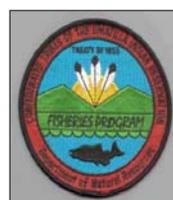


Tucannon and Touchet River Endemic Broodstock Development

Hatchery Program Review 2000-2012

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This program is a cooperative effort of the Washington Department of Fish and Wildlife, the Nez Perce Tribe and the Confederated Tribes of the Umatilla Indian Reservation. The program is funded by the Bonneville Power Administration and administered by the United States Fish and Wildlife Service under the Lower Snake River Compensation Plan.

INTRODUCTION and BACKGROUND

This paper provides background information, program development history and an assessment of program performance for the Washington Department of Fish and Wildlife's (WDFW) Tucannon and Touchet rivers endemic stock summer steelhead (*Oncorhynchus mykiss*) hatchery program. The coverage period is from program initiation in 2000 to the present (spring of 2012).

A precipitous decline in numbers of Snake River steelhead and other anadromous fish between 1962 and the mid 1970s alarmed management agencies such as the WDFW. The rapid decline in steelhead and a commensurate loss of recreational opportunity for Washington's residents spurred Washington to partner with other State and Federal management agencies, where they negotiated with federal agencies such as the Corps of Engineers (COE) to mitigate for adult fish losses to anadromous populations and lost resident fishing opportunity caused by construction and operation of the four lower Snake River power dams. The Lyons Ferry and Wallowa stock steelhead programs were initiated early on to achieve mitigation goals and have been described in other LSRCP summary documents.

Snake River and Mid-Columbia summer steelhead populations were listed as threatened under the Endangered Species Act (ESA) in 1997. The NOAA Fisheries 1998 Hatchery Biological Opinion (BiOp) cited Lyons Ferry stock steelhead as constituting "jeopardy" to listed Snake River and Mid-Columbia River summer steelhead populations. One recommendation from the BiOp was that new broodstocks be developed to replace the Lyons Ferry stock. In 1999, WDFW, the LSRCP, and the tribal co-managers within SE Washington agreed to start "tests" of endemic broodstocks (consisting of natural origin fish trapped from local streams) in the Tucannon and Touchet Rivers (Figure 1). The Tucannon and Touchet rivers were chosen as possible locations based on rivers where Lyons Ferry stock fish were currently being released and the presence of, and close proximity to, existing LSRCP facilities where adult trapping locations existed. These "test" programs were to be initially evaluated for 5-years, after which a decision would be made regarding their ability to replace the existing hatchery stock program for mitigation in their respective river while reducing potential negative effects mentioned in the BiOp. Performance of each program has varied, and the information to make an informed decision of whether or not to fully implement these program was incomplete at 5-years, so the "test" programs were extended.

The overall goal of each endemic stock program was for the eventual replacement of the Lyons Ferry stock steelhead in the Tucannon and Touchet rivers. However, based on biological information at the time, the management intents for each river were different. In the Tucannon River, the summer steelhead population was considered depressed and declining, so the intent/priority of the endemic stock program was to 1) provide a conservation program whereby hatchery fish would be unmarked (not available for harvest) so they could contribute to spawning in the Tucannon River to rebuild the natural origin steelhead population, and 2) provide a harvest mitigation program in the Tucannon River, but with a stock of native origin so that if they escaped the fishery they would be of the most appropriate stock for natural spawning.

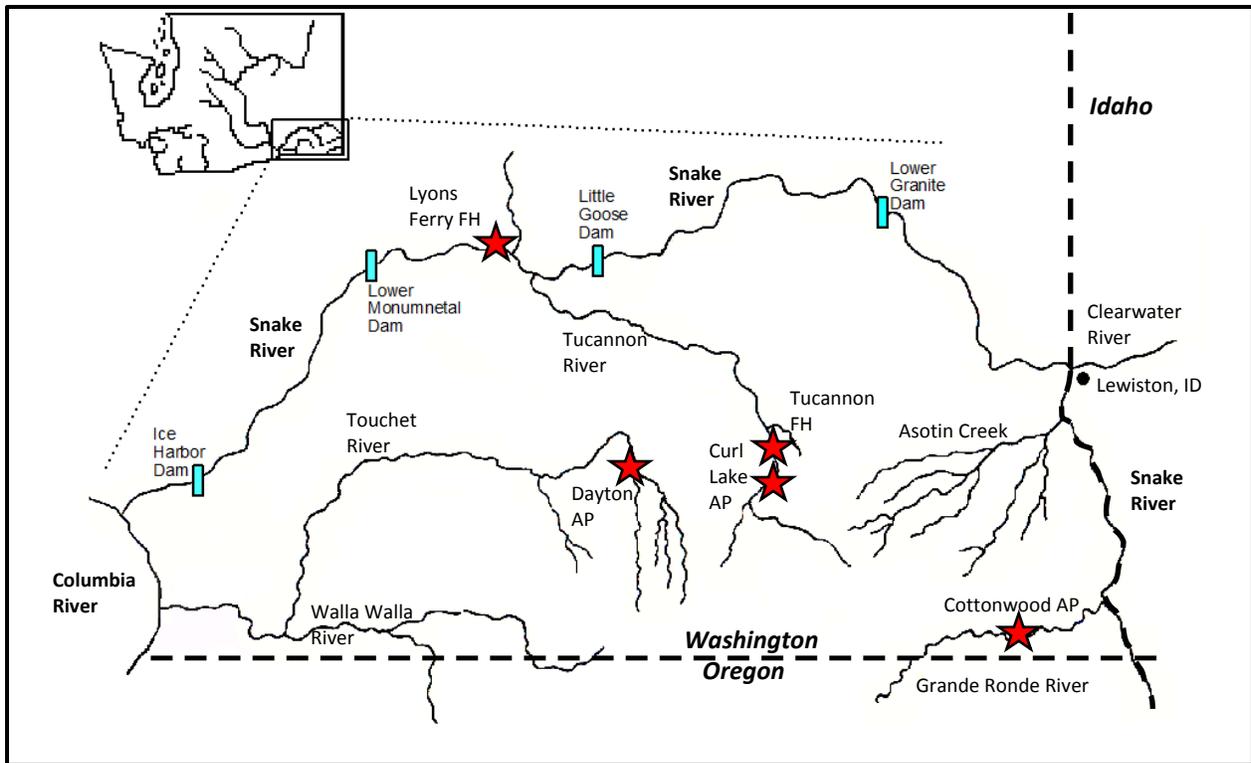


Figure 1. WDFW LSRCP hatchery facilities (hatcheries and acclimation ponds) in SE Washington.

In the Touchet River the summer steelhead population was considered depressed, but appeared stable (300-400 spawners/year based on a population index area above the city of Dayton). As such, WDFW believed that implementing a conservation program was not necessary, rather, the sole intent should be to provide fish for harvest mitigation. However, similarly to the Tucannon River program, should they escape the fishery, the fish would be the appropriate stock for natural spawning. This management intent was not agreed to by the co-manager (Umatilla Tribe), but was allowed to move forward for testing the feasibility of the program. Before full-implementation of the program can occur, both parties will have to agree on the overall intent of the program in the Touchet River.

Each test program was set to produce 50,000 smolts annually. This number was decided upon based on available raceway space at Lyons Ferry Hatchery, assumed smolt-to-adult returns, and the number of broodstock available (natural origin) that would have to be trapped from each river. Concurrently, smolt production of Lyons Ferry stock steelhead in each river was reduced. Each program would be deemed successful if smolt-to-adult return rates (SARs) were at least 0.5%. Natural origin adults would be trapped from each river (32 total from each: ~16 males and ~16 females) to meet broodstock needs. Trapped fish would be transported to LFH, held, spawned, and the progeny reared to either the pre-smolt (Tucannon) or smolt (Touchet) stage and direct stream released. The Tucannon stock would be transported to Tucannon FH in February for final rearing on Tucannon River water prior to release as smolts in the upper Tucannon River basin. Each program was to rear fish to a target size of 4.5 fish/lb at Age 1.

WDFW established short term management objectives for the endemic stock programs, those objectives were: 1) Establish endemic broodstocks, 2) Return adults and achieve SAR's of 0.5%, 3) Remove the potentially depressing effect of a long-term out-of-basin hatchery stock on ESA listed populations, and 4) ensure that each program was compliant with the ESA and WDFW Policies to protect and recover wild stocks. The long-term goals and program intents have been previously stated.

To determine the success/failure of each endemic stock program, monitoring and evaluation staff developed criteria by which they would assess each program: 1) in-hatchery survival and performance 2) estimate adult returns and survival to each river, 3) Increase our understanding of the status and trends of natural origin steelhead in each river, 4) determine life history and genetic characterization of natural steelhead populations in the Touchet and Tucannon rivers, and 5) assess feasibility and impacts to the natural populations from broodstock collections.

PROGRAM ASSESSMENT

The first step to development of the endemic broodstocks was to determine if adequate numbers of natural origin steelhead could be trapped from each river. Based on prior information (Figure 2), it was believed that trapping enough fish at the Dayton Adult Trap for the Touchet stock would be reasonably easy, with broodstock needs requiring about 10-15% of the population from the surveyed index area in the upper Touchet River Basin. However, in the Tucannon River, numbers of adult steelhead trapped at the Tucannon Fish Hatchery were very low, and would not support the number of fish needed for broodstock. Monitoring and evaluation staff constructed a temporary floating weir and deployed it in the lower Tucannon River (rkm 17) to trap fish for broodstock. Higher stream flows and debris frequently sunk the floating weir allowing fish to pass unimpeded, but adequate numbers of steelhead were trapped to establish the broodstock and meet program egg goals.

During this time of broodstock development, WDFW actively collected tissue samples from all wild origin adults captured at the adult traps so genetic profiles could be determined from each stock. Since the Lyons Ferry stock program had been in existence in each of these rivers for nearly 20 years, and there were known temporal and spatial overlaps of fish that spawned in the river, there was concern that considerable introgression could have occurred between the Lyons Ferry and natural origin stocks. If this was the case, WDFW, the co-managers, and NOAA Fisheries would have to question whether or not the development of these endemic stocks was worth the effort. The genetic comparisons showed there were still distinct stocks (Figure 3). The Touchet River stock appeared more genetically distinct, while the Tucannon River stock was more similar to the Lyons Ferry stock.

