Return, Size, and Age of Steelhead at the Besadny Anadromous Fisheries Facility, 2010

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ABSTRACT

An annual steelhead assessment project began in 1992 at the Besadny Anadromous Fisheries Facility (BAFF) to (1) assess the return of the three steelhead strains to BAFF and (2) collect basic biological information on each strain.

Spring operations in 2010 began on March 25 when the ponds were sorted to look for steelhead with Chambers Creek and Ganaraska fin clips and continued through April 14. During this period, 699 steelhead were handled at BAFF. The run consisted of 219 Chambers Creek strain steelhead, 150 Ganaraska, 62 Skamania and 268 unclipped, misclipped or stray steelhead from other states.

The 2010 spring run total of 699 steelhead was near the five year average of 771 for BAFF. The increases observed in the weight indices for steelhead captured during the 2010 spring are likely due to a larger percentage of the run being age 5 females. The 2006 year class has dominated returns to BAFF since the spring of 2008. Subsequent stocking years have returned in lower number although the 2007 stocking year class has returned in moderate numbers.

Summer/fall fish collections began on October 12 when the ponds were sorted to look for targeted species. Ponds were sorted twice during October and three times in November to process migrating fish. Twenty-four steelhead were captured at BAFF during the 2010 summer/fall run. This change was 80 percent lower than the fall 2009 run when 122 steelhead were captured. Thirty-eight percent of the 2010 steelhead had identifiable Skamania clips. The 2005 stocking year class appears to have been successful with measurable returns noted in the summer/fall collection years of 2008 through 2010.

Gamete collections for the two spring strains of steelhead were good from BAFF in 2010 and should result in normal numbers of Chambers Creek and Ganaraska being stocked in 2011. Adult Skamania used as brood fish have not been collected from either steelhead facility since 2008 due to VHS concerns. This alteration will result in no further Skamania stocking by Wisconsin for the foreseeable future.

INTRODUCTION

Wisconsin began its Lake Michigan rainbow/steelhead trout fishery in 1963 when rainbow trout were stocked in a Door County stream (Daly 1968). During the years following the original stocking, many changes in the fishery occurred including changes in the strains and the age of fish stocked. Since 1988, Wisconsin has stocked three steelhead strains, Skamania, Chambers Creek and Ganaraska for its Lake Michigan steelhead program. Although similar in appearance, each strain has unique characteristics that make each important to the overall steelhead program. We hoped that these strains would provide a good return to the creel and provide more fishing opportunities throughout the year for anglers in tributary streams.

To enhance the steelhead fishery and continue the time series of biological information collected during earlier studies, an annual steelhead assessment project was initiated by Fisheries Management at the C.D. Besadny Anadromous Fishery Facility (BAFF) weir in 1992. The goals of this project are to (1) assess the return of the three steelhead strains to BAFF, (2) to collect basic biological information on each strain, and (3) from 2004 through 2009, monitor the outmigration of steelhead and other trout and salmon smolts from the Kewaunee River. This report summarizes the data collected during the 2010 migratory runs of adult steelhead at BAFF.

METHODS

Spring operations at BAFF began in early spring when ice on the Kewaunee River broke up and continued until April 14. Water was passed through the collection ponds and down the fish ladder, attracting migrating steelhead up the ladder and into the ponds. Ponds were sorted at least once a week, and as fish proceeded through BAFF, they were checked for clips, sex and ripeness. Steelhead were measured to the nearest 1 mm and weighed to the nearest 0.01 kg. All fish received a caudal fin clip to denote that data had been collected from that fish. Ripe fish with the appropriate strain fin clip were spawned, allowed to recover, and then released upstream of the facility. Fish that were not ripe, but having the appropriate fin clip were returned to a holding pond. All other fish were measured, weighed, revived and released upstream. By April 14, the Kettle Moraine State Hatchery had collected enough fertilized eggs to meet the requested quotas and the steelhead portion of the facility was closed.

Fall operations began in late September when the ladder began to operate and continued until November 16. Steelhead were checked for fin clips, and a subsample were weighed, measured and passed upstream of the facility.

The data were analyzed using basic fishery statistics, such as average length and weight by sex and clip. Before steelhead smolts were stocked into the Kewaunee River, they were marked with unique fin clips by strain. Chambers Creek strain steelhead were marked with left maxillary, adipose-left maxillary or left maxillary-left ventral clips with each unique clip

used once in three years. Ganaraska strain steelhead were marked with adipose-left ventral, adipose-right ventral or both ventral clips. Skamania were marked with right maxillary, adipose-right maxillary or right maxillary-right ventral clips. This allowed us to assign returning steelhead to year classes by fin clip and use of a length frequency table to estimate return rate by stocking. A regression of length and weight for each strain was calculated. By using standard weight and trophy weight, which are the measure of the weight of a 660 mm steelhead and the weight of the 95th percentile of steelhead respectively, we were able to track recent weight trends in the population.

RESULTS

Spring

Spring operations in 2010 began on March 25 when the ponds were sorted to look for steelhead with Chambers Creek and Ganaraska fin clips and continued through April 14 when the ponds were emptied. During this period, 699 steelhead were handled at BAFF. The run consisted of 219 Chambers Creek strain steelhead (31.3% of the run), 150 Ganaraska (21.5%), 62 Skamania (8.9%) and 268 (38.3%) unclipped, misclipped or strays from other streams or states (Table 1). The number of fish handled during the spring run in 2010 was lower than the 815 that returned in 2009, but was more than the eight year running average of 667 fish. Chambers Creek steelhead returned slightly earlier than the Ganaraska strain (Table 2).

