



United States Department of the Interior

FISH AND WILDLIFE SERVICE

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MEMORANDUM

To: Fishery Associate Manager
Columbia River Basin, Region 1, Portland, OR

From: Acting Complex Manager
Dworshak-Kooskia NFH Complex

Subject: Dworshak NFH Spawning Report- Summer Steelhead BY2006

Attached is the Spawning Report for Brood Year 2006 summer steelhead as prepared from information collected by the Dworshak Hatchery Staff, Idaho Fishery Resource Office and Idaho Fish Health Center. The report covers fish ladder operation, adult collection, spawning summary, spawning procedures, and egg and adult disposition.

cc: Dworshak NFH
Idaho FRO
Idaho FHC
Kooskia NFH
IDFG - Boise
IDFG - Lewiston
Nez Perce Fisheries - Lapwai

SPAWNING REPORT

Brood Year 2006
Steelhead

August 9, 2006

U.S. Fish and Wildlife Service
Dworshak Fisheries Complex
Ahsahka, Idaho

Brood Year 2006 Steelhead

Adult Collection/Ladder Operation

Adult summer steelhead (SST) for Brood Year 2006 (BY06) were collected in the fall of 2005 and in the winter and spring of 2006 to represent the entire run. The ladder was open on October 3, 2005 to October 17, then opened October 20 and closed the next day for collection of early-return SST. During this 15 day period there were 596 early-run steelhead collected for spawning in the spring of 2006. The ladder was then opened intermittently during the fall for collection of coho salmon for the Nez Perce Tribe (NPT). There were an excess of 635 BY06 SST trapped during this process and anesthetized with carbon dioxide. They were then loaded onto NPT trucks and transported to Hog Island near Lewiston, Idaho, for release in the Clearwater River. The ladder was closed the final time for coho collection on November 18, 2005. The ladder was again opened on February 21, 2006 for collection of winter and spring returning SST (Table 1). The ladder was reopened intermittently throughout the spring to limit the number of SST entering the hatchery and closed for the final time on April 26, 2006. During this staggered ladder operation, a total of 3,243 adult SST entered the hatchery, including 323 jacks.

Table 1. Dworshak adult return-rack summary, BY2006 SST.

Date Fish Examined	Males	Females	Week Total	Cumulative Numbers	Cumulative % of Run
10/11/05	122	123	245	245	7.6
10/18/05	109	98	207	452	13.9
10/25/05	95	49	144	596	18.4
02/28/06	69	217	286	882	27.2
03/07/06	96	155	251	1,133	34.9
03/14/06	129	255	384	1,517	46.8
03/21/06	163	334	497	2,014	62.1
03/28/06	117	240	357	2,371	73.1
04/04/06	63	171	234	2,605	80.3
04/11/06	32	79	111	2,716	83.7
04/18/06	88	189	277	2,993	92.3
04/25/06	40	62	102	3,095	95.4
05/02/06	58	90	148	3,243	100.0
Total	1,181	2,062	3,243	3,243	

Source: DNFH - Final Spawning Activity Report, BY06SST
IFRO - STH05NT.xls; IFRO - SST Rack Returns 05-06;

There were also 29 wild SST trapped and released back into the mainstem of the Clearwater River the day they were examined. These wild fish are not included in Table 1.

The final spawning day was May 2 and the adult holding ponds were drained the following day. Historically, the male:female adult return ratio has been 1:2.2. In 2006 the return ratio was 1:1.7. Figure 1 illustrates the numbers of adult SST returns since 1994.

