Grand River Webber Fish Ladder 2008 Report

Ionia, T7N, R5W, Sec. 33
Grand River, 2008

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Environment

The Grand River in Ionia County is a large warmwater stream with a mean flow of 1,200 cfs. The habitat is mostly run and pool with scattered riffles with a substrate of sand, gravel, cobble, and a few boulders. The surface geology is primarily glacial moraine deposits that have been cut through by the river. The river shoreline has natural banks and river terraces with residential and commercial development. Landuse is mostly agricultural with scattered forest and residential use. Approximately, 8% of the landuse is urban with the communities of Jackson, Lansing, Grand Ledge and Portland in the watershed.

The gradient and deep river valleys make it favorable for hydro-electric power. The Webber Dam is located 102 river miles upstream of Lake Michigan and and at this point the Grand River has a drainage area of 1,737 sq miles (Figure 1.). It is one of six hydroelectric facilities on the mainstem and was constructed in 1907. It is currently a 2.2 mega watt facility that is owned by Consumers Energy with the FERC Licence #2566. The impoundment covers seven miles of river and 660 acres. It averages 25 ft in depth and has a retention time of 2.5 days.

There is good angler access below the dam. A boat launch is located on the west side with west tailwater access and parking. The east side also has a parking area and access to the east tailwater. Anglers mainly fish the tailwater, but there is some angling activity on the impoundment mostly from residents that live on the impoundment.

History

Following the introduction of salmonines to the Great Lakes in the mid-1960's, a fish ladder was constructed in 1975 at the sixth Street Dam in downtown Grand Rapids. The objective of this project was to pass salmon upstream and provide additional angling opportunities. The success of this project, and the success of a similar facility at the Berrien Springs Dam on the St. Joseph River, prompted the State of Michigan to construct additional ladder facilities on the next four dams upstream of Sixth Street. Completed in 1981, these ladders allow for fish passage, and migrating fish are able to reach upstream of Downtown Lansing.

Webber Dam was the only facility on the Grand River constructed with an underground-viewing chamber. This room contains a 2-foot wide by 5-foot tall viewing window to accommodate fish passage observation. Limited evaluation of passage occurred at this facility in the early 1980's (Rykman 1986). Coho salmon and steelhead have been stocked upstream of the ladder in Lansing with the goal being to imprint salmon and improve returns. Chinook salmon are stocked only in the lower Grand River. An average of 300,000 coho salmon are stocked in the Grand River with 95% of fish in

Lansing. Of approximately 75,000 steelhead yearlings stocked in the Grand River system, 30,000 are stocked at Lansing.

Beginning in 1992 on the St. Joseph River, both Michigan and Indiana DNR began recording fish passage on time-lapse VCR's using CCTV cameras. This was done 24 hours per day whenever the ladders were open. Accuracy of counting fish passing the facilities and identification of fish were nearly 100% (Dexter and Ledet 1995). However, reviewing hundreds of tapes produced each year was a very time consuming process.

Recent advancements in computer technology have allowed for the development of digital imagery of fish passage. In 1999 Michigan began working with Salmonsoft to develop a customized program to assist in counting fish that pass through ladder facilities. This program has been quite successful and has been through several program upgrades in a short time period.

The main purpose of this status report is to estimate fall 2008 fish passage of the Webber Ladder. This report also evaluates the high stocking rates of coho salmon in Lansing through returns to the ladder and creel of the Upper Grand River.

Current Status

The Webber viewing room was prepared for counting during the fall of 2008. A 35 amp electrical service exists in the viewing room. The window was cleaned and a stainless steel panel to provide light reflection was added to the wall opposite of the window. A total of six 300 watt halogen floodlights were used to illuminate the window.

The customized computer software (Fishtick by Salmonsoft Version 2.2.1.1) received the signal from an analog CCTV camera (Panasonic Super Dynamic WV-CP450). The fishtick software checked each frame (at a frame rate between 1 and 30 frames per second as specified by the user) using a detection algorithm to determine whether a fish was present. If a fish was detected, the frame was written to the hard drive. The user could also specify the number of frames to be written both before and after a fish was detected to ensure that the direction of passage could be determined.

The review portion of the Fishtick software allows the operator to review files created by the capture software. Fisheries personnel scan through the recorded frames, varying the frame rate between 1 to 60 frames per second. As the reviewer identifies fish, the Fishtick review program enters the data into a customized Excel spreadsheet database.

