Fall 2006 through Spring 2007

WISCONSIN
DEPT. OF NATURAL RESOURCES

Wisconsin Department of Natural Resources
Bureau of Fisheries Management and Habitat Protection

Root River Steelhead Facility

Fall 2006 and Spring 2007

Jim Thompson
Brad Eggold

Wisconsin Department of Natural Resources
Bureau of Fisheries Management and Habitat Protection
Southern Lake Michigan Work Unit
600 E. Greenfield Ave.
Milwaukee, WI 53204

July, 2007

Abstract – The Fall 2006 season at the Root River Steelhead Facility (RRSF) was busy. Ideal flow conditions resulted in extremely large numbers of chinook returning. We were able to obtain a good sample of all species for our biological sampling protocol. Collection of skamania strain steelhead brood fish was productive. A total of 10,318 chinook salmon, 1,400 coho salmon, 964 steelhead and 124 brown trout were examined during fall, 2005 and spring, 2006. We were able to capture and transport 339 broodstock skamania steelhead to the Kettle Moraine Springs Hatchery. Most of the chinook captured were passed upstream. Approximately 800,000 coho eggs were obtained at RRSF, and 300,000 were obtained from the Besadny Anadromous Fish Facility (BAFF) in Kewaunee, WI. This is slightly short of our goal of 1.5 million. In the past, egg-take shortfalls have been augmented by contributions from other states. Due to the discovery of Viral Hemorrhagic Septicemia virus (VHS) in Lake Michigan, new restrictions on fish and egg transfers are in place and it is doubtful that we will be able to continue this practice. The spring 2007 return of steelhead was very sporadic due to frequent extremely high water events and unusually cold temperatures. The majority of the spring steelhead (71%) were passed upstream. Two hundred sixty-three were spawned, while another 60 were sacrificed for health assessment after spawning. The spring spawners produced 660,000 eggs and the Besadny Facility contributed the remainder to meet our spring steelhead goal. All 124 brown trout captured were passed upstream. The estimated population of chinook salmon above the weir was 40,362 (± 6,518 SD). Population estimates for the other species were brown trout: 1,984 (± 1,358 SD), coho salmon: 1,511 (± 378 SD), fall steelhead: 938 (± 504 SD). Spring population estimates were chambers creek steelhead: 973 (± 520 SD), and ganaraska steelhead: 455 (± 298 SD).

For 2007 a number of management issues have been assigned high priority. The coho run was modest and although stocking goals for coho will most likely be met, there are serious concerns about the effect the overwhelming number of chinook returning may be having on the numbers of coho returning to the facility. Changes to the stocking protocol have been implemented in an attempt to increase the coho return to the Root river. The number of yearling coho stocked into the river has been increased and a portion of the chinook quota has been re-allocated away from the river. Hopefully this will increase coho returns while decreasing chinook returns to RRSF. Also, due to concerns over spreading VHS, we can no longer (beginning in fall 2007) transport adult fish from RRSF to the Kettle Moraine State Fish Hatchery as in the past. Other modifications to protocol may be needed as the impact of VHS becomes better understood.

The Root River Steelhead Facility (RRSF) is one of three weirs operated by Wisconsin Department of Natural Resources (WDNR) to collect information and broodstock from Lake Michigan trout and salmon. The Strawberry Creek Weir in Sturgeon Bay targets chinook salmon, while the Besadny Area Fishery Facility (BAFF) on the Kewaunee River targets coho salmon and steelhead and the RRSF contributes primarily steelhead and coho. In addition, BAFF and RRSF function as backup collection sites for the other species. Brown trout do not return well to the weir sites, and are collected in the lower reaches of the rivers with a boat electroshocker. Management of trout and salmon in Lake Michigan brood rivers is intended to ensure adequate egg collections, conserve the genetic diversity of feral trout and salmon stocks and provide fishing opportunities. To accomplish these objectives, weir operations follow strategies outlined by WDNR guiding documents (e.g., Ives 1996, WDNR 1999).

The weirs provide a more efficient and reliable method to collect adult salmonids than the portable weirs and electrofishing efforts employed during past years. The RRSF was constructed in 1994 through a cooperative effort by WDNR, Salmon Unlimited, City of Racine and U.S. Fish & Wildlife Service. In addition to providing a collection and processing site for returning adult salmonids, the RRSF provides a unique educational tool for school groups and other interested publics.

This paper reports the results of data collected at the RRSF during fall, 2006 and spring, 2007. These data contribute to a long-term index of chinook, coho and steelhead populations in the Root River, and are collected to fulfill three objectives: 1) track the abundance of salmonid returns, 2) measure growth and condition of each species and/or strain, and 3) estimate return rate of each species.

METHODS

During operation of the weir, a minimum of 100 fish per targeted species and fin clip were sampled. Sampled fish were measured to the nearest millimeter, weighed to the nearest 0.1 pound, examined for fin clips, gender and condition. The remaining fish were tallied by species, gender and fin clip. Gametes were stripped from these fish, if needed. After this initial handling, fish were either passed upstream or sacrificed (fish health or contaminant samples). All fish passed upstream were given an upper caudal clip for population estimates.

All non-target species or fin clips were tallied by species, fin clip and sex, given an upper caudal clip and passed upstream. All coded wire tagged (CWT) fish are marked by an adipose-only clip, and have a tiny microtag implanted in their heads. The CWT fish were measured, weighed and sacrificed; heads were removed from behind the opercular flap, and frozen for later examination. Fish were collected as needed for other studies including disease or contaminant samples.

Size and condition

Trends in size and condition of all species processed at RRSF are calculated. Only fish with both total length and weight data are included in calculations of average, standard and trophy weight (95^{th} percentile of the weight distribution), and standard weight (predicted weight at a given length based on a length-weight regression). The lengths used for calculation of standard weight are: 30 inches for chinook, 22 inches for coho, 22 inches for steelhead, and 20 inches for brown trout.

Coho salmon growth, age and maturity evaluation

Work continues on the growth, age and maturity study of coho salmon. In order to reach the vision of a Healthy Great Lakes Ecosystem described in the Strategic Vision of the Great Lakes Fishery Commission for the Decade of the 1990s and to more quickly detect changes in the forage base in Lake Michigan, accurate coho salmon data by age is needed. Unlike other salmon and trout that mature in 2-4 years and then return to spawning facilities, coho salmon only spend two summers in the lake prior to returning to their stocking stream. This study will allow Wisconsin to build a database on growth and maturity by age of coho salmon stocked in the Root River. This data will help fisheries biologists around the lake refine stocking models, growth parameters, forage trends and survival and mortality rates of coho salmon. Coho salmon marked as part of this study are expected to imprint on the Root River and home to the Root River when they mature and attempt to spawn. Most mature at age 2+, with a few showing up at age 1+. Adipose fin-clipped, uniquely coded wire tagged (CWT) coho are collected at RRSF as part of fall spawning/harvesting operations. Adipose clipped/CWT coho salmon will also be collected through the

WDNR contact creel survey, by other states, and during other WDNR surveys, but the primary collection technique will be at RRSF.

During spawning operations at RRSF, coho salmon with an adipose fin clip are marked with a uniquely numbered jaw tag, weighed, and measured. Heads from all jaw tagged coho salmon will be collected and transported to the WDNR Milwaukee Office for storage and processing. During the winter months, coho salmon heads collected at RRSF and from other sources will be checked for CWTs. Coho salmon heads with a CWT detected will be dissected for CWT recovery. Extracted CWTs will be decoded and the data entered into the database for subsequent trend analysis.

Steelhead strain evaluation

Steelhead stocking targets in the Root River were 35,000 per strain until 1999, when chambers creek and ganaraska targets were reduced to 27,000. All steelhead stocked in the broodstock rivers (Root and Kewaunee Rivers) are marked with a fin clip to identify the strain and yearclass. Each strain is assigned three fin clips (two fin clips prior to 1997), which are rotated annually. The three clips allow much cleaner separation of year-classes than the two-year clip rotation used previously. In addition to their use in identifying fish for breeding purposes, the fin clips allow each strain to be evaluated. This includes age of returning fish, return rates and population estimates by strain.