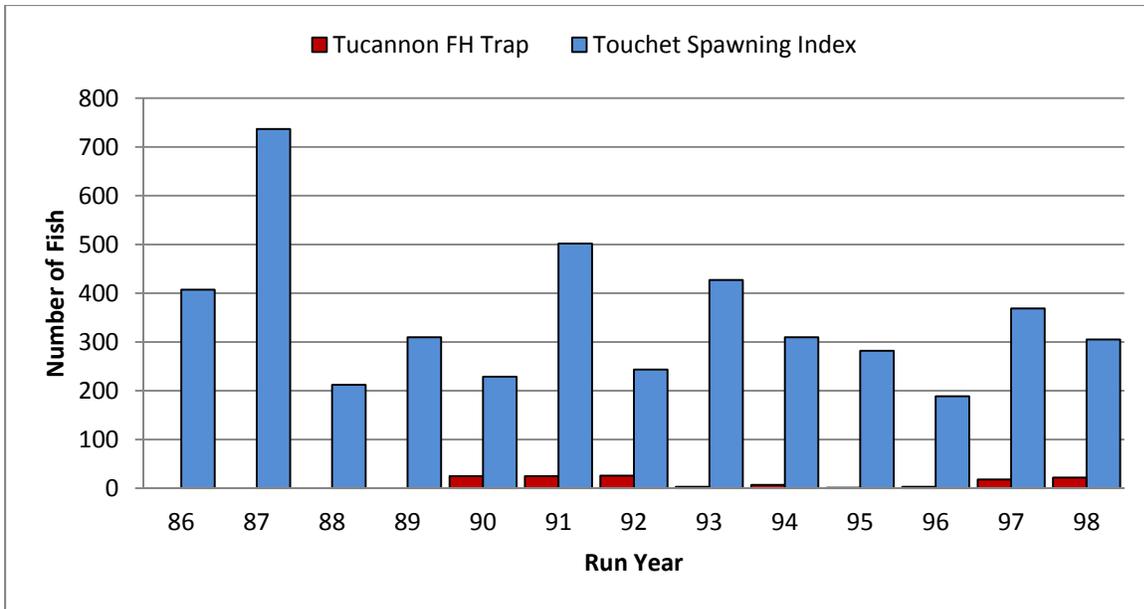


Figure 2. The number of summer steelhead trapped at the Tucannon FH adult trap, or estimated summer steelhead in an index area of the Touchet River upstream of Dayton, 1986-1998 Run Years.

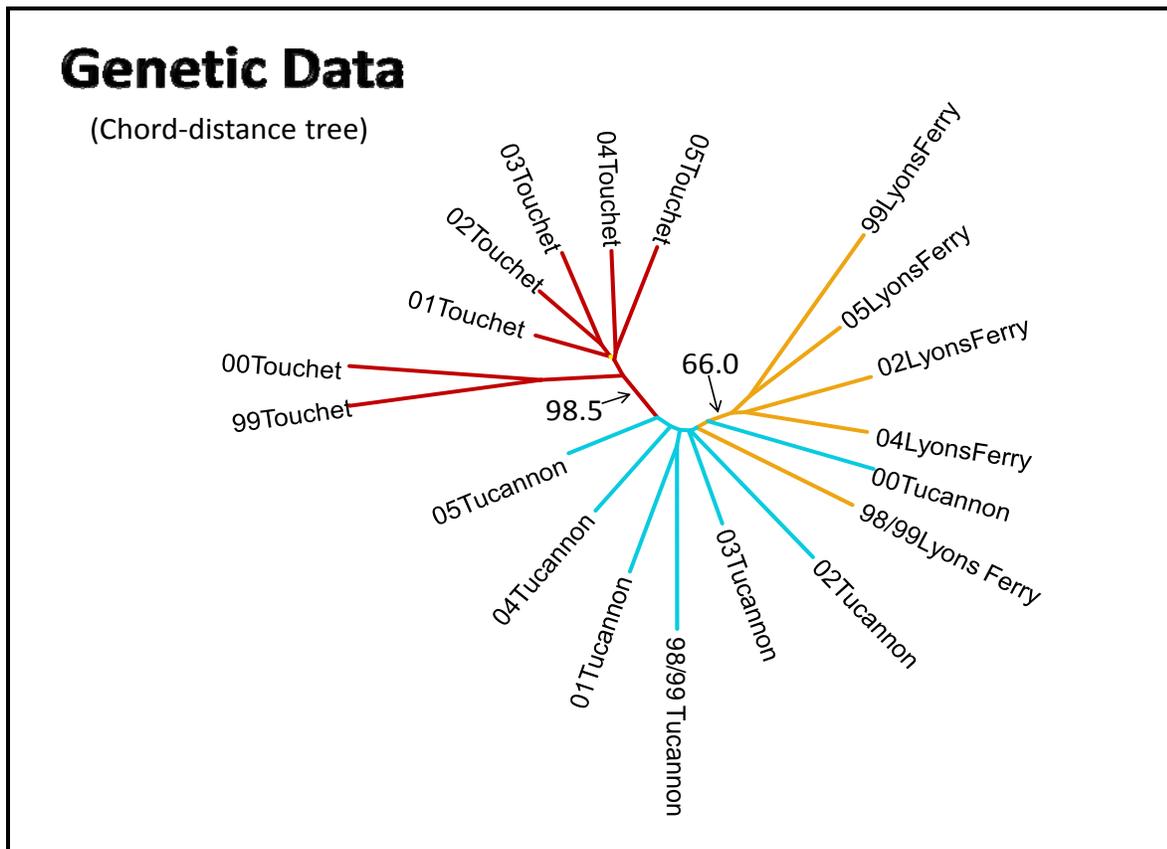


Figure 3. Chord-distance tree for temporally stratified adult samples. Node support numbers are values from bootstrap analysis (1000 bootstraps).

At the end of the 5-year “test”, WDFW evaluation staff summarized and provided an assessment and recommendations for each program. Broodstock collections were going well and the genetic data supported the presumption that we still had distinct stocks of steelhead within the Tucannon and Touchet rivers. However, due to difficulties in adult trapping in both rivers (high stream flows and debris which disabled traps), we were not able to assess total adult returns or survival; the basis for our determining program success and implementation. As such, WDFW staff recommended continuing the “test” period and transitioned to the use of PIT Tags for adult return and survival evaluations. In addition, there were many issues during rearing at the hatchery that had yet to be resolved: 1) multiple and extended eggtakes, 2) unripe or not enough males available for spawning, 3) poor feeding of the juveniles (especially in the Touchet stock) as they appeared to maintain a very high fright response while in the raceways, 4) size goals not being achieved, 5) very high coefficients of variation (fork length) with bi-modal distribution at release; with many in the lower mode that were considered non-migrants. All of these factors were confounding each program to some degree, so it was felt more time was needed to properly evaluate each program. Over the next five years, steps were taken to improve aspects of the hatchery rearing. At the same time, information from returning adults with PIT tags was available, so each program could be further and more effectively evaluated.

For the Tucannon River stock, size at release became more consistent with less variability, and adult returns and survival improved accordingly. Further, during our development of Hatchery and Genetic Management Plans (HGMP’s) in 2009, NOAA Fisheries indicated they would no longer support the continued release of Lyons Ferry stock steelhead into the Tucannon River. As such, WDFW and the co-managers agreed to cease all Lyons Ferry stock releases into the Tucannon following the 2010 release, with the intent to ramp up to full implementation of the endemic stock program in the Tucannon River. Hatchery modifications were needed before the full endemic stock program (150,000 smolts) in the Tucannon River could be achieved. Therefore, an interim program goal of 75,000 smolts (100% conservation) was agreed upon, with the program increasing in steps once facility modifications occurred. The program is anticipated to increase to 100,000 smolts with the 2013 brood (50,000 conservation, 50,000 harvest mitigation), and 150,000 smolts by 2015 (50,000 conservation, 100,000 harvest mitigation).

For the Touchet River stock, size at release has improved and adult returns and survival responded. However, for an unknown reason(s), overall survivals and returns of the Touchet River stock have been about 1/3 of the Tucannon River stock. In addition, there are still some negative aspects in the hatchery rearing and continuing concerns about the need for any form of supplementation (intentional or defacto) in the Touchet. As such, WDFW and the co-managers have not reached a decision on the fate of this program. A decision is expected in late 2012.

PROGRAM ASSESSMENT – TUCANNON STOCK

Currently, about 18-19 females (and an equal or greater number of males) are needed to meet program needs of 75,000 smolts. A 2x2 matrix spawn is typically applied when enough males are ripe on spawn days; though some males get used multiple times during the spawning season. Due to the low number of spawners, the effective population size (N_e) each year has been relatively small (Table 1), which has raised concerns within WDFW management about the use of F_1 generation hatchery fish for future broodstock use. To date, 6% of the Tucannon endemic broodstock have consisted of F_1 hatchery origin fish.

Table 1. Effective population size of Tucannon River endemic hatchery steelhead broodstock, 2000-2012 broods.

Brood	00	01	02	03	04	05	06	07	08	09	10	11	12
N_e	36	30	29	32	30	36	29	25	23	- - -	34	41	36

Run timing of both natural and endemic stock fish have been documented at the Tucannon FH Trap. Over the last four years of adult trapping, hatchery endemic stock fish return about 1-week earlier than natural origin fish. Broodstock collection has typically been from the earlier part of the run, allowing for earlier spawning and more time for rearing. However, since the decision was made to implement the program, we've attempted to collect the brood from the center portion of the run to the Tucannon FH (Figure 4). The number of steelhead returning to the Tucannon FH trap has dramatically increased over the past few years (Figure 5). The returns have been dominated by wild and endemic origin steelhead, with very few Lyons Ferry stock fish returning to the Tucannon FH. This has been a direct result of moving all Lyons Ferry stock releases to the lower Tucannon River.

Between 2000 and 2012, disposition of the Tucannon River broodstock was as follows: 86% have been spawned, 7% were pre-spawn mortalities and 7% were not used and returned to the river for natural spawning. We have collected scales from the broodstock and from representative adults trapped on the river to determine age composition of each year's run. Fish collected for broodstock are similar in overall age distribution of the run (Figure 6). Based on the scale samples collected, about 1% of the annual return of natural origin steelhead are repeat spawners.

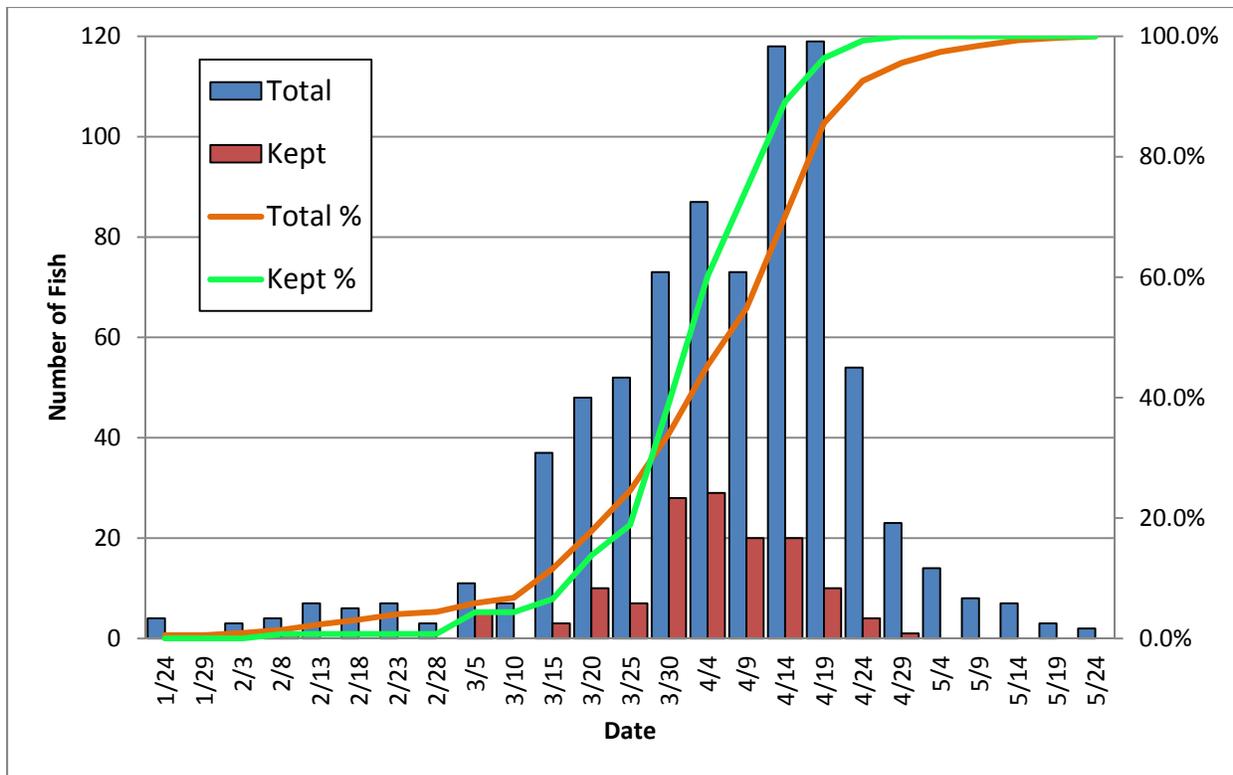


Figure 4. Number and percentage of Tucannon River wild origin steelhead trapped and collected for broodstock at the Tucannon FH adult trap (2008-2011 run years).

