

Technical Memorandum

Date: 9 July 2015 Project Number: 1937.01

To: Kimball Storedahl

From: Catherine Morello, Eric Jeanes, Dudley Reiser

Subject: CM-16 – Control of Non-native Predatory Fish: Completion of Year 5 Monitoring in Daybreak Ponds

cc: Randy Sweet

Introduction

Storedahl Property LLC owns and J.L. Storedahl & Sons, Inc. (Storedahl) operates a gravel processing plant in rural Clark County, Washington, near the East Fork Lewis River (EFLR). This site is known as the Daybreak Mine. The existing structural setting for the Daybreak Mine dates from 1968 and possibly earlier. In April 2002 Storedahl prepared a multi-species Habitat Conservation Plan (HCP) covering the (then) proposed expansion of Daybreak Gravel Mine and its existing operations. Among other things, the HCP was designed to ameliorate potential effects of river channel shift into the gravel mining pits and ponds. The HCP was approved by the National Marine Fisheries Service (NMFS) in early April 2004 and an Incidental Take Permit (ITP) issued on April 15, 2004 (Permit No. 1483). Under conditions outlined in the HCP, the ITP, and incorporated as Reasonable and Prudent Measures specified in the Biological Opinion (BO) associated with the ITP (NMFS 2004), periodic fish sampling of the Storedahl Mine Ponds to control non-native predatory fishes is required and has been described as Conservation Measure No. 16 (CM-16) in the HCP.

Justification and Permitting

Conservation Measures (CMs) were established in the Daybreak HCP in order to contribute to regional and local conservation efforts to protect and restore the eight covered species of fish¹ and their habitats. Specifically, CM-16 is designed to reduce the potential for predation by non-native fishes on the covered species in the East Fork Lewis River and Dean Creek. The measure as described in the HCP is as follows:

¹ Covered fish species in the HCP include: 1) steelhead (*Oncorhynchus mykiss*); 2) Chinook salmon (*O. tshawytscha*); 3) chum salmon (*O. keta*); 4) coho salmon (*O. kisutch*); 5) bull trout (*Salvelinus confluentus*); 6) Sea-run cutthroat trout (*O. clarki clarki*); 7) Pacific lamprey (*Lampetra tridentata*); and 8) River lamprey (*Lampetra ayresi*).

CM-16 Control of Non-native Predatory Fishes

The frequency of backwater flood flows from the East Fork Lewis River into Pond 5 will be reduced by reconfiguring the southern and western berms around Pond 5 and by installing a single outlet from Pond 5 for surface water. Concurrently, the quantity of existing and potential habitat available to non-native predatory fishes in the existing Daybreak ponds will be reduced by significantly narrowing ponds 1, 2, 3, and 4. Target harvests of non-native predatory fishes to reduce their numbers in the existing ponds will occur under the direction of WDFW warmwater fish biologists in years 5, 10, and 15 following implementation of covered activities and the issuance of any other required permits. Storedahl will install rock barriers to restrict movement of fish between the existing and created pond. Educational signs will be installed to warn the public about the dangers of releasing non-native fish species to the ponds and the adjacent stream and river.

R2 Resource Consultants, Inc. (R2) completed the Year 5 fisheries monitoring of non-native predatory fishes as outlined in CM-16 on behalf of Storedahl in April 2015. This Technical Memorandum (TM) describes the methods used and the results of the monitoring effort. The sampling was conducted in consultation with Jeffrey Fisher, SW Washington Branch Chief of NOAA-NMFS and Jim Byrne District Biologist with the Washington Department of Fish and Wildlife (WDFW). The sampling was covered under the federal ITP (Permit 1483). R2 applied for and received the necessary Washington State Scientific Collection Permit from the WDFW. The goal of reducing the non-native predator population was accomplished with the removal of a total of 55 largemouth bass (*Micropterus salmoides*) (200 mm or greater) from the ponds, as well other smaller bass and non-native species as described in the sections below.

Existing Conditions

Previous gravel mining operations at the Daybreak site have resulted in the formation of five off channel ponds (Figures 1 and 2). Historically, these ponds would overflow into Dean Creek, a nearby tributary. Conservation Measure 4 (CM-04) of the HCP required a change in management of discharge water from Pond 5 in order to provide seasonal water quality benefits to Dean Creek. Surface outflow from Pond 5, the main pond, was required to be restricted to a single location and controlled by installation of a gravity-fed outlet structure at the northwest corner of Pond 5. Use of the controlled pond levels and the single release point will direct pond discharge directly to Dean Creek during the fall, winter and spring. During the warmer summer months, cooler water can be pumped from Pond 5 to augment flow in Dean Creek as needed.



Recent sampling efforts in Pond 5 (R2 2013) identified one native Olympic mudminnow (*Novumbra hubbsi*), and four non-native fish species, which included largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), brown bullhead (*Ameiurus nebulosus*) and miscellaneous sculpin species. Further analysis of the photographs taken of the mudminnow indicated that this fish was most likely a banded killifish (*Fundulus diaphanous*). Banded killifish are not native to western Washington, but are commonly found in the Lewis River area (pers. comm. J. Byrne WDFW).