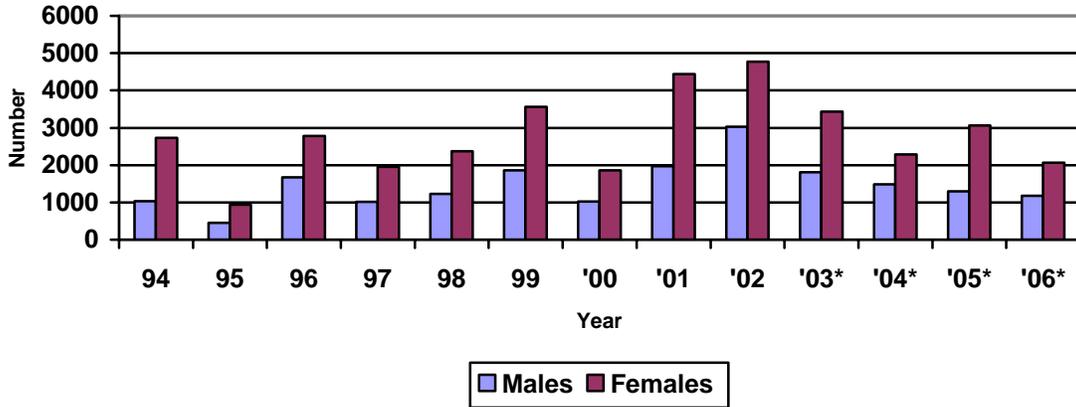


Figure 1. Dworshak adult SST returns 1994-2006

* Ladder only opened part of the season
 Source: DNFH- Spawning Report SST BY05
 Spawning/Egg Take Plan SST BY06
 ST06EgTk.xls
 IFRO - SST Rack Returns, Sth06ent.xls

Fish coming up the ladder in the fall were initially held in Holding Pond 9 (HP9). There were 16 fish of the 596 early returns which died before spawning began (prespawning mortality). Formalin treatments were started in October 2005, and appeared to control fungus. The fish were treated 1-3 times/week with a one-hour standing bath of formalin. Complete records of formalin treatments are in the 2006 SST Brood Year book. Table 2 compares prespawning mortality and formalin treatments from the past several years.

Table 2. Prespawning mortality SST 1994-2006

Year	94	95	96	97	98	99	00	01	02	03	04	05	06
% Mort	9	18	3	10	7	3	2	4	5	20	11	7	3
Formalin	No	Yes	No*	Yes									

*1996 Only six fish treated with formalin, 731 fish untreated.
 Source: DNFH-Annual Spawning Reports, Steelhead 1994-2005
 Spawning Activity Report, BY06 SST Take 1

Approximately 20-60 males were held over each week to assist with spawning the following week. These hold-over males were usually placed in HP2 and spawned first the following week at the beginning of the spawning day. The milt was collected and stored in coolers until the newly trapped fish from HP9 were spawned. This helped alleviate the problem of having numerous ripe females at the start of each spawning day with few or no males for fertilization. After spawning the early-return fish during Takes 1-2, almost all fish spawned each week were those trapped and held in HP9 sometime during the seven days prior to spawning.

Table 3 depicts the total mortality of unspawned adults since 1996. This includes prespawning mortality, the number which died in holding ponds during the spawning season, and the adults which were green killed, killed as surplus, or killed as spent or non-viable adults.

Table 3. Total mortality of unspawned adult SST returns 1996 – 2006.

Mortality	1996	1997	1998	1999	2000	2001	2002	2003*	2004	2005	2006
Prespawning	21	37	23	16	9	23	28	101	57	35	16
Died in Pond	794	467	769	458	663	1880	1166	101	264	230	215
Green, Surplus, & Spent	640	244	635	447	110	209	1,556	2,545	403	603	516
Total	1,455	748	1,427	921	782	2,112	2,750	2,747	724	868	747
% of Run	32	25	40	17	27	33	35	52	19	20	23

*Because no surplus adults were outplanted in 2003 by the NPT, all of these fish are recorded as surplus mortality

Prespawning= Adult mortality before first day of spawning

Died in Pond= Adult mortality from first day of spawning until final day of spawning

Green kills = Females cut before ripe, fish in BRD studies, Univ studies, CWT sampling, & Nez Perce Tribe studies

Surplus= Excess fish held late into spawning season or no outplanting available-carcasses to food bank or bear program

Spent= Water-hardened, over-ripe, non-viable eggs, spawned out fish, etc

Source: DNFH-Spawning and Run Summary DwFR.DBF 1996-06

Annual Spawning Reports, Steelhead 1996-05

Monthly Production Narrative, January 2006

Final Spawning Activity Report BY06 SST

Spawning numbers/ratio

There were 1,911 SST spawned over the BY06 season, 895 males (including 183 jacks) and 1,016 females. Females have always outnumbered males in returns to Dworshak so the goal of a 1:1 male:female spawning ratio is difficult to achieve. While the male:female return ratio was 1:1.7 for BY06 SST, the spawning ratio was reduced to 1:1.4. Of the 183 jacks spawned during the season, 102 were for Dworshak National Fish Hatchery (DNFH), 44 for Clearwater State Fish Hatchery (CWH), and 37 for Magic Valley State Fish Hatchery (MVH). These jack numbers are from the Idaho Fishery Resource Office (IFRO) spawning table counts. Figure 2 illustrates the total male:female spawning numbers by egg Take for BY06 SST. These include eggs taken for Dworshak, CWH, and MVH.