Population estimates

Fish that are passed by the weir are marked with a caudal (tail) clip, and recaptures of marked fish are noted in the creel survey for a mark-recapture population estimate of the population above the weir. Population estimates for each species or strain are derived from one of two equations. When sample sizes were adequate, the Petersen equation for mark and recapture was used (Ricker 1975):

$$N = \frac{M * C}{R} \quad (1)$$

Where

N = size of population in the river
M = number of marked fish at large in the river
C = number of recaptured fish
R = number of marked fish in the recapture sample

The sample standard deviation was calculated as:

$$S(N) = \sqrt{\frac{M^2 * C * (C - R)}{R^3}} \quad (2)$$

For species or strains with low sample sizes (i.e., 3 or fewer marked recaptures), the Bailey's modified equation was used for the population estimate (Ricker 1975):

$$N = \frac{M * (C + 1)}{R + 1} \quad (3)$$

With sample standard deviation:

$$S(N) = \sqrt{\frac{M^2 * (C + 1) * (C - R)}{(R + 1)^2 * (R + 2)}} \quad (4)$$

RESULTS AND DISCUSSION

The tenth season of operation for RRSF began June 28, 2006 and concluded April 16, 2007. A total of 10,318 chinook, 1,400 coho, 964 steelhead and 124 brown trout were examined (Table 1).

Chinook salmon

A total of 10,318 chinook salmon were examined at RRSF during fall, 2006 (Table 2). Eggs for hatchery production were taken at Strawberry Creek near Sturgeon Bay. Nearly all (95.3%) of the chinook captured were passed upstream. Analysis of length-weight data (Table 3) revealed that average length (32.1 inches), weight (11.7 pounds) and standard weight (9.1 pounds) of returning chinook marked an upward turn in all three. While encouraging, lakewide concerns about the overabundance of chinook salmon remain.

Coho salmon

A total of 1,400 coho salmon were examined at RRSF (Table 4). Most (81%) were passed upstream. One hundred forty-nine were sacrificed for coded wire tags, 60 for health assessments and 58 were mortalities in the facility. About 800,000 eggs were taken at the weir. The age composition (based on length-frequencies) indicated that the run was comprised of 48% age 1+ and 52% age 2+ coho salmon (Table 5). Average coho length (22.0 inches) and weight (4.0 pounds) continue to be down, however these numbers reflect an unusually high number of coho of Age 1+ returning in 2006. Coho normally return at Age 2+. Beginning in spring 2007, chinook and coho salmon stocking numbers were adjusted in order to re-allocate more yearling coho stocked into the Root while shifting numbers of stocked chinook to other nearshore locations. Without the ability to obtain coho eggs from other states during years of egg-take shortfalls due to the impact of Viral Hemorrhagic Septicemia (VHS), every effort must be made to insure larger numbers of coho return to RRSF. It is possible that the overwhelming density of chinook in the river may be an impediment to larger numbers of coho reaching the facility.

Steelhead

A total of 964 steelhead were examined at RRSF from June 28, 2006 to April 16, 2007. Slightly over half (501 or 52%) were passed upstream (Table 6). One hundred -twenty steelhead were sacrificed for disease testing. In addition, 339 skamania-strain steelhead were transported as broodstock to KMSH during late summer and fall. Egg collection totals for the other two strains were 370,000 and 290,000 chambers creek and ganaraska, respectively.

During most years, age 3 and 4 fish contribute the bulk of the steelhead run, and this trend continued for fall 2006 and spring 2007 (Table 8). Since the weir became operational in 1994, steelhead return rates have fluctuated. Return rates prior to 1997, fall and spring combined, averaged slightly over 2% for year-classes followed through age 7. For year classes that have been followed through age 7 since then, no clear trend is evident. Weak year classes were the 1997 and 1999, with much stronger in 1998 and 2000. Fish health surveys of steelhead during spawning events at the facility have shown the parent stock to be in good overall health

Steelhead strain evaluation

The percent age composition of the spawning runs was assigned from age-length keys developed from 475 known age finclipped fall fish and 218 known age finclipped spring fish (Table 8). During fall, age 2 fish represented 0.6% of the return, age 3 were 55.6%, age 4 were 24.2%, age 5 were 15.6%, age 6 were 1.9%, and age 7 were 1.3%. During spring, age 2 represented 17.4% of the return, age 3 were 21.1%, age 4 were 28.0%, age 5 were 7.8%, age 6 were 22.0% and 7 were 3.7% (Table 8). Following the extremely strong 1998 year class for all strains, 1999 was poor. The 2000 year class was modestly successful and the 2001, although not followed through completion, is very well represented for Chambers creek and Ganaraska.

The Skamania steelhead program is at a crossroads due to the pathogen Viral Hemorrhagic Septicemia (VHSv). This virus is causing a number of changes to be implemented in Lake Michigan fish management and fish propagation. Due to new protocols in place to try and slow the spread of this virus, beginning immediately we are no longer able to transport Skamania strain brood (parent) fish from the weir to the Kettle Moraine State Fish Hatchery for overwintering and spawning. The steelhead program is currently under review as we address the impacts of VHS on the fishery and on our fish handling protocols. For more information on VHS and other Lake Michigan fisheries topics, visit: http://dnr.wi.gov/fish/pages/vhs.html.

Population estimates

The number of chinook handled at the weir during 2006 was 10,318 (Table 1), and the population estimate was 40,362 (± 6,518 SD)(Table 12). This is the all-time highest estimate since weir operations began. The total number of coho processed was 1,400, with a population estimate of 1,511 (± 378 SD). The number of fall steelhead handled was 340 with a population estimate of 938 (± 504 SD). Chambers creek were estimated at 973 (± 520 SD), while the ganaraska estimate was 455 (± 298 SD).

REFERENCES

Ives, D. 1996. Anadromous feral broodstock protocol. Wisconsin Department of Natural Resources. Madison, WI. 2 pages.

Ricker, 1975. Computation and interpretation of biological statistics of fish populations. Bulletin 191. Department of the Environment, Fisheries and Marine Service. Ottawa, Canada. 382 pages.

Wisconsin Department of Natural Resources (WDNR). 1999. Lake Michigan steelhead fisheries management plan 1999. Wisconsin Department of Natural Resources. Madison, WI. Administrative Report 44. 19 pages.

Table 1. Summary of chinook salmon, coho salmon, steelhead and brown trout captured at the Root River Steelhead Facility during 1998 to 2007.

CHINOOK SALMON

Harvest year	Harvested	Passed upstream	Misc. samples	Total
Fall, 1998	67	3,845	65	3,977
Fall, 1999	221	5,381	420	6,022
Fall, 2000	244	6,965	166	7,375
Fall, 2001	432	9,697	84	10,213
Fall, 2002	308	9,912	120	10,340
Fall, 2003	0	149	0	149
Fall, 2004	0	378	0	378
Fall, 2005	0	3,608	15	3,623
Fall, 2006	482	9,836	0	10,318

COHO SALMON

Harvest year	Harvested	Passed upstream	Misc. samples	Total
Fall, 1998	328	3,336	336	4,000
Fall, 1999	154	978	18	1,150
Fall, 2000	472	2,921	15	3,408
Fall, 2001	314	942	71	1,327
Fall, 2002	221	2,076	217	2,514
Fall, 2003	0	126	72	198
Fall, 2004	0	1,148	111	1,259
Fall, 2005	105	657	79	841
Fall, 2006	59	1,133	208	1,400

STEELHEAD

Harvest year	Harvested	Passed upstream	Misc. samples	Total
Fall, 1998	86	64	1	151
Spring, 1999	0	2,131	132	2,263
Fall, 1999	50	19	1	70
Spring, 2000	0	2,107	64	2,171
Fall, 2000	160	59	0	219
Spring, 2001	63	790	6	859
Fall, 2001	314	176	0	490
Spring, 2002	0	1,180	123	1,303
Fall, 2002	253	48	0	301
Spring, 2003	0	977	83	1,060
Fall, 2003	252	6	0	258
Spring, 2004	0	966	62	1,028
Fall, 2004	296	77	0	373
Spring, 2005	1	819	65	885
Fall, 2005	91	25	0	116
Spring, 2006	1	784	60	845
Fall, 2006	340	196	0	536
Spring, 2007	3	305	120	428

BROWN TROUT

Harvest year	Harvested	Passed upstream	Misc. samples	Total
Fall, 1998	14	202	12	228
Fall, 1999	0	125	0	125
Spring, 2000	0	6	0	6
Fall, 2000	2	241	0	243
Spring, 2001	0	2	0	2
Fall, 2001	1	176	0	177
Fall, 2002	3	291	0	294
Spring, 2003	0	1	0	1
Fall, 2003	0	53	0	53
Spring, 2004	0	3	0	3
Fall, 2004	0	28	0	28
Spring, 2005	0	6	0	6
Fall, 2005	0	141	0	141
Spring, 2006	0	1	0	1
Fall, 2007	0	124	0	124

Table 2. Number of chinook salmon harvested, passed upstream and sampled at the Root River Steelhead Facility during fall, 2006.