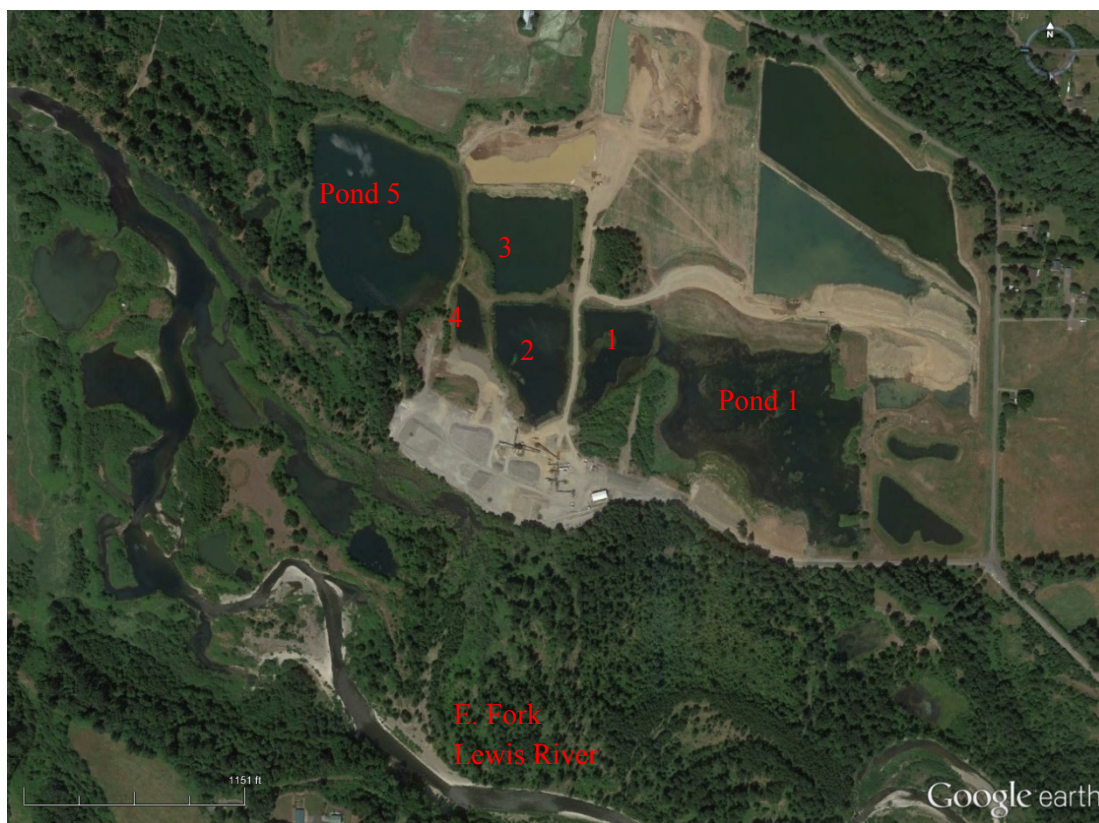


Figure 2. Daybreak Mine ponds, La Center, Washington 2015. Prepared with Google Maps, image date 14 July 2014.

In addition, the mainstem EFLR supports five anadromous fish species, including: Chinook (*Oncorhynchus tshawytscha*), coho (*O. kisutch*) and chum (*O. keta*) salmon; steelhead (*O. mykiss*) and sea-run cutthroat trout (*O. clarkii*). Bull trout are also present in the Lewis River, but are not believed to be present in the EFLR (Sweet et al. 2004). However, significant or long-term presence of these anadromous species in the Daybreak ponds is unlikely due to the poor water quality present during summer months. Previous monitoring of the ponds in 2012 found only warmwater species (R2 2013).

Methodology

Under the provisions outlined in CM-16, R2 coordinated with WDFW warmwater fish biologists to develop and implement a selective harvest plan for largemouth bass and other non-native predator species in the Daybreak Ponds. This targeted harvest is stipulated to occur in years 5, 10 and 15 of the HCP in an effort to reduce predator abundance and potential predation on the covered species. The April 2015 sampling of the ponds represented the Year 5 effort. Targeted

minnow trapping, electrofishing and gillnetting were used to reduce the number of largemouth bass in the existing ponds. Minnow trapping was the first sampling methodology applied and was used to identify the possible presence of juvenile salmonids prior to electrofishing or gill netting. Fish of sufficient size to feed on juvenile salmonids were targeted in the sampling effort, however all life stages were sampled. The sampling of Daybreak Ponds 1-5 occurred during 20-24 April 2015.

Minnow Trapping

Minnow traps were the first sampling protocol performed in each pond, along with a water quality and visual survey of the overall pond conditions. Nineteen gee-type traps were used in the ponds. The traps were constructed of 1/4" (6.4 mm) square galvanized wire mesh and measured 16 inches (42 cm) long and 9 inches (23 cm) wide with a 1 inch (25 mm) entrance hole. These traps were generally set in water depths ranging from 1.0 to 4.0 ft. The traps were baited with commercial salmon eggs prior to deployment. Traps were left to soak overnight and checked for catch the following morning. Minnow traps were set at intervals around the shorelines of all five ponds.

Electrofishing

A barge-based electrofishing system was used to sample the perimeter of all five ponds. The barge-based system consisted of a Coffelt VVP-15 electrofishing unit powered by a 5000 W, 240-Volt AC gasoline powered generator mounted in a 16 foot Jon boat. The electrofisher was operated in a straight DC configuration with settings consistent with guidelines established by the WDFW (Temple and Pearsons 2008). A mobile electrode system (Vincent 1971) using two 30 cm stainless steel balls suspended from booms as cathodes and a 24 cm aluminum anode attached to an electrical cable was used to produce straight DC voltages and electrotaxis. Fish were captured in a knotless nylon dipnet and placed in an electrically isolated live car that was carried in the barge. Two trained R2 biologists operated the barge-based system. Captured native fish including largescale suckers (*Catostomus macrocheilus*) and sculpin species were immediately released away from the sampling area. All other fish were placed in a cooler with a light MS-222 solution for holding.

Gill Netting

Gill nets were set in ponds 1, 2 and 5. The gill nets measured 120 feet long and 6 feet deep. Rather than being made of a single mesh size, the nets were made of an experimental or 'test' mesh varying from .75 inches to 3.0 inches in size. Four nets were set in Pond 5 (Figure 2). One net was set in each Pond 1 and Pond 2. No nets were set in Ponds 3 or 4 due to the dense

vegetation and shallow depth of the ponds. Nets were checked in the evening and then left to soak overnight. The nets were then removed the following day. Native fish were released and all other fish were placed in a cooler with an MS-222 solution.