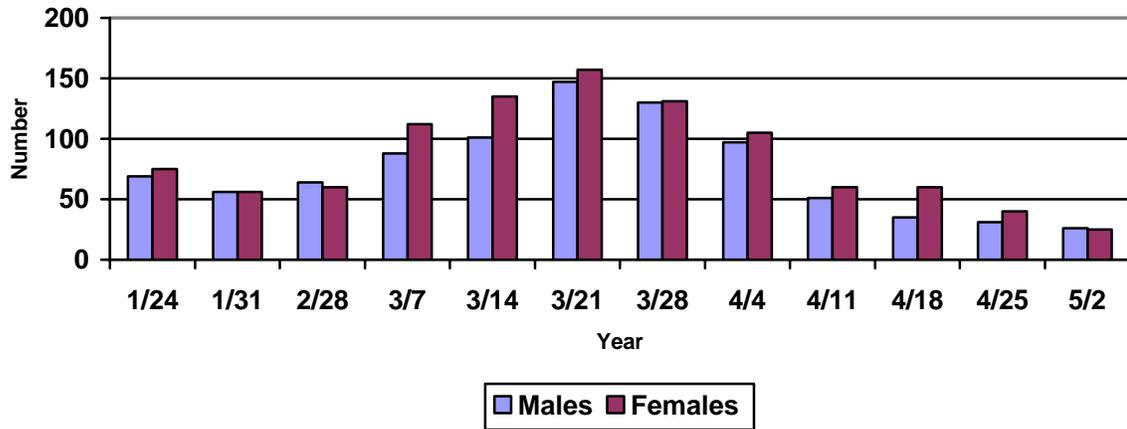


Figure 2. Total male/female spawning numbers for BY2006 SST

(Numbers include adult SST for Dworshak, Clearwater, and Magic Valley hatcheries.)

Source: DNFH-Spawning Activity Reports BY2006 SST

Spawning/Egg Take Plan BY06; ST06EgTk.xls

Figure 3 illustrates the number of eyed eggs into the BY06 SST Dworshak program only.

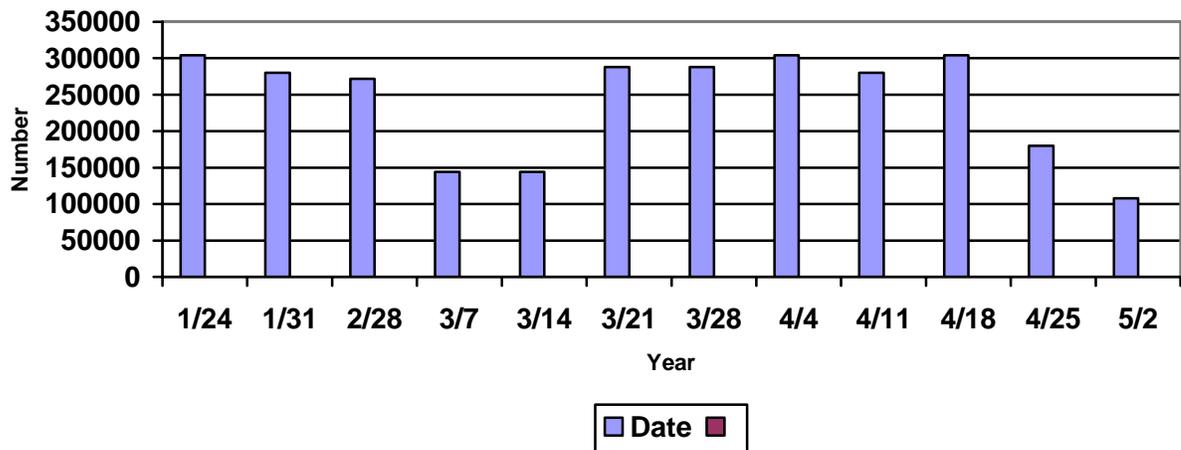


Figure 3. Number of eyed eggs into the DNFH program for BY06 SST-Dworshak NFH only.

Source: DNFH-Spawning/Egg Take Plan BY2006; ST06EgTk.xls

Table 4 illustrates the adult SST spawned for DNFH, CWH and MVH.

Table 4. Adult SST spawned during BY06 season.