Chambers Creek Strain

A total of 219 Chambers Creek strain steelhead were handled during the spring run of 2010, the most abundant known strain fish handled (Table 1). They ranged in length from 408 mm to 825 mm and had an average length of 693 mm. Chambers Creek weight ranged from 0.70 kg to 5.24 kg and averaged 2.70 kg. The average length and average weight for Chambers Creek steelhead was slightly larger than those measured in 2009.

Males comprised 32.9 % of the run and averaged 674 mm in length and 2.68 kg in weight (Table 3). All three Chambers Creek fin clips were observed for male fish, with the left maxillary left ventral (LMLV) the most common. Returning fish were assigned to age classes based on known fin clips. In 2010, males returned at ages 2 through 5 (Table 4). Age 4 fish were the most common and they averaged 719mm in length and 3.07 kg in weight. Other age male steelhead returned in lower numbers.

Females comprised 67.1% of the run and averaged 703 mm in length and 3.18 kg in weight (Table 3). All three Chambers Creek fin clips were observed for female fish in 2010, with the LMLV the most common. Returning fish were assigned to age classes based on known fin clips. In 2010, females returned at ages 3 through 5 (Table 4). Age 5 fish were the most common, followed by age 4 steelhead. Age 3 returned in substantially lower numbers in 2010. Age 5 female Chambers Creek steelhead averaged 711 mm in length and 3.26 kg in weight.

Ganaraska strain

One hundred and fifty Ganaraska strain steelhead were handled during the spring run of 2010 (Table 1). Lengths ranged from 262 mm to 790 mm and averaged 648 mm. Weights ranged from 0.20 kg to 4.28 kg with an average weight of 2.52 kg. The average length and average weight for Ganaraska steelhead was similar to 2009 averages.

Males comprised 26.0% of the run in 2010 and had an average length of 623 mm and an average weight of 2.22 kg (Table 3). All three Ganaraska fin clips were observed for returning males in 2010 in nearly equal number with the adipose right ventral (ARV) clip the most common. Based on fin clips, ages 2 through 5 male Ganaraska returned during the spring migration (Table 4). Age 3 fish were the most common, with slightly lower numbers of age 4 and age 5 fish captured. Age 3 males averaged 592 mm in length and 1.88 kg in weight.

Females comprised 74.0% of the run and averaged 656 mm in length and 2.63 kg in weight (Table 3). All three clips were detected for female Ganaraska, with the BV clip the most common. Most of the returning females were age 5 and had an average length of 676 mm and an average weight of 2.77 kg (Table 4). Age 3 and age 4 female Ganaraska were also present in returns but in lower numbers than age 5 females.

Skamania strain

A total of 62 Skamania strain steelhead returned to BAFF during spring operations (Table 1). Lengths ranged from 630 mm to 890 mm and averaged 751 mm (Table 1). Weights ranged from 2.00 kg to 5.48 kg with an average weight of 3.41 kg. Skamania average length and weight increased in 2010 from those measured in 2009 primarily due to the return of the 2005 year class.

Males comprised 51.6% of the run in 2010 and had an average length of 769 mm and an average weight of 3.59 kg (Table 3). Three Skamania fin clips were observed for returning males in 2010 with the right maxillary right ventral (RMRV) clip the most common. Based on fin clips, age 3 through age 5 male Skamania returned during the spring migration (Table 4). Age 5 fish were the most common, with fewer fish of other ages captured. Age 5 males averaged 765 mm in length and 3.55 kg in weight.

Females comprised 48.4% of the run and averaged 732 mm in length and 3.21 kg in weight (Table 3). Three clips were detected for female Skamania, with the right maxillary right ventral (RMRV) clip the most common. Most of the returning females were age 5 and had an average length of 737 mm and an average weight of 3.23 kg (Table 4).

Non-broodstock steelhead

The final component of the spring run were those steelhead not used for broodstock collection. Although the majority of these fish were Chambers Creek, Ganaraska, or

Skamania strain steelhead, they were unclipped, misclipped, or were study fish from another stream. Clipped or unclipped fish from other states were also part of this category. During the 2010 spring run, we counted 268 (38.3% of the run) steelhead/rainbow trout which were in this category (Table 1). Similar to known strain steelhead, they were processed during each day of operation and peaked on March 25 (Table 2).

Summer/Fall

Summer/fall fish collections began on October 1 when the ponds were filled. BAFF ponds were sorted at least five times during October and November to process migrating fish. Thirty-four steelhead were captured at BAFF during the summer/fall run of 2010 (Table 2). This collection was a large decline in return when compared to the fall 2009 run.

Nine identifiable Skamania with two unique Skamania fin clips were observed during the fall 2010 run (Table 5). A total of six right maxillary right ventral (RMRV) fin clipped Skamania were observed. They averaged 746 mm in length and 3.37 kg in weight. Based on the fin clip (RMRV), these fish were most likely from the 2005 year class making them age 5. Three additional right maxillary (RM) fin clipped fish were examined and were likely age 4.

A single Chamber Creek female with a left maxillary clip measuring 443 mm in length and 0.80 kg in weight returned in the fall of 2010 (Table 5). Based upon fin clip it is likely that this fish was from the 2009 year class.

Three Ganaraska with adipose left ventral (ALV) returned in 2010 (Table 5). The three males averaged 404 mm in length and 0.77 kg in weight. Based upon fin clip it is likely that these fish were from the 2009 year class.