Fish Handling

After electrofishing, trapping or gill netting, all non-native captured fish were placed into darkened recovery units with a light dose of MS-222. The catch was again inspected for the presence of native fish that were not released at the time of capture. Native fish (sculpin and sucker species) were returned back into the ponds. All non-native fish were euthanized with an overdose of MS-222 measured and disposed of (buried) upland from the ponds.

Efforts to Minimize Injury to Non-target Fish

Efforts were taken during the sampling to minimize any adverse effects on juvenile salmonids and other native species. Although juvenile salmonids were not expected in the study area, the areas were visually assessed for salmonid presence and minnow traps were set and inspected, prior to electrofishing and gill netting. The areas sampled in this study are lentic (lake like and unmoving) and require briefer periods of electrical current for sampling. This enabled quicker fish capture and removal from the electrical field. Stress, rather than shocking, has been correlated to the reduced survival of juvenile salmonids exposed to electrofishing (Nielsen 1998). Handling of all non-target fish processed as part of this sampling effort was minimized, thereby reducing potential stress to the animals. Only experienced individuals properly trained in the use of electrofishing equipment performed the surveys. R2 personnel are experienced in electrofishing for juvenile salmonids in local rivers, including the Storedahl ponds, and have encountered low unintentional injury and/or mortality rates (R2 2006).

Water Quality

A calibrated Quanta backpack style four-in-one water quality meter was used to sample the water quality in each pond prior to sampling. The parameters measured included water temperature, dissolved oxygen, conductivity and pH. Water quality was sampled in the open-water (vegetation free) and deeper areas of the ponds. Readings were taken in a graduated profile from the surface to the bottom of each pond.

Fish Sampling Results

Fish species captured during the 2015 Daybreak pond sampling included in order of dominance: bluegill (*Lepomis macrochirus*), largemouth bass (*Micropterus salmoides*), yellow perch (*Perca flavescens*), misc. sculpin (*Cottidae sp.*), brown bullhead (*Ameiurus nebulosus*), banded killifish

(*Fundulus diaphanous*), largescale sucker (*Catostomus macrocheilus*), northern pikeminnow (*Ptychocheilus oregonensis*) and one coho salmon (*Oncorhynchus kisutch*) (Table 1).

Representative fish photographs are included at the end of this report. Other aquatic species observed/captured included various species of tadpoles, crawfish, frogs and turtles.

A total of 480 individual fish were caught during the five day sampling effort; with 461 of those fish removed from the ponds (Table 1). Final disposition of the fish varied according to their origin and condition upon capture. Fish species that were targeted for removal included brown bull head, bluegill, killifish, largemouth bass and yellow perch regardless of size. Fish species that were returned to the ponds included sculpin species and largescale suckers regardless of size. Average length of captured fish ranged from 48.6 mm (sculpin spp.) to 600.0 mm (largescale sucker) (Table 2). Largescale suckers were the largest species on average captured. Larger sized fish were captured via gill netting than electrofishing or in minnow traps. All sizes of largemouth bass were captured and removed ranging from young juveniles (40 mm) through spawning size adult fish (560 mm).

Table 1. Total fish catch and disposition after capture during sampling of the Daybreak Mine ponds near the East Fork Lewis River, Washington, 2015.

Fish species (native/non-native status) and disposition after capture (removed/returned)										
Method/ Pond	Brown Bullhead Non-native Removed	Bluegill Non- native Removed	Banded Killifish Non-native Removed	Largemouth Bass Non-native Removed	Yellow Perch Non-native Removed	Coho Native Removed (deceased)	Northern Pikeminnow Native Removed (deceased)	Misc. Sculpin Native Returned	Largescale Sucker Native Returned	Total
Minnow trapping										
1		7						1		8
2		2			4			1		7
3		2								2
4		7								7
5		7								7
Electrofishing										
1	4	43		18	7					72
2	2	65		14	31			3	2	117
3	5	25		12	9			7		58
4	2	44	6	11	1					64
5	1	59		28	7			3		98
Gill netting										
1									2	2
2										0
5				34	2	1	1			38
Total	14	261	6	117	61	1	1	15	4	480

Table 2. Average length (Total Length - mm) of different species of fish captured during sampling of the Daybreak Mine ponds near the East Fork Lewis River, Washington, 2015.

	Brown Bullhead	Bluegill	Banded Killifish	Largemouth Bass	Yellow Perch	Coho	Northern Pikeminnow	Misc. Sculpin	Largescale Sucker	Total
Minnow trapping		40.0				58.5		52.5		43.2
Electrofishing	176.9	58.2	74.8	184.7	98.4			48.0	575.0	95.8
Gill netting				296.3	182.5	260.0	500.0		625.0	311.3
Total	176.9	56.4	74.8	217.1	98.5	260.0	500.0	48.6	600.0	110.3

Minnow Trapping

A total of 31 fish were captured with minnow traps in the ponds (Table 3). No native species (other than sculpin) were observed in minnow traps, or visually in any pond. The most numerous species captured was bluegill (n=25). Yellow perch (n=4) and miscellaneous sculpin species (n=2) were also captured in the traps. The largest fish in the minnow traps, a bluegill, measured 72 mm. The greatest average catch per trap was in Pond 4, measuring 1.2 fish per trap. Pond 4 provided a large amount of shallow, vegetated area that was suitable for young and/or small fish that were easily captured in minnow traps. Pond 3 had the lowest average catch per trap (0.3 fish per trap). All bluegill and yellow perch captured in the minnow traps were removed from the ponds and all miscellaneous sculpin were returned to the ponds.

Table 3. Number of fish captured in minnow traps by pond and species, Daybreak Mine ponds, 2015.