The fish ladder passed up to 30 cubic feet per second of river water and was open September 1 through November 24. Water levels entering the ladder were controlled by a 200 amp electrical service and motorized slide gate installed in 2002. Whenever the window needed to be cleaned for better viewing, the slide gate was lowered to shut the flow off. The installation of the motorized gate resulted in better control and safer ladder operations. The computer was used to record fish passage for the fall run period, and in past years spring runs and summer movement was recorded. Files were read by a student intern at the Plainwell Fisheries Lab and verified by SLMMU technicians for accuracy in both counts and fish identification.

A progressive-access design creel survey was conducted on the upper Grand River in 2003 and 2004. Two sections were surveyed. Survey sections were: Grand Ledge (T.4N., R.4W., Sec. 2 and 3) to Moores Park (T.4N., R.2W., Sec.21-downstream of Martin Luther King Jr. Blvd.), and Lyons (T.7N., R.5W., Sec.19) to Portland (T.6N., R.5W., Sec.28). One clerk working from a vehicle collected angler count and interview data. The clerk worked two weekend days and three random week days per week during the survey period. Only one of the two sections was assigned for counting and interviewing during a sample day, and the section was chosen randomly. Two instantaneous counts of anglers were made per sample day. All anglers were visible from bridge crossings and access points. Shore and boat anglers were treated as a single mode when counting and interviewing. Each count began from either the upstream or downstream end of a section and progressed to the opposite end. Starting location was randomized. Time of count was randomized to cover times within the sample period. No holidays were scheduled for sampling. Counting and interviewing were done on the same days. One of two shifts was selected each sample day. No predetermined interviewing route was used. In 2003 survey periods were from March 1 through April 30, and from September 1 through November 30. Sections and months were estimated separately. In 2004, the survey period was March 1 through November 30.

The ladder was opened for operation and fish counting on September 1, 2008. Coho salmon were the most common species to use the ladder during this period (Table 1). A total of 1,575 coho salmon passed upstream through the ladder. The majority of coho movement was in September (864) followed by November (586) and October (125). Coho passage peaked in September with 54.9 % of the total passage occurring between September 8 and 29 (Tables 2-4). Passage of chinook salmon was lower than coho with a total of 233. Chinook salmon migration peaked in September with 60.1%, followed by October with 22.3% of the passage occurring, and 17.6% in early November. A total of 164 steelhead passed upstream through the ladder during the fall period. Six other species passed through the ladder in this period, including carp (509), channel catfish (12), walleye (30), smallmouth bass (10), bluegill (5), and rock bass (5). Carp movement through the ladder was highest during the month of September.

Counts of fish passage were tallied in four hour blocks (Table 5). Due to a glitch in the Webber Excel spreadsheet, the time of passage was not recorded for the months of November and part of October. In the months that the time of passage was recorded (September and part of October), most of the chinook moved through the ladder during the 8 am to noon block and the noon to 4 pm block. The movement of chinook then began to decline during the 4 pm to 8 pm block. Coho salmon movement reflected similar patterns to the chinook's time of passage.

On average 257,920 coho were stocked per year in the Grand River between 1998 and 2008 (Figure 2). No stocking occurred in 2004 or 2007 due to budget cuts. Coho passage for 2001, 2002, and 2008 was 3,573, 2,173, and 1,575, respectively (Figure 2). By averaging the previous year and current year stocking numbers, coho return rate to the ladder was estimated to be 0.9%, 0.6%, and 0.7% for 2001, 2002, and 2008, respectively.

There was a total of 17,996 and 64,143 angler hours in 2003 and 2004, respectively between the Village of Lyons and City of Lansing at Moores Dam (Appendix 1). The 2003 creel survey covered five months, and the 2004 creel survey covered nine months. Warm water species such as smallmouth bass, bluegill, and rock bass consisted of the highest catches. The coho salmon catch (harvest and

release) was 432 for 2003 and 318 for 2004. The coho stocking return to the creel by averaging the previous and current years stocking numbers to account for adults (age 1.1) and jacks (1.0) was 0.1% for 2003 and 2004.

Analysis and Discussion

The Fishtick software worked well at capturing and reviewing frames of fish passage. Because of the location of the ladder exit in the impoundment, there was a significant amount of debris entering the ladder. The impoundment orients such that a southwest wind blows debris directly at the ladder. At times there was a blizzard of debris (leaf and stick material) going through the ladder capturing very large files that significantly increased reading time.

During the 2008 fish passage period at Webber Dam, there were a variety of fish species that traveled up and down the ladder. These species included steelhead, chinook, coho, channel catfish, walleye, smallmouth bass, carp, rock bass, and bluegill. The coho, Chinook, steelhead, and carp were the majority of fish that passed up the ladder. Most salmon also appear to use the ladder during early morning to mid-day with less in the evening. The migration of species downstream through the Webber Ladder was low in the fall of 2008 but was observed as high for warmwater species during summer months during previous years recordings. These patterns of species and times of passage compared to the St. Joseph River ladders (Dexter and Ledet 1995).