Take	Spawn Date 2006	DNFH Males Total ¹	DNFH Jacks	DNFH Females	CWH Males Total ¹	CWH Jacks	CWH Females	MVH Males Total ¹	MVH Jacks	MVH Females
1E ²	1/24	69	14	75						
2E ²	1/31	56	6	56						
3	2/28	64	10	60						
4	3/7	26	7	30	62	24	82			
5	3/14	29	8	30	72	20	105			
6	3/21	55	12	55				92	3	102
7	3/28	61	11	55				69	23	76
8	4/4	35	1	55				62	11	50
9	4/11	51	14	60						
10	4/18	35	4	60						
11	4/25	31	6	40						
12	5/2	26	9	25						
Total		538	102	601	134	44	187	223	37	228

¹ Jacks included in Total Males. Jack count from IFRO spawning table count. DNFH jack count using milt cup counts at the conclusion of spawning = 87 Dw; 38 CW; 21 MV = 146 jacks total.

² E= Early returning adults (Fall 2005)

Source: DNFH-Spawning/Egg Take Plan BY2006; ST06EgTk.xls
Spawning Activity Report, BY06 SST

Spawning Procedures

Spawning began with Take 1 on Tuesday, January 24, 2006. Take 2 was spawned the following Tuesday, January 31. These first two Egg-Takes were from the fish which returned in October, 2005 (early-return adults). There were a total of 125 males and 131 females spawned during these Takes, yielding approximately 620,000 eyed eggs. Take 3 was spawned on February 28, and spawning was conducted each Tuesday until May 2. Having a three-week break between spawning the early and mid/late-returning adults resulted in a high egg-survival of the early returning fish while maintaining the full spectrum of the run with mid and late Takes. This spawning scenario will probably be repeated in 2007.

Once the early-returning adults were spawned, personnel from both IFRO and DNFH concurrently inspected and spawned the most recently trapped adults from HP9. Adult SST were pushed by mechanical crowders from HP9 into a channel, moved into a channel basket, and placed into an anesthetic bin. Ripe fish were spawned each week for either Dworshak or Idaho Department of Fish & Game (IDFG) hatcheries. Excess fish were either outplanted or killed and given to the appropriate source (see *Adult Disposition*). Snouts from fish which had coded wire tag (CWT) implants were collected, whether the fish was spawned or not. As mentioned under *Adult Collection*,

20-60 males were kept in either HP1 or HP2 to help ensure enough milt at the start of the next week's spawn. Dworshak coordinated the timing of SST egg collection with the state by communication with personnel from Clearwater Hatchery and the IDFG main office (see *Egg Disposition*).

The adult SST were anesthetized with carbon dioxide at a rate of 400 to 1000 mg/l solution buffered with 8 to 10 pounds of sodium bicarbonate. Although carbon dioxide (CO₂) as an anesthetic appears more stressful to the fish than MS-222, carcasses anesthetized with CO₂ can be used for human consumption. Oxygen was provided at a rate of one l/minute. Spinal columns of ripe females were severed using a pneumatic knife. The females were then placed on a table for 5-15 minutes for blood drainage. The ventral side was then cut open using a spawning knife and eggs were collected in disinfected colanders. After ovarian fluid was drained, the eggs were poured into a clean bucket.

Milt from ripe males was stripped into Styrofoam cups, and a one-percent saline solution was added to assist in milt motility. The milt solution was poured onto the eggs and swirled to aid in more complete fertilization. After sufficient time had elapsed for fertilization to take place (one to two minutes), the eggs were rinsed of sperm, blood, and other organic matter.

After rinsing, eggs were placed in Heath incubator trays at approximately 6,785 eggs per tray (one female). In the tray was a 75 mg/l iodophor solution buffered with sodium bicarbonate. As a precaution against disease transmission, eggs were maintained in this solution for approximately 30 minutes. The egg trays were then pushed into the incubator stack, flushing the iodine. Water flow rate was approximately 4-5 gallons/minute and temperature averaged approximately 54EF while the eggs were in the trays. Formalin treatments were administered 3-5 days per week to control fungus on the eggs.

Upon eye-up (approximately 15 days after fertilization at 54°F), the eggs were shocked. The next day eggs for Dworshak's program were enumerated and sorted using an electronic egg picker and counter (Van Gaalen Model-100). Eggs from Takes 1-9 were initially loaded into hatching jars at final tanking densities, with no mid-season splits of any Takes necessary. Due to lack of nursery tanks, eggs from Takes 10-12 were enumerated and returned to Heath trays (6,000-6,350 per tray) and hatched in the trays. Once Takes 1-2 were moved from the nursery to outside ponds at the end of May and beginning of June, fry from Takes 10-12 were moved into these vacated nursery tanks to start on feed. The water flow was approximately five gpm in both the trays and jars. The hatching jars drained into 670 gallon rectangular nursery tanks. As the fry swam up in the jars, they flowed into these tanks for initial rearing.

