Return, Size, and Age of Steelhead at the Besadny Anadromous Fisheries Facility, 2011

Steve Hogler and Steve Surendonk

ABSTRACT

An annual steelhead assessment project begun 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 2011 began on April 11 and continued through April 27 when the ponds were emptied. During this period, 598 steelhead were handled at BAFF. The run consisted of 142 Chambers Creek strain steelhead, 146 Ganaraska, 8 Skamania and 302 unclipped, misclipped or strays from other streams or states. The number of fish handled during the spring run in 2011 was lower than the 699 handled in 2010. In 2011, Chambers Creek and Ganaraska strain steelhead returned in near equal numbers.

Summer/fall fish collections began on October 7. Forty-one steelhead were captured at BAFF during the summer/fall run of 2011. This collection was a slight increase in returns compared to the 2010 return. Five Skamania with identifiable clips were captured with one right maxillary right ventral (RMRV) fin clipped and four right maxillary (RM) clip Skamania captured. Also captured were four Chambers Creek steelhead and 32 unknown steelhead.

Gamete collections for the two spring strains of steelhead were good from BAFF in 2011 and should result in normal numbers of Chambers Creek and Ganaraska being stocked in 2012.

INTRODUCTION

Wisconsin initiated a 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. From 1988 through 2008, Wisconsin stocked three steelhead strains, Skamania, Chambers Creek and Ganaraska for its Lake Michigan 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 fishing tributary streams. However, since 2009 Skamania strain steelhead have not been stocked because of VHS concerns.

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 each steelhead strain to BAFF and (2) to collect basic biological information on each strain. This report summarizes the data collected during the 2011 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 throughout April. 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 on 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 had the appropriate fin clip were returned to a holding pond. All other fish were measured, weighed, revived and released upstream. By April 27, the Kettle Moraine State Hatchery had collected enough fertilized eggs to meet the requested quotas and the steelhead aspect of the facility was closed.

Fall operations begin on October 7 when the ponds were sorted and continued until December 1. Steelhead were checked for fin clips, 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 erre 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. 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. These clips allowed WDNR staff to assign returning steelhead to year classes

by fin clip and use a length frequency table to estimate return rate by stocking year (it is not possible to distinguish age 3 from age 6 due to overlap, by default all fish greater than age 3 were assigned to age 3). A regression of length and weight for each strain was calculated. By using standard weight and trophy weight, 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 2011 began on April 11 when the ponds were sorted to look for steelhead with Chambers Creek and Ganaraska fin clips and continued through April 27 when the ponds were emptied. During this period, 598 steelhead were handled at BAFF (Table 1). The run consisted of 142 Chambers Creek strain steelhead (23.7% of the run), 146 Ganaraska (24.4%), 8 Skamania (1.3%) and 302 (50.5%) unclipped, misclipped or strays from other streams or states. The number of fish handled during the spring run in 2011 was lower than the 699 handled in 2010 and 27.3% lower than the five year running average of 822 fish. In 2011, Chambers Creek and Ganaraska strain steelhead returned in near equal number.

Chambers Creek Strain

A total of 142 Chambers Creek strain steelhead were handled during the spring run of 2011 (Table 1) and were captured during each day of operation (Table 2). They ranged in length from 255 mm to 800 mm, and had an average length of 597 mm. Chambers Creek weight ranged from 0.20 kg to 5.56 kg and averaged 2.12 kg. The average length and average weight for Chambers Creek steelhead were lower than in 2010 and the lowest measured since 2003. In 2011, standard weight and trophy weight increased from 2010 and were the highest standard weight and the trophy weight noted since 2003 and 2009, respectively.

Males comprised 57.0% of the Chambers Creek run and averaged 504 mm in length and 1.34 kg in weight (Table 3). All three Chambers Creek fin clips were observed for male fish, with the left maxillary (LM) the most common. Returning fish were assigned to age classes based on fin clips. In 2011, males returned at ages 2 through 5 (Table 4). Age 2 fish were the most common, and they averaged 454 mm in length and 0.91 kg in weight.