Steelhead passage was low compared to other Michigan river systems and past recordings at the Webber Ladder. Most steelhead migrate during March and April and consist of the Michigan winter strain. The 164 steelhead passed between September and late November were most likely Michigan winter strain although some may have been stray skamania strain (summer run).

Chinook salmon passage was also low at 233. The ladder was open during normal migrations, which typically occur between August and the end of November for both Chinook and coho salmon. Chinook salmon stocking in the Grand River and all of Lake Michigan have decreased since 1999 due to low forage levels. Stocking only occurs in net pens at Grand Haven and direct stockings to the river below Grand Rapids.

Coho salmon passage was low at 1,575 compared to previous years, which ranged from 2,000 to 3,500. Part of the reduction in passage may have reflected the absence of stocking in 2007 due to budget cuts. The coho salmon that did pass were either jacks or strays. Based on the smaller size of the fish, it was assumed that most were jacks from the 2008 stocking.

Returns of coho salmon to the ladder and creel, based on high stocking rates of the upper Grand River, were very low at less than one percent for both. Although there was an impressive amount of angling effort in 2003 with over 64,000 angler hours, most of the catch was warmwater species and not salmon. It appears that the return to creel has decreased significantly since 1981 when Ryckman (1986) estimated a return of coho salmon of 2.8%. The average stocking rate of coho in 1980 and 1981 was 345,000 with 43% of those stocked below the City of Grand Rapids. Stocking rates have remained relatively high in the upper Grand River with most of the fish stocked in Lansing. The lower return may be decreased survival of stocked coho salmon in the river and in Lake Michigan. Predation on

downstream migrating smolts and mortality from passing over dams may have increased. Lower forage levels may have also decreased coho salmon survival and returns to the Grand River. Catch rates may also be higher in the lower Grand River; however, only 1,892 and 989 coho salmon were caught in the lower Grand River (Grand Rapids and Rogue River) in 2002 and 2003, respectively (Statewide Angler Survey Program unpublished data).

During the 2008 fish passage period at Webber Dam, the diversity and total number non-salmonid fish species was very low. This low number of fish species could be due to the velocity of water in the ladder, ability of fish to find the ladder, time it takes for fish to go through the ladder, or river environmental conditions. For migrating salmon, the returns are also low and may have to do with the miles of river and obstructions fish encounter before reaching the Webber Ladder. Salmon must travel 102 miles upstream past 6th Street Dam, Lyons Dam, and the remains of Wagar Dam before reaching Webber Dam. There was also a noticeable difference in salmon passage on the St. Joseph River at the South Bend Fish Ladder, which is 56 miles from Lake Michigan, compared to the Berrien Springs Ladder in 1993 (Dexter and Ledet 1995).

Management Direction

The Grand River provides a great year around fishery in close proximity to some of Michigan's largest urban areas. The fish ladders are passing salmon and extending this unique fishery all the way into Lansing. Future management of the system should continue to use salmon stocking and the fish ladders as management tools. More specific management recommendations are listed below:

1. Consider a different coho salmon stocking strategy that will maintain existing returns to Lansing while making better use of an expensive resource. This strategy should consider moving the majority of coho stockings to the lower Grand River, while maintaining a limited stocking effort in the upper river for imprinting salmon to Lansing.

2. Continue to monitor the return of stocked salmon and the Grand River fishery through periodic observations at the Webber Fish Ladder and with creel surveys. These activities should especially be conducted to evaluate any stocking location changes. Spring passage monitoring is necessary to continue to evaluate steelhead salmon returns.

3. Evaluate salmon passage at the 6th Street Ladder in Grand Rapids. In order to understand salmon return rates to the Grand River, it is necessary to enumerate passage at the first fish ladder. Passage declines at each ladder as fish migrate upstream, as seen in the St. Joseph River.

4. Continue the use of Fishtick software as a tool to count fish passage at the Webber Fish Ladder. Threshold levels should be evaluated to reduce frames stored with debris. This will assist in future reviewing and counting of fish.

5. Catch-up on Webber fish passage files. There are at least five years of data that should be added to the 2001, 2002, and 2008 data set that would assist in the evaluation of salmon returns and use of the ladder.

Table 1. Total fish passage by species and month on the Grand River at Webber Dam fish ladder, 2008.