DISCUSSION

Since 1992, we have been monitoring trends of several factors associated with the annual steelhead spawning migrations up the Kewaunee River to BAFF. These factors include abundance and run timing for each strain, length and weight and return rate.

Timing and Abundance of the Run

Spring

Timing

Early in Wisconsin's steelhead program, spring migratory runs had been predictable with large numbers of Chambers Creek returning to the weir at the onset of operations in March followed by increasing Ganaraska numbers in April before the run ended in early May (Hogler and Surendonk 2004). However, since 1999 steelhead runs at BAFF have been markedly different in timing and abundance as compared to those occurring before 1999

(Hogler and Surendonk 2006). Since 1999, run timing does not appear to be as distinct as was historically observed. From 1999 through 2007, the run has been limited to a two or three week period with the highest number of fish of all strains handled the first day of operation and sharply declining numbers thereafter. Since 2008, however, the spring run although not entirely like the pre-1999 runs have begun to look more like earlier years with a more distinct Chambers Creek run and Ganaraska run. There now appears to be a one to two week difference in the run timing of Chambers Creek and Ganaraska strains unlike the period between 1999 and 2007 when there was little difference in run time of the spring strains. It is likely improved hatchery spawning practices have aided in the separation of the two spring runs.

Abundance

Abundance of steelhead during spring runs has changed greatly during the pre and post 1999 period similar to run timing. Spring runs before 1999 consisted of several thousand steelhead, but from 1999 through 2007 run total averaged just 499 steelhead per year (Figure 1).

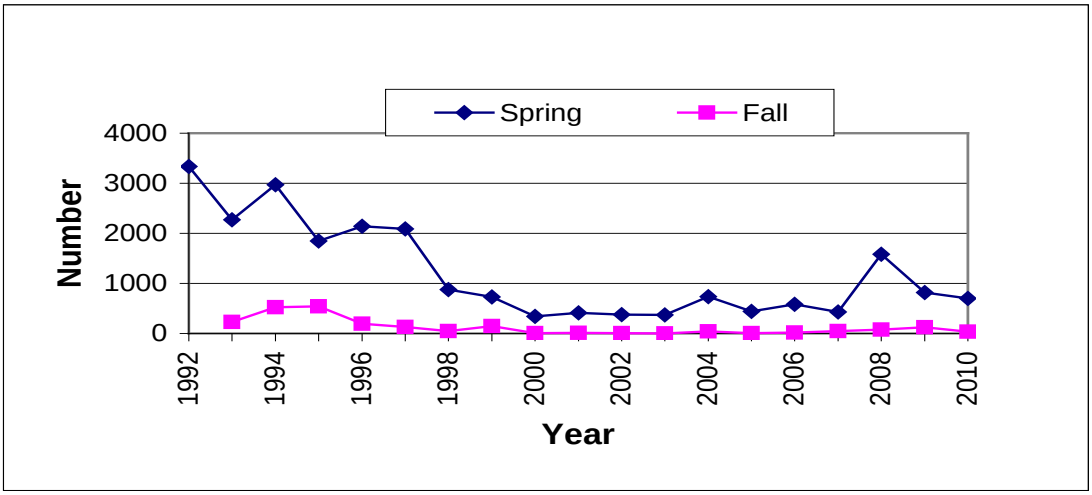

Figure 1. Return number to BAFF on the Kewaunee River for spring and summer/fall runs from 1992 through 2010.

Since 2008, spring returns have improved. The 1,582 steelhead that returned to BAFF during the spring 2008 run tripled the return number from what was observed in 2007 and was the highest number of steelhead handled since the spring of 1997 (Figure 1). Although return number declined in 2009 and 2010, they have remained above what was observed from 2000 through 2007. There is no clear explanation for the decrease in run number observed in the spring steelhead runs since 1992 or the big increase observed in the spring of 2008.

Likely the decreases observed in spring runs since 1997 were due to a combination of factors including, ecosystem changes in Lake Michigan, unseasonable weather (warm or

cold), low Lake Michigan water levels making it difficult for fish to migrate upstream, low river flows due to poor spring runoff, poor water quality, poor survival of smolts, or high lake harvest of adult steelhead.

Likewise the increase noted in 2008 is likely due to a combination of factors. These factors could include, stocking levels, good river flows at the appropriate times (spring and fall), reduced lake harvest of adult steelhead or increased smolt survival.

Stocking number does not appear to contribute significantly to the decline in run number observed from 1997 through 2007 or to the increase in run number seen since 2008 (Figure 2). Stocking numbers have remained relatively stable for all strains, generally varying from year to year within 10-12% of the stocking goal of 35,000 for each strain, except in 2007 when only Ganaraska were stocked in near normal number and 2009 when Chambers Creek were stocked at a near normal level. The decline in Ganaraska stocking number in 2009 may substantially reduce future runs starting in the spring of 2011. No Skamania were stocked in 2009 or 2010.