Females comprised 43.0% of the run and averaged 674 mm in length and 3.16 kg in weight (Table 3). All three Chambers Creek fin clips were observed for female fish in 2011, with the LMLV the most common. With the use of fin clips, returning fish can be assigned to age classes. In 2011, females returned at ages 3 through 5 (Table 4). Age 3 fish were the most common, and averaged 649 mm in length and 2.91 kg in weight.

Ganaraska strain

A total of 146 Ganaraska strain steelhead were handled during the spring run (Table 1; Table 2). Lengths ranged from 236 mm to 770 mm and averaged 576 mm. Weights ranged from 0.10 kg to 5.12 kg with an average weight of 2.15 kg (Table 1). The average length and average weight for Ganaraska steelhead in 2011 were the lowest noted since 2005. Standard and trophy weights in 2011 for Ganaraska were the highest noted since 2004.

Males comprised 50.7% of the Ganaraska run in 2011 with an average length of 489 mm and an average weight of 1.31 kg (Table 3). All three Ganaraska fin clips were observed for returning males in 2011 with the adipose left ventral (ALV) clip the most common. Based on fin clips, ages 2 through 5 male Ganaraska returned during the spring migration (Table 4). Age 2 males were the most common age captured and they averaged 592 mm in length and 1.88 kg in weight.

Females comprised 49.3% of the run and averaged 666 mm in length and 3.01 kg in weight (Table 3). All three clips were detected for female Ganaraska, with the ALV clip the most common. Most of the returning females were age 4 and had an average length of 674 mm and an average weight of 3.12 kg (Table 4). Age 3 female Ganaraska were also commonly captured.

Skamania strain

Since the cessation of Skamania stocking, spring return numbers which had always been low have declined further. In 2011, we captured a total of eight Skamania strain steelhead during spring operations (Tables 1). They were captured on the first three days of operation (Table 2). Lengths ranged from 645 mm to 840 mm and averaged 751 mm (Table 1). Weights ranged from 2.20 kg to 5.0 kg with an average weight of 3.46 kg. Standard and trophy weights increased for Skamania in 2011, but because of low return numbers they should be viewed cautiously.

Males comprised 37.5% of the run in 2011 and had an average length of 812 mm and an average weight of 4.37 kg (Table 3). Females comprised 62.5% of the run and averaged 715 mm in length and 2.91 kg in weight. Two Skamania fin clips were observed for returning males while 3 fin clips were observed for females.

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 2011 spring run, we counted 302 (50.5% 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 (Table 2).

Summer/Fall

Summer/fall fish collections began on October 7 when the ponds were filled. BAFF ponds were sorted at least seven times during fall operations to process migrating fish. Forty-one steelhead were captured at BAFF during the summer/fall run of 2011 (Table 2). This number was a slight increase in return when compared to the 2010 return.

Five Skamania with identifiable clips were captured. One right maxillary right ventral (RMRV) fin clipped Skamania was observed (Table 7). The right maxillary (RM) clip was the most common

Also captured were four Chambers Creek steelhead and 32 unknown strain steelhead.

DISCUSSION

Spring

Abundance of steelhead during spring runs has changed greatly since 1992 (Figure 1). Large runs noted in the early 1990's declined to very low levels from 2000-2003 and have only recently shown some improvements.