Month	Steelhead	Chinook	Coho	Channel catfish	Walleye	Smallmouth bass	Carp	Rock bass	Blue-gill
March									
April									
August									
September	16	140	864	8	13		505		1
October	29	52	125	4	13	9	4	5	4
November	119	41	586		4	1			
December									
Total	164	233	1575	12	30	10	509	5	5

Table 2. Number of fish passage each day on the Grand River, Michigan at the Webber Dam fish ladder in September 2008.

Day	Coho	Chinook	Steelhead	Carp	Channel catfish	Walleye	Smallmouth bass	Bluegill	Rock Bass	Total:
1	0	0	0	0	0	0	0	0	0	0
2	0	0	0	134	0	0	0	0	0	134
3	0	0	0	51	0	0	0	0	0	51
4	0	0	0	23	0	0	0	0	0	23
5	1	0	0	12	0	0	0	0	0	13
6	0	0	0	176	0	0	0	0	0	176
7	0	0	0	72	0	4	0	0	0	76
8	0	0	0	0	0	0	1	0	0	1
9	1	0	0	0	0	0	0	0	0	1
10	3	0	0	1	0	0	0	0	0	4
11	4	0	1	1	0	0	0	0	0	6
12	42	9	0	-2	0	0	0	0	0	49
13	66	62	0	2	3	0	0	0	0	133
14	45	2	2	-1	0	6	0	0	0	54
15	78	8	2	-1	-2	0	-2	0	0	83
16	25	7	0	0	3	0	0	0	0	35
17	15	2	0	0	0	0	0	0	0	17
18	32	8	1	0	1	0	0	0	0	42
19	40	7	1	0	0	0	0	1	0	49
20	32	5	1	1	1	0	0	0	0	40
21	76	10	1	-1	0	0	0	0	0	86
22	38	4	1	-1	0	0	0	0	0	42
23	36	3	0	0	0	0	0	0	0	39
24	41	4	2	6	0	0	0	0	0	53
25	49	4	2	10	0	0	0	0	0	65
26	55	2	0	17	2	2	1	0	0	79
27	36	1	1	4	0	1	0	0	0	43
28	43	2	0	0	0	0	0	0	0	45
29	48	0	0	0	0	0	0	0	0	48
30	58	0	1	1	0	0	0	0	0	60
31	0	0	0	0	0	0	0	0	0	0
Total	864	140	16	505	8	13	0	1	0	1547

Table 3. Number of fish passage each day on the Grand River, Michigan at the Webber Dam fish ladder in October 2008.

Day	Coho	Chinook	Steelhead	Carp	Channel catfish	Walleye	Smallmouth bass	Bluegill	Rock Bass	Total:
1	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0
13	11	9	4	4	4	4	5	4	5	50
14	36	4	0	1	0	3	3	0	0	47
15	34	7	6	0	0	2	1	0	0	50
16	16	9	2	0	0	2	0	0	0	29
17	3	6	3	-1	0	1	0	0	0	12
18	5	3	3	0	0	0	0	0	0	11
19	9	2	2	0	0	1	0	0	0	14
20	3	4	1	0	0	0	0	0	0	8
21	0	1	0	0	0	0	0	0	0	1
22	0	1	1	0	0	0	0	0	0	2
23	4	3	0	0	0	0	0	0	0	-1
24	0	-1	0	0	0	0	0	0	0	-1
25	0	2	2	0	0	0	0	0	0	4
26	3	0	0	0	0	0	0	0	0	3
27	1	1	1	0	0	0	0	0	0	3
28	0	1	1	0	0	0	0	0	0	2
29	0	0	1	0	0	0	0	0	0	1
30	0	0	2	0	0	0	0	0	0	2
31	0	0	0	0	0	0	0	0	0	0
Total	125	52	29	4	4	13	9	4	5	245

Table 4. Number of fish passage each day on the Grand River, Michigan at the Webber Dam fish ladder in November 2008.

Day	Coho	Chinook	Steelhead	Carp	Channel catfish	Walleye	Smallmouth bass	Bluegill	Rock Bass	Total:
1	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0
5	586	41	119	0	0	4	1	0	0	751
6	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0
Total	586	41	119	0	0	4	1	0	0	751

Table 5. Time of fish passage by fish species at the Webber Dam fish ladder on the Grand River in 2008.

	fish species	No. (%)	
Time of Day	Steelhead	Chinook	Coho
0000-0359	120 (73.2)	49 (21.0)	612 (38.9)
0400-0759	3 (1.8)	7 (3.0)	47 (3.0)
0800-1159	16 (9.8)	57 (24.5)	291 (18.5)
1200-1559	8 (4.9)	53 (22.7)	300 (19.0)
1600-1959	14 (8.5)	54 (23.2)	277 (17.6)
2000-2359	3 (1.8)	13 (5.6)	48 (3.0)
Total number	164	233	1575