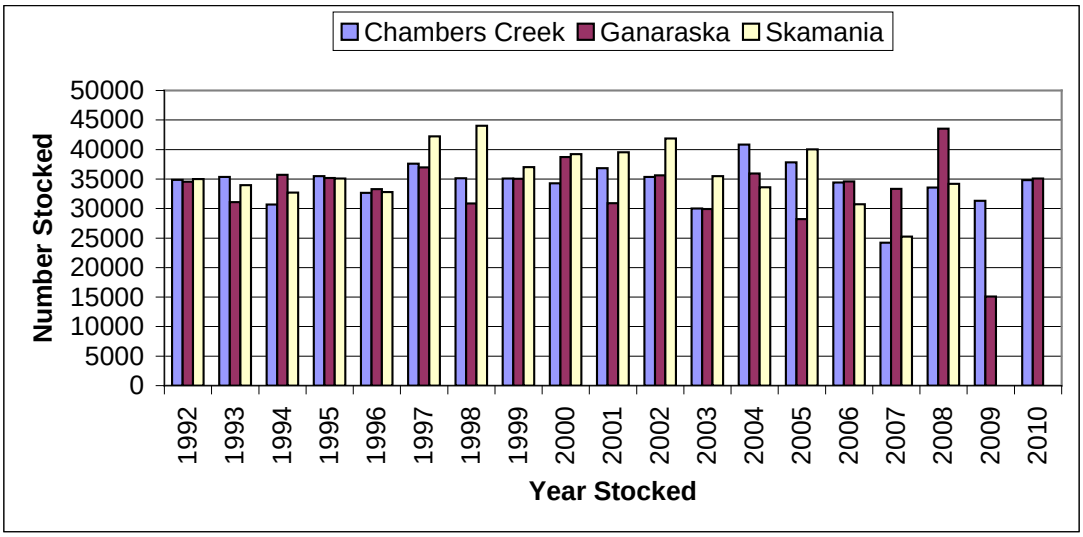

Figure 2. Stocking number by strain for steelhead stocked into the Kewaunee River from 1992 through 2010.

During the previous 5 years, we experienced unusual spring conditions with snow melt, rain and the river being ice free in February. It is likely many mature steelhead missed this early pulse of water and had difficulty navigating upstream when day length and maturity level reached critical levels because of low river flow. In 2010, spring water flow and stage were closer to normal allowing steelhead to migrate up the Kewaunee River at an appropriate time. The length of the run was shortened because river flow quickly began to drop by mid-April.

Lakewide angler harvest of adult fish may also affect the number of returning spawners to BAFF. The annual steelhead harvest in the 1990's averaged just over 92,800 fish with harvests during 1994, 1995 and 1998 exceeding 110,000 steelhead (Peterson and Eggold

2009). The decline in returns noted in years following this spike in harvest can likely be partially explained by the high harvest. However, recently the annual harvest has declined to an average of 49,846 steelhead per year for the past five years (Eggold, 2010). The lag in time from the year of stocking to the year that steelhead are harvested coupled with steelhead stocking from other Lake Michigan agencies and natural reproduction, make the relationship between harvest and return number difficult to understand. To illustrate this point, despite the marked reduction in harvest of steelhead from the Wisconsin waters of Lake Michigan from 2000 to 2007, the number of steelhead returning to BAFF did not increase but rather declined. It is likely that reductions in harvest from one jurisdiction may be balanced by increased harvest from anglers in other states, resulting in no net increase in the return to weir of Wisconsin stocked steelhead or because return is not entirely linked to angler harvest in Wisconsin.

Mortality of smolts may also play an important role in determining the number adult steelhead returning to BAFF. Size at stocking has been shown to be an important factor in the survival of smolts and their ultimate contribution to the fishery (Seelbach 1985). Smolts stocked before 2007 were smaller in length than the 200 mm recommended by Seelbach (1985) and many were less than 150 mm. Bartron (2003) indicated that steelhead stocked at less than 150 mm in length survive poorly and contribute little to the fishery as adults.

Size at stocking continues to be a concern. Early in the steelhead program stocked steelhead average above the level recommended by Bartron (2003) and angler harvest and weir returns were strong (WDNR 1999). However, by the mid 1990's average stocking size began to decline, reaching their lowest sizes in 2003 (Chambers Creek-117 mm, Ganaraska-112 mm and Skamania-135 mm). Angler harvest and weir returns also declined during that period. Since 2004, stocked steelhead began to increase in size reaching the stocking size goal in 2009. It is not clear how size at stocking affects harvest and return because in 2006 stocked steelhead were less than the length goal when stocked but the return of this stocking year class as adults was strong in 2009 and slightly weaker in 2010. Linkages between stocking size and weir returns should be closely monitored in the coming years.

In addition to physical size and condition, other factors, such as river flow, water quality, disease status, the amount of fat reserve, and predation by avian and fish predators on recently stocked steelhead may also influence the number of smolts that survive and return as adults.

Fall

The 34 steelhead handled at BAFF in the summer/fall of 2010 was the lowest total since 2006 when 15 steelhead were captured and was only 29.3% of what was captured in 2009 (Table 5). The summer/fall run continues to be much lower than historic runs of the early 1990's. Poor river conditions, with low flow and warm water temperatures are likely responsible for some of the declines seen in fall runs since the late 1990's.

Strain Performance

Chambers Creek

Average length and average weight increased in 2010 over 2009 levels, but standard weight and trophy weight declined for Chambers Creek steelhead (Table 1, Figure 3). The increase in average length and weight is likely due to an increase in the number of age 4 fish that returned to the weir in 2010, as compared to 2009 when age 3 steelhead dominated the run. Standard and trophy weights decreased in 2010 from 2009 values (Figure 3). Over the past five years, the girth of returning steelhead has visibly lessened. The decline in standard and trophy weights reflects the reduction in steelhead weight. The lack of large steelhead in the spring run suggests that forage on Lake Michigan may be an issue, or that low river levels may be preventing large fish from reaching BAFF.