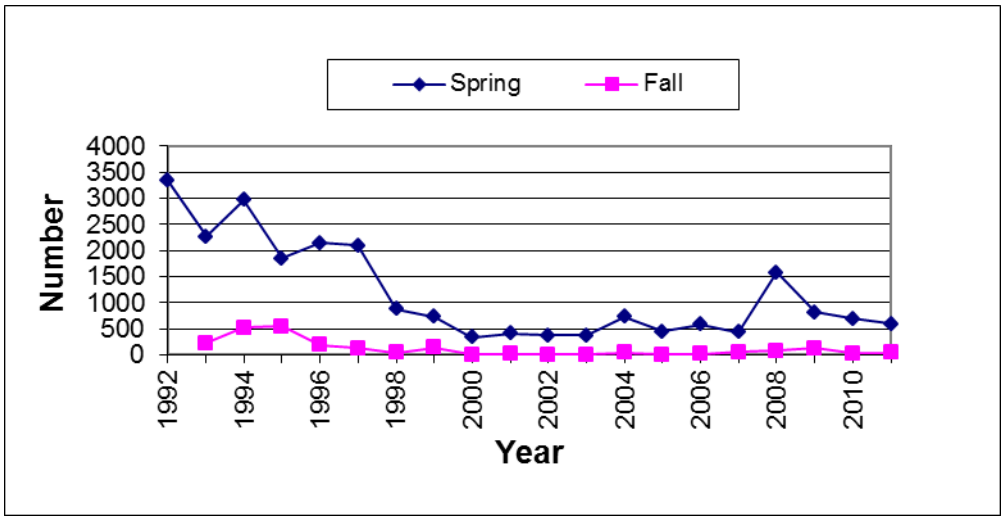

Figure 1. Return number to BAFF on the Kewaunee River for spring and summer/fall runs from 1992 through 2011.

The spring 2011 run of 598 steelhead maintained a decline that began in 2008 (Table 1; Figure 1). 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 1992 were due to a combination of factors including, ecosystem changes within 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.

The decline in return number in 2011 is likely due to several factors including a late spring with low river flow during the spawning run and a large manure spill in the upper Kewaunee River that occurred during the stocking period in 2009. Potentially the poor return of Chambers Creek steelhead in 2011 could be related to decreased survival or poor imprinting caused by this spill. In addition, since half of the Ganaraska destined for the Kewaunee River were stocked into another river because of the manure spill, reduced returns were not unexpected. Poor survival or imprinting of those Ganaraska that were stocked could have further reduced their return rate.