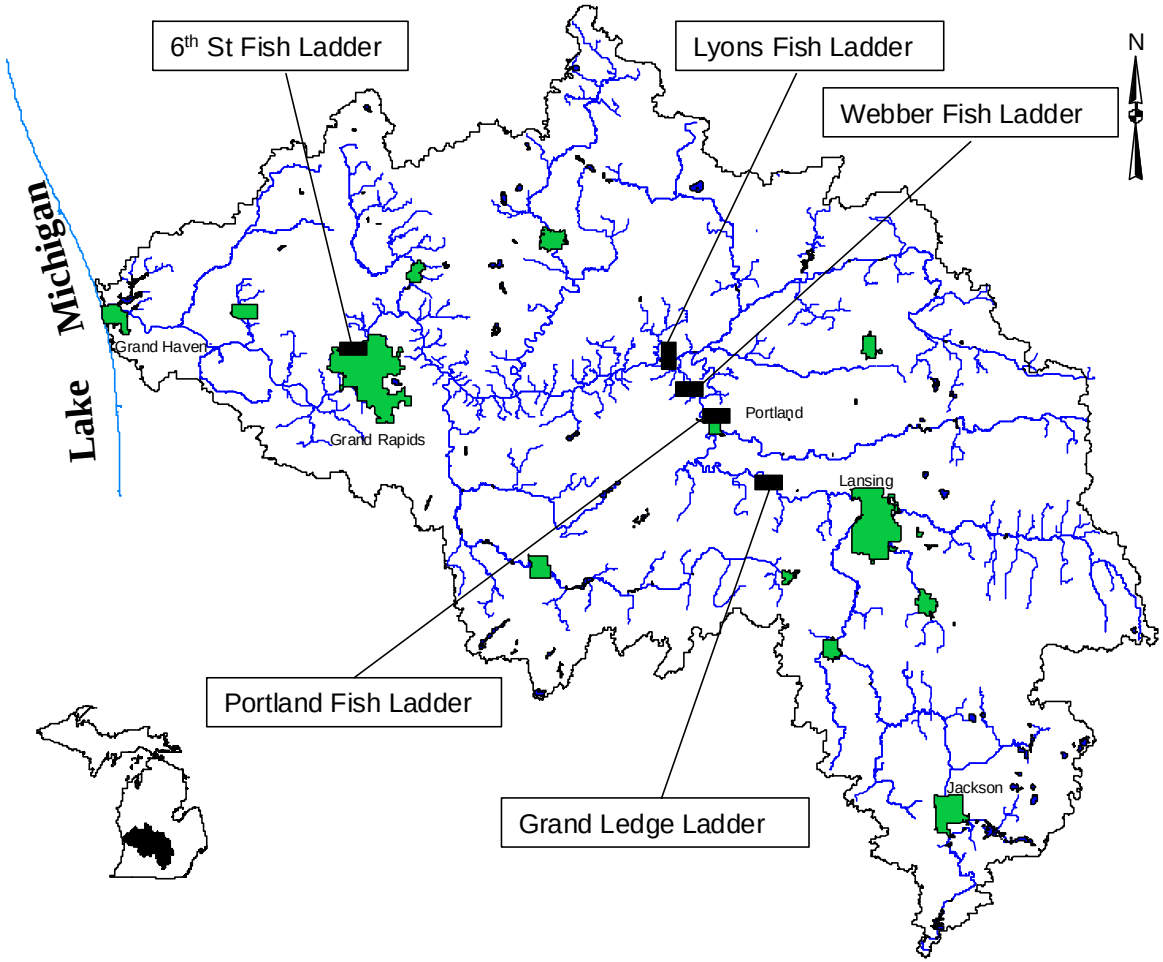

Figure 1. Grand River watershed and location of fish ladders.