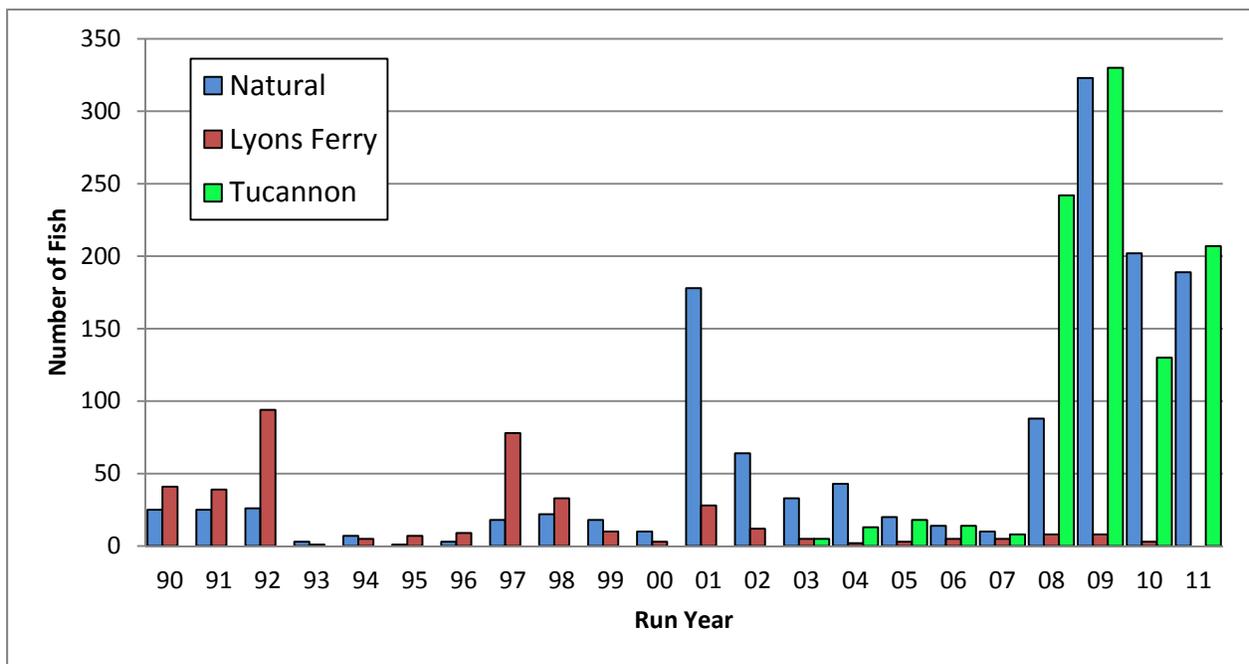


Figure 5. Adult steelhead trapped at Tucannon FH adult trap (1990-2011 Run Years).

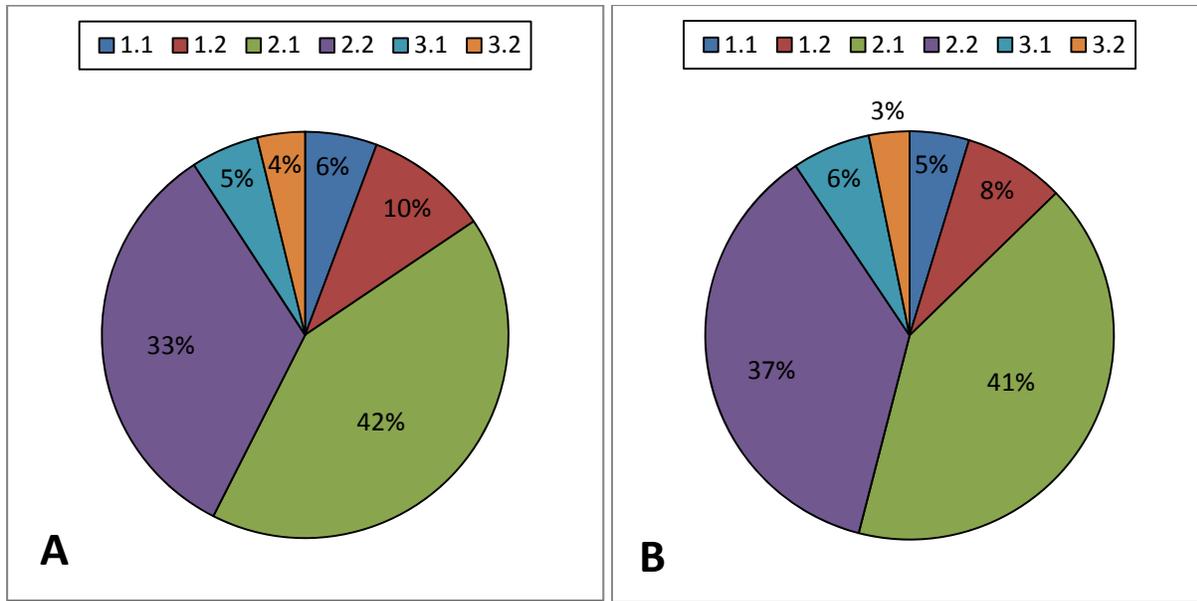


Figure 6. Age composition of natural origin summer steelhead collected for broodstock (A) or from the entire population (B) of the Tucannon River, 1999-2010 Run Years.

For each steelhead program at Lyons Ferry Hatchery, counts or estimates of production are made at various life stages. Over the years, the number of green eggs and eyed-eggs have been estimated through either volumetric or weight sampling methods, or from mechanical egg counters. Eyed egg-to-smolt survival has been relatively consistent, though variable, for the entire Tucannon River endemic steelhead program (Figure 7). Fish health has generally not been a problem at LFH because of high quality pathogen free ground water. However, in 2009, 2011 and 2012,

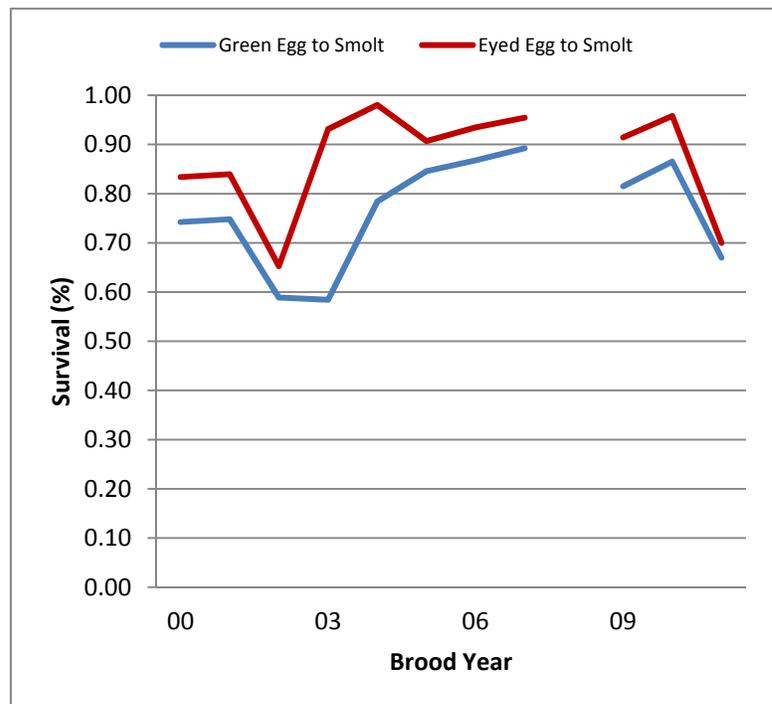


Figure 7. Green-egg and eyed-egg to smolt survival of LFH stock fish reared at Lyons Ferry Hatchery.

IHNV was detected in the ovarian fluid of spawned Tucannon River females. Per agency protocol, progeny from these females were not reared at the hatchery, but were released back into the Tucannon River as fry. In the 2011 brood, the presence of IHNV in the broodstock and the subsequent release of those fry limited the overall production of steelhead for that year (Figure8); other years have not been

as affected and program goals were met. Bacterial coldwater disease has sometimes been present during the rearing cycle, though the disease has not affected overall smolt production of the Tucannon stock.

Each release group is currently 100% coded-wire tagged and currently receives 15,000 PIT tags for estimating adult returns and assessing straying. None of these fish are currently marked for harvest (ad-clip), but a portion will be clipped in future years. During coded-wire tagging, a complete count of the stock is provided, with any mortalities subtracted from that point forward to estimate total smolt release numbers. At release, a minimum of 200 smolts are sampled a few days before release to estimate smolt size (length, weight, CV, fish/lb, K-Factor). During the first few years of the program, program size goals were not being met (Figure 9). Changes in rearing strategies were implemented and since then program goals have been met on a more consistent basis since.