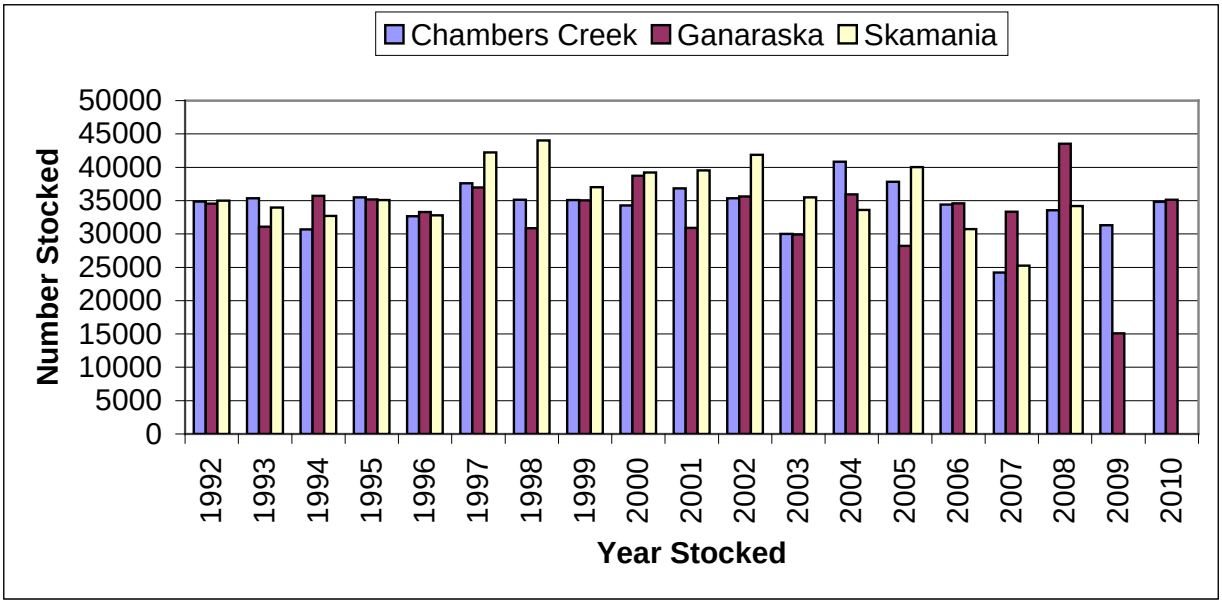

Figure 2. Stocking number by strain for steelhead stocked into the Kewaunee River from 1992 through 2010.

Fall

The 41 steelhead handled at BAFF in the summer/fall of 2011 was larger than the number handled in 2010. However the number of Skamania captured in 2011 declined (Table 1; Figure 2). This decline is not unexpected because of the cessation of Skamania stocking in 2009. 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

Since 2003 the number of returning Chambers Creek steelhead has varied from a low of 66 fish in 2005 to a high of 499 in 2008. The return of 142 Chambers Creek steelhead in 2011 was below the eight year average of 205 (Table 1). Based on the age of returning Chambers Creek steelhead, most of the drop in numbers are due a lack of older fish (Table 4). Most of the returning Chamber Creek steelhead in 2011 were either age 2 or age 3 with very few age 4 and older fish captured. This trend is in contrast to the 1990's when the majority of returning Chambers Creek steelhead were age 4 or age 5 (Hogler and Surendonk 2004). It is unclear why fewer older Chambers Creek steelhead are captured.

Average length and weight decreased in 2011 from 2010 levels and are near the lowest levels since 2003 (Table 1, Figure 3). The decrease in average length and weight is likely due to an increase in the number of age 2 fish that returned to the weir in 2011. Standard and trophy weights increased in 2011 indicating good growth in 2011 due to abundant alewife. However, since 1992 weight trends are mixed showing steady or slightly decreasing weights which may be indicative of declining forage in Lake Michigan during this period.

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 fish were stocked. The best return rates for age 4 Chambers Creek have been for fish stocked in 2001 and 2006 (Table 6). The poorest age 4 returns were from 2003 and 2008. Overall the best returns have been from Chambers Creek stocked in 2006 and 2007.

In 2011 we saw the second highest number of fish return at age 2 since 2001. This may bode well for returns over the next several years if the 2010 stocking year class continues to return well (Table 6).

Ganaraska

Ganaraska strain steelhead have also had variable returns since 2003 with return numbers varying from a low of 68 in 2003 to a high of 545 in 2008. The return of 146 Ganaraska in 2011 was less than the eight year average return of 206. Similar to Chambers Creek the largest drops in return are for fish older than age 3.

Ganaraska steelhead have had more variation in yearly average length and weight than have Chambers Creek strain fish (Table 1). The large drop in average length and weight noted in 2011 is likely due to a large increase in the number of age 2 fish in the run. In 2011 standard and trophy weight indices increased and were the highest noted since 2004 and are reflective of recent forage changes in Lake Michigan (Table 1 and Figure 3).

Since the majority of Ganaraska fish traditionally returned at age 4, we would expect to see the highest return rate of a year class occur three years after fish were stocked. The best return rates for age 4 Ganaraska have been for fish stocked in 2001 and 2006 (Table 7). The poorest age 4 returns were from 2002 and 2003. Overall, the best returns have been