Idaho Fish Health Center Disease Sampling

On January 10, 2006, there were 50 adult males and 10 jacks from the early-returned BY06 SST injected with salmon gonadotropin-releasing hormone analogue (sGnRHa). This was done to induce gamete maturation for spawning the following two weeks. These fish were transferred from HP1 into HP2 after injection. Of these injected males,

there were 29 injected and two control males spawned during Take 1, and 29 injected and no controls were spawned during Take 2. The remaining males which were injected were mortalities before being used. All carcasses from injected males were disposed of in the landfill.

Approximately 3.1 percent (7/227) of the females sampled for MVH (Takes 6-7-8) tested positive for *infectious hematopoietic necrosis virus* (IHNV). Testing was done by personnel from the Idaho Fish Health Center (IFHC). Disease testing on eggs for CWH was done by the IDFG Eagle Creek Laboratory. Approximately 0.5 percent (1/187) of the females from Takes 5-6 for CWH tested positive for IHNV. All eggs taken for either MVH or CWH which tested positive for IHN were discarded. There were 26.4 percent (28/106) adult SST sampled for Dworshak which tested positive for IHN. Twenty-five of the 28 fish which tested positive were from the last egg Take on May 2. Dworshak does not cull eggs which test positive for IHNV in its production program.

Spawning Summary

A total of 12 egg Takes were spawned this season, beginning on January 24, 2006, and ending on May 2. There were 1,016 females and 895 males spawned and the average fecundity of SST enumerated at DNFH was 6,785 eggs/female. Table 5 summarizes the egg survival for BY06 SST spawning. Early-returning adults (October) were spawned in Takes 1-2, and later returning adults (February-May) were spawned from Takes 3-12.

Table 5. Spawning Egg Takes from BY2005 SST.

Total Male Dworshak Clearwater Magic Valley	Total Female Dworshak Clearwater Magic Valley	Ave Eggs/ Females Enumerated at Dworshak	% Enumerated Eye-up Eggs Enumerated at Dworshak*	% Total Eye-up Eggs Enumerated at Dworshak**
895	1,016	6,785	94.9	89.0

*% Enumerated eye-up =eyed eggs enum /eyed eggs enum + dead eggs enum (Eggs incub/enum @ DNFH only)

** % Total eye-up =eyed eggs enum /est green eggs produced (incl green eggs culled during enumeration) (Eggs incub/enum @ DNFH only)

Source: DNFH-Egg Enumeration/Disposition Summary, BY2006 SST
Final Spawning Activity Report, BY2006 SST

Egg Disposition

There were an estimated 6.9 million green eggs from BY06 SST taken for all the programs at Dworshak. As was done in recent years, Dworshak incubated the CWH eggs until eye-up, at which time personnel from CWH shocked and transported the eggs for enumeration at the CWH facility. Eggs from only when one female (1/187) tested positive for IHNV for CWH. There were approximately 1.2 million eggs shipped to CWH from these two Takes. After enumeration, personnel from CWH stated there were 1.15 million eyed eggs available for their program, exceeding the 960,000 eyed egg target.

There were an estimated 1.5 million green eggs shipped from Dworshak to CWH for MVH from Takes 6-7-8. These eggs were shipped to CWH the same day spawning took place. Dworshak also provided 12,000 green eggs for IDFG and Potlatch Pulp & Paper Mill School Outreach Program. These eggs were taken from Take 6 of Dworshak production. The hatchery also provided approximately 1,000 eyed eggs for aquarium-rearing at various elementary schools for the Information and Education program at Dworshak.

After shipping eggs for CWH, MVH, and Potlatch, Dworshak put an estimated 2.9 million eyed eggs into either hatching jars or incubator trays for its production (Table 6).

Table 6. Egg disposition of BY2006 SST spawned at Dworshak.

Egg Take	Spawn Date 2006	Dworshak Eyed Eggs into Program	Clearwater	Magic Valley	Potlatch Pulp/Paper
			Eyed Eggs*	Green Eggs Estimated	Green Eggs
1	25-Jan	304,000			
2	1-Feb	280,000			
3	28-Feb	272,000			
4	7-Mar	144,000			
5	14-Mar	144,000	501,923		
6	21-Mar	288,000	647,524		
7	28-Mar	288,000		671,400	12,000
8	4-Apr	304,000		509,200	
9	11-Apr	280,000		335,000	
10	18-Apr	304,000			
11	25-Apr	180,000			
12	2-May	108,000			
Total		2,896,000	1,149,447	1,515,600	12,000

*Take 5 CWH- Eggs from five females culled before shipping – none tested positive for IHN.