Pond #	No. of Traps	Bluegill	Yellow Perch	Misc. Sculpin	Total
1	19	7		1	8
2	13	2	4	1	7
3	8	2			2
4	6	7			7
5	11	7			7
Total		25	4	2	31

Electrofishing

A total of 409 fish were captured in the Daybreak ponds by electrofishing (Table 4). The largest fish captured was a largescale sucker measuring 600 mm total length (TL); the largest largemouth bass measured 510 mm TL. Pond 2 had the highest electrofishing catch with a total of 117 fish. Killifish were only captured in Pond 4, which was a shallow pond with a large amount of vegetative cover providing good habitat for smaller fish. The two largescale suckers and the miscellaneous sculpins that were captured were returned to the ponds, all other fish were removed.

Table 4. Number of fish captured by electrofishing by pond and species, Daybreak Mine ponds, 2015.

Pond #	Brown Bullhead	Bluegill	Banded Killifish	Largemouth Bass	Yellow Perch	Misc. Sculpin	Largescale Sucker	Total
1	4	43		18	7			72
2	2	65		14	31	3	2	117
3	5	25		12	9	7		58
4	2	44	6	11	1			64
5	1	59		28	7	3		98
Total	14	236	6	83	55	13	2	407

Note: Largescale suckers and the miscellaneous sculpin were released back to the ponds, all other fish were removed.

Gill Netting

A total of 40 fish were captured in the gill net sets in the Daybreak ponds, with the highest catch in Pond 5, totaling 38 fish. Pond 5 is the largest pond and correspondingly had the most gill net sets (Table 5). No fish were captured in Pond 2. No gill nets were set in ponds 3 or 4. Two largescale suckers were captured in Pond 1 and were released alive back into the pond. All other fish were deceased when the nets were checked (coho and pikeminnow) or were removed (bass and perch).

Table 5. Number of fish captured in gill nets by pond and by species in the Daybreak Mine ponds, 2015.

Pond #	# Net Sets	Largemouth Bass	Yellow Perch	Coho	Northern Pikeminnow	Largescale Sucker	Total
1	1					2	2
2	1						0
5	4	34	2	1	1		38
Total		34	2	1	1	2	40

Note: Largescale suckers were released back into the pond after capture, all other fish were removed.

Water Quality

Water quality parameters including temperature, dissolved oxygen, pH and conductivity were measured near the deepest point of each pond (Table 6). Pond temperatures ranged from 13.2°C to 17.8°C. Dissolved oxygen levels in the ponds were well within the range suitable for salmonids with the exception of the bottom of Pond 1, where DO measured 1.05 mg/L.

Table 6. Water quality parameters measured in the Daybreak Mine ponds, April 20-24, 2015.

Pond #	Depth (ft)	Temp (C)	Conductivity (mS/cm)	DO (mg/l)	pH
1	0	14.7	0.107	9.76	7.66
1	1	14.7	0.107	9.44	7.56
1	4	14.7	0.108	8.28	7.22
1	7	14.6	0.115	1.05	7.02
2	0	16.2	0.106	10.8	8.86
2	2	16.2	0.106	10.8	8.81
2	4	16.1	0.105	10.21	8.66
2	6	16.0	0.105	9.77	8.49
3	0	16.5	0.108	10.82	7.74
3	2	16.3	0.108	11.01	7.58
3	5	14.9	0.11	11.31	7.40
3	8	14.2	0.111	10.45	7.31
3	11	13.5	0.113	9.38	7.21
3	14	13.2	0.112	7.82	7.42
4	0	16.1	0.086	11.43	10.08
4	1	16.1	0.087	11.37	10.07
4	3	16.1	0.087	11.41	10.06
4	5	16.1	0.086	10.66	10.00
5	0	17.8	0.107	10.75	8.84
5	3	16.9	0.106	11.77	8.94
5	6	16.4	0.106	11.46	8.92
5	9	15.2	0.105	12.18	9.00
5	12	14.8	0.105	12.28	8.97
5	15	14.12	0.105	10.94	8.51

Conclusions

The removal methods used during the April 20-24, 2015 sampling were intended to reduce the numbers of non-native predatory fishes from the Daybreak ponds. The effort concentrated on largemouth bass as they represent the largest potential predatory risk to salmonids. Overall, the sampling effort resulted in the removal of a total of 55 largemouth bass (200 mm or greater) from the ponds. The majority of these fish (approximately 30-40) were gravid females that were prone to capture on their nests during the April spawning period. The majority of these females (estimated 15-20) were taken from Pond 5. An adult pikeminnow and several larger yellow perch and bluegill were also removed from the ponds. While the pikeminnow is a native predator in Washington and as such was not specifically targeted for removal, it did not survive gill netting and was disposed of with the non-native fish.

The reduction in the non-native largemouth bass population and other non-native predatory fishes from the ponds that was achieved through this sampling effort should reduce the predatory risk to native fish species that may occur in the pond. In addition, the reduction in the bass population reduces the number of bass that could potentially leave the ponds (due to an extreme flood event) and enter the East Fork Lewis River.

In terms of gear effectiveness, gill netting was found to be the most successful adult fish removal technique in Pond 5. Although electrofishing was effective in other ponds, the greater depth of Pond 5 rendered it less conducive to capturing larger fish. A single yearling coho (260 mm) was the only salmonid captured during the sampling effort. This fish was caught by gill net in Pond 5 and was likely flushed into the pond as a fry during a high flow event and overwintered there. The coho did not survive the gill netting and was disposed of with the non-native predator fish. Pond 5 is the pond most likely to become connected to Dean Creek under high water conditions. Coho fry (50-60 mm) were observed in nearby shallow river overflow areas (Ridgefield Pits), but not in the Daybreak Ponds.

Of note is that Pond 4 appears to contain a population of banded killifish. Six fish were captured and other fish were visually observed in the shallow water. These fish are native to the east coast of the United States (Wydoski and Whitney 2003). Banded killifish generally remain in shallow water (usually less than 1 foot in depth), and so may not be a common prey item for larger bass. Banded killifish are extremely hardy and can live in wet vegetation for several days without access to water (Wydoski and Whitney 2003).

References

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PHOTOGRAPHS



Photo 1. Pikeminnow (top) and two largemouth bass from the Daybreak Ponds, April 2015.