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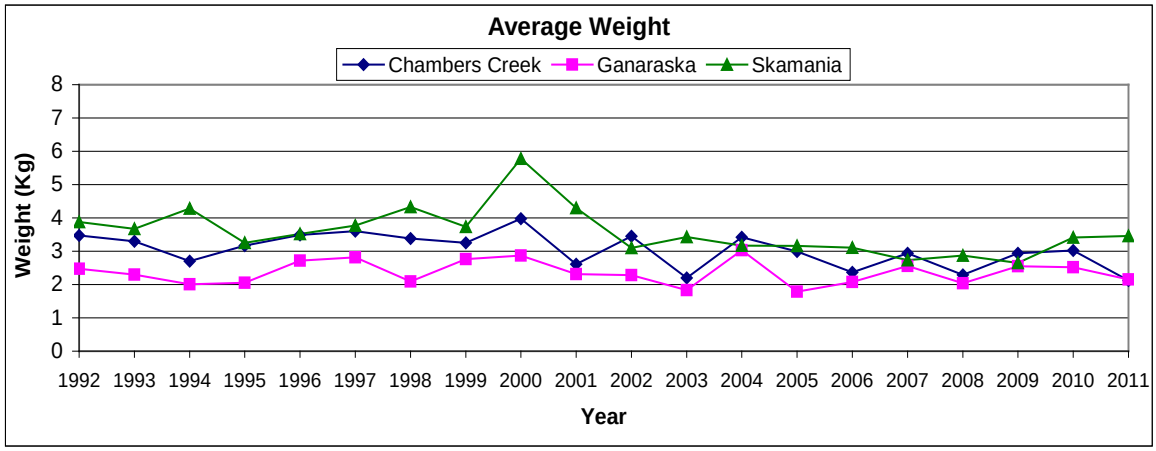

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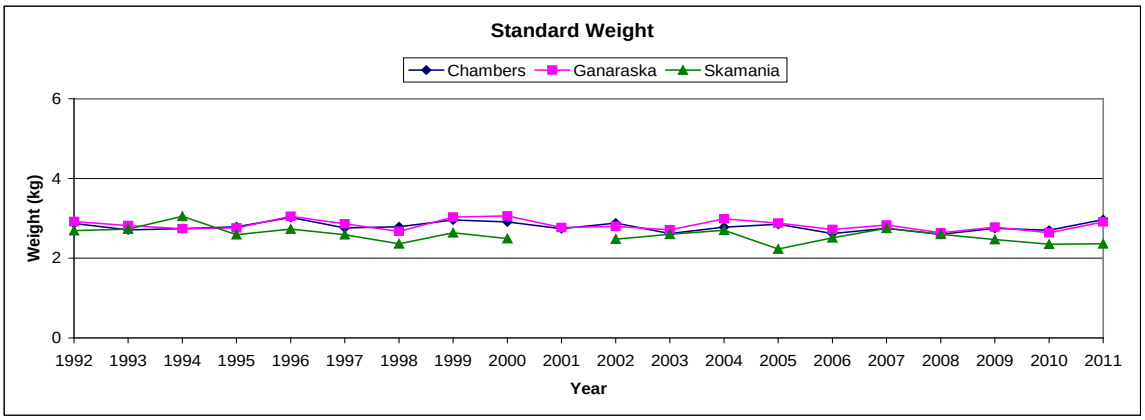

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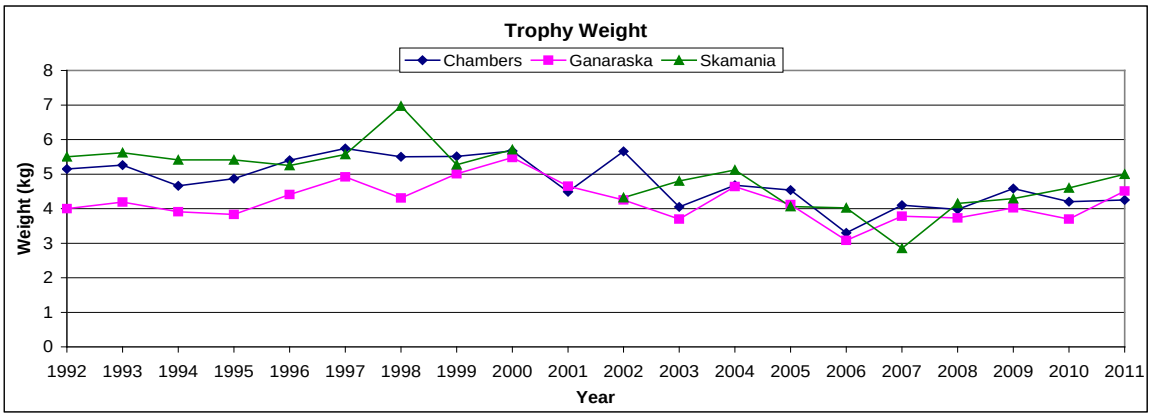