Date	Number Harvested	Number passed upstream	Number of Miscellaneous Samples	Total number of fish
28-Aug-2006	0	15	0	15
31-Aug-2006	0	123	0	123
07-Sep-2006	0	188	0	188
11-Sep-2006	0	280	0	280
14-Sep-2006	0	306	0	306
21-Sep-2006	3	484	0	487
25-Sep-2006	2	597	0	599
28-Sep-2006	2	409	0	411
02-Oct-2006	8	750	0	758
04-Oct-2006	141	568	0	709
05-Oct-2006	273	974	0	1,247
09-Oct-2006	8	631	0	639
11-Oct-2006	8	567	0	575
12-Oct-2006	4	1,068	0	1,072
16-Oct-2006	3	713	0	716
18-Oct-2006	10	744	0	754
19-Oct-2006	2	712	0	714
23-Oct-2006	6	234	0	240
26-Oct-2006	2	80	0	82
30-Oct-2006	5	158	0	163
06-Nov-2006	0	145	0	145
13-Nov-2006	5	90	0	95
Totals	482	9,836	0	10,318

Table 3. Average weight, average length, standard weight and trophy (95th percentile) weight for the major salmonid species returning to the Root River Steelhead Facility during 1995 to 2007.

Season	Number used in analysis	Average weight (pounds)	Average length (inches)	Standard weight	Trophy weight
CHINOOK SALMON					
1995 – 96	443	12.0 ± 5.9	30.7 ± 5.2	10.1	21.0
1996 – 97	703	11.7 ± 5.7	30.7 ± 5.4	9.8	21.1
1997 – 98	490	12.7 ± 4.9	32.5 ± 4.4	9.5	21.1
1998 – 99	389	12.2 ± 5.0	31.9 ± 4.3	9.5	19.6
1999 – 2000	418	13.2 ± 4.4	32.5 ± 3.8	9.9	19.9
2000 – 01	536	12.3 ± 5.7	31.1 ± 5.7	9.7	20.0
2001 – 02	672	15.7 ± 5.2	34.3 ± 4.3	10.3	23.5
2002 – 03	538	13.3 ± 4.8	32.8 ± 4.7	9.4	19.9
2003 – 04	-	-	-	-	-
2004 – 05	100	7.9 ± 5.2	26.9 ± 6.3	9.0	16.2
2005 – 06	689	9.3 ± 3.5	29.8 ± 4.4	8.7	14.8
2006 – 07	650	11.7±3.1	32.1 ± 2.8	9.1	17.0
COHO SALMON					
1995 – 96	594	3.1 ± 2.5	19.6 ± 5.1	3.6	9.0
1996 – 97	1,273	5.1 ± 2.4	23.9 ± 4.7	3.5	8.3
1997 – 98	828	3.8 ± 1.7	21.8 ± 3.5	3.5	6.7
1998 – 99	477	4.3 ± 1.7	23.4 ± 3.1	3.4	7.5
1999 – 2000	338	7.1 ± 4.4	25.5 ± 5.9	4.0	13.5
2000 – 01	472	8.2 ± 2.5	27.3 ± 3.2	3.9	11.6
2001 – 02	316	6.8 ± 2.9	25.9 ± 4.9	3.7	10.3
2002 – 03	445	4.8 ± 1.7	23.8 ± 3.0	3.5	7.6
2003 – 04	93	5.1 ± 2.3	23.9 ± 4.7	3.7	8.2
2004 – 05	383	5.7 ± 2.1	25.6 ± 3.5	3.4	9.2
2005 – 06	680	5.4 ± 2.1	24.9 ± 3.8	3.4	8.6
2006 – 07	629	4.0 ± 2.4	22.0 ± 4.8	3.5	8.0
STEELHEAD					
1995 – 96	963	6.2 ± 2.7	25.6 ± 4.3	3.7	11.0
1996 – 97	626	7.2 ± 2.4	27.4 ± 3.3	3.6	11.2
1997 – 98	522	5.8 ± 2.9	25.7 ± 4.9	3.4	11.2
1998 – 99	603	6.2 ± 2.0	25.9 ± 3.3	3.9	9.8
1999 – 2000	766	7.3 ± 2.5	27.2 ± 3.9	3.6	11.0
2000 – 01	482	5.0 ± 1.7	24.1 ± 2.7	3.7	8.4
2001 – 02	674	6.9 ± 2.4	26.9 ± 3.7	3.6	10.5
2002 – 03	526	5.3 ± 2.3	24.5 ± 4.1	3.6	9.4
2003 – 04	576	6.7± 2.1	26.7 ± 3.2	4.0	10.5
2004 – 05	764	5.9 ± 2.3	25.6 ± 4.0	3.6	9.5
2005 – 06	541	5.6 ± 1.5	25.4 ± 2.8	3.7	8.1
2006 – 07	771	7.2 ± 2.3	27.4 ± 3.4	3.8	11.1
BROWN TROUT					
1995 – 96	201	5.3 ± 2.2	22.4 ± 3.3	3.6	9.0
1996 – 97	162	4.6 ± 2.1	21.4 ± 4.0	3.4	7.8
1997 – 98	250	6.7 ± 3.4	24.0 ± 3.7	3.8	14.1
1998 – 99	55	6.6 ± 3.2	24.3 ± 3.5	3.5	13.5
1999 – 2000	120	6.7 ± 2.6	23.9 ± 3.7	3.5	10.1
2000 – 01	0				
2001 – 02	95	5.2 ± 1.8	21.9 ± 3.1	3.7	8.2
2002 – 03	156	5.5 ± 1.6	22.5 ± 2.2	4.0	8.0
2003 – 04	44	6.3 ± 2.4	23.6 ± 2.6	4.0	11.7
2004 – 05	30	7.5 ± 3.0	25.3 ± 3.6	4.1	13.8
2005 – 06	76	6.3 ± 2.6	23.4 ± 3.2	3.3	11.8
2006 – 07	80	6.4 ± 2.7	23.7 ± 3.6	3.5	11.0

Table 4. Number of coho salmon harvested, passed upstream and sampled at the Root River Steelhead Facility during fall, 2006.

Date	Number Harvested	Number passed upstream	Number of miscellaneous samples	Total Number of fish
07-Sep-2006	0	2	0	2
14-Sep-2006	0	5	0	5
21-Sep-2006	0	28	2	30
25-Sep-2006	0	69	2	71
28-Sep-2006	0	33	1	34
02-Oct-2006	0	9	1	10
04-Oct-2006	1	12	0	13
05-Oct-2006	0	28	3	31
09-Oct-2006	0	12	1	13
11-Oct-2006	0	11	2	13
12-Oct-2006	0	48	0	48
16-Oct-2006	4	25	2	31
18-Oct-2006	6	35	7	48
19-Oct-2006	1	110	15	126
23-Oct-2006	20	87	11	118
26-Oct-2006	0	12	1	13
30-Oct-2006	25	370	96	491
06-Nov-2006	2	83	28	113
13-Nov-2006	0	154	36	190
Totals	59	1133	208	1,400

Table 5. Estimated age composition of coho salmon (sexes combined) examined at the Root River Steelhead Facility during fall, 1995 through 2006. During 1995 to 1998, age was based on age-length key developed from known-age fin-clipped coho salmon. After 1998, ages were assigned by length-frequency of measured fish.

Year of Return	Percent age composition 1+	2+	Number used in analysis	Total return
1995	24 %	76 %	1,349	3,321
1996	32 %	68 %	4,170	4,406
1997	5 %	95 %	6,978	7,894
1998	12 %	88 %	2,439	4,000
1999	44 %	56 %	341	1,150
2000	7 %	93 %	472	3,408
2001	16 %	84 %	320	1,327
2002	16%	84%	334	2,514
2003	17%	83%	93	198
2004	17%	83%	363	1,259
2005	20%	80%	680	841
2006	48%	52%	593	1,400

Figure 1. Standard weight for the major salmonid species returning to the Root River Steelhead Facility during 1994 to 2005.