Photo 2. Coho salmon (deceased) captured in a gill net from the Daybreak Ponds, April 2015.



Photo 3. Yellow perch captured from the Daybreak Ponds, April 2015.



Photo 4. Banded killifish captured from the Daybreak Ponds (Pond 4), April 2015.



Photo 5. Bluegill, killifish, bullhead, largemouth bass, yellow perch and juvenile largemouth bass captured from the Daybreak Ponds, April 2015.

APPENDIX A

Pond	Method	Set/ trap	Species	Length (mm)	Disposition	Pond	Method	Set/ trap	Species	Length (mm)	Disposition
1	electro	all	b. bullhead	220	removed	1	electro	all	bluegill	50	removed
1	electro	all	b. bullhead	305	removed	1	electro	all	bluegill	40	removed
1	electro	all	b. bullhead	280	removed	1	electro	all	bluegill	45	removed
1	electro	all	b. bullhead	210	removed	1	electro	all	bluegill	50	removed
1	electro	all	bluegill	130	removed	1	electro	all	bluegill	40	removed
1	electro	all	bluegill	35	removed	1	electro	all	bluegill	45	removed
1	electro	all	bluegill	30	removed	1	electro	all	bluegill	50	removed
1	electro	all	bluegill	75	removed	1	electro	all	bluegill	40	removed
1	electro	all	bluegill	150	removed	1	electro	all	bluegill	45	removed
1	electro	all	bluegill	165	removed	1	electro	all	bluegill	50	removed
1	electro	all	bluegill	85	removed	1	electro	all	bluegill	40	removed
1	electro	all	bluegill	75	removed	1	electro	all	bluegill	45	removed
1	electro	all	bluegill	80	removed	1	electro	all	bluegill	50	removed
1	electro	all	bluegill	150	removed	1	electro	all	bluegill	40	removed
1	electro	all	bluegill	89	removed	1	electro	all	bluegill	45	removed
1	electro	all	bluegill	62	removed	1	electro	all	bluegill	50	removed
1	electro	all	bluegill	60	removed	1	electro	all	bluegill	40	removed
1	electro	all	bluegill	40	removed	1	electro	all	bluegill	45	removed
1	electro	all	bluegill	45	removed	1	electro	all	bluegill	50	removed
1	electro	all	bluegill	50	removed	1	electro	all	bluegill	40	removed
1	electro	all	bluegill	40	removed	1	electro	all	bluegill	45	removed
1	electro	all	bluegill	45	removed	1	electro	all	bluegill	50	removed
1	electro	all	bluegill	50	removed	1	electro	all	bluegill	40	removed
1	electro	all	bluegill	40	removed	1	electro	all	bluegill	45	removed
1	electro	all	bluegill	45	removed	1	electro	all	bluegill	50	removed
1	electro	all	bluegill	50	removed	1	electro	all	largemouth	460	removed
1	electro	all	bluegill	40	removed	1	electro	all	largemouth	450	removed
1	electro	all	bluegill	45	removed	1	electro	all	largemouth	390	removed

Pond	Method	Set/ trap	Species	Length (mm)	Disposition	Pond	Method	Set/ trap	Species	Length (mm)	Disposition
1	electro	all	largemouth	205	removed	1	minnow	17	bluegill	35	removed
1	electro	all	largemouth	260	removed	1	minnow	5	bluegill	42	removed
1	electro	all	largemouth	195	removed	1	minnow	5	bluegill	51	removed
1	electro	all	largemouth	180	removed	1	minnow	6	bluegill	40	removed
1	electro	all	largemouth	175	removed	1	minnow	13	bluegill	45	removed
1	electro	all	largemouth	160	removed	1	minnow	10	bluegill	55	removed
1	electro	all	largemouth	90	removed	1	minnow	4	empty		
1	electro	all	largemouth	85	removed	1	minnow	1	empty		
1	electro	all	largemouth	70	removed	1	minnow	9	empty		
1	electro	all	largemouth	60	removed	1	minnow	12	empty		
1	electro	all	largemouth	200	removed	1	minnow	19	empty		
1	electro	all	largemouth	160	removed	1	minnow	7	empty		
1	electro	all	largemouth	50	removed	1	minnow	2	empty		
1	electro	all	largemouth	65	removed	1	minnow	16	empty		
1	electro	all	largemouth	70	removed	1	minnow	11	empty		
1	electro	all	y. perch	125	removed	1	minnow	15	empty		
1	electro	all	y. perch	85	removed	1	minnow	8	empty		
1	electro	all	y. perch	150	removed	1	minnow	3	empty		
1	electro	all	y. perch	92	removed	1	minnow	14	empty		
1	electro	all	y. perch	83	removed	1	minnow	18	sculpin	65	returned
1	electro	all	y. perch	80	removed						
1	electro	all	y. perch	81	removed						
1	gill	1	sucker	650	returned						
1	gill	1	sucker	600	returned						

Pond	Method	Set/ trap	Species	Length (mm)	Disposition
2	electro	all	b. bullhead	42	removed
2	electro	all	b. bullhead	80	removed
2	electro	all	bluegill	35	removed
2	electro	all	bluegill	83	removed
2	electro	all	bluegill	85	removed
2	electro	all	bluegill	45	removed
2	electro	all	bluegill	40	removed
2	electro	all	bluegill	83	removed
2	electro	all	bluegill	87	removed
2	electro	all	bluegill	74	removed
2	electro	all	bluegill	79	removed
2	electro	all	bluegill	63	removed
2	electro	all	bluegill	72	removed
2	electro	all	bluegill	70	removed
2	electro	all	bluegill	45	removed
2	electro	all	bluegill	110	removed
2	electro	all	bluegill	100	removed
2	electro	all	bluegill	73	removed
2	electro	all	bluegill	65	removed
2	electro	all	bluegill	32	removed
2	electro	all	bluegill	62	removed
2	electro	all	bluegill	68	removed
2	electro	all	bluegill	87	removed
2	electro	all	bluegill	81	removed
2	electro	all	bluegill	45	removed

