roads and bridges allow it and it can be fit into the stocking program, the plan is to continue to incorporate larger capacity vehicles into the stocking vehicle fleet.

In the spring of 2012, SV1433 (3,200-gallon unit) was brought online and the process of determining the unit's carrying capacity was started. Overall, the new 3,200-gallon unit design performed very well in the first several years of use. However, as with any new unit and design, it was not without several minor issues that had to be resolved. Modifications that were needed were implemented prior to the spring 2014 stocking season and appear to have solved those issues. Cadillac Fabrication also installed four, six-inch, curbside emergency discharge ports. In a situation where the normal air-actuated valves under each 800-gallon tank failed, a significant number of fish would inevitably perish if they could not be off-loaded. The four new ports provide the unit driver an alternate method of off-loading fish, an increased level of comfort hauling large compartment loads, and a much-improved margin of safety for the fish.

In October 2014, construction on a second 3,200-gallon unit began. Construction progressed very well and the final outfitting, detailing, and graphics were completed on November 11 just before the end of the year. This new 3,200-gallon unit will replace SV1340 which was the last 750-gallon Manchester stocking unit in the fleet and will add significant carrying capacity to stocking fleet. A third 3,200-gallon unit is envisioned and will be incorporated into fleet operations some time in fiscal year 2016.

Fish stocking unit construction, operation, and maintenance are important and in specific instances, legally mandated each year (i.e. annual Michigan Department of Transportation inspections). The more significant Transportation Unit expenses for FY14 include regular diesel fuel and biodiesel B-20 fuel, emergency and routine vehicle maintenance and modifications, unit outfitting, tires, liquid oxygen equipment, Mackinaw Bridge tolls, Michigan Commercial Driver's License (CDL) training, and driver training. Commercial vendors provide the majority of the scheduled vehicle maintenance; however, hatchery maintenance staff provides the emergency assistance that keeps these units on the road during stressful stocking periods.

Given the constantly increasing cost to maintain the stocking vehicles, the need to report and track vehicle records has similarly increased. Since the diesel mechanic position was vacated, the process of tracking maintenance/repair information has been under review. The Keller ENCOMPASS™ computer program was put in place in FY13 and the ability to track and efficiently maintain vehicles has improved. The Keller ENCOMPASS™ program, while still under evaluation, appears to be filling a significant gap in fleet management capabilities.

The multi-year biodiesel fuel evaluation started in FY08 and continued in FY14. No specific fuel-related vehicle issues have arisen as a result of using soybean oil-based biofuel. Biofuel 20 (20% soybean oil content) and Biofuel 15 (15% soybean oil content) have proven to be a very adequate fuel and a convenient, timesaving on-site fueling option for drivers (Table 57). It is the intention of the FTU to continue using and evaluating Biofuel 20 during the spring of FY15.

TABLE 57. Five-year comparison of fuel usage and fuel costs for fish transportation.

Item	2010	2011	2012	2013	2014
Diesel					
Fuel used (gallons)	12,663	14,795	12,032	13,239	14,116
Total cost	$37,862	$53,201	$47,780	$54,085	$53,295
Average cost/gallon	$2.99	$3.60	$3.97	$4.09	$3.78
Biodiesel					
Fuel used (gallons)	4,373	1,933	0	4,248	3,677
Total cost	$12,911	$7,749	$0.00	$16,055	$13,840
Average cost/gallon	$2.95	$4.01	$0.00	$3.78	$3.76
Total fuel expense	$50,773	$60,950	$47,780	$70,140	$67,135
Cost savings using biodiesel	$163	-$797	$0.00	$1,299	$43

FISH DISTRIBUTION

Efforts to increase the number of fish transported and stocked per stocking trip has been a goal of interest for the FTU. The six large capacity vehicles including the four intermediate units, one semi replacement unit, and one 3,200-gallon straight unit illustrate their combined contribution and value to the fleet. In FY14, these six units were responsible for 29.8% of the total trips, 32.3% of the total miles, stocking 47.7% of the total number of fish and 54.9% of the total weight (182,113 kg) of fish stocked. In situations where they can be used efficiently, these six units accounted for over half of the total fish number stocked and just under half of the total fish weight stocked in FY14.