Return rates from an individual year of stocking can also be evaluated by the use of fin clips. Since the majority of Chambers Creek fish traditionally returned at age 4, we would expect to see the highest return rate of a year class occur three years after the fish were stocked. In 2010, 4-year-old Chambers Creek steelhead stocked in 2007 returned to BAFF at the second highest rate (3.68 fish thousand stocked) since 2009 when 2006 stocked fish returned at 5.69 per thousand stocked (Table 6). Overall, the best return rates for age 4 Chambers Creek have been for fish stocked in 2001 and 2006.

The return of 2008 stocked fish as age 3 steelhead was the second highest return since 2008 fish when 2006 return at age 3 (Table 6). It is hoped that the trend of increasing return continues.

Ganaraska

Ganaraska strain steelhead had more variation in yearly average length and weight than Chambers Creek strain fish (Table 1). In 2010, the average length of Ganaraska increased from what was measured in 2009, however all three weight indices decreased (Table 1, Figure 3). It is possible that the declines in weight may be linked to forage levels in Lake Michigan.

The return rate for Ganaraska stocked in 2007 was the lowest return of age 4 Ganaraska since stocking year class 2003 returned in 2006 (Table 7). The 2004 and 2006 stocking year classes continue to be the best returning year classes. The return of stocking year classes 2008 and 2009 has been lower than average and when coupled with sharply reduced stocking numbers in 2009 because of a manure spill in the Kewaunee River watershed, the return of Ganaraska in the next several years could be very low.

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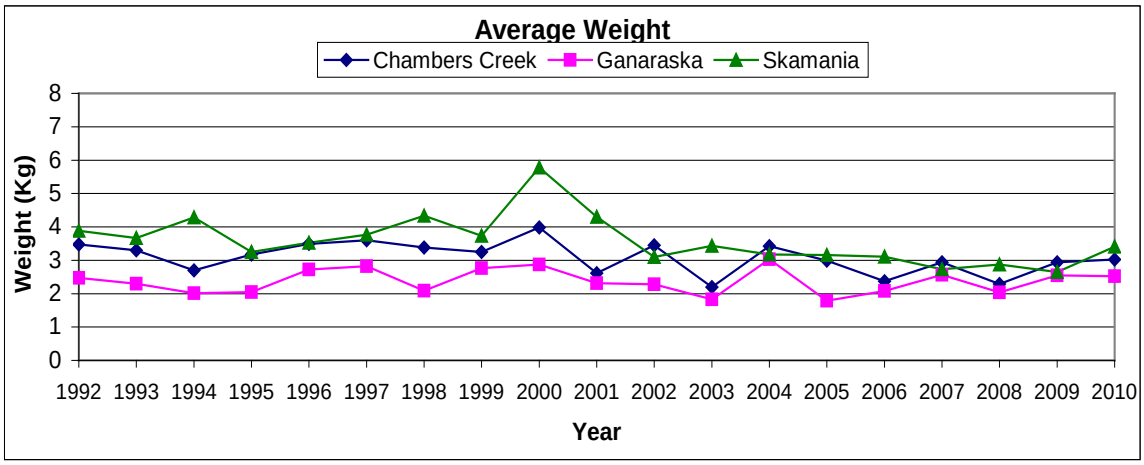

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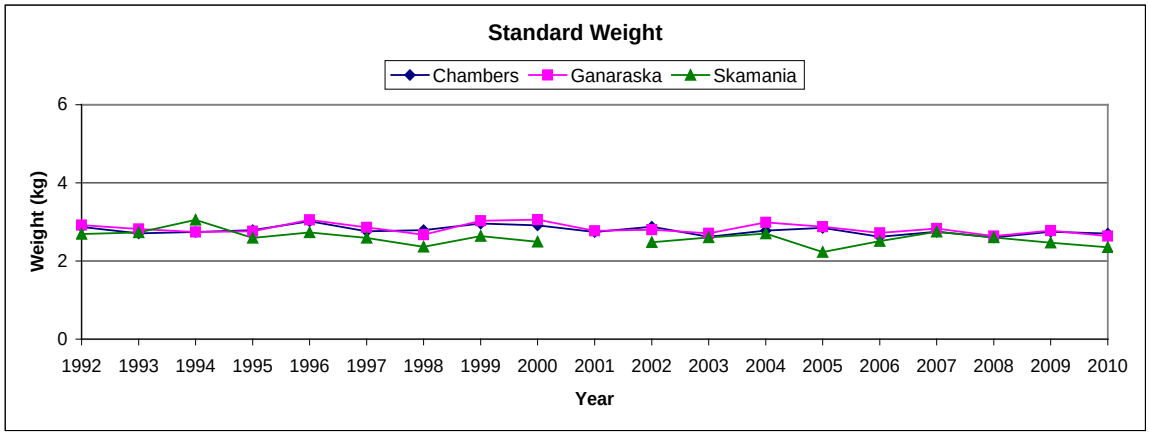

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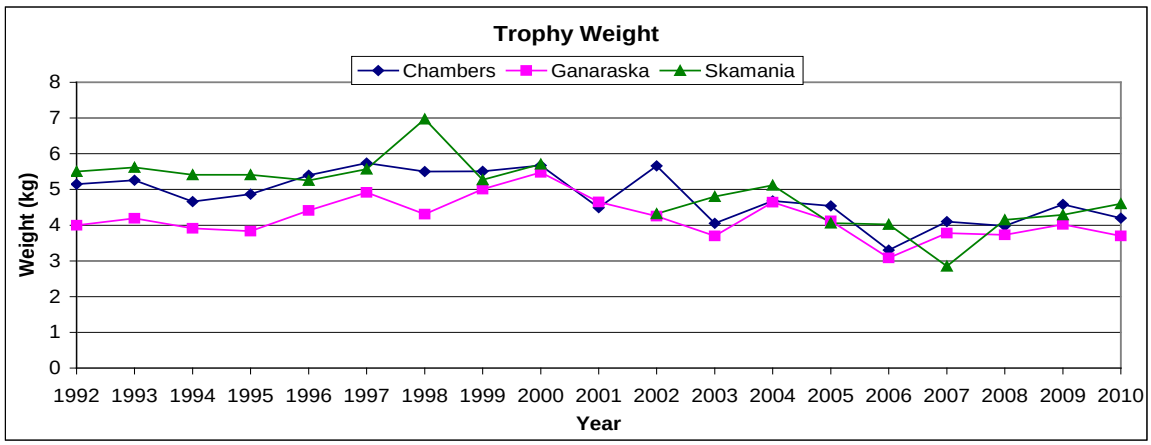