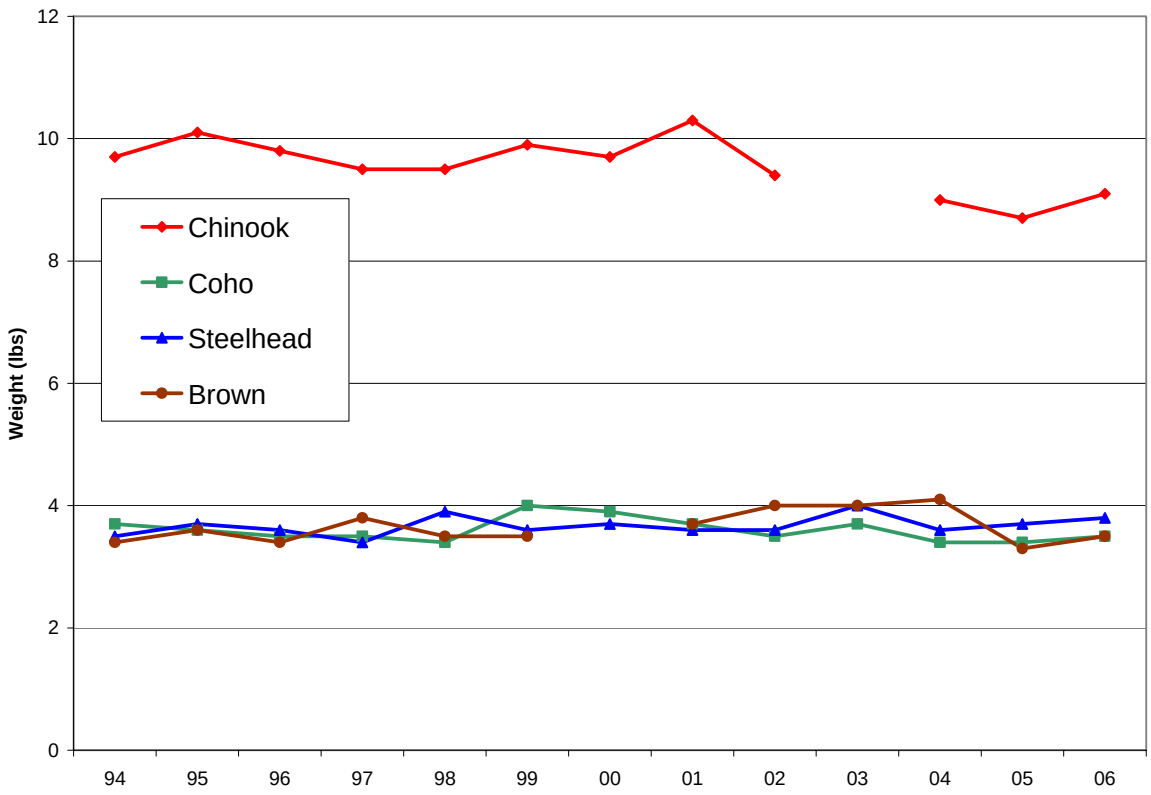


Table 6. Number of steelhead harvested, passed upstream and sampled at the Root River Steelhead Facility during fall, 2006 and spring, 2007.

Date	Number Harvested	Number Passed Upstream	Number of miscellaneous samples	Total Number of fish
28-Jun-2006	58	2	0	60
30-Jun-2006	34	3	0	37
14-Jul-2006	43	1	0	44
28-Aug-2006	52	4	0	56
31-Aug-2006	33	6	0	39
07-Sep-2006	55	2	0	57
11-Sep-2006	26	4	0	30
14-Sep-2006	0	29	0	29
21-Sep-2006	0	20	0	20
25-Sep-2006	38	7	0	45
28-Sep-2006	0	32	0	32
02-Oct-2006-30-Oct-2006	1	66	0	67
06-Nov-2006-13-Nov-2006	0	20	0	20
22-Mar-2007	0	53	0	53
26-Mar-2007	1	44	60	105
02-Apr-2007	2	168	60	230
12-Apr-2007	0	33	0	33
16-Apr-2007	0	7	0	7
Totals	343	501	120	964

7. Return rate of steelhead to the Root River Weir during 1994 through 2006. Number at age were estimated by expanding the proportion at each age in the aged sample against the return of known-strain steelhead. Fall data include only skamania; spring data combine chambers creek and ganaraska returns.

year	number	return	Number at age								Return
class	stocked	time	age 1	age 2	age 3	age 4	Age 5	age 6	age 7	total	Rate
1994	37,347	fall	76	78	87	37	3	14	10	306	0.82%
	72,313	spring	0	299	534	116	133	45	1	1129	1.56%
	109,660	**total**	**76**	**377**	**621**	**154**	**136**	**59**	**12**	**1435**	**1.31%**
1995	34,254	fall	0	27	25	31	12	39	43	178	0.52%
	69,983	spring	0	25	111	807	216	19	21	1199	1.71%
	104,237	**total**	**0**	**52**	**136**	**838**	**228**	**59**	**64**	**1377**	**1.32%**
1996	35,262	fall	0	0	18	84	20	8	3	133	0.38%
	70,225	spring	0	47	850	815	10	9	0	1731	2.47%
	105,487	**total**	**0**	**47**	**868**	**899**	**30**	**17**	**3**	**1864**	**1.73%**
1997	37,484	fall	0	0	46	5	5	2	0	58	0.15%
	66,735	spring	0	38	323	61	18	6	8	455	0.68%
	104,219	**total**	**0**	**38**	**369**	**66**	**23**	**8**	**8**	**513**	**0.49%**
1998	35,528	fall	0	5	231	156	30	10	6	438	1.23%
	53,914	spring	0	122	578	723	146	19	3	1591	2.95%
	89,442	**total**	**0**	**127**	**809**	**879**	**176**	**29**	**3**	**2029**	**2.3%**
1999	37,010	fall	0	5	77	41	2	7	6	138	0.37%
	54,405	spring	0	25	245	107	15	4	2	398	0.73%
	91,415	**total**	**0**	**30**	**322**	**148**	**17**	**11**	**8**	**536**	**0.59%**
2000	35,247	fall	8	0	154	130	1	9	-	302	0.86%
	54,160	spring	0	42	403	444	100	4	13	1006	1.86%
	89,407	**total**	**8**	**42**	**557**	**574**	**101**	**13**	**13**	**1308**	**1.46%**
2001	33,634	fall	0	38	103	8	75	-		224	0.67%
	54,189	spring	0	100	323	376	268	76		1143	2.11%
	87,823	**total**	**0**	**138**	**426**	**384**	**343**	**76**		**1367**	**1.56%**
2002	35,448	fall	0	2	85	117	-			204	0.58%
	54,273	spring	0	12	106	129	27			274	0.50%
	89,721	**total**	**0**	**14**	**191**	**246**	**27**			**478**	**0.53%**
2003	35,145	fall	0	0	268	**-**				268	0.76%
	58,920	spring	0	101	270	97				468	0.79%
	94,065	**total**	**0**	**101**	**538**	**97**				**736**	**0.78%**
2004	35,930	fall	0	3	**-**					3	0.01%
	55,033	spring	0	30	73					103	0.19%
	90,963	**total**	**0**	**33**	**73**					**106**	**0.12%**
2005	34,452	fall	0	-						0	0.00%
	54,346	spring	0	60						60	0.11%
	88,798	**total**	**0**	**60**						**60**	0.06%

Table 8. Estimated age composition of steelhead (sexes combined) examined at the Root River Steelhead Facility during 1994 – 2007. Age is based on age-length key developed from known-age fin clipped steelhead. Total number represents the number of steelhead used in the analysis.

Year of return	Percent age composition							Total Number
	1+	2+	3+	4+	5+	6+	7+	
Fall – 1994	8.9	7.5	43.2	34.2	6.2	-	-	146
Spring – 1995		7.3	31.3	38.0	12.7	10.7	-	450
Fall – 1995	15.6	12.2	21.8	49.7	0.7	-	-	147
Spring – 1996		11.0	36.1	33.1	9.1	10.1	0.6	692
Fall – 1996	-	26.3	36.8	5.3	31.6	-	-	21
Spring – 1997		1.0	22.1	42.5	22.5	10.5	1.4	483
Fall – 1997	-	4.4	14.2	67.2	9.6	4.4	-	135
Spring – 1998		15.3	35.9	37.6	5.6	5.2	0.4	287
Fall – 1998	-	-	29.3	44.0	25.3	1.4	-	75
Spring – 1999		2.1	46.5	44.2	7.3	-	-	385
Fall – 1999	-	-	32.3	54.7	5.2	7.8	-	51
Spring – 2000		8.0	21.3	53.6	14.2	3.0	-	714
Fall – 2000	-	2.7	25.3	46.7	6.7	8.0	10.7	75
Spring – 2001		3.5	83.2	8.9	1.4	2.8	0.2	482
Fall – 2001	2.4	1.4	72.8	1.5	13.3	26.3	7.0	212
Spring – 2002		4.2	23.2	68.3	1.5	0.8	2.0	575
Fall – 2002	-	-	26.8	53.9	1.7	2.7	14.8	278
Spring – 2003	-	13.1	52.9	14.1	19.2	0.8	-	491
Fall – 2003	-	14.1	57.6	15.3	11.1	0.8	1.1	262
Spring – 2004	-	1.5	39.2	54.0	1.8	2.3	1.0	385
Fall – 2004	-	0.8	41.6	52.8	0.8	4.0	-	125
Spring – 2005	-	14.7	15.3	54.5	14.5	0.6	0.4	490
Fall – 2005	-	-	79.8	7.3	0.1	6.4	5.5	109
Spring – 2006	-	4.2	38.4	18.4	38.1	0.6	0.3	354
Fall – 2006	-	0.6	55.6	24.2	15.6	1.9	1.3	475
Spring – 2007	-	17.4	21.1	28.0	7.8	22.0	3.7	218

Table 9. Average length and weight at age (± 1 SD) of fall-run skamania-strain steelhead at the Root River Steelhead Facility during 1994 to 2006. Data from 2000 - 2004 were taken from fish transported and held at Kettle Moraine Springs Hatchery, so some weight loss likely occurred.