The other 12 smaller units including one 4X4 unit, one Manchester unit, three Cadillac units, and seven Peterson units accounted for hauling 52.3% of the total number of fish stocked and 45.1% (150,033 kg) of the total fish weight stocked (Table 58).

TABLE 58. Summary for fish transportation.

Vehicle number	Unit type	Number of trips	Distance (miles)	Total stocked	
				number	weight (kg)
SV1040	4X4	28	5,522	107,835	1,696.8
SV1340	Manchester	18	4,115	80,528	4,099.9
SV1342	Cadillac	33	9,131	767,162	14,931.7
SV1343	Cadillac	36	10,089	400,395	20,381.1
SV1344	Intermediate	16	5,200	212,064	10,728.3
SV1345	Intermediate	21	4,167	581,696	20,603.1
SV1346	Semi-replacement	23	7,718	1,530,465	38,697.1
SV1350	Petersen	21	4,660	321,895	13,000.3
SV1351	Petersen	21	6,210	144,894	10,518.0
SV1352	Petersen	34	8,996	1,087,766	17,834.2
SV1353	Petersen	19	6,140	157,244	12,553.7
SV1354	Petersen	15	4,952	346,230	8,411.0
SV1355	Petersen	27	5,668	627,005	16,205.7
SV1356	Intermediate	22	6,336	386,950	13,728.6
SV1357	Cadillac	23	5,797	262,018	12,351.2
SV1380	Petersen	26	6,868	265,364	18,049.9
SV1405	Intermediate	21	5,855	319,421	14,956.9
SV1433	3,200 gallons straight	25	8,037	1,141,297	84,099.0
NA	Other	155	7,829	13,315,998	8,608.6
Totals		584	123,290	22,056,227	341,455.1

A combination of various stocking events occur that do not use vehicles in the fleet. These can include the use of stocking tanks in pickup trucks, stocking tanks on trailers pulled by trucks, and fish transported in fry boxes in trucks/SUVs/trailers for stocking.

TRAINING AND SAFETY

As needed, the FTU assists MDNR employees with the process of obtaining Michigan CDLs. In this way, the training activities can be tailored to meet both driver and division needs. Commercial driver training is usually three to four days of class instruction, range activity, and monitored over-the-road driving practice. Over a period of many years this commercial driver training plan has produced safe commercial driver operators and has provided a good understanding of the rules of the road. As a requirement of his employment with the State of Michigan, Daniel Operhall, a new technician at Thompson State Fish Hatchery, completed the training and testing requirements for a Class B CDL with air brake and tank endorsement in July 2014 at Platte River State Fish Hatchery.

FY14 was a safe year for stocking fish in Michigan. Fisheries Division employees logged over 123,971 miles, stocking in a variety of driving conditions statewide and there were no reportable vehicle incidents in FY14.

FISH MARKING UNIT

ADMINISTRATION

The Fish Marking Unit budget allotment was $43,578 in FY14. Total Fish Marking Unit expenditures for the year were $17,212 leaving a final balance of $26,366 (60.5% under the budgeted allotment). The individual budget subcomponents of overtime, CSS&M, and state workers also underspent their budgeted amounts by 72.1, 30.2, and 86.0%, respectively.

Salary and wage expenses charged to the Fish Marking Unit budget decreased by 28% from FY13 to FY14. This decrease can be attributed to the Great Lakes Mass Marking Initiative that uses USFWS AutoFish System marking trailers. The use of the AutoFish System marking technology (automated fin clipping and decimal CWT injection) as part of the Michigan marking program reduces fish marking labor. As more species are marked using this technology, fish marking labor costs should continue to drop while concurrently marking larger numbers of fish in less time.

The subcategory of CSS&M was allotted $15,889 and was also underspent by 30.2% (or $4,798). Tag expenditures can be highly variable from year to year, depending on the number and size of the fish marking projects completed in a given fiscal year. In FY14, marking projects were completed using decimal CWTs purchased in previous years or tags left over from other completed projects. In FY14, these tags were used in the AutoFish System trailer to mark Atlantic Salmon and to manually tag steelhead for the index port study and Lake Sturgeon in the streamside hatcheries. As a result, significant savings were realized for the Fish Marking Unit budget. The most significant tag purchase in FY14 was for 5,200 PIT tags from Biomark™ Incorporated. The cost for these tags was $9,955. They were used to tag Great Lakes strain Muskellunge stocked in two broodstock lakes and Lake Sturgeon from several streamside hatcheries as part of rehabilitation projects.