Figure 3. Weights trends for steelhead during spring migrations at BAFF, 1992-2011: (A) Average weight for each strain for that year, (B) Standard weight is based on the projected weight of a 660 mm steelhead, (C) Trophy weight for each strain based on the 95th percentile of weighed steelhead.

from Ganaraska stocked in 2004 and 2006. Overall, the best stocking years for Ganaraska were 2004 and 2006.

In 2011, we saw the second highest number of fish return at age 2 since 2004. This change may bode well for returns over the next several years if the 2010 stocking year class continues to return well (Table 7).

Skamania

Skamania strain steelhead have been a small, but consistent portion of spring runs on the Kewaunee River although the majority of Skamania are captured during summer/fall runs (Table 1; Table 5). All three weight indices increased in 2011 over 2010 levels, but because of low return number should be viewed cautiously.

The number of Skamania collected during the fall run has varied greatly. Lack of fall rain may be responsible for the variation in run number. After good returns in 2007 through 2009 fall returns have dropped sharply due to the cut in Skamania stocking. Further decline in Skamania number is expected as the population ages. Looking at the return rate of Skamania based on spring returns, it appears Skamania stocked in 2006 have had the highest total return of stocking years since 2001 (Table 8)

Comparison of Strain Performance

All three strains had poorer returns to the weir in 2011 as compared to the 2010 run (Tables 1; Table 5). Of the spring running strains Chambers Creek and Ganaraska have returned to BAFF in near equal number since 2003. Survival based on return per thousand stocked indicates that Ganaraska has had more consistent returns and 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, 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 on Lake Michigan, or be the result of greater numbers of younger fish in the run because low water or because of 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.

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 2012. Adult Skamania to be used as brood fish were not collected from either steelhead facility in 2011 due to VHS concerns.

REFERENCES

Daly, R. 1968. Chasing Rainbows. Wisconsin Conservation Bulletin. July-August 1968. 2 p.

Hogler, S. and S. Surendonk. 2004. Return, Size, Age and Movement of Steelhead at the Besadny Anadromous Fisheries Facility, 2004. Wisconsin Department of Natural Resources. 25 p.

Table 1. Summary of steelhead length and weight data collected during spring migratory runs at BAFF, on the Kewaunee River, 2003-2011.

Year	Strain	Number	Run %	Average Length (mm)	Length Range (mm)	Average Weight (kg)	Weight Range (kg)	Standard Weight (kg)*	Trophy Weight (kg)**
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							
2011	Chambers	142	23.7	577	255-800	2.12	0.20-5.56	2.97	4.25
	Ganaraska	146	24.4	576	236-770	2.15	0.10-5.12	2.91	4.51
	Skamania	8	1.3	751	645-840	3.46	2.20-5.00	2.36	5.00
	Other	302	50.5						
	Total	598							

* 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 2011 operations at BAFF, by strain of steelhead.

Spring Run Steelhead

Date	Chambers Creek	Ganaraska	Skamania	Other	Day Total
April 11, 2011	82	72	5	170	329
April 13, 2011	17	30	2	48	97
April 18, 2011	22	29	1	56	108
April 25, 2011	11	7		19	37
April 27, 2011	10	8		9	27
Total	142	146	8	302	598

Summer/Fall Run Steelhead during 2011.