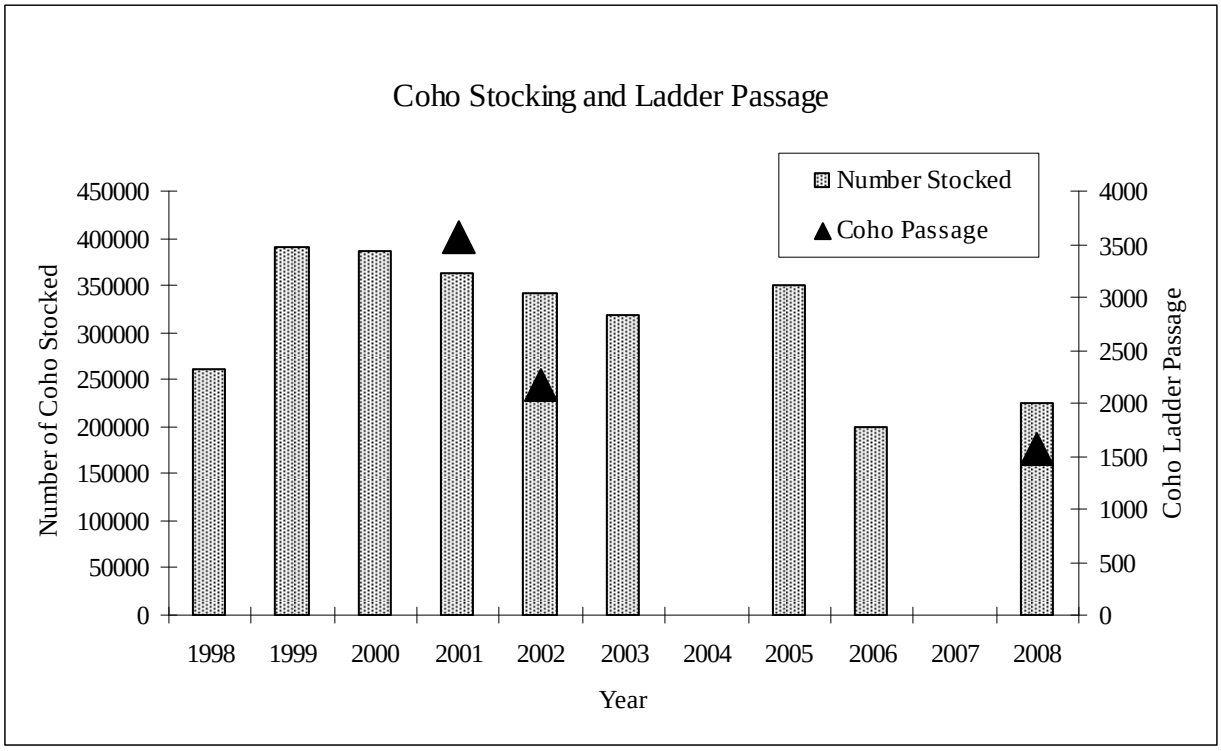

Figure 2. Coho stocking and ladder passage at the Webber Fish Ladder in the Grand River from 1998 to 2008.

References

Dexter, J.L. and N.D. Ledet. 1995. Estimates of fish passage at St. Joseph River in 1993 using time-lapse video recording. Michigan Department of Natural Resources, Fisheries Technical Report 95-4, Ann Arbor, Michigan.

Ryckman, J.R. 1986. Effectiveness of fish ladders in the Grand River. Michigan Department of Natural Resources, Fisheries Research Report 1937, Ann Arbor, Michigan.

Appendix 1

Creel data from the 2003 and 2004 upper Grand River surveys. These data are part of the Statewide Angler Survey Program database on the Michigan Department of Natural Resources, Fisheries Division intranet site at:
http://connect.michigan.gov/portal/binary/com.epicentric.contentmanagement.servlet.ContentDeliveryServlet/DNR/Fish/ResourceTools/Statewide-Angler-Survey-Program
More information on methods and results is available on this site.

Estimated harvest, catch per hour, and fishing pressure from the upper Grand River in 2003. Two standard errors are given in parentheses.