Pond	Method	Set/ trap	Species	Length (mm)	Disposition
2	electro	all	bluegill	40	removed
2	electro	all	bluegill	40	removed
2	electro	all	bluegill	63	removed
2	electro	all	bluegill	42	removed
2	electro	all	bluegill	61	removed
2	electro	all	bluegill	73	removed
2	electro	all	bluegill	78	removed
2	electro	all	bluegill	71	removed
2	electro	all	bluegill	42	removed
2	electro	all	bluegill	68	removed
2	electro	all	bluegill	91	removed
2	electro	all	bluegill	163	removed
2	electro	all	bluegill	73	removed
2	electro	all	bluegill	42	removed
2	electro	all	bluegill	46	removed
2	electro	all	bluegill	43	removed
2	electro	all	bluegill	40	removed
2	electro	all	bluegill	51	removed
2	electro	all	bluegill	55	removed
2	electro	all	bluegill	103	removed
2	electro	all	bluegill	72	removed
2	electro	all	bluegill	60	removed
2	electro	all	bluegill	52	removed
2	electro	all	bluegill	98	removed
2	electro	all	bluegill	31	removed

Pond	Method	Set/ trap	Species	Length (mm)	Disposition
2	electro	all	bluegill	42	removed
2	electro	all	bluegill	73	removed
2	electro	all	bluegill	81	removed
2	electro	all	bluegill	71	removed
2	electro	all	bluegill	63	removed
2	electro	all	bluegill	41	removed
2	electro	all	bluegill	51	removed
2	electro	all	bluegill	62	removed
2	electro	all	bluegill	61	removed
2	electro	all	bluegill	57	removed
2	electro	all	bluegill	60	removed
2	electro	all	bluegill	52	removed
2	electro	all	bluegill	63	removed
2	electro	all	bluegill	44	removed
2	electro	all	bluegill	42	removed
2	electro	all	bluegill	35	removed
2	electro	all	bluegill	37	removed
2	electro	all	largemouth	450	removed
2	electro	all	largemouth	510	removed
2	electro	all	largemouth	460	removed
2	electro	all	largemouth	435	removed
2	electro	all	largemouth	380	removed
2	electro	all	largemouth	230	removed
2	electro	all	largemouth	220	removed
2	electro	all	largemouth	225	removed

Pond	Method	Set/ trap	Species	Length (mm)	Disposition
2	electro	all	largemouth	290	removed
2	electro	all	largemouth	228	removed
2	electro	all	largemouth	65	removed
2	electro	all	largemouth	60	removed
2	electro	all	largemouth	60	removed
2	electro	all	largemouth	50	removed
2	electro	all	sculpin	60	returned
2	electro	all	sculpin	73	returned
2	electro	all	sculpin	39	returned
2	electro	all	sucker	550	returned
2	electro	all	sucker	600	returned
2	electro	all	y. perch	225	removed
2	electro	all	y. perch	155	removed
2	electro	all	y. perch	150	removed
2	electro	all	y. perch	163	removed
2	electro	all	y. perch	151	removed
2	electro	all	y. perch	185	removed
2	electro	all	y. perch	135	removed
2	electro	all	y. perch	140	removed
2	electro	all	y. perch	110	removed
2	electro	all	y. perch	105	removed
2	electro	all	y. perch	110	removed
2	electro	all	y. perch	118	removed
2	electro	all	y. perch	90	removed
2	electro	all	y. perch	95	removed

Pond	Method	Set/ trap	Species	Length (mm)	Disposition	Pond	Method	Set/ trap	Species	Length (mm)	Disposition
2	electro	all	y. perch	83	removed	2	gill	1	empty		
2	electro	all	y. perch	75	removed						
2	electro	all	y. perch	77	removed	2	minnow	10	bluegill	32	removed
2	electro	all	y. perch	78	removed	2	minnow	10	bluegill	33	removed
2	electro	all	y. perch	80	removed	2	minnow	6	empty		
2	electro	all	y. perch	85	removed	2	minnow	19	empty		
2	electro	all	y. perch	110	removed	2	minnow	13	empty		
2	electro	all	y. perch	82	removed	2	minnow	15	empty		
2	electro	all	y. perch	86	removed	2	minnow	1	empty		
2	electro	all	y. perch	84	removed	2	minnow	17	empty		
2	electro	all	y. perch	60	removed	2	minnow	16	empty		
2	electro	all	y. perch	71	removed	2	minnow	8	empty		
2	electro	all	y. perch	49	removed	2	minnow	10	sculpin	40	returned
2	electro	all	y. perch	85	removed	2	minnow	5	y. perch	60	removed
2	electro	all	y. perch	86	removed	2	minnow	2	y. perch	57	removed
2	electro	all	y. perch	90	removed	2	minnow	7	y. perch	57	removed
2	electro	all	y. perch	83	removed	2	minnow	10	y. perch	60	removed

Pond	Method	Set/ trap	Species	Length (mm)	Disposition
3	electro	all	b. bullhead	260	removed
3	electro	all	b. bullhead	103	removed
3	electro	all	b. bullhead	180	removed
3	electro	all	b. bullhead	173	removed
3	electro	all	b. bullhead	124	removed
3	electro	all	bluegill	105	removed
3	electro	all	bluegill	114	removed
3	electro	all	bluegill	130	removed
3	electro	all	bluegill	108	removed
3	electro	all	bluegill	140	removed
3	electro	all	bluegill	100	removed
3	electro	all	bluegill	100	removed
3	electro	all	bluegill	97	removed
3	electro	all	bluegill	90	removed
3	electro	all	bluegill	104	removed
3	electro	all	bluegill	99	removed
3	electro	all	bluegill	87	removed
3	electro	all	bluegill	62	removed
3	electro	all	bluegill	60	removed
3	electro	all	bluegill	80	removed
3	electro	all	bluegill	73	removed
3	electro	all	bluegill	71	removed
3	electro	all	bluegill	80	removed
3	electro	all	bluegill	40	removed
3	electro	all	bluegill	41	removed