Figure 3. Weights trends for steelhead during spring migrations at BAFF, 1992-2008: (A) Average weight for each strain for that year, (B) Standard weight is based on the projected weight of a 660 mm steelhead, (C) Trophy weight for each strain based on the 95th percentile of weighed steelhead.

Skamania

Skamania strain steelhead have been a small, but consistent portion of spring runs on the Kewaunee River (Table 1). Average length and weight and trophy weight increased in 2010, while standard weight decreased (Figure 3). But, since we handle a low number of Skamania in spring and since they are normally summer/fall returning fish, the indices we collect in spring should be viewed cautiously.

The number of Skamania collected during the fall run has varied greatly (Tables 1 and 5). Spring and fall returns for the six most recent years have been very low and is indicative of decreasing and finally cessation of Skamania stocking because of VHS concerns. Return rates of stocked Skamania have varied greatly with the good return (for Skamania) from the 2006 stocking year class and poorer return rates of other stocked year classes (Table 9).

Comparison of Strain Performance

All three strains had poorer returns to the weir in 2010 as compared to the 2009 run (Tables 1 and 5). Of the spring running strains since 2001, Ganaraska have returned to BAFF in slightly greater total number. Survival based on return per thousand stocked also indicates that Ganaraska had a slightly better overall return than Chambers Creek strain steelhead. The return rate of Skamania per thousand stocked is the lowest of the three strains of steelhead.

Based on measured size and trophy weights, Skamania continue to be the largest steelhead followed by Chambers Creek and then Ganaraska (Table 1). Mixed results from the three weight trends may indicate forage problems in Lake Michigan, or be the result of greater numbers of younger (smaller) fish in the run because low water inhibited the upstream movement of larger steelhead or from poor survival of earlier stocked year classes (Figure 3). Angler harvest of adult steelhead in some years may have also reduced the number of steelhead returning to BAFF.

SUMMARY

The 2010 spring run total was 14.2% less than the run total of 2009 making it the lowest spring run total at BAFF since 2007. Decreases in the most of the weight indices for steelhead captured during the 2010 spring are likely due to declining forage levels in Lake Michigan. Long term changes in weight trends are likely due to the absence of age 5 and older fish which were present in past runs. Why older fish are absent from recent runs is unknown at this time and may be related to angler harvest, fish health, stocking location or predation on smolts.

The 2010 summer/fall steelhead run was the worst run since 2006 (Table 5). The cessation of Skamania stocking after 2008 and very dry summers and falls have resulted in low river levels that limited the fall/summer run of Skamania into the Kewaunee River.

Gamete collections for the two spring strains of steelhead were good from BAFF in 2010 and should result in near normal numbers of Chambers Creek and Ganaraska being stocked in 2011. Adult Skamania to be used as brood fish have not been collected from either steelhead facility for several years due to VHS concerns. That change will result in no Skamania stocking in Wisconsin for the foreseeable future unless gametes or fingerlings are obtained from another source or Wisconsin develops an isolated holding facility.

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Table 1. Summary of steelhead length and weight data collected during spring migratory runs at BAFF, on the Kewaunee River, 2002-2010.