Species	C/H	March	April	September	October	November	Season
HARVEST							
Coho salmon	0.0049	0	0	11	78	0	89
	(0.0053)	(0)	(0)	(18)	(93)	(0)	(95)
Chinook salmon	0.0126	0	0	16	210	0	226
	(0.0090)	(0)	(0)	(30)	(156)	(0)	(159)
Rainbow trout	0.0023	0	9	0	32	0	41
	(0.0037)	(0)	(19)	(0)	(64)	(0)	(67)
Smallmouth bass	0.0127	0	0	0	206	23	228
	(0.0161)	(0)	(0)	(0)	(286)	(41)	(289)
Walleye	0.0106	0	0	111	56	23	190
	(0.0090)	(0)	(0)	(130)	(84)	(41)	(160)
Bluegill	0.0748	485	38	707	116	0	1,346
	(0.0603)	(595)	(76)	(856)	(232)	(0)	(1,071)
Carp	0.0059	0	0	91	15	0	106
	(0.0075)	(0)	(0)	(130)	(31)	(0)	(134)
Channel catfish	0.0094	81	40	16	32	0	169
	(0.0107)	(160)	(77)	(33)	(64)	(0)	(191)
TOTAL HARVEST	0.1332	566	88	952	745	45	2,396
	(0.0667)	(616)	(110)	(877)	(430)	(58)	(1,161)
RELEASED							
Coho salmon	0.0191	179	0	60	104	0	343
	(0.0221)	(358)	(0)	(100)	(137)	(0)	(396)
Chinook salmon	0.0070	0	0	0	126	0	126
	(0.0083)	(0)	(0)	(0)	(149)	(0)	(149)
Rainbow trout	0.0386	0	645	16	34	0	695
	(0.0339)	(0)	(598)	(31)	(67)	(0)	(603)
Smallmouth bass	0.1258	362	467	560	604	270	2,263
	(0.0707)	(504)	(363)	(484)	(819)	(496)	(1,240)
Walleye	0.0304	283	121	111	32	0	546
	(0.0236)	(382)	(111)	(110)	(64)	(0)	(418)
Northern pike	0.0026	0	0	48	0	0	48
	(0.0055)	(0)	(0)	(98)	(0)	(0)	(98)
Common white sucker	0.0270	0	391	95	0	0	485
	(0.0237)	(0)	(405)	(121)	(0)	(0)	(423)
Redhorse	0.0012	0	22	0	0	0	22
	(0.0022)	(0)	(40)	(0)	(0)	(0)	(40)
Rock bass	0.0056	0	20	81	0	0	102
	(0.0069)	(0)	(40)	(116)	(0)	(0)	(123)
Channel catfish	0.0188	162	0	177	0	0	339
	(0.0172)	(255)	(0)	(169)	(0)	(0)	(306)
Carp	0.0035	0	0	0	62	0	62
	(0.0050)	(0)	(0)	(0)	(89)	(0)	(89)
Bluegill	0.1720	1,198	0	1,896	0	0	3,094
	(0.1039)	(1,067)	(0)	(1,483)	(0)	(0)	(1,827)
TOTAL RELEASED	0.4516	2,184	1,666	3,044	963	270	8,126
	(0.1468)	(1,316)	(818)	(1,588)	(853)	(496)	(2,428)
TOTAL CATCH	0.5847	2,750	1,754	3,996	1,707	315	10,522
	(0.1673)	(1,453)	(825)	(1,814)	(956)	(499)	(2,692)
ANGLER HOURS		2,567	3,592	3,910	7,033	893	17,996
		(856)	(1,163)	(1,102)	(1,343)	(452)	(2,304)
ANGLER TRIPS		1,197	1,287	1,744	2,083	406	6,717
		(436)	(656)	(574)	(485)	(228)	(1,112)

Estimated harvest, catch per hour, and fishing pressure for upper Grand River in 2004.
Two standard errors are given in parentheses.