Pond	Method	Set/ trap	Species	Length (mm)	Disposition
3	electro	all	bluegill	47	removed
3	electro	all	bluegill	43	removed
3	electro	all	bluegill	51	removed
3	electro	all	bluegill	40	removed
3	electro	all	bluegill	27	removed
3	electro	all	largemouth	210	removed
3	electro	all	largemouth	200	removed
3	electro	all	largemouth	165	removed
3	electro	all	largemouth	172	removed
3	electro	all	largemouth	101	removed
3	electro	all	largemouth	138	removed
3	electro	all	largemouth	200	removed
3	electro	all	largemouth	80	removed
3	electro	all	largemouth	60	removed
3	electro	all	largemouth	55	removed
3	electro	all	largemouth	71	removed
3	electro	all	largemouth	65	removed
3	electro	all	sculpin	41	returned
3	electro	all	sculpin	46	returned
3	electro	all	sculpin	42	returned
3	electro	all	sculpin	41	returned
3	electro	all	sculpin	45	returned
3	electro	all	sculpin	47	returned
3	electro	all	sculpin	52	returned
3	electro	all	y. perch	98	removed

Pond	Method	Set/ trap	Species	Length (mm)	Disposition
3	electro	all	y. perch	86	removed
3	electro	all	y. perch	81	removed
3	electro	all	y. perch	70	removed
3	electro	all	y. perch	78	removed
3	electro	all	y. perch	84	removed
3	electro	all	y. perch	73	removed
3	electro	all	y. perch	75	removed
3	electro	all	y. perch	67	removed
3	minnow	8	bluegill	72	removed
3	minnow	8	bluegill	42	removed
3	minnow	1	empty		
3	minnow	2	empty		
3	minnow	3	empty		
3	minnow	4	empty		
3	minnow	5	empty		
3	minnow	6	empty		
3	minnow	7	empty		

Pond	Method	Set/ trap	Species	Length (mm)	Disposition
4	electro	all	b. bullhead	80	removed
4	electro	all	b. bullhead	145	removed
4	electro	all	bluegill	40	removed
4	electro	all	bluegill	45	removed
4	electro	all	bluegill	50	removed
4	electro	all	bluegill	55	removed
4	electro	all	bluegill	60	removed
4	electro	all	bluegill	40	removed
4	electro	all	bluegill	45	removed
4	electro	all	bluegill	50	removed
4	electro	all	bluegill	55	removed
4	electro	all	bluegill	60	removed
4	electro	all	bluegill	45	removed
4	electro	all	bluegill	50	removed
4	electro	all	bluegill	40	removed
4	electro	all	bluegill	35	removed
4	electro	all	bluegill	32	removed
4	electro	all	bluegill	35	removed
4	electro	all	bluegill	37	removed
4	electro	all	bluegill	39	removed
4	electro	all	bluegill	67	removed
4	electro	all	bluegill	150	removed
4	electro	all	bluegill	41	removed
4	electro	all	bluegill	46	removed
4	electro	all	bluegill	64	removed

Pond	Method	Set/ trap	Species	Length (mm)	Disposition
4	electro	all	bluegill	32	removed
4	electro	all	bluegill	40	removed
4	electro	all	bluegill	68	removed
4	electro	all	bluegill	70	removed
4	electro	all	bluegill	114	removed
4	electro	all	bluegill	73	removed
4	electro	all	bluegill	75	removed
4	electro	all	bluegill	132	removed
4	electro	all	bluegill	44	removed
4	electro	all	bluegill	105	removed
4	electro	all	bluegill	93	removed
4	electro	all	bluegill	82	removed
4	electro	all	bluegill	63	removed
4	electro	all	bluegill	112	removed
4	electro	all	bluegill	31	removed
4	electro	all	bluegill	37	removed
4	electro	all	bluegill	51	removed
4	electro	all	bluegill	70	removed
4	electro	all	bluegill	73	removed
4	electro	all	bluegill	70	removed
4	electro	all	bluegill	132	removed
4	electro	all	killifish	82	removed
4	electro	all	killifish	75	removed
4	electro	all	killifish	61	removed
4	electro	all	killifish	74	removed

Pond	Method	Set/ trap	Species	Length (mm)	Disposition
4	electro	all	killifish	85	removed
4	electro	all	killifish	72	removed
4	electro	all	largemouth	210	removed
4	electro	all	largemouth	71	removed
4	electro	all	largemouth	65	removed
4	electro	all	largemouth	41	removed
4	electro	all	largemouth	218	removed
4	electro	all	largemouth	130	removed
4	electro	all	largemouth	290	removed
4	electro	all	largemouth	225	removed
4	electro	all	largemouth	63	removed
4	electro	all	largemouth	190	removed
4	electro	all	largemouth	47	removed
4	electro	all	y. perch	100	removed
4	minnow	3	bluegill	25	removed
4	minnow	3	bluegill	27	removed
4	minnow	4	bluegill	27	removed
4	minnow	9	bluegill	45	removed
4	minnow	9	bluegill	50	removed
4	minnow	11	bluegill	35	removed
4	minnow	11	bluegill	30	removed
4	minnow	18	empty		
4	minnow	14	empty		

Pond	Method	Set/ trap	Species	Length (mm)	Disposition
5	electro	all	b. bullhead	275	removed
5	electro	all	bluegill	104	removed
5	electro	all	bluegill	102	removed
5	electro	all	bluegill	55	removed
5	electro	all	bluegill	52	removed
5	electro	all	bluegill	58	removed
5	electro	all	bluegill	61	removed
5	electro	all	bluegill	73	removed
5	electro	all	bluegill	64	removed
5	electro	all	bluegill	70	removed
5	electro	all	bluegill	55	removed
5	electro	all	bluegill	62	removed
5	electro	all	bluegill	68	removed
5	electro	all	bluegill	25	removed
5	electro	all	bluegill	30	removed
5	electro	all	bluegill	35	removed
5	electro	all	bluegill	40	removed
5	electro	all	bluegill	25	removed
5	electro	all	bluegill	30	removed
5	electro	all	bluegill	35	removed
5	electro	all	bluegill	40	removed
5	electro	all	bluegill	25	removed
5	electro	all	bluegill	30	removed
5	electro	all	bluegill	35	removed
5	electro	all	bluegill	40	removed