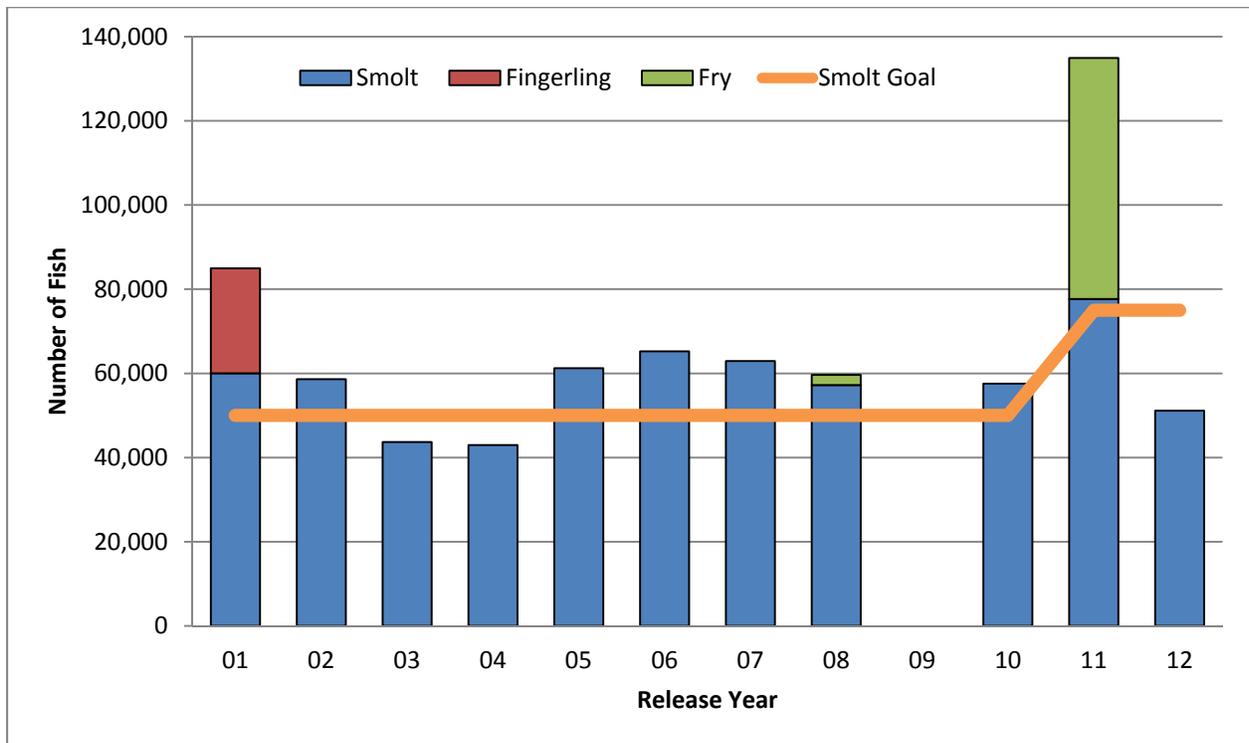


Figure 8. Smolt releases of Tucannon River stock steelhead, 2001-2012 release years.

With the implementation of the steelhead programs in SE Washington in the early 1980’s, WDFW established monitoring efforts that gathered information on the hatchery steelhead (electrofishing for residuals in streams, migrants captured in smolt traps, estimating returning adults through creel surveys, spawning ground surveys, and the operation of adult traps). These monitoring activities also allowed WDFW to collect information on natural steelhead production. However, efforts to fully understand the interaction of hatchery and natural fish are incomplete as environmental conditions often limited the quality of the data (i.e. high stream flows during spawning surveys, or washed out adult traps).

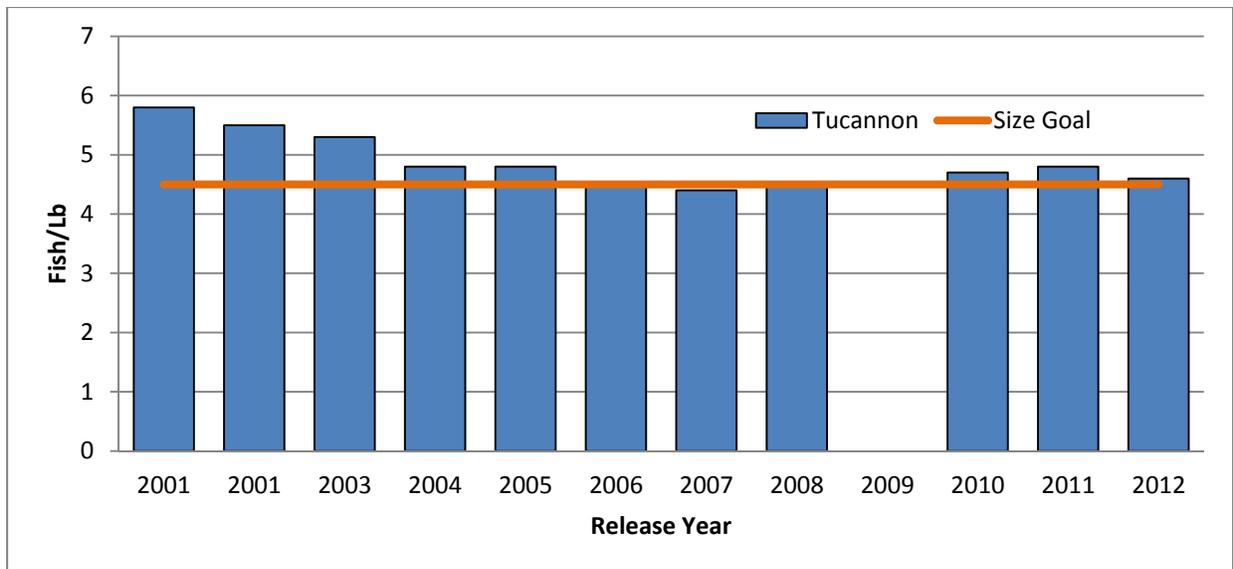


Figure 1. Size at release of Tucannon River endemic stock steelhead.

Due to these problems, WDFW has recently focused their natural production monitoring for steelhead in the Tucannon River with PIT tags. Natural origin migrants (Figure 10) are tagged at the smolt trap in the lower Tucannon River, and currently WDFW has deployed four in-stream PIT Tag arrays throughout the Tucannon River basin (Figure 11) to estimate adults returning to the river. PIT Tags implanted in both natural and hatchery endemic fish will allow WDFW to estimate natural and hatchery origin compositions into the Tucannon River.

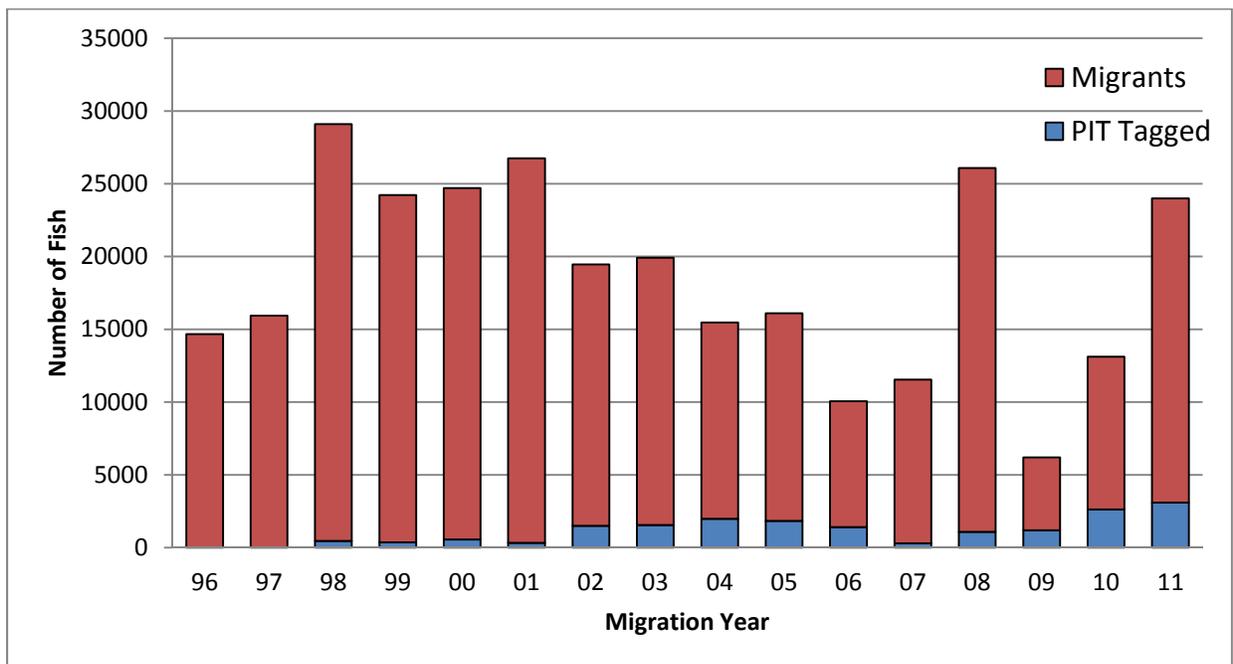


Figure 10. Estimated number of natural origin steelhead smolts from the Tucannon River, 1996-2011 migration years, and the number of PIT tagged smolts.

Through the use of PIT Tags, WDFW has been able to compare run timing of natural, endemic and LFH stock adults back to the Snake (at Ice Harbor Dam) and Tucannon rivers (Figure 12). Lyons Ferry stock steelhead return to each river significantly earlier. Smolt-to-adult survival of endemic stock fish closely mirrors survivals that have been estimated for natural origin steelhead from the Tucannon River (Figure 13), and are similar to Lyons Ferry stock steelhead performance in the last few years. More importantly, the Tucannon endemic stock survival to the project area is well above the 0.5% goal that was established when the program began, providing one of the basic factors in our decision to expand this program and eliminate the releases of Lyons Ferry stock into the Tucannon River. Progeny per Parent for the Tucannon endemic stock back to the project area (above Ice Harbor Dam) has averaged 28, another indicator of the program’s success.

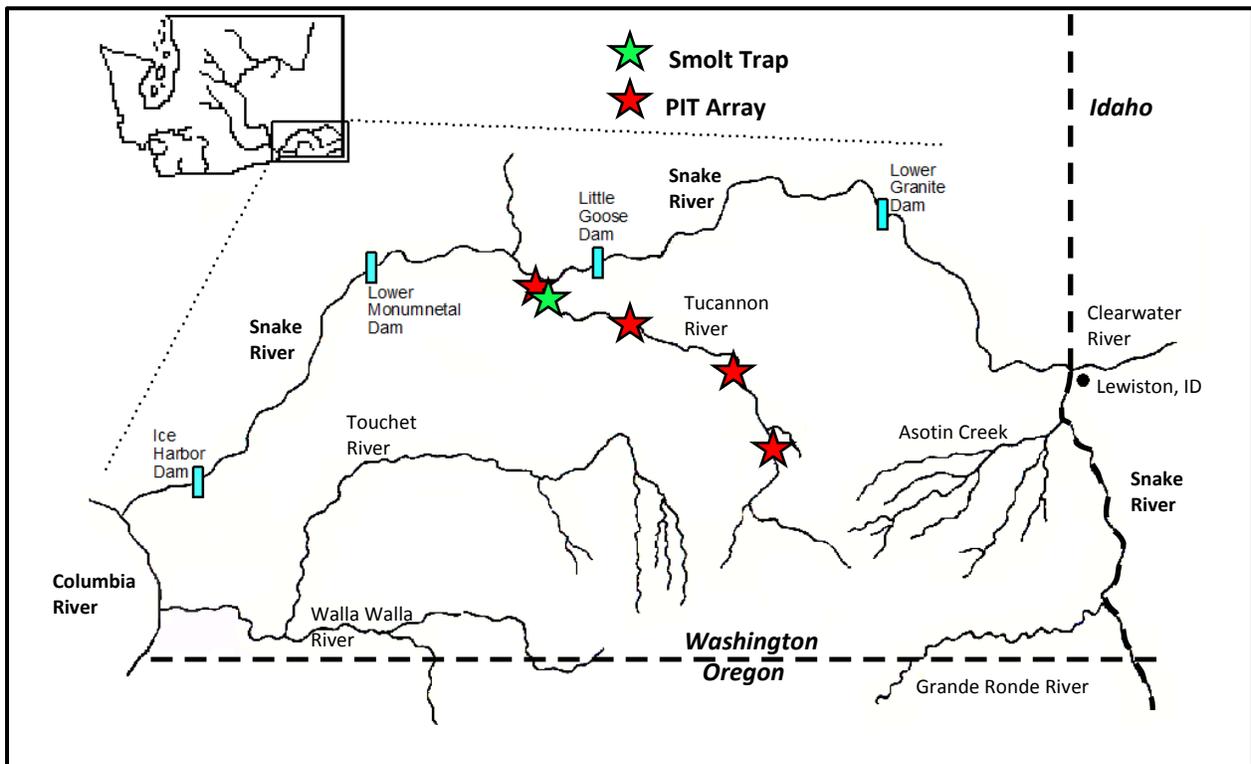


Figure 11. Current locations of the smolt trap and PIT Tag Arrays in the Tucannon River.