Year	Strain	Number	Run %	Average Length (mm)	Length Range (mm)	Average Weight (kg)	Weight Range (kg)	Standard Weight (kg)*	Trophy Weight (kg)**
2002	Chambers	51	13.6	716	440-860	3.45	0.6-5.7	2.88	5.66
	Ganaraska	61	16.2	662	375-870	2.82	0.4-4.7	2.80	4.25
	Skamania	17	4.5	718	586-788	3.10	1.6-4.3	2.48	4.32
	Other	247	65.7	--	--	--	--	--	--
	Total	376							
2003	Chambers	81	21.8	617	425-800	2.20	0.8-4.5	2.62	4.05
	Ganaraska	68	18.3	556	360-732	1.83	0.6-3.9	2.71	3.70
	Skamania	16	4.3	741	572-842	3.43	1.9-4.8	2.60	4.80
	Other	206	55.5	--	--	--	--	--	--
	Total	371							
2004	Chambers	203	27.6	713	440-845	3.42	0.94-5.32	2.78	4.68
	Ganaraska	162	22.0	663	250-810	3.03	0.18-5.10	2.99	4.64
	Skamania	31	4.2	709	540-894	3.17	1.46-5.32	2.70	5.12
	Other	339	46.1	--	--	--	--	--	--
	Total	735							
2005	Chambers	66	14.9	675	400-850	2.99	0.68-5.12	2.85	4.54
	Ganaraska	125	28.2	537	280-869	1.79	0.2-5.92	2.88	4.12
	Skamania	15	3.4	732	685-815	3.16	2.4-4.06	2.23	4.06
	Other	237	53.5	--	--	--	--	--	--
	Total	443							
2006	Chambers	135	23.2	633	435-762	2.37	0.60-4.12	2.62	3.30
	Ganaraska	249	42.8	588	397-794	2.08	0.40-5.32	2.72	3.08
	Skamania	17	2.9	704	630-795	3.11	2.02-4.02	2.51	4.02
	Other	181	31.1	--	--	--	--	--	--
	Total	582							
2007	Chambers	163	37.8	679	405-810	2.94	0.56-4.76	2.75	4.10
	Ganaraska	128	29.8	629	370-770	2.56	0.52-4.42	2.83	3.78
	Skamania	2	0.5	658	630-685	2.73	2.46-3.00	2.75	2.85
	Other	138***	31.9	--	--	--	--	--	--
	Total	431							
2008	Chambers	499	31.5	627	400-840	2.29	0.60-4.74	2.60	3.98
	Ganaraska	545	34.5	595	372-815	2.04	0.58-4.64	2.64	3.73
	Skamania	21	1.3	689	420-820	2.87	0.62-4.42	2.60	4.15
	Other	517	32.7	--	--	--	--	--	--
	Total	1582							
2009	Chambers	272	33.4	677	440-832	2.94	0.90-5.62	2.75	4.58
	Ganaraska	219	26.9	636	415-785	2.55	0.72-4.90	2.78	4.02
	Skamania	32	3.9	679	590-815	2.65	1.78-4.40	2.47	4.29
	Other	292	35.8						
	Total	815							
2010	Chambers	219	31.3	693	408-825	3.02	0.70-5.24	2.70	4.20
	Ganaraska	150	21.5	648	262-790	2.52	0.20-4.28	2.64	3.70
	Skamania	62	8.9	751	630-890	3.41	2.00-5.48	2.35	4.60
	Other	268	38.3						
	Total	699							

* Standard weight is a prediction based on a 660.4-mm steelhead.

** Trophy weight is based on the 95 percentile of weighed steelhead.

*** Includes 99 steelhead checked for fin clips and returned to the river.

Table 2. Daily totals during 2010 operations at BAFF, by strain of steelhead.

Spring Run Steelhead

Date	Chambers Creek	Ganaraska	Skamania	Other	Day Total
March 25	121	44	27	108	300
March 30	18	8	1	28	55
April 07	68	70	32	100	270
April 14	12	28	2	32	74
Total	219	150	62	268	699

Summer/Fall Run Steelhead

Date of Operation	Chambers Creek	Ganaraska	Skamania	Other	Not Noted	Day Total
October 01*					1	1
October 12		1	6	6		13
October 20					7	7
October 21*					1	1
November 02	1		3	5		10
November 09		2				2
November 16				1		1
Total	1	3	9	12	9	34

***Dead in pond.

Table 3. Average length, weight and run number by strain, clip, and sex during the spring spawning run at BAFF, 2010.

	Male			Female		
Strain and Clip	**Average Length (mm)**	**Average Weight (kg)**	**Run Number**	**Average Length (mm)**	**Average Weight (kg)**	**Run Number**
Chambers Creek						
Left Maxillary, Left Ventral (LMLV)	641	2.41	28	711	3.26	77
Adipose, Left Maxillary (ALM)	660	2.54	18	644	2.47	7
Left Maxillary (LM)	719	3.07	26	699	3.17	63
Chambers Creek combined average	**674**	**2.68**		**703**	**3.18**	
Ganaraska						
Adipose, Left Ventral (ALV)	690	2.81	11	685	3.00	27
Adipose, Right Ventral (ARV)	592	1.88	15	592	2.02	29
Both Ventral (BV)	603	212	13	676	2.77	55
Ganaraska combined average	**623**	**2.22**		**656**	**2.63**	
Skamania						
Adipose, Right Maxillary (ARM)	753	4.44	2	752	3.50	1
Right Maxillary (RM)	761	3.49	7	709	3.07	6
Right Maxillary, Right Ventral (RMRV)	765	3.55	23	737	3.23	23
Skamania combined average	**769**	**3.59**		**732**	**3.21**	

Table 4. The age distribution, length, and weight of returning clipped steelhead by sex for the Kewaunee River spring 2010.

Chambers Creek

Age (Male)	2	3	4	5	Age (Female)	2	3	4	5
Measured	9	18	26	19	Measured		7	63	77
Average Length (mm)	439	660	719	737	Average Length (mm)	--	644	699	711
Range (mm)	408-470	560-810	550-800	622-803	Range	--	600-745	600-825	603-795
Weighed	9	18	26	19	Weighed	--	7	63	77
Average Weight (kg)	0.84	2.54	3.07	3.16	Average Weight (kg)	--	2.47	3.17	3.26
Range (kg)	0.70-1.10	1.62-4.30	1.64-4.18	2.20-4.36	Range (kg)	--	2.04-3.06	2.12-5.24	1.80-4.92

Ganaraska

Age (Male)	2	3	4	5	Age (Female)	2	3	4	5
Measured	4	15	11	9	Measured	--	29	27	55
Average Length (mm)	398	592	690	694	Average Length (mm)	--	592	685	676
Range (mm)	262-450	515-651	520-790	630-745	Range	--	536-745	610-745	587-765
Weighed	4	15	11	9	Weighed	--	29	27	55
Average Weight (kg)	0.63	1.88	2.81	2.78	Average Weight (kg)	--	2.02	3.00	2.77
Range (kg)	0.20-0.90	1.00-2.58	1.08-4.28	2.10-4.00	Range (kg)	--	1.40-3.40	1.80-4.00	1.50-4.20