Date of Operation	Chambers Creek	Ganaraska	Skamania	Other	Not Noted	Day Total
October 11, 2011				1		1
October 14, 2011					6	6
October 18, 2011	2		3	3		8
October 25, 2011					6	6
November 1, 2011	1					1
November 8, 2011			2	5		7
December 1, 2011					12	12
Total	3		5	9	24	41

Table 3. Average length, weight and run number by strain, clip, and sex during the spring spawning run at BAFF, 2011.

	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)	633	2.44	14	649	2.91	35
Adipose, Left Maxillary (ALM)	681	2.36	5	689	3.13	9
Left Maxillary (LM)	465	1.00	62	719	3.69	17
Chambers Creek combined average	**504**	**1.34**	**81**	**674**	**3.16**	**61**
Ganaraska						
Adipose, Left Ventral (ALV)	439	0.90	54	652	2.87	12
Adipose, Right Ventral (ARV)	638	2.67	12	664	2.98	34
Both Ventral (BV)	599	2.03	8	674	3.12	26
Ganaraska combined average	**489**	**1.31**	**74**	**666**	**3.01**	**72**
Skamania						
Adipose, Right Maxillary (ARM)				645	2.28	1
Right Maxillary (RM)	815	4.55	2	775	3.63	2
Right Maxillary, Right Ventral (RMRV)	805	4.02	1	690	2.52	2
Skamania combined average	**812**	**4.37**	**3**	**715**	**2.91**	**5**

Table 4. The age distribution, length, and weight of returning clipped steelhead by sex for the Kewaunee River spring 2011.

Chambers Creek

Age (Male)	2	3*	4	5	Age (Female)	2	3*	4	5
Measured	59	14	5	3	Measured	0	35	9	17
Average Length (mm)	454	633	616	681	Average Length (mm)	--	649	689	719
Range (mm)	255-520	530-710	435-760	0.20-1.30	Range	--	570-800	650-735	645-760
Weighed	59	14	5	3	Weighed	0	35	9	17
Average Weight (kg)	0.91	2.44	2.36	2.84	Average Weight (kg)	--	2.91	3.13	3.69
Range (kg)	0.20-1.30	1.28-3.44	0.72-3.90	2.26-398	Range (kg)	--	1.72-5.56	2.60-3.80	2.30-4.47

*may contain Age 6 fish

Ganaraska

Age (Male)	2	3*	4	5	Age (Female)	2	3*	4	5
Measured	53	8	12	1	Measured	2	26	34	10
Average Length (mm)	434	599	638	720	Average Length (mm)	448	674	664	693
Range (mm)	236-505	545-690	455-720		Range	445-450	570-770	590-740	590-765
Weighed	53	8	12	1	Weighed	2	26	34	10
Average Weight (kg)	0.85	2.03	2.67	3.41	Average Weight (kg)	0.85	3.12	2.98	3.28
Range (kg)	0.10-1.40	1.42-2.66	0.81-3.83		Range (kg)	0.77-0.92	1.90-5.12	2.10-4.19	2.18-4.85

*may contain Age 6 fish

Skamania

Age (Male)	2	3*	4	5	Age (Female)	2	3*	4	5
Measured	0	1		2	Measured		2	1	2
Average Length (mm)	--	805		815	Average Length (mm)	--	690	645	775
Range (mm)	--			790-840	Range	--	650-730		740-810
Weighed	0	1		2	Weighed	0	2	1	2
Average Weight (kg)	--	4.37		4.55	Average Weight (kg)	--	2.52	2.28	3.63
Range (kg)	--			4.10-5.00	Range (kg)	--	2.20-2.83		3.53-3.72

*may contain Age 6 fish

Table 5. Steelhead fin clip trends detected at BAFF during fall migrations, 2005-2011