*Take 6 CWH- Eggs from nine females culled before shipping – one tested positive for IHN.

*CWH – eyed egg numbers from communication with Randy R. CWH staff, after enumeration at CWH.

Source: DNFH- Egg Enumeration and Disposition Summary, BY2006 SST

Spawning/Egg Take Plan BY2006 SST.

University of Idaho Research

This is the 10th year that Dworshak has provided excess SST gametes to the University of Idaho (U of I). On-going experiments are testing how the steelhead sperm controls intracellular pH, along with carbon dioxide and pH effects on sperm motility. Eggs were used to examine nitric oxide effects on fertility. Dworshak provided 423 ml of milt from 71 males and 29,700 eggs from 57 females for the season-long study. Dworshak also provided 109 ml of ovarian fluid from 13 females. All eggs and milt given for this

research were partial lots shared with DNFH and excess to Dworshak's spawning needs. Rolf Ingermann from the U of I directed this research.

Dworshak also provided 12 ml SST milt for research coordinated by Rolf Ingermann and Joe Cloud from the U of I for the Columbia River Inter-Tribal Fish Commission (CRITFC). This research involves the feasibility of reconditioning spawned steelhead. Ryan Branstetter from CRITFC is directing this research.

Dworshak also provided Joe Cloud with two ovaries from one spawned SST female during Take 4 of SST spawning. This research is for germinal stem cell research.

Dworshak also provided James Nagler with six ml of milt from three males and all the eggs from one female during Take 7. These gametes were used for laboratory exercises of fertilization of fish eggs as part of Biology 481 (Ichthyology) class at the U of I.

Idaho Fish and Game Research

Dworshak provided Matt Campbell with fin clips from a total of 125 adult males and 129 females during egg Takes 2, 4, 6, and 11. These are sent to the IDFG's Eagle Fish Genetics Lab in Eagle Idaho. The department is attempting to develop a genetic sampling and monitoring plan for Idaho's steelhead programs.

Adult Disposition

There were 628 hatchery adults outplanted from Dworshak during the spring return of BY06 SST (Table 7). None returned to the hatchery. This outplanting was done by staff from Dworshak and the NPT. In addition, Dworshak donated 125 adult SST to the Nez Perce Tribe on November 8, 2005. These fish were for tribal harvest training at the Nez Perce Tribal Hatchery at Cherry Lane. These fish were categorized as outplanted by IFRO.

Table 7. Adult steelhead outplanted from Dworshak NFH in 2006.

Date	Male	Jacks ¹	Female	Total	Location
3/15/2006	85	32	318	403	Peasley Ck South Fork Clearwater R.
3/29/2006	5	4	220	225	Peasley Ck South Fork Clearwater R.
Total*	90	36	538	628	

¹Jack number included in Male number

Source: DNFH - Spawning Activity Report, BY2006 SST.

IFRO - Summary by Stream for Supplementation, BY2006 SST

IFRO- Adult Steelhead Outplants from Dworshak and Kooskia NFH Fall 2005 & Spring 2006 rev 01-Aug-06.

*IFRO also included 125 SST which were donated to the NPT as outplanted, totaling 753 outplants. See Table 8

There were 29 wild fish which were caught in the trap this year. These fish were returned to the river the same day they were examined and not counted in the Adult Return data.

Usable fish carcasses from spawning and culling activities were provided to a processor to be packaged for human consumption under either a Food Bank program or a

cooperative program with the Federal Bureau of Prisons. Complete adult disposition is illustrated in Table 8.

Table 8. Adult disposition of BY2006 SST from Dworshak.

Destination	Number	Comments
Bear/Eagle Program	183	Idaho Fish & Game bear program
Food Bank/Fed Bureau of Prisons	2,187	Latham Processing, Orofino, Idaho
Outplanted	628	See Table 7
Research	40	School programs, Univ. research
Tribe	125	Nez Perce Tribal harvest training
Landfill	80	Carcass deteriorated beyond food bank use
Total	3,243	

Source: DNFH-Spawning Activity Report BY2006 SST, Final for BY06 SST
Spawning and Run Summary, BY2006 SST

Acknowledgments

The efforts of many individuals from several different projects went into spawning BY06 steelhead. Everyone involved is to be commended on a successful steelhead spawning season.