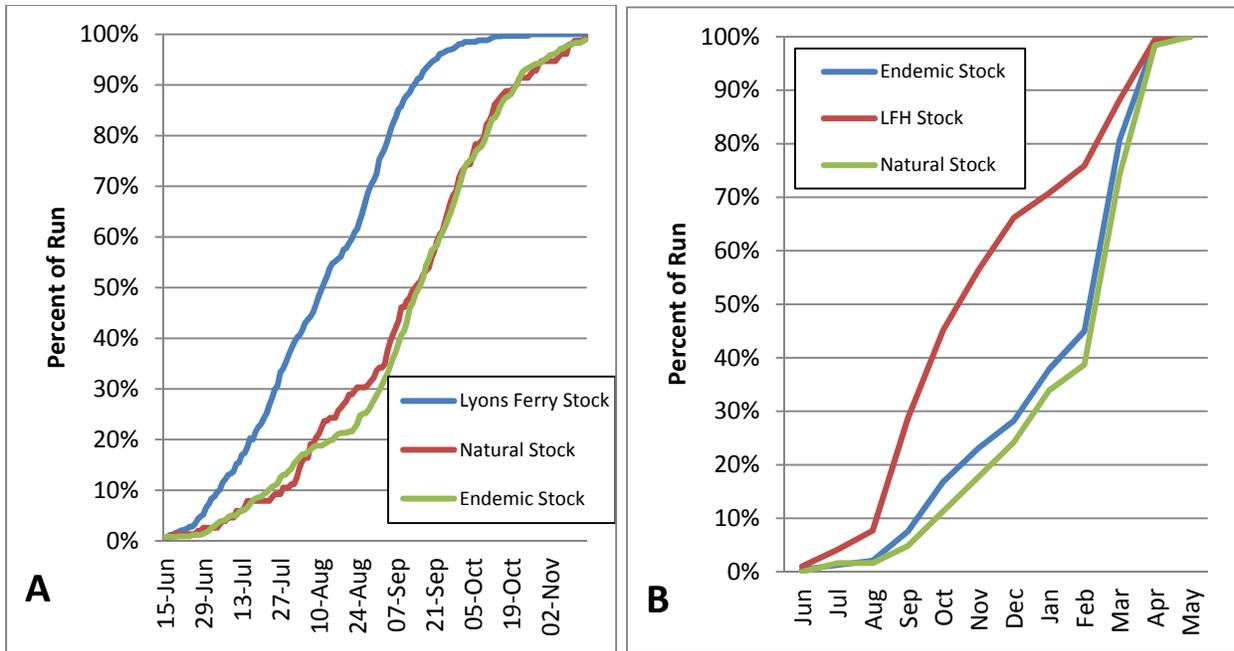


Figure 12. Run timing of natural, hatchery endemic, and Lyons Ferry stock summer steelhead (Tucannon River releases) over Ice Harbor Dam (A) or into the Tucannon River (B) based on PIT Tags, 2009-2011 run years.

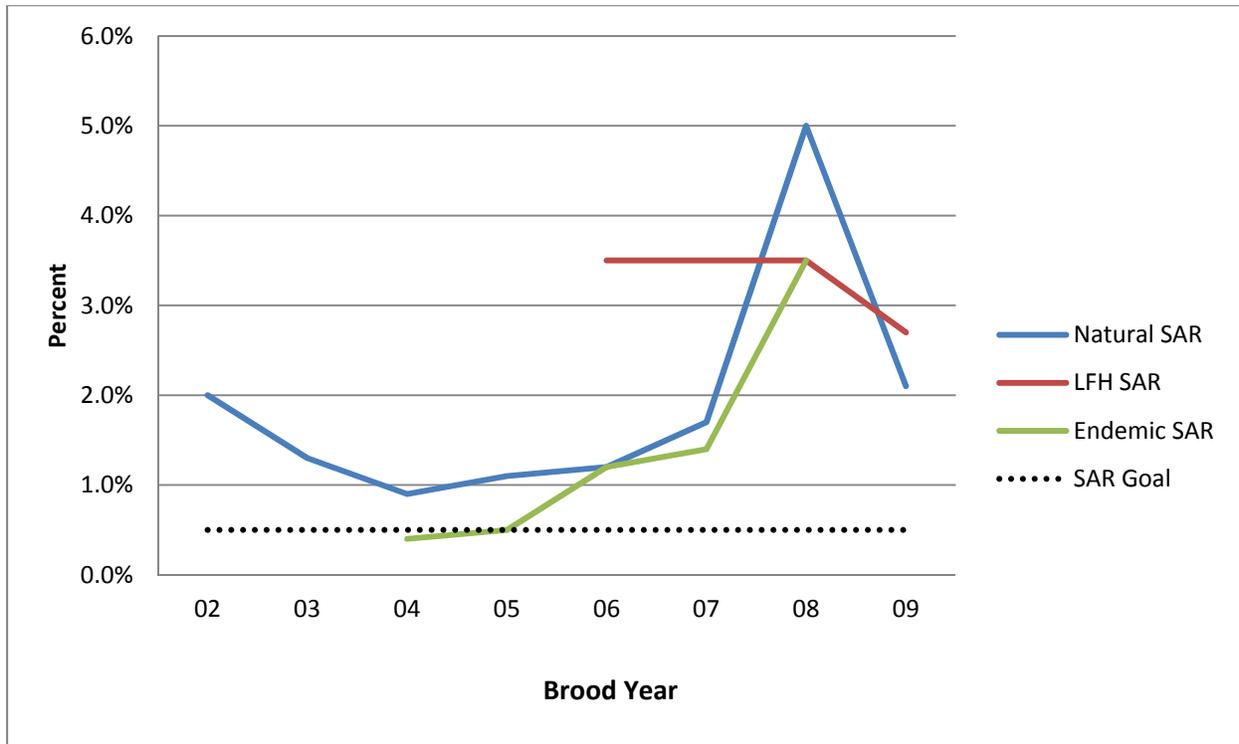


Figure 13. Smolt-to-adult return survival (SAR) of WDFW natural, Tucannon hatchery endemic, and Lyons Ferry stock summer steelhead from the Tucannon River.

PIT Tags in returning adults (all three stocks of steelhead in the Tucannon River) provided us with the necessary data to make decisions about expanding the Tucannon endemic hatchery program in the Tucannon River. In addition, the data have provided insight as to what has been limiting steelhead production in the Tucannon River (Table 2). Based on multiple years of return data from all three stocks of steelhead that come out of the Tucannon River, we believe that only 30-35% (could be as high as 50%) of the adult steelhead that cross Ice Harbor Dam actually return to the Tucannon River, with the remaining entering other locations – the majority in areas above Lower Granite Dam. WDFW believes this behavior is either 1) a natural migration pattern, 2) adults are following cold water coming from the Clearwater River basin, 3) adults are seeking over-wintering locations outside the reservoir impacted area caused by the four lower Snake River Dams, or 4) are blocked by the dams from returning downstream to the Tucannon River later in the winter/early spring. Initially, about 65-70% of the returning adults migrate upstream of Lower Granite Dam, with about 15-20% estimated to fall/migrate back, some of which return to the Tucannon River. By taking these estimates of “straying” into consideration, WDFW has calculated a modified Progeny:Parent ratio of fish returning to the Tucannon River only. Between 2000-2009, WDFW had collected 319 fish for use as broodstock, with an estimated 1,950 returns to the Tucannon River, for a progeny:parent ratio of 6.1:1.

Table 2. Estimated percentages of summer steelhead (hatchery and natural) from the Tucannon River that return to the Tucannon River or remain above Lower Granite Dam, based on PIT Tag detections.

Stock (Migration Years)	Number of PITs Detected at IHR Dam (N)	Enter Tucannon River	Remain above LGR Dam	Unknown Location
LFH – Tucannon Release (06-10)	790	23%	55%	22%
Tucannon Endemic (04-10)	752	29%	55%	16%
Tucannon Natural (04-10)	165	29%	53%	18%

With both natural and hatchery fish PIT Tagged, WDFW has been able to estimate escapement into the Tucannon River (Figure 14). For the estimates, we’ve assumed that as high as 50% of Tucannon origin steelhead that cross Ice Harbor Dam return to the Tucannon River. Overall escapement of wild origin steelhead to the Tucannon River remains low, and is below the recommended minimum abundance threshold (MAT) of natural-origin adults (285 spawners) described in WDFW’s Fishery Management Evaluation Plan (FMEP) and by the Interior Columbia Technical Review Team (ICTRT).

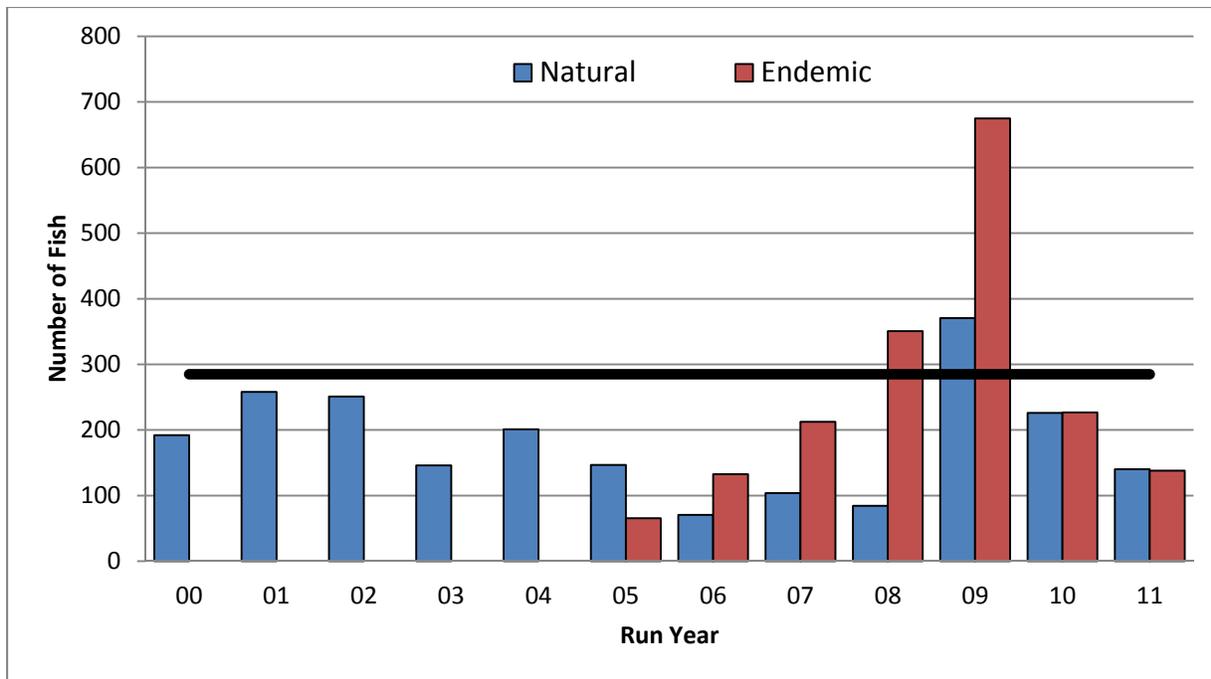


Figure 14. Estimated number of Tucannon River natural and hatchery endemic stock steelhead escaping into the Tucannon River, 2000-2011 run years.