Strain and fin clip	2005	2006	2007	2008	2009	2010	2011
Skamania							
Adipose, Right Maxillary (ARM)			14	1			1
Right Maxillary (RM)	4	1	13	1	6	3	3
Right Maxillary, Right Ventral (RMRV)	1		1	38	66	6	1
Total Skamania	***5***	***1***	***28***	***40***	***72***	***9***	***5***
Chambers Creek							
Left Maxillary (LM)			1			1	2
Left Maxillary, Left Ventral (LMLV)		1	2				
Adipose, Left Maxillary (ALM)							2
Total Chambers Creek	***0***	***1***	***3***	***0***	***0***	***1***	***4***
Ganaraska							
Adipose, Right Ventral (ARV)							
Adipose, Left Ventral (ALV)					1	3	
Both Ventral (BV)							
Total Ganaraska	***0***	***0***	***0***	***0***	***1***	***3***	***0***
Adipose, Left Pectoral (ALP)			1		1		
Left Pectoral (LP)			1		2	1	1
Right Pectoral (RP)						1	
Right Ventral (RV)							2
No Clips	1		9	6	37	9	5
Misc. Clips							
Clip Not Noted	1	13		30	3	10	24
Total Others	***2***	***13***	***11***	***36***	***43***	***21***	***32***
Total Fall Steelhead Run	**7**	**15**	**42**	**76**	**116**	**34**	**41**

Table 6. Return rates (number per thousand stocked) for Chambers Creek steelhead during spring migrations on the Kewaunee River, 2002-2011.

	Year Stocked									
Return Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
2002	0.05	--	--	--	--	--	--	--	--	--
2003	1.79	0.17	--	--	--	--	--	--	--	--
2004	4.53	1.02	0.00	--	--	--	--	--	--	--
2005	0.62	0.48	0.20	0.20	--	--	--	--	--	--
2006	0.14	0.23	0.27	2.69	0.11	--	--	--	--	--
2007	0.00	0.00	0.17	2.69	0.82	0.52	--	--	--	--
2008	0.00	0.00	0.33	1.05	1.61	10.80	0.54	--	--	--
2009	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	2.79	3.68	0.75	0.29	--
2011	0.00	0.00	0.00	0.00	0.00	0.15	0.83	0.42	1.41	1.69
Total	7.13	1.90	1.10	6.80	2.62	19.95	7.49	1.26	1.70	1.69

Table 7. Return rates (number per thousand stocked) for Ganaraska steelhead during spring migrations on the Kewaunee River, 2002-2011.

	Year Stocked									
Return Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
2002	0.16	--	--	--	--	--	--	--	--	--
2003	1.49	0.45	--	--	--	--	--	--	--	
2004	3.40	1.26	0.37	--	--	--	--	--	--	
2005	0.58	0.73	0.67	1.72	--	--	--	--	--	
2006	0.36	0.19	0.70	5.39	0.57	--	--	--	--	
2007	0.00	0.00	0.13	2.36	0.74	0.52	--	--	--	
2008	0.00	0.00	0.87	2.03	1.98	10.50	0.81	--	--	
2009	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	1.85	1.14	1.01	0.26	
2011	0.00	0.00	0.00	0.00	0.00	0.52	0.33	1.06	1.06	1.56
Total	5.99	2.63	2.74	11.64	3.64	17.64	3.78	2.23	1.32	1.56

Table 8. Return rates (number per thousand stocked) for Skamania steelhead during spring migrations on the Kewaunee River, 2002-2011.

	Year Stocked									
Return Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
2002	0.00	--	--	--	--	--	--	--	Discontinued stocking This Strain	Discontinued stocking This Strain
2003	0.03	0.05	--	--	--	--	--	--		
2004	0.53	0.12	0.00	--	--	--	--	--		
2005	0.33	0.05	0.00	0.00	--	--	--	--		
2006	.0.03	0.05	0.34	0.06	0.00	--	--	--		
2007	.0.00	0.00	0.03	0.03	0.00	0.00	--	--		
2008	0.00	0.00	0.00	0.30	0.25	0.00	0.04	--		
2009	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	1.50	0.51	0.09		
2011	0.00	0.00	0.00	0.00	0.00	0.10	0.16	0.03		
Total	0.92	0.27	0.37	0.42	0.29	2.29	0.89	0.12		