Season	Strain	Age 2+	Age 3+	Age 4+	Age 5+	Age 6+	Age 7+
Fall, 1994	Skamania	23.6 (± 0) 4.5 (± 0) N = 1	26.1 (± 1.8) 5.6 (± 1.1) N = 52 / 43	29.9 (± 1.8) 8.3 (± 1.5) len N = 40 wt N = 31	31.9 (± 2.7) 10.2 (± 2.2) len N = 13 wt N = 12	33.6 (± 1.0) 11.6 (± 1.3) N = 11	
Fall, 1995	Skamania	25.8 (± 1.0) 5.3 (± 0.8) N = 14	27.0 (± 1.5) 6.2 (± 1.1) N = 27	30.5 (± 2.0) 9.1 (± 2.1) N = 70	31.7 (± 1.1) 10.5 (± 1.4) N = 6		
Fall, 1996	Skamania	22.1 (± 0) 4.0 (± 0) N = 1	27.2 (± 1.4) 6.7 (± 0.7) N = 7	28.8 (± 0) 8.0 (± 0) N = 1	32.1 (± 1.7) 10.1 (± 1.8) N = 2		
Fall, 1997	Skamania	28.5 (± 1.0) 7.1 (± 0.9) N = 6	27.1 (± 1.1) 6.0 (± 1.0) len N = 19 wt N = 18	31.1 (± 1.8) 9.1 (± 1.9) N = 91	32.1 (± 1.3) 9.6 (± 1.1) N = 12	34.5 (± 1.7) 12.3 (± 3.3) N = 7	36.0 (± 0) 12.9 (± 0) N = 1
Fall, 1998	Skamania		25.8 (± 1.4) 5.1 (± 0.8) N = 22	30.0 (± 2.1) 8.0 (± 1.6) N = 44	31.9 (± 2.0) 9.5 (± 1.5) N = 19		
Fall, 1999	Skamania		28.3 (± 1.6) 7.3 (± 0.8) N = 14	29.0 (± 1.2) 8.0 (± 1.1) N = 25	31.6 (± 2.1) 10.6 (± 0.4) N = 2	32.2 (± 0.6) 10.0 (± 1.1) N = 4	
Fall, 2000	Skamania	26.4 (± 0) 7.0 (± 1.4) N = 2	27.8 (± 1.2) 7.5 (± 1.0) N = 19	30.2 (± 2.0) 8.5 (± 2.0) len N = 37 wt N = 38	28.9 (± 0.5) 8.6 (± 1.0) N = 8	31.2 (± 1.0) 10.6 (± 1.8) N = 6	32.3 (± 2.3) 10.1 (± 1.8) N = 8
Fall, 2001	Skamania		27.0 (± 1.3) 6.8 (± 1.1) len N = 135 wt N = 53	25.5 (± 0.6) 6.6 (± 0.2) len N = 3 wt N = 2	31.5 (± 1.4) 9.3 (± 1.5) len N = 5 wt N = 3	30.5 (± 1.1) 10.1 (± 1.9) len N = 15 wt N = 10	32.6 (± 1.6) 10.9 (± 1.3) len N = 7 wt N = 5
Fall, 2002	Skamania		26.6 (±1.4) 6.2 (± 1.4) len N = 69 wt N = 11	28.7 (± 1.6) 8.0 (± 1.3) len N = 132 wt N = 41	30.0 (± 0.9) 7.3 len N = 4 wt N = 1	30.3 (± 0.7) 7.8 (± 1.1) len N = 6 wt N = 2	32.2 (± 0.9) 10.4 (± 1.1) len N = 31 wt N = 8
Fall, 2003	Skamania	25.4 (± 1.6) 6.3 (± 1.7) N = 10	26.1 (± 1.9) 6.4 (± 1.2) N = 66	29.5 (± 1.4) 8.6 (± 1.0) N = 16	32.1 (±) 2.4 10.9 (± 1.8) N = 17	30.7 7.5 N = 1	
Fall, 2004	Skamania	24.0 (± 0) 4.4 (± 0) N=1	26.3 (± 2.1) 6.2 (± 1.3) N=52	29.2 (± 1.7) 7.9 (± 1.5) N=66	31.8 (± 0) 10.1 (± 0) N=1	32.5 (± 2.6) 10.0 (± 1.6) N=5	
Fall, 2005	Skamania		27.0 (± 1.2) 6.0 (± .8) N=85	28.6 (± 1.1) 7.3 (± 1.0) N=12	29.1 (± 0) 7.1 (± 0) N=1	30.1 (± .9) 8.1 (± 1.1) N=7	32.2 (± 0.7) 9.1 (± 1.1) N =6
Fall, 2006	Skamania	27.3 (±.6) 6.0 (±1.5) N=4	27.3 (±1.2) 7.0 (±1.0) N=262	30.2 (±1.7) 9.4 (±1.8) N=114	29.7 (±1.4) 8.7 (±1.6) N=81		32.0 (±1.0) 11.6 (±1.3) N=6

Table 10. Average length and weight at age (± 1 SD) of spring-run chambers creek-strain steelhead at the Root River Steelhead Facility during 1995 to 2007.