According to NOAA Fisheries and the ICTRT, the Tucannon River summer steelhead population is comprised of the Tucannon River and other smaller tributaries that flow directly into the Snake River below Lower Granite Dam (Almota Creek, Deadman Creek, Alkali Flat Creek, and Penewawa Creek). The estimates provided in Figure 14 are only for the Tucannon River. Limited information is available on the natural steelhead population sizes in these smaller tributaries of the Snake River. However, according to the FMEP, natural origin spawning escapement below the MAT does not meet the minimum for allowing fisheries for hatchery steelhead to occur where that population exists. Obtaining population estimates and determining stock origin of natural origin steelhead from these smaller tributaries of the Snake River may be vital in order to maintain a mitigation fishery on the Tucannon River.

Examining adult PIT tag returns, we’ve observed that all three groups of steelhead that are from, or were released into, the Tucannon River (natural origin, LFH stock, Tucannon endemic stock), “stray” above Lower Granite Dam, and return to the Tucannon River at about the same rate every year (Table 2). This observation of “straying” into areas above point of origin is not unique to Tucannon River steelhead. The PIT Tag array near the mouth of the Tucannon has provided data indicating that other populations of steelhead (both hatchery and wild) are straying into the Tucannon as well. In fact, the PIT tag data indicates that about 1/3 of the natural origin steelhead entering the Tucannon River during the spring months are from other river basins (Figure 15).

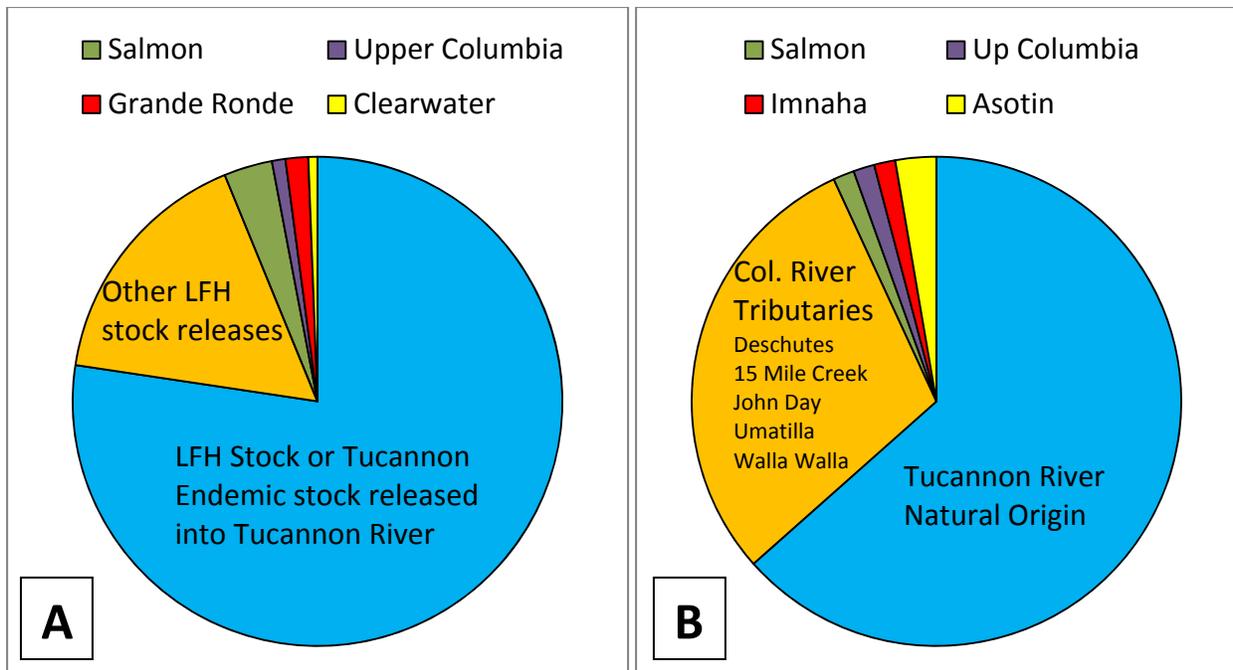


Figure 15. Percent composition (actual number – not expanded by mark rate) of Hatchery (A) and Wild (B) origin adult PIT tagged steelhead entering the Tucannon River between February-April, 2005-2011 Run Years.

Similar to the Tucannon River steelhead that stray above Lower Granite Dam, these other populations, especially those from the Columbia River tributaries, initially pass the mainstem dams and then are unable or unwilling to fallback to their natal stream. With the Tucannon River natural population at depressed/critical levels, these other populations represent a genetic risk to the natural population.

PROGRAM ASSESSMENT – TOUCHET STOCK

Currently, about 13-15 females (and an equal or greater number of males) are needed to meet program needs of 50,000 smolts. A 2x2 matrix spawn is typically applied when enough males are ripe on spawn days; though some males get used multiple times during the spawning season. Due to the low number of spawners, the effective population size (N_e) each year has been relatively small (Table 3), which is a concern of WDFW management should F_1 generation hatchery fish be needed for future broodstock use until the program could be expanded. To date, we have not used any Touchet Endemic hatchery stock in the spawning process.

Table 3. Effective population size of Touchet River endemic hatchery steelhead broodstock, 2000-2012 broods.

Brood	00	01	02	03	04	05	06	07	08	09	10	11	12
N_e	18	25	31	33	24	33	36	33	24	27	28	25	29

Run timing of both wild and endemic stock fish have been documented at the Touchet River Adult Trap. Unlike the Tucannon River, run timing to the Touchet River Adult Trap is similar between the two stocks. Due to issues with extended spawn times and poor rearing success with this stock in the hatchery, broodstock have been collected over the earlier part of the run, allowing for earlier spawning and more time for rearing (Figure 16). However, for the last two years, collection of broodstock has been compressed to a 3-week time period during the peak of the run. The number of steelhead estimated on the spawning grounds above the city of Dayton (natural and hatchery origin) has remained relatively stable over time (Figure 17). The returns within this area have been dominated by natural origin steelhead, with generally less than 20% hatchery fish on the spawning grounds.

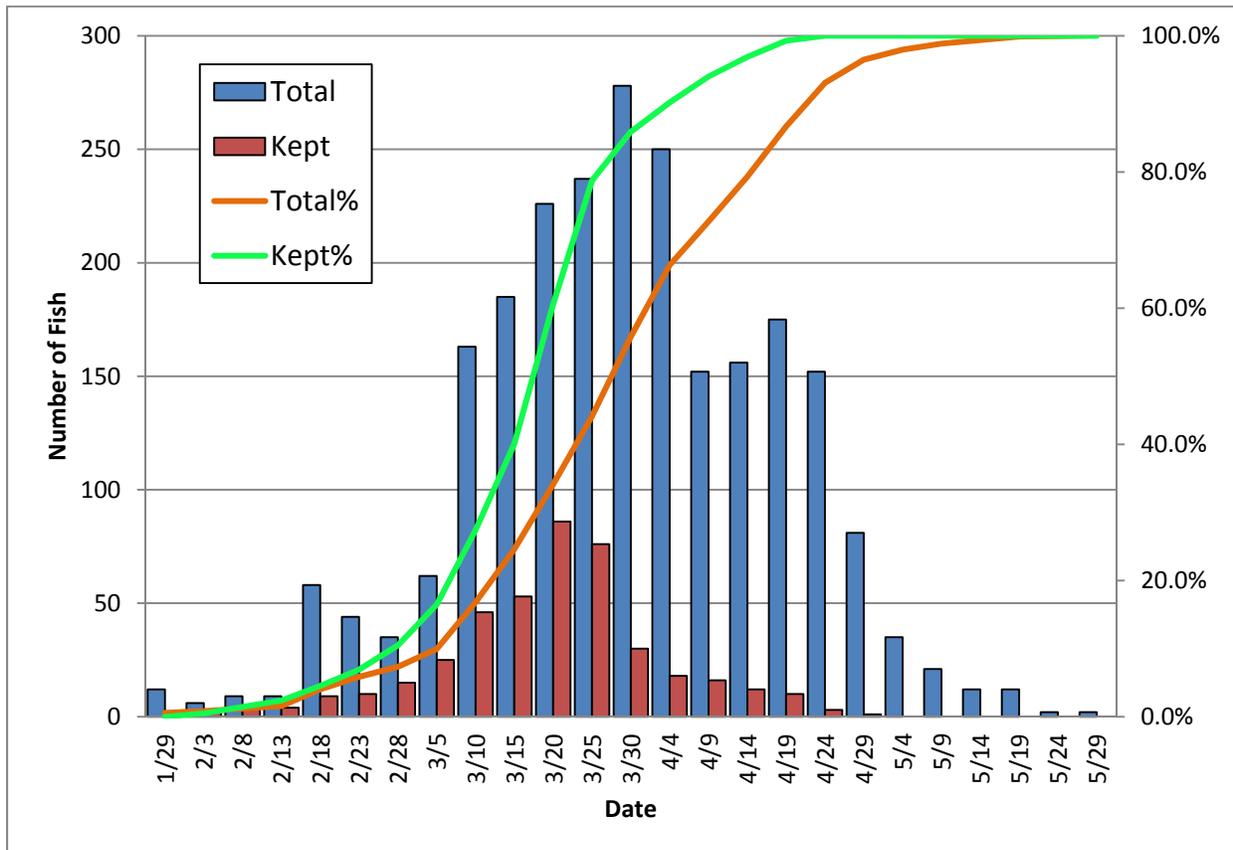


Figure 16. Number and percentage of Touchet River wild origin steelhead trapped and collected for broodstock at the Dayton Adult trap, Touchet River (1999-2011 run years).