Skamania

Age (Male)	2	3	4	5	Age (Female)	2	3	4	5
Measured	0	2	7	23	Measured		1	6	23
Average Length (mm)	--	830	761	765	Average Length (mm)	--	752	709	737
Range (mm)	--	775-885	630-890	677-834	Range	--		675-783	689-785
Weighed	0	2	7	23	Weighed	0	1	6	23
Average Weight (kg)	--	4.44	3.49	3.55	Average Weight (kg)	--	3.50	3.07	3.23
Range (kg)	--	3.40-5.48	2.00-4.60	2.50-4.86	Range (kg)	--		2.54-3.90	2.30-4.30

Table 5. Steelhead fin clip trends detected at BAFF during fall migrations, 2004-2010

Strain and fin clip	2004	2005	2006	2007	2008	2009	2010
Skamania							
Adipose, Right Maxillary (ARM)	4			14	1		
Right Maxillary (RM)	21	4	1	13	1	6	3
Right Maxillary, Right Ventral (RMRV)		1		1	38	66	6
Total Skamania	***25***	***5***	***1***	***28***	***40***	***72***	***9***
Chambers Creek							
Left Maxillary (LM)				1			1
Left Maxillary, Left Ventral (LMLV)			1	2			
Adipose, Left Maxillary (ALM)							
Total Chambers Creek	***0***	***0***	***1***	***3***	***0***	***0***	***1***
Ganaraska							
Adipose, Right Ventral (ARV)							
Adipose, Left Ventral (ALV)						1	3
Both Ventral (BV)							
Total Ganaraska	***0***	***0***	***0***	***0***	***0***	***1***	***3***
Adipose, Left Pectoral (ALP)				1		1	
Left Pectoral (LP)				1		2	1
Right Pectoral (RP)							1
No Clips		1		9	6	37	9
Misc. Clips							
Clip Not Noted	13	1	13		30	3	10
Total Others	***13***	***2***	***13***	***11***	***36***	***43***	***21***
Total Fall Steelhead Run	**38**	**7**	**15**	**42**	**76**	**116**	**34**

Table 6. Return rates (number per thousand stocked) for Chambers Creek steelhead during spring migrations on the Kewaunee River, 2001-2010.

	Year Stocked									
Return Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
2001	0.00	--	--	--	--	--	--	--	--	--
2002	0.09	0.05	--	--	--	--	--	--	--	--
2003	0.15	1.79	0.17	--	--	--	--	--	--	--
2004	0.00	4.53	1.02	0.00	--	--	--	--	--	--
2005	0.00	0.62	0.48	0.20	0.20	--	--	--	--	--
2006	0.00	0.14	0.23	0.27	2.69	0.11	--	--	--	--
2007	0.00	0.00	0.00	0.17	2.69	0.82	0.52	--	--	--
2008	0.00	0.00	0.00	0.33	1.05	1.61	10.80	0.54	--	--
2009	0.00	0.00	0.00	0.13	0.17	0.08	5.69	2.44	0.09	--
2010	0.00	0.00	0.00	0.00	0.00	0.00	2.79	3.68	0.75	0.29
Total	0.24	7.13	1.90	1.10	6.80	2.62	19.80	6.66	0.84	0.29

Table 7. Return rates (number per thousand stocked) for Ganaraska steelhead during spring migrations on the Kewaunee River, 2001-2010.

	Year Stocked									
Return Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
2001	0.08	--	--	--	--	--	--	--	--	--
2002	0.08	0.16	--	--	--	--	--	--	--	--
2003	0.00	1.49	0.45	--	--	--	--	--	--	--
2004	0.03	3.40	1.26	0.37	--	--	--	--	--	--
2005	0.00	0.58	0.73	0.67	1.72	--	--	--	--	--
2006	0.00	0.36	0.19	0.70	5.39	0.57	--	--	--	--
2007	0.00	0.00	0.00	0.13	2.36	0.74	0.52	--	--	--
2008	0.00	0.00	0.00	0.87	2.03	1.98	10.50	0.81	--	--
2009	0.00	0.00	0.00	0.00	0.14	0.35	4.25	1.50	0.16	--
2010	0.00	0.00	0.00	0.00	0.00	0.00	1.85	1.14	1.01	0.26
Total	0.19	5.99	2.63	2.74	11.64	3.64	17.12	3.45	1.17	0.26

Table 8. Return rates (number per thousand stocked) for Skamania steelhead during spring migrations on the Kewaunee River, 2001-2010.

	Year Stocked									
Return Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
2001	0.00	--	--	--	--	--	--	--	--	--
2002	0.03	0.00	--	--	--	--	--	--	--	--
2003	0.03	0.03	0.05	--	--	--	--	--	--	--
2004	0.03	0.53	0.12	0.00	--	--	--	--	--	--
2005	0.00	0.33	0.05	0.00	0.00	--	--	--	--	--
2006	0.00	.0.03	0.05	0.34	0.06	0.00	--	--	--	--
2007	0.00	.0.00	0.00	0.03	0.03	0.00	0.00	--	--	--
2008	0.00	0.00	0.00	0.00	0.30	0.25	0.00	0.04	--	--
2009	0.00	0.00	0.00	0.00	0.03	0.04	0.69	0.18	0.00	--
2010	0.00	0.00	0.00	0.00	0.00	0.00	1.50	0.51	0.09	--
Total	0.09	0.92	0.27	0.37	0.42	0.29	2.19	0.73	0.09	--