Season	Strain	Age 2+	Age 3+	Age 4+	Age 5+	Age 6+	Age 7+
Spring, 1995	Chambers Cr.	20.9 (± 1.1)	23.9 (± 1.7)	28.1 (± 1.4)	28.5 (± 1.4)	31.3 (± 0.9)	
		4.2 (± 1.1)	4.6 (± 1.1)	7.6 (± 1.2)	7.8 (± 1.3)	10.0 (± 1.1)	
		N = 3	N = 73	N = 89	N = 32	N = 25	
Spring, 1996	Chambers Cr.	18.5 (± 0.8)	25.2 (± 1.4)	27.9 (± 1.4)	29.5 (± 1.8)	31.2 (± 1.3)	32.0 (± 0.6)
		2.2 (± 0.3)	5.6 (± 1.1)	7.4 (± 1.2)	9.3 (± 1.6)	10.5 (± 1.5)	12.0 (± 0.7)
		N = 22	N = 87	N = 90	N = 52	N = 41	N = 3
Spring, 1997	Chambers Cr.		24.8 (± 1.3)	28.6 (± 1.9)	27.4 (± 1.6)	32.2(± 1.1)	
			5.3 (± 1.0)	8.3 (± 1.5)	6.6 (± 1.5)	11.2 (± 1.6)	
			N = 33	N = 77	N = 70	N = 35	
Spring, 1998	Chambers Cr.		23.8 (± 1.4)	27.7 (± 2.3)	28.9 (± 1.8)	32.1 (± 0.8)	
			4.3 (± 0.8)	7.0 (± 2.0)	7.5 (± 1.2)	10.2 (± 1.3)	
			N = 42	N = 39	N = 5	N = 7	
Spring, 1999	Chambers Cr.	18.6 (± 0.4)	23.8 (± 1.6)	28.3 (± 2.0)	28.6 (± 2.3)		
		2.7 (± 0.8)	4.7 (± 0.8)	7.6 (± 1.3)	8.0 (± 1.8)		
		N = 2	N = 13	N = 96	N = 4		
Spring, 2000	Chambers Cr.	17.2 (± 1.1)	26.2 (± 1.8)	29.3 (± 1.8)	29.8 (± 2.2)	30.3 (± 1.5)	
		1.6 (± 0.3)	6.3 (± 1.1)	8.3 (± 1.4)	8.7 (± 1.8)	8.6 (± 1.9)	
		N = 12	N = 26	N =90	N = 54	N = 8	
Spring, 2001	Chambers Cr.		23.9 (± 1.6)	27.5 (± 3.3)	31.3 (± 0)	27.8 (± 0.4)	
			4.7 (± 0.8)	6.9 (± 2.0)	10.7 (± 0)	7.1 (± 0.5)	
			N = 62	N = 8	N = 1	N = 4	
Spring, 2002	Chambers Cr.		25.5 (± 1.8)	28.9 (± 1.8)	30.3 (± 2.4)	29.9 (± 2.3)	32.3 (± 1.3)
			5.4 (± 1.1)	8.0 (± 1.6)	9.8 (± 1.4)	8.7 (± 1.6)	11.2 (± 1.8)
			N = 17	N = 206	N = 2	N = 2	N = 8
Spring, 2003	Chambers Cr.	16.9 (±1.4)	24.8 (± 1.3)	28.2 (± 1.5)	28.8 (± 2.2)	28.6 (± .7)	
		1.8 (± .4)	5.1 (± 1.0)	7.4 (± 1.3)	7.7 (± 1.5)	7.1 (± .4)	
		N =20	N =72	N = 27	N = 19	N = 2	
Spring, 2004	Chambers Cr.	16.5 (± 1.8)	24.8 (± 1.4)	28.6 (± 1.8)		31.1 (± 1.6)	32.6 (± .7)
		1.6 (± .4)	5.4 (± .9)	7.9 (± 1.5)		9.7 (± 1.4)	11.0 (± .7)
		N = 3	N = 48	N = 112		N = 5	N = 4
Spring, 2005	Chambers Cr.	17.7 (± 1.2)	24.3 (± 1.1)	27.6 (± 1.9)	29.2 (± 2.2)	28.9 (± 1.7)	
		1.9 (± .3)	4.9 (± .8)	7.1 (± 1.6)	8.1 (± 1.9)	7.8 (± .7)	
		N = 6	N = 38	N = 81	N = 21	N = 3	
Spring, 2006	Chambers Cr.	17.9 (± .7)	23.5 (± 1.4)	27.1 (± 1.5)	25.5 (± 1.2)		32.4 (± 0)
		2.1 (± .3)	4.8 (± .9)	6.6 (± 1.0)	5.6 (± .9)		9.5 (± 0)
		N = 5	N = 22	N = 49	N = 115		N = 1
Spring 2007	Chambers Cr.	18.0 (±1.0)	25.8 (± 1.3)	26.8 (±1.1)	27.8 (± 1.2)	29.6 (± 1.0)	29.7 (± .8)
		2.0 (± 0.4)	5.6 (± 1.0)	6.5 (± 0.9)	7.1 (± 0.5)	8.2 (± 1.0)	8.5 (± 1.8)
		N=29	N=14	N=34	N=7	N=55	N=2

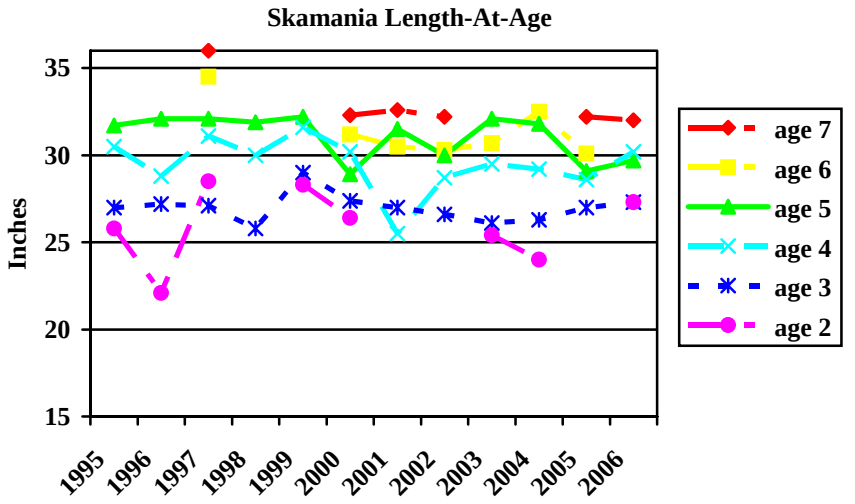
Table 11. Average length and weight at age (± 1 SD) of spring-run ganaraska-strain steelhead at the Root River Steelhead Facility during 1995 to 2007.

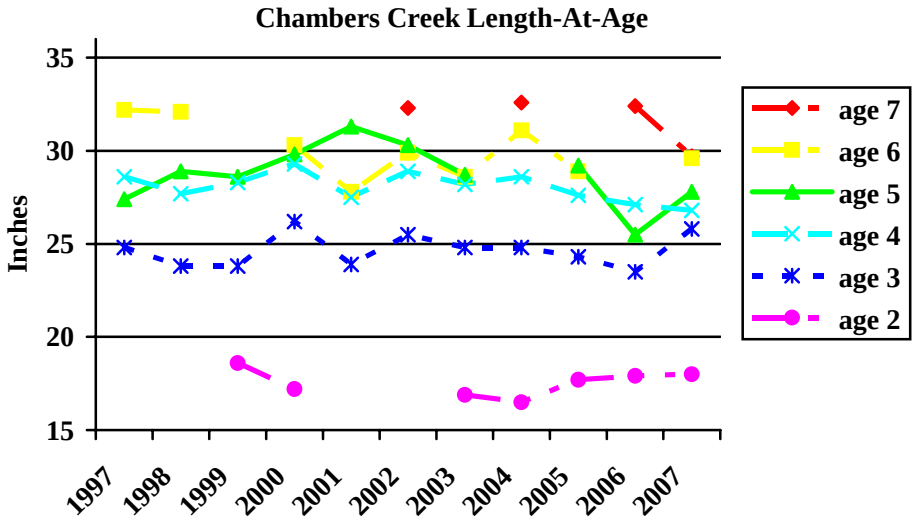
Season	Strain	Age 2+	Age 3+	Age 4+	Age 5+	Age 6+	Age 7+
Spring, 1995	Ganaraska	16.5 (± 1.3) 1.5 (± 0.5) N = 30	21.5 (± 2.3) 3.3 (± 1.0) len N = 68 wt N = 67	24.2 (± 2.2) 5.0 (± 1.4) N = 81	27.5 (± 1.7) 7.2 (± 2.0) N = 24	28.8 (± 1.2) 8.0 (± 1.4) N = 23	32.5 (± 0) 12.5 (± 0) N = 1
Spring, 1996	Ganaraska	16.6 (± 1.9) 1.7 (± 0.5) N = 57	23.5 (± 1.8) 4.7 (± 1.2) N = 167	25.1 (± 2.0) 5.7 (± 1.4) N = 113	26.7(± 1.9) 7.1 (± 1.5) N = 22	28.6 (± 1.5) 8.7 (± 1.5) N = 29	32.2 (± 0) 12.5 (± 0) N = 1
Spring, 1997	Ganaraska	15.1 (± 1.9) 1.2 (± 0.4) N = 3	23.5 (± 2.1) 4.3 (± 1.3) N = 75	28.4 (± 1.9) 7.9 (± 1.6) N = 125	27.7 (± 2.1) 7.4 (± 1.7) N = 30	27.1 (± 0) 6.7 (± 0) N = 1	
Spring, 1998	Ganaraska	16.7 (± 1.3) 1.6 (± 0.3) N = 45	21.4 (± 1.9) 3.3 (± 0.8) N = 66	25.1 (± 2.6) 5.2 (± 1.5) N = 94	27.0 (± 0.8) 5.9 (± 0.6) N = 7	31.2 (± 0.2) 9.3 (± 0.7) N = 3	30.4 (± 0) 4.9 (± 0) N = 1
Spring, 1999	Ganaraska	17.1 (± 1.6) 2.0 (± 0.6) N = 6	23.7 (± 1.4) 4.9 (± 0.9) N = 167	26.2 (± 1.7) 6.6 (± 1.3) N = 79	27.6 (± 2.0) 7.4 (± 1.8) N = 25		
Spring, 2000	Ganaraska	16.8 (± 1.6) 1.6 (± 0.4) N = 37	25.1 (± 2.2) 5.8 (± 1.6) N = 73	28.6 (± 2.1) 8.3 (± 1.9) N = 202	28.3 (± 2.3) 8.2 (± 2.1) N = 18	29.4 (± 1.7) 9.0 (± 1.1) N = 5	
Spring, 2001	Ganaraska	16.9 (± 0.6) 1.6 (± 0.3) N = 14	23.7 (± 1.5) 4.7 (± 0.8) N = 273	27.1 (± 2.4) 7.0 (± 2.1) N = 18	29.3 (± 1.0) 9.0 (± 0.6) N = 3	28.9 (± 1.3) 8.7 (± 1.7) N = 4	32.8 (± 0) 12.5 (± 0) N = 1
Spring, 2002	Ganaraska	16.0 (± 1.6) 1.5 (± 0.4) N = 17	23.2 (± 1.5) 4.2 (± 0.7) N = 86	27.3 (± 1.7) 7.1 (± 1.4) N = 103	28.1 (± 2.4) 8.0 (± 2.5) N = 5	28.9 (± 0.5) 8.1 (± 0.2) N = 2	
Spring, 2003	Ganaraska	17.0 (± 1.3) 1.9 (± .8) N = 39	22.8 (± 1.7) 4.3 (± 1.0) N = 116	27.2 (± 2.0) 6.5 (± 1.3) N = 23	25.4 (± 2.2) 5.8 (± 1.7) N = 48		
Spring, 2004	Ganaraska	15.6 (± 3.3) 1.6 (± 1.0) N = 3	23.7 (± 1.7) 4.8 (± 1.0) N = 103	27.2 (± 2.1) 7.1 (± 1.5) N = 96	28.4 (± 1.5) 8.1 (± 1.1) N = 7	30.2 (± .8) 8.8 (± .6) N =4	
Spring, 2005	Ganaraska	17.3 (± 1.8) 2.0 (± .6) N = 66	22.7 (± 2.2) 4.1 (± 1.2) N = 37	26.4 (± 1.7) 6.2 (± 1.2) N = 186	27.7 (± 2.0) 7.1 (± 1.6) N = 50		32.6 (± 2.0) 10.3 (± .6) N = 2
Spring, 2006	Ganaraska	16.5 (± 1.5) 1.6 (± .5) N = 8	23.8 (± 1.9) 4.7 (± .9) N = 116	24.8 (± 1.2) 5.0 (± 1.3) N = 3	26.7 (± 1.8) 6.0 (± 1.3) N = 20	28.9 (± .5) 7.1 (± 1.3) N =2	
Spring 2007	Ganaraska	18.2 (± 3.6) 2.2 (± 1.3) N = 8	23.6 (± 1.7) 4.6 (± 0.9) N = 34	26.2 (± 1.9) 6.3 (± 1.4) N = 28	28.3 (± 3.0) 7.6 (± 2.6) N = 3	27.8 (± 0.5) 6.6 (± 0.5) N = 2	30.1 (± 1.6) 8.3 (± 1.7) N = 6