Both VTS and travel categories were overspent in FY14. Due to the highly variable nature of Fish Marking Unit VTS and travel expenses, it is difficult to accurately budget for these two subcategories.

The state worker budget subcategory of $27,089 was underspent by 86% (or $23,281). A significant percentage of this budget was not used in FY14 due to the use of the USFWS AutoFish System trailer. The AutoFish System trailer functions very efficiently and only requires a minimal amount of state worker labor for its operation and has almost eliminated the need for additional state worker labor on large projects using this technology. Large salmonid mass marking projects (Atlantic Salmon, Chinook Salmon, and Lake Trout) still require some state worker labor for equipment setup and take down, moving/loading fish, and manually tagging fish that are either too large or too small for AutoFish System tagging machine capabilities. However, the amount of labor required for tagging all Chinook Salmon and Lake Trout has been significantly reduced since mass marking technology has been incorporated into the marking program. Determining the amount of state worker labor needed per marking project is an ongoing process. Given time, the actual labor requests will eventually realign with actual state worker use on these mass marking projects.

The budget subcategory of overtime was underspent by 70.1%. The percentage of dollars not spent is relatively insignificant because the allotment for the year is only $300. The amount budgeted for overtime was not needed to complete approved division marking projects in FY14 but should remain in place to cover project overtime, as needed, in future years.

In addition, a review of the total number of fish marked in FY14 reveals a significant reduction from the past four fiscal years. This, taken in conjunction with the labor reduction due to mass marking, would account for the overall reduction in Fish Marking Unit expenses for this past fiscal year. Current indications suggest this trend will continue into FY15 and beyond (Table 59).

TABLE 59. Five-year comparison of fish marking costs and marking data.

Item	2010	2011	2012	2013	2014
Wages	$38,354	$72,603	$62,103	$63,681	$45,891
CSS&M	$10,203	$9,915	$33,484	$20,212	$1,136
VTS	$332	$155	$586	$151	$354
Travel	$672	$340	$1,722	$1,235	$1,876
State workers	$28,194	$23,955	$16,877	$16,175	$3,808
Overtime	$250	$162	$199	$0	$84
Food–OTC	$9,420	$275	$0	$0	$0
Tag cost	$0	$20,856	$32,235	$23,139	$9,955
Total fish marked	8,677,643	11,749,583	19,182,151	10,126,621	3,454,485

FACILITIES AND EQUIPMENT

Major expenditures for the Fish Marking Unit included PIT tags (discussed above), electrical needs for the AutoFish System trailer, and the purchase of several uninterrupted power supplies to maintain power with the coded-wire-tagging equipment.

FISH MARKING PROJECTS

A total of 3,454,485 fish were marked in FY14. This represents a 66% reduction in the number of fish marked compared to FY13. This decrease can mostly be attributed to fewer Walleye fry being OTC-bath marked than had been done in previous years. There were also several studies that concluded in FY13, a Brown Trout strain comparison study, and a steelhead acclimation study that also reduced the total number of fish marked in FY14.

Decimal Coded-Wire Tag Projects

In FY14, just over 1.6 million fish were marked with decimal CWTs. These included Atlantic Salmon, Chinook Salmon, and Lake Trout to be stocked in lakes Michigan and Huron that were marked using the USFWS AutoFish System trailer, receiving both an adipose fin clip and decimal CWT.

Michigan strain steelhead were manually marked at Wolf Lake State Fish Hatchery with an adipose fin clip and decimal CWT for the index port study.

Fin Clipping Projects

In FY14 just over 72,000 fish were marked with fin clips. These included Atlantic Salmon at LSSU and Skamania strain steelhead at Bodine State Fish Hatchery, Indiana, that were manually fin clipped by university and Fisheries Division staff. Additionally, Chinook Salmon to be stocked in Lake Superior received an adipose fin clip only, using the AutoFish System trailer.

PIT Tagging Projects

In FY14, 3,500 fall fingerling Great Lakes strain Muskellunge were PIT tagged for two inland broodstock lakes.

Other Marking Projects

Several other marking projects were completed in FY14 including Walleye fry marked with OTC (bath) and Lake Sturgeon (streamside hatcheries) marked with decimal CWTs, fin clips, PIT tags, and various combinations of these.

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