Species	C/H	March	April	May	June	July	August	September	October	November	Season
HARVEST											
Coho salmon	0.0019	0	0	0	0	0	0	0	119	0	119
	(0.0026)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(165)	(0)	(165)
Chinook salmon	0.0028	0	0	0	0	0	0	0	177	0	177
	(0.0027)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(169)	(0)	(169)
Rainbow trout	0.0020	0	99	0	0	0	0	0	0	28	127
	(0.0023)	(0)	(140)	(0)	(0)	(0)	(0)	(0)	(0)	(49)	(148)
Smallmouth bass	0.0051	0	0	41	9	0	28	221	30	0	329
	(0.0062)	(0)	(0)	(65)	(18)	(0)	(56)	(383)	(59)	(0)	(397)
Walleye	0.0310	0	0	435	120	335	367	644	30	60	1,990
	(0.0180)	(0)	(0)	(641)	(126)	(352)	(358)	(780)	(58)	(79)	(1,139)
Redhorse	0.0108	0	608	0	28	0	0	0	59	0	696
	(0.0116)	(0)	(726)	(0)	(58)	(0)	(0)	(0)	(117)	(0)	(738)
Black crappie	0.0115	0	0	0	0	0	647	93	0	0	741
	(0.0154)	(0)	(0)	(0)	(0)	(0)	(968)	(192)	(0)	(0)	(986)
Bluegill	0.1713	0	0	0	3,185	1,380	4,940	1,275	207	0	10,987
	(0.0929)	(0)	(0)	(0)	(2,733)	(1,702)	(4,660)	(1,483)	(425)	(0)	(5,870)
Largemouth bass	0.0045	0	0	0	289	0	0	0	0	0	289
	(0.0085)	(0)	(0)	(0)	(542)	(0)	(0)	(0)	(0)	(0)	(542)
Rock bass	0.0100	0	100	41	138	279	52	0	30	0	640
	(0.0091)	(0)	(138)	(83)	(197)	(510)	(105)	(0)	(58)	(0)	(582)
Carp	0.0020	0	0	69	19	44	0	0	0	0	131
	(0.0024)	(0)	(0)	(118)	(39)	(87)	(0)	(0)	(0)	(0)	(152)
Channel catfish	0.0438	0	0	21	139	939	784	929	0	0	2,812
	(0.0363)	(0)	(0)	(41)	(166)	(1,359)	(766)	(1,702)	(0)	(0)	(2,315)
Common white sucker	0.0006	0	0	0	38	0	0	0	0	0	38
	(0.0012)	(0)	(0)	(0)	(79)	(0)	(0)	(0)	(0)	(0)	(79)
TOTAL HARVEST	0.2974	0	807	607	3,966	2,977	6,818	3,163	650	88	19,076
	(0.1066)	(0)	(752)	(662)	(2,803)	(2,266)	(4,836)	(2,426)	(510)	(93)	(6,598)
RELEASED											
Coho salmon	0.0031	0	0	0	0	0	0	0	199	0	199
	(0.0037)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(240)	(0)	(240)
Smallmouth bass	0.2518	35	4,059	327	929	4,350	4,281	1,647	388	136	16,152
	(0.1166)	(51)	(4,534)	(607)	(1,206)	(4,557)	(2,859)	(1,484)	(346)	(170)	(7,326)
Largemouth bass	0.0412	0	0	176	691	258	1,199	299	22	0	2,645
	(0.0243)	(0)	(0)	(336)	(674)	(379)	(1,199)	(459)	(46)	(0)	(1,537)
Walleye	0.0333	0	570	0	9	943	56	184	373	0	2,136
	(0.0186)	(0)	(733)	(0)	(19)	(827)	(80)	(211)	(319)	(0)	(1,173)
Muskellunge	0.0010	0	0	0	0	0	0	66	0	0	66
	(0.0020)	(0)	(0)	(0)	(0)	(0)	(0)	(130)	(0)	(0)	(130)
Common white sucker	0.0073	0	19	0	124	0	324	0	0	0	467
	(0.0069)	(0)	(37)	(0)	(151)	(0)	(410)	(0)	(0)	(0)	(438)
Redhorse	0.0044	0	57	0	0	0	0	197	30	0	284
	(0.0049)	(0)	(82)	(0)	(0)	(0)	(0)	(299)	(59)	(0)	(315)
Rock bass	0.0944	23	50	0	2,437	2,957	394	142	22	28	6,054
	(0.0528)	(51)	(102)	(0)	(1,802)	(2,753)	(514)	(220)	(46)	(61)	(3,340)
Carp	0.0095	0	0	34	123	375	52	0	0	28	613
	(0.0078)	(0)	(0)	(69)	(142)	(456)	(103)	(0)	(0)	(61)	(497)
Bluegill	0.3024	0	1,670	0	5,482	6,983	3,801	1,154	41	264	19,395
	(0.1496)	(0)	(3,495)	(0)	(4,471)	(6,585)	(3,111)	(1,811)	(83)	(525)	(9,423)
Green Sunfish	0.0035	0	0	0	0	0	225	0	0	0	225
	(0.0071)	(0)	(0)	(0)	(0)	(0)	(456)	(0)	(0)	(0)	(456)
Yellow Perch	0.0010	0	0	0	0	63	0	0	0	0	63
	(0.0019)	(0)	(0)	(0)	(0)	(124)	(0)	(0)	(0)	(0)	(124)
TOTAL RELEASED	0.7530	58	6,424	538	9,794	15,930	10,332	3,690	1,076	456	48,298
	(0.2085)	(72)	(5,773)	(697)	(5,019)	(8,530)	(4,466)	(2,427)	(541)	(558)	(12,578)
TOTAL CATCH	1.0504	58	7,231	1,145	13,760	18,907	17,150	6,852	1,726	544	67,374
	(0.2425)	(72)	(5,821)	(961)	(5,748)	(8,826)	(6,583)	(3,432)	(744)	(566)	(14,203)
ANGLER HOURS		2,279	5,646	2,073	9,592	14,499	13,670	7,288	7,441	1,657	64,143
		(706)	(1,678)	(1,688)	(2,713)	(3,071)	(3,129)	(1,436)	(1,147)	(562)	(6,036)
ANGLER TRIPS		1,035	2,293	739	3,102	3,959	4,150	2,738	2,782	837	21,635
		(626)	(959)	(430)	(934)	(1,048)	(1,069)	(739)	(709)	(332)	(2,402)