Table 12. Population estimates for chinook, coho and steelhead salmon returning to the Root River during fall, 1999 through spring, 2007. Fall steelhead are mostly skamania, but may include other strains.

Year	Species	Number of marked fish	Number of recaptured fish	Number of marked fish in recapture sample	Population size (±) 1 SD
Fall, 1999	Chinook	5,381	18	7	13,836 ± 4,088
	Coho	978	111	35	3,101 ± 434
	Fall steelhead	19	13	0	266 ± 181
	Brown	125	17	2	750 ± 342
Spring, 2000	Chambers Creek	460	1	0	-
	Ganaraska	1,006	21	13	1,625 ± 278
Fall, 2000	Chinook	6,965	72	13	38,575 ± 9,685
	Coho	2,921	38	11	10,091 ± 2,565
	Fall steelhead	59	16	6	157 ± 51
	Brown	241	22	1	2,771 ± 1,529
Spring, 2001	Chambers Creek	128	8	2	384 ± 157
	Ganaraska	475	27	6	2,137 ± 769
Fall, 2001	Chinook	9,697	142	82	16,792 ± 1,205
	Coho	942	2	1	1,413 ± 471
	Fall steelhead	175	40	3	1,794 ± 762
	Brown	176	71	1	6,336 ± 3,607
Spring, 2002	Chambers Creek	564	15	9	940 ± 198
	Ganaraska	372	14	9	579 ± 115
Fall, 2002	Chinook	9,912	178	143	12,338 ± 458
	Coho	2,079	109	38	5,963 ± 781
	Fall Steelhead	48	5	3	72 ± 19
	Brown	291	11	6	534 ± 147
Spring, 2003	Chambers Creek	185	8	7	211 ± 28
	Ganaraska	497	19	11	858 ± 168
Fall, 2003	Chinook	149	6	5	179 ± 33
	Coho	126	4	3	168 ± 48
	Fall steelhead	6	23	0	144 ± 100
	Brown	53	25	2	663 ± 449
Spring, 2004	Chambers Creek	350	20	7	1,000 ± 305
	Ganaraska	421	32	5	2,694 ± 1,107
Fall, 2004	Chinook	378	4	1	1,512 ± 1,309
	Coho	1,148	11	10	1,263 ±120
	Fall steelhead	77	4	3	103 ± 30
	Brown	28	9	0	280 ± 188
Spring, 2005	Chambers Creek	224	7	6	261 ± 40
	Ganaraska	388	9	7	499 ± 89
Fall, 2005	Chinook	3,608	50	25	7,216 ± 1,020
	Coho	657	3	3	657 ± 0
	Fall steelhead	25	6	0	175 ± 115
	Brown	141	6	0	987 ± 646
Spring, 2006	Chambers Creek	321	18	6	963 ± 321
	Ganaraska	321	8	3	856 ±391
Fall, 2006	Chinook	9,836	119	29	40,362 ± 6,518
	Coho	1,133	3	2	1,511 ± 378
	Fall steelhead	125	14	1	938 ± 504
	Brown	124	15	0	1,984 ± 1,358
Spring, 2007	Chambers Creek	139	13	1	973 ± 520
	Ganaraska	65	6	0	455 ±298
	Spring Skamania	17	2	0	51 ± 29

Figure 2. Steelhead mean length-at-age at the Root River Steelhead Facility during 1995 to 2007. Skamania data from 2001 - 2004 were taken from fish transported and held at Kettle Moraine Springs Hatchery.