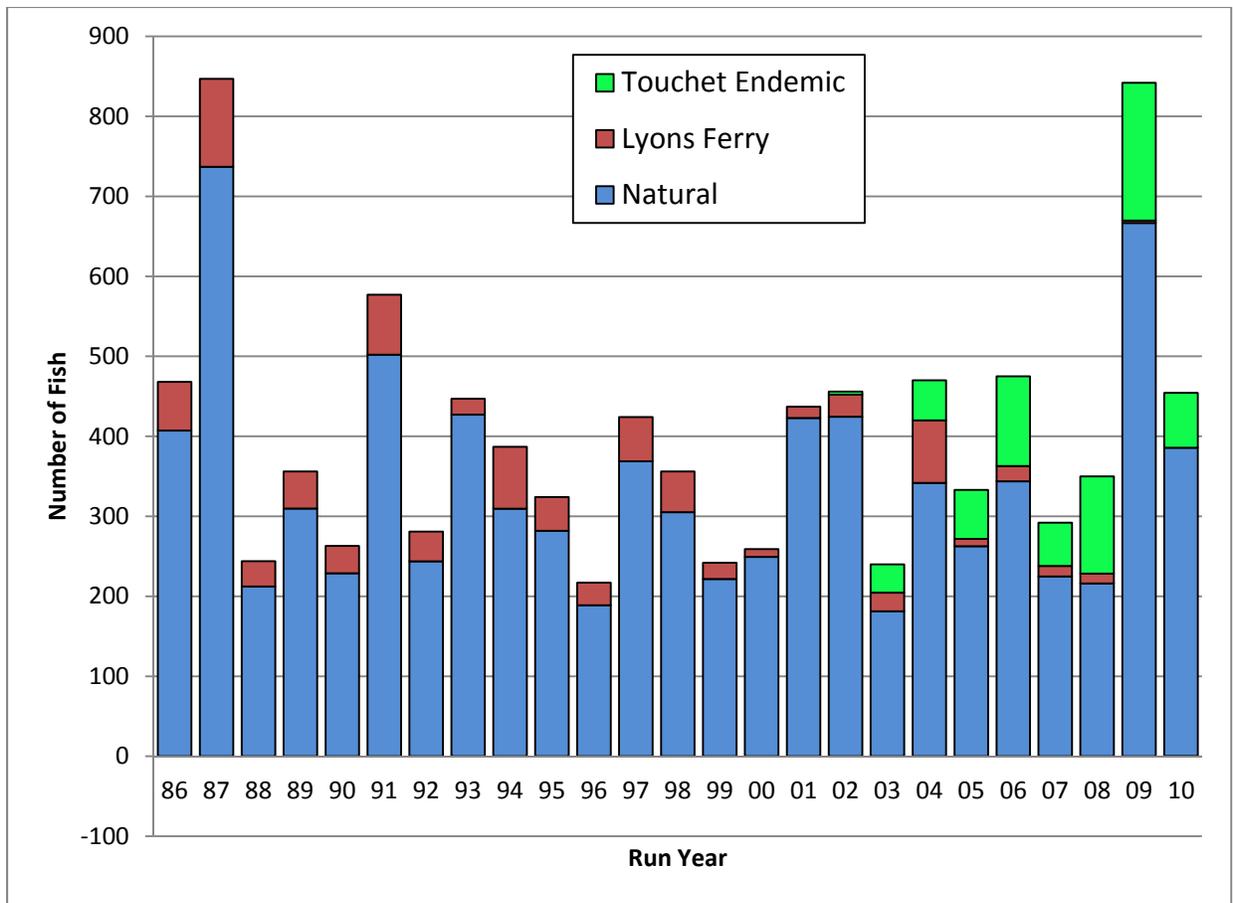


Figure 17. Estimated adult steelhead in the Index Area of the Touchet River above the city of Dayton (1986-2010 Run Years).

Between 2000 and 2012, disposition of the Touchet River broodstock was as follows: 86% have been spawned, 11% were pre-spawn mortalities, and 3% were not used and returned to the river for natural spawning. WDFW evaluation staff has collected scales from the broodstock collections and from representative samples of adults trapped on the river to determine age composition of each year's run. Fish collected for broodstock are similar in overall age distribution of the run (Figure 18). About 5% of the annual return of natural origin steelhead are repeat spawners.

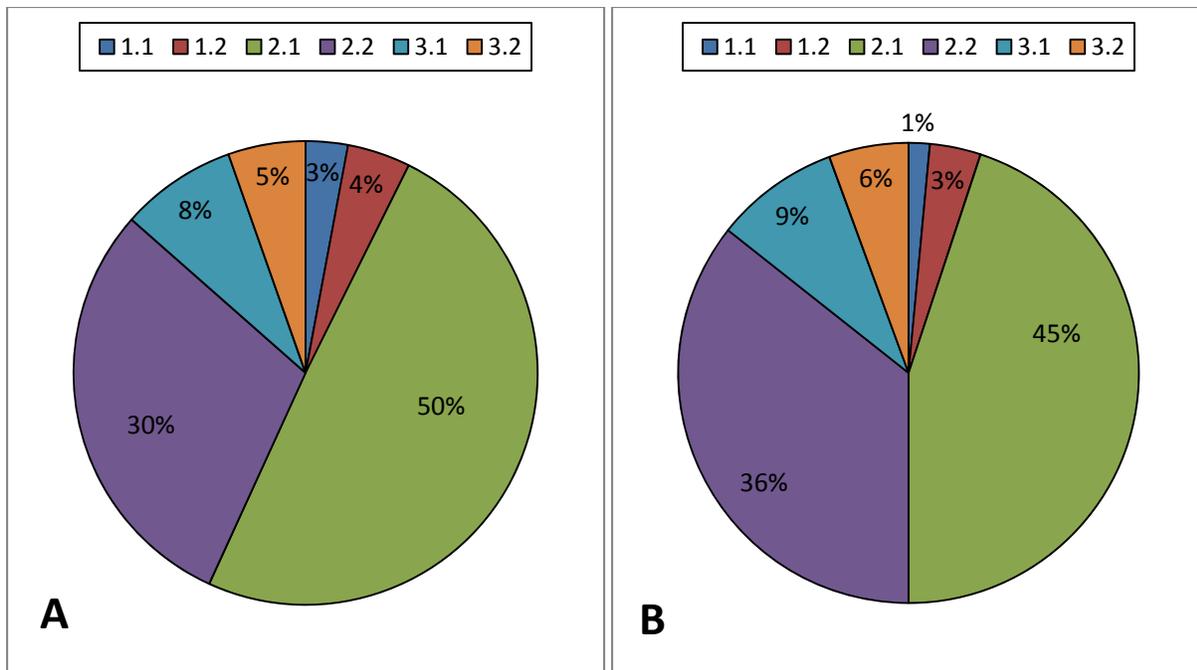


Figure 18. Age composition of natural origin summer steelhead collected for broodstock (A) or from the entire population (B) of the Touchet River, 1999-2010 Run Years.

For each steelhead program at Lyons Ferry Hatchery, counts or estimates of production are made at various life stages. Over the years, the number of green eggs and eyed-eggs have been estimated through either volumetric or weight sampling methods, or from mechanical egg counters. Eyed egg-to-smolt survival has been relatively consistent, though variable, for the entire Touchet River endemic steelhead program (Figure 19). Fish health has generally not been a problem at LFH because of high quality pathogen free ground water. However, in 2005, 2006 and 2009, IHNV was detected in the ovarian fluid of spawned Touchet River females. Per agency protocol, progeny from these females were not reared at the hatchery, but were released back into the Touchet River as fry. Additional females were collected to offset the loss, and overall production was not impacted. Bacterial coldwater disease has sometimes been present during the rearing cycle, though the disease has not affected overall smolt production of the Touchet stock (Figure 20).

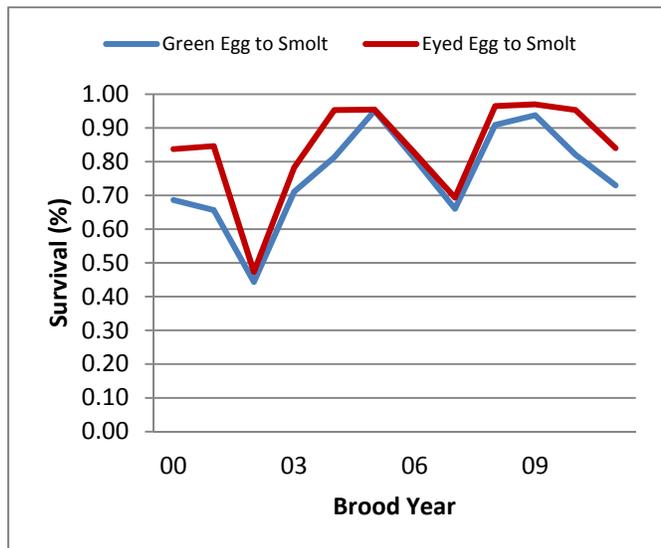


Figure 19. Green-egg and eyed-egg to smolt survival of Touchet River endemic stock fish reared at Lyons Ferry Hatchery.

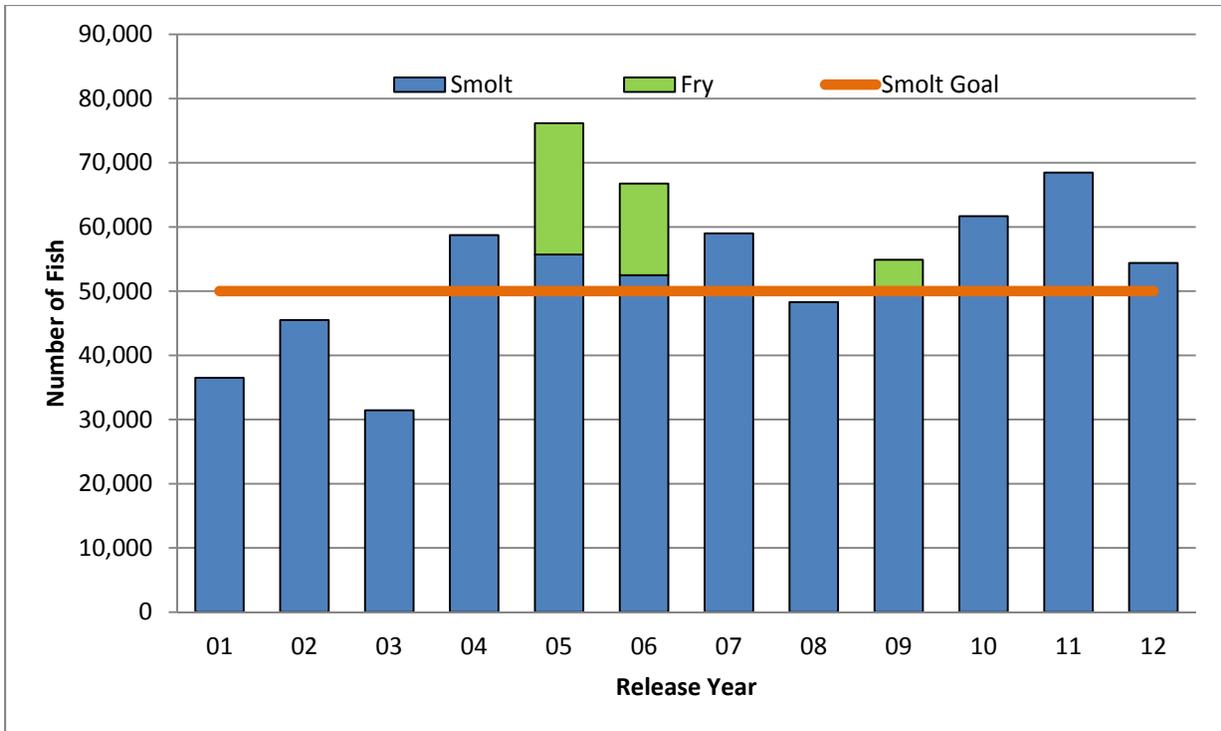


Figure 20. Smolt releases of Touchet River stock steelhead, 2001-2012 release years.