Pond	Method	Set/ trap	Species	Length (mm)	Disposition
5	electro	all	bluegill	25	removed
5	electro	all	bluegill	30	removed
5	electro	all	bluegill	35	removed
5	electro	all	bluegill	40	removed
5	electro	all	bluegill	25	removed
5	electro	all	bluegill	30	removed
5	electro	all	bluegill	35	removed
5	electro	all	bluegill	40	removed
5	electro	all	bluegill	25	removed
5	electro	all	bluegill	30	removed
5	electro	all	bluegill	35	removed
5	electro	all	bluegill	40	removed
5	electro	all	bluegill	25	removed
5	electro	all	bluegill	30	removed
5	electro	all	bluegill	35	removed
5	electro	all	bluegill	40	removed
5	electro	all	bluegill	25	removed
5	electro	all	bluegill	30	removed
5	electro	all	bluegill	35	removed
5	electro	all	bluegill	40	removed

Pond	Method	Set/ trap	Species	Length (mm)	Disposition
5	electro	all	bluegill	30	removed
5	electro	all	bluegill	35	removed
5	electro	all	bluegill	40	removed
5	electro	all	bluegill	25	removed
5	electro	all	bluegill	30	removed
5	electro	all	bluegill	35	removed
5	electro	all	bluegill	40	removed
5	electro	all	bluegill	25	removed
5	electro	all	bluegill	30	removed
5	electro	all	bluegill	35	removed
5	electro	all	largemouth	175	removed
5	electro	all	largemouth	280	removed
5	electro	all	largemouth	170	removed
5	electro	all	largemouth	165	removed
5	electro	all	largemouth	140	removed
5	electro	all	largemouth	180	removed
5	electro	all	largemouth	107	removed
5	electro	all	largemouth	155	removed
5	electro	all	largemouth	175	removed
5	electro	all	largemouth	140	removed
5	electro	all	largemouth	265	removed
5	electro	all	largemouth	315	removed
5	electro	all	largemouth	330	removed
5	electro	all	largemouth	510	removed
5	electro	all	largemouth	245	removed

Pond	Method	Set/ trap	Species	Length (mm)	Disposition
5	electro	all	largemouth	170	removed
5	electro	all	largemouth	260	removed
5	electro	all	largemouth	98	removed
5	electro	all	largemouth	105	removed
5	electro	all	largemouth	120	removed
5	electro	all	largemouth	210	removed
5	electro	all	largemouth	58	removed
5	electro	all	largemouth	115	removed
5	electro	all	largemouth	90	removed
5	electro	all	largemouth	65	removed
5	electro	all	largemouth	58	removed
5	electro	all	largemouth	430	removed
5	electro	all	largemouth	142	removed
5	electro	all	sculpin	45	returned
5	electro	all	sculpin	50	returned
5	electro	all	sculpin	43	returned
5	electro	all	y. perch	120	removed
5	electro	all	y. perch	95	removed
5	electro	all	y. perch	92	removed
5	electro	all	y. perch	96	removed
5	electro	all	y. perch	80	removed
5	electro	all	y. perch	62	removed
5	electro	all	y. perch	61	removed

Pond	Method	Set/ trap	Species	Length (mm)	Disposition
5	gill	3	coho	260	removed
5	gill	1	largemouth	500	removed
5	gill	1	largemouth	450	removed
5	gill	1	largemouth	445	removed
5	gill	1	largemouth	215	removed
5	gill	1	largemouth	340	removed
5	gill	1	largemouth	330	removed
5	gill	2	largemouth	390	removed
5	gill	2	largemouth	430	removed
5	gill	2	largemouth	445	removed
5	gill	2	largemouth	560	removed
5	gill	2	largemouth	480	removed
5	gill	2	largemouth	440	removed
5	gill	2	largemouth	195	removed
5	gill	2	largemouth	290	removed
5	gill	2	largemouth	240	removed
5	gill	2	largemouth	225	removed
5	gill	2	largemouth	300	removed
5	gill	2	largemouth	265	removed
5	gill	2	largemouth	185	removed
5	gill	2	largemouth	190	removed
5	gill	2	largemouth	240	removed
5	gill	2	largemouth	180	removed
5	gill	2	largemouth	140	removed
5	gill	2	largemouth	195	removed

Pond	Method	Set/ trap	Species	Length (mm)	Disposition
5	gill	2	largemouth	150	removed
5	gill	2	largemouth	145	removed
5	gill	2	largemouth	185	removed
5	gill	2	largemouth	165	removed
5	gill	3	largemouth	450	removed
5	gill	3	largemouth	290	removed
5	gill	3	largemouth	235	removed
5	gill	3	largemouth	310	removed
5	gill	3	largemouth	295	removed
5	gill	3	largemouth	180	removed
5	gill	2	pikeminnow	500	removed
5	gill	3	y. perch	215	removed
5	gill	3	y. perch	150	removed

Pond	Method	Set/ trap	Species	Length (mm)	Disposition
5	minnow	9	bluegill	39	removed
5	minnow	9	bluegill	32	removed
5	minnow	10	bluegill	35	removed
5	minnow	11	bluegill	35	removed
5	minnow	15	bluegill	35	removed
5	minnow	15	bluegill	32	removed
5	minnow	19	bluegill	60	removed
5	minnow	12	empty		
5	minnow	13	empty		
5	minnow	14	empty		
5	minnow	16	empty		
5	minnow	17	empty		
5	minnow	18	empty		