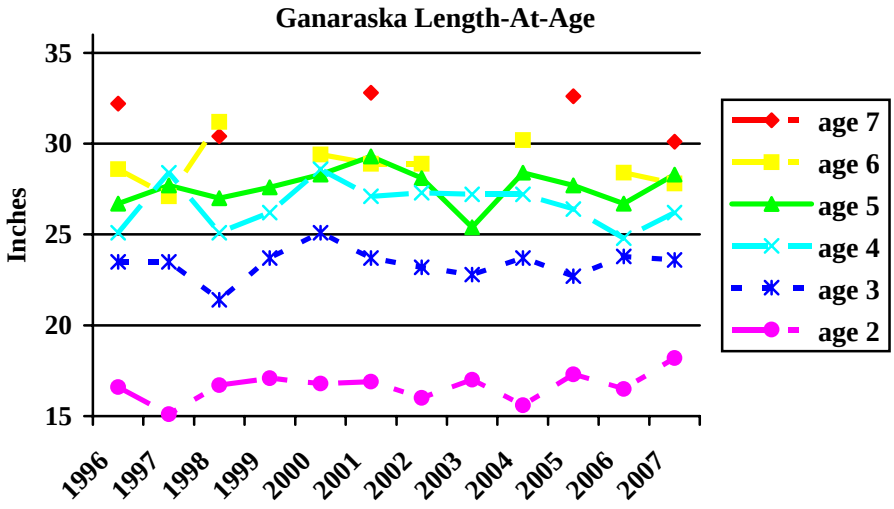
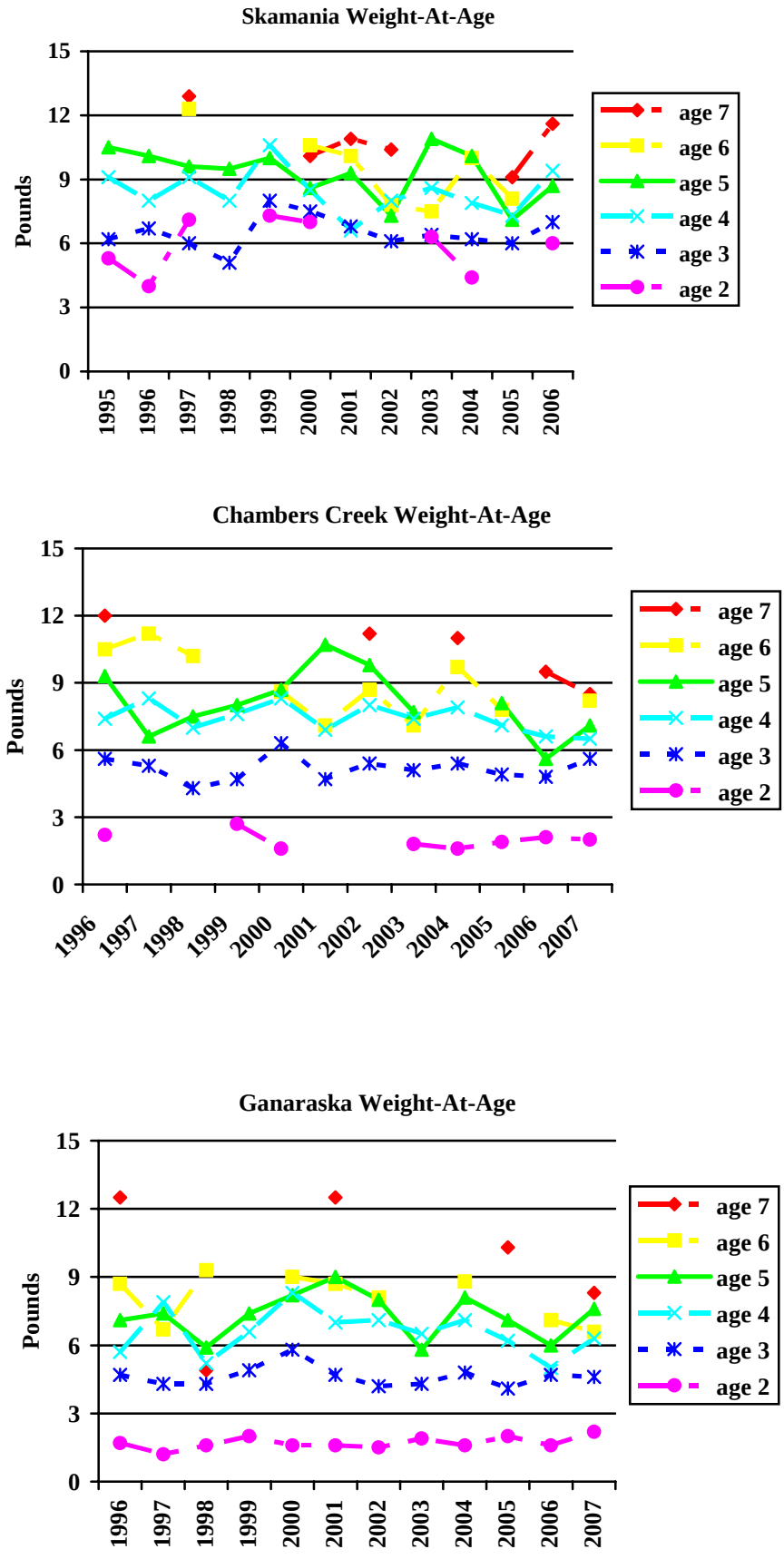


Figure 3. Steelhead mean weight-at-age at the Root River Steelhead Facility during 1995 to 2006. Skamania data from 2001- 2003 were taken from fish transported and held at Kettle Moraine Springs Hatchery.



APPENDIX A. ROOT RIVER STOCKING NUMBERS

Table A-1. Number of fingerling chinook salmon stocked in the Root River during 1994 - 2006. Chinook salmon were marked with an oral dose of Oxytetracycline (OTC) during 2001. Totals for 1999 and 2006 represent reductions in statewide stocking quotas.

Year stocked	Total number	Strain	Fin clip
1994	75,533	Lake Michigan	LP
	60,000	Lake Michigan	None
1995	99,000	Lake Michigan	RP
	69,250	Lake Michigan	None
1996	158,000	Lake Michigan	None
1997	142,500	Lake Michigan	None
1998	161,500	Lake Michigan	None
1999	143,100	Lake Michigan	None
2000	142,900	Lake Michigan	None
2001	143,973	Lake Michigan	None (OTC)
2002	140,280	Lake Michigan	None
2003	143,935	Lake Michigan	None
2004	143,900	Lake Michigan	None
2005	144,035	Lake Michigan	None
2006	113,945	Lake Michigan	None (OTC)

Table A-2. Number of coho salmon stocked in the Root River during 1994 – 2006. Targets were 40,600 spring yearlings and 10,000 fall fingerings.

Year stocked	Total number	Strain	Fin clip	Age
1994	66,080	Lake Ontario	None	Spring yearling 1+
	55,954	Lake Ontario	RMLP	Fall fingerling 0+
	50,389	Lake Michigan	RP	Spring yearling 1+
1995	65,100	Lake Michigan	RMRP	Spring yearling 1+
	54,832	Lake Michigan	RMLV	Fall fingerling 0+
1996	40,590	Lake Michigan	RMRV	Spring yearling 1+
	63,697	Lake Michigan	LP	Fall fingerling 0+
1997	48,107	Lake Michigan	RP	Spring yearling 1+
	6,668	Lake Michigan	REL	Spring yearling 1+
	4,208	Lake Michigan	None	Spring yearling 1+
	20,604	Lake Michigan	None	Fall fingerling 0+
1998	33,666	Lake Michigan	None	Spring yearling 1+
	10,000	Lake Michigan	None	Fall fingerling 0+
1999	45,945	Lake Michigan	None	Spring yearling 1+
	13,824	Lake Michigan	None	Fall fingerling 0+
2000	41,375	Lake Michigan	None	Spring yearling 1+
	10,030	Lake Michigan	None	Fall fingerling 0+
2001	27,970	Lake Michigan	None	Spring yearling 1+
	11,080	Lake Michigan	A-CWT	Spring yearling 1+
	10,260	Lake Michigan	None	Fall fingerling 0+
2002	29,954	Lake Michigan	None	Spring yearling 1+
	10,648	Lake Michigan	A-CWT	Spring yearling 1+
	12,285	Lake Michigan	None	Fall fingerling 0+
2003	31,514	Lake Michigan	None	Spring yearling 1+
	10,845	Lake Michigan	A-CWT	Spring Yearling 1+
2004	40,623	Lake Michigan	None	Spring yearling 1+
	14,500	Lake Ontario	None	Fall fingerling 0+
2005	9,755	Lake Ontario	A-CWT	Spring yearling 1+
	30,855	Lake Ontario	None	Spring yearling 1+
	12,739	Lake Michigan	None	Fall fingerling 0+
2006	10,000	Lake Michigan	None	Fall fingerling 0+
	36,510	Lake Michigan	None	Spring yearling 1+
	7,560	Lake Michigan	A-CWT	Spring yearling 1+

Table A-3. Number of steelhead stocked in the Root River during 1994 – 2006. Stocking targets were 35,000 per strain, reduced to 27,000 chambers creek and ganaraska after 1998.

Year stocked	Total number	Strain	Fin clip
1994	30,417	Skamania	RM
	35,124	Chambers Creek	LM
	34,759	Ganaraska	LV
1995	37,347	Skamania	ARM
	37,819	Chambers Creek	ALM
	34,494	Ganaraska	ALV
1996	34,254	Skamania	RM
	34,579	Chambers Creek	LM
	35,404	Ganaraska	ARV
1997	35,262	Skamania	RMRV
	35,024	Chambers Creek	LMLV
	35,201	Ganaraska	BV
1998	37,484	Skamania	ARM
	33,187	Chambers Creek	ALM
	33,548	Ganaraska	ALV
1999	35,528	Skamania	RM
	26,951	Chambers Creek	LM
	26,963	Ganaraska	ARV
2000	37,010	Skamania	RMRV
	27,287	Chambers Creek	LMLV
	27,118	Ganaraska	BV
2001	35,247	Skamania	ARM
	27,060	Chambers Creek	ALM
	27,100	Ganaraska	ALV
2002	33,634	Skamania	RM
	27,064	Chambers Creek	LM
	27,125	Ganaraska	ARV
2003	35,448	Skamania	RMRV
	27,123	Chambers Creek	LMLV
	27,150	Ganaraska	BV
2004	35,145	Skamania	RM
	31,039	Chambers Creek	LM
	27,881	Ganaraska	ALV
2005	35,930	Skamania	ARM
	27,058	Chambers Creek	ALM
	27,975	Ganaraska	ARV
2006	34,452	Skamania	RMRV
	27,398	Chambers Creek	LMLV
	26,948	Ganaraska	BV

Funding provided by
Great Lakes Salmon and Trout Stamp.
Artist: Craig Fairbert

PUB – FH – 836 2007