Each release group is currently 100% coded-wire tagged and currently receives 5,000-10,000 PIT tags for estimating adult returns and assessing straying. None of these fish are currently marked for harvest (ad-clip), but all would be clipped in future years if the program is expanded for harvest mitigation.

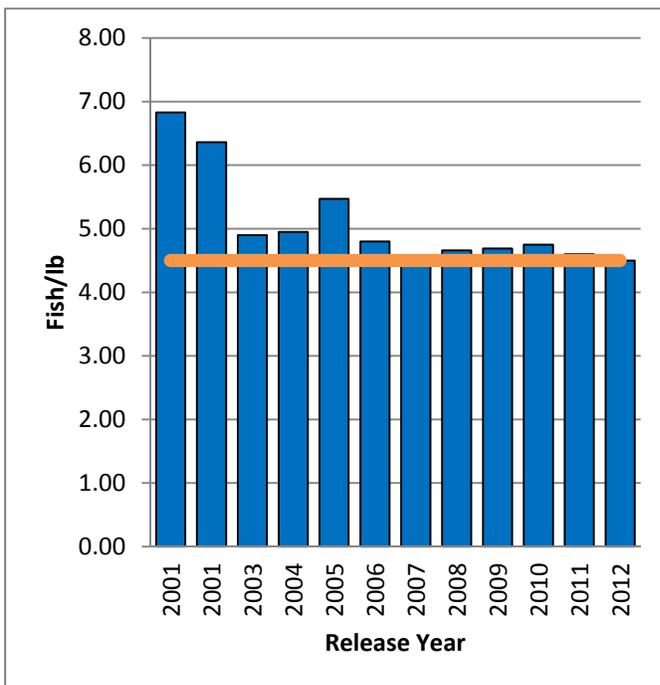


Figure 21. Size at release of Touchet River endemic stock steelhead.

During coded-wire tagging, a complete count of the stock is provided, with any mortalities subtracted from that point forward to estimate total smolt release numbers. At release, a minimum of 200 smolts are sampled a few days before release to estimate smolt size (length, weight, CV, fish/lb, K-Factor). During the first few years of the program, program size goals were not being met (Figure 21). Changes in rearing strategies were implemented and program goals have been met on a more consistent basis since.

Similar to the Tucannon River monitoring, though started at a later date, WDFW has recently focused their natural production monitoring for steelhead in the Touchet River with PIT tags. Natural origin migrants are

currently being tagged at two smolt traps operated in the Touchet River, and currently WDFW has deployed one in-stream PIT Tag array to estimate adults returning to the Touchet River. Through the use of PIT Tags, WDFW has been able to compare run timing and adult returns of natural, endemic and LFH stock adults over McNary Dam (Figure 22).

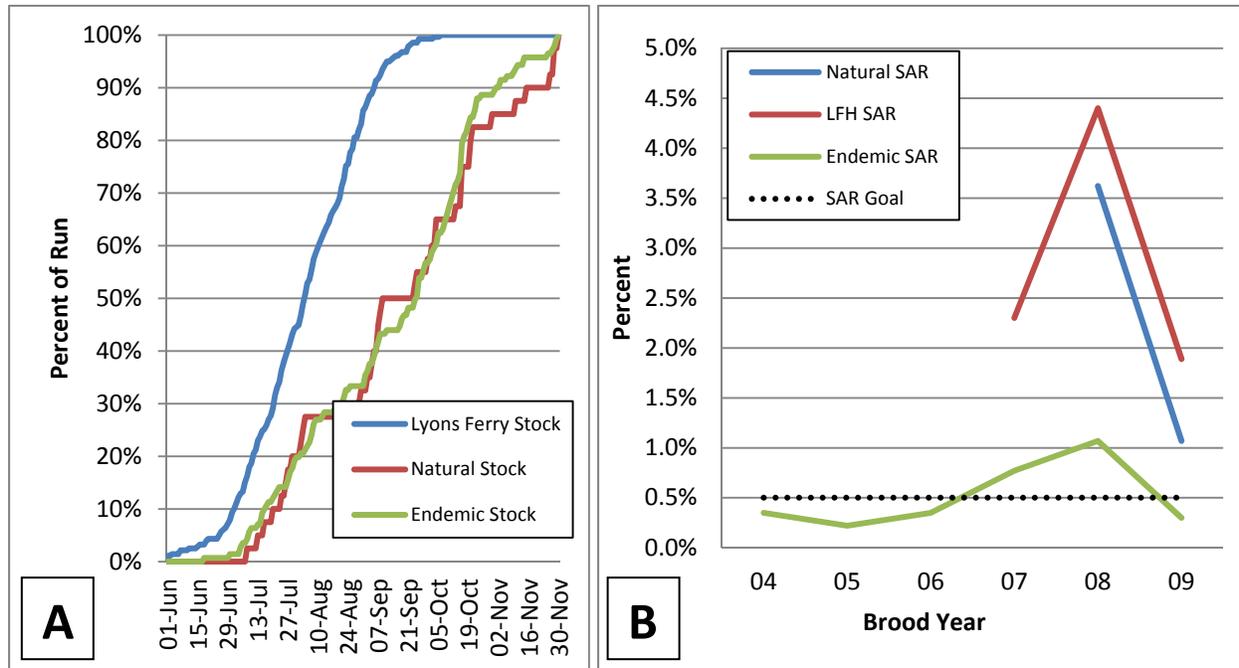


Figure 22. Run timing (A) and smolt-to-adult survival (B) of natural, hatchery endemic, and Lyons Ferry stock summer steelhead (Touchet River releases) as measured at McNary Dam.

Unfortunately, the PIT Array in the Touchet River has not been in operation long enough to allow estimates of adults back to the Touchet River. Lyons Ferry stock steelhead arrive at McNary Dam significantly earlier than either the endemic or natural stock. Smolt-to-adult survival of endemic stock fish is much lower than has been estimated for natural origin or Lyons Ferry stock steelhead from the Touchet River (Figure 23). The mean estimated survival of the Touchet Endemic stock as measured at McNary Dam is only 0.45%, below our established criteria for the program performance to the Touchet.

Also similar to the Tucannon River steelhead, all three Touchet River stocks of steelhead are straying into the Snake River Basin upon initial return (Table 4), though with later run timing, both the endemic stock and natural origin fish tend to stray into the Snake River at a lower rate as compared to the Lyons Ferry stock fish. However, with as many as 50% of the endemic stock steelhead straying into the Snake River basin, SAR's of the endemic stock will have to substantially improve to meet program goals of adults and survival to the Touchet River. As with the Tucannon River, the cause of this straying behavior is unknown. However, low stream flows and high water temperatures in the Walla Walla River when adults are returning are likely factors.

Table 4. Estimated percentages of summer steelhead (hatchery and natural) from the Touchet River that return to the Walla Walla Basin, or pass/remain above Ice Harbor Dam, based on PIT Tag detections.

Stock (Migration years)	Number of PITs Detected at McNary Dam	Pass Above IHR Dam	Enter Walla Walla River	Unknown Location
LFH – Touchet River Release (08-10)	286	84%	12%	4%
Touchet River Endemic (08-10)	145	50%	36%	14%
Touchet River Natural (08-10)	47	34%	28%	38%

By taking these estimates of “straying” into consideration, WDFW has calculated a modified Progeny:Parent ratio of fish returning to the Touchet River only. Between 2000-2009, WDFW had collected 299 fish for use as broodstock, with an estimated 679 returns to the Touchet River, for a progeny:parent ratio of 2.3:1; an indication of this programs overall poor success. Further, production estimates for Touchet River natural steelhead indicate the stock is near replacement levels (Figure 24). Given the poor success of the endemic program, and indications that the natural population is stable and may recover to a healthy level, local fish management and evaluation staffs have recommended that the Touchet endemic stock program be stopped. A final policy decision has not been reached.

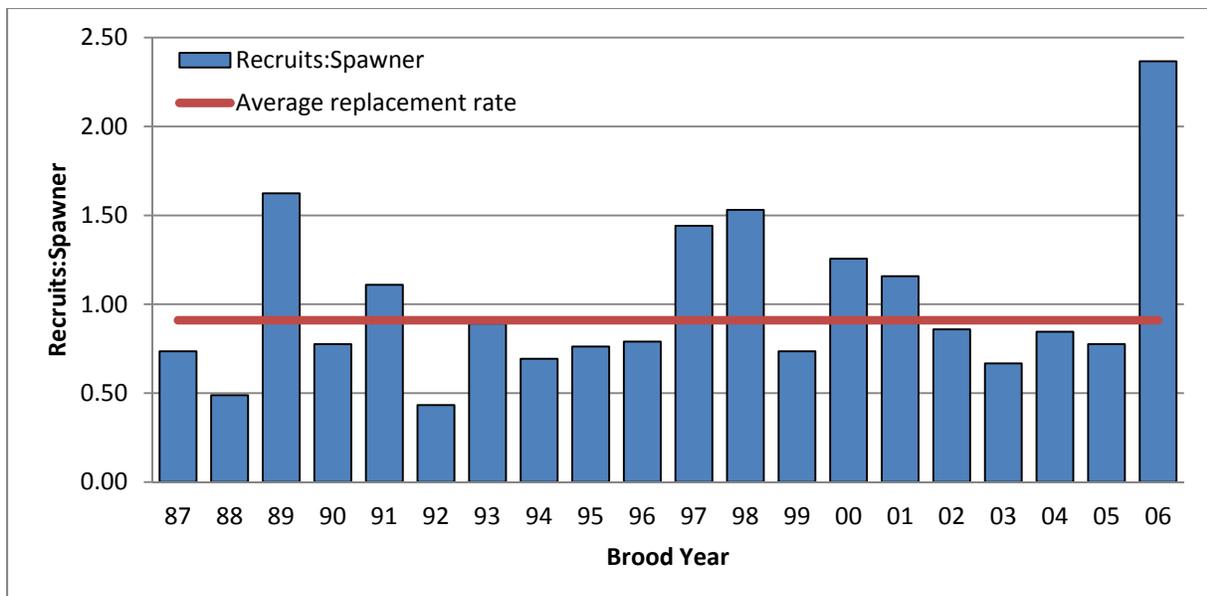


Figure 24. Recruits:Spawner ratios of naturally produced summer steelhead from the Touchet River based on index area spawning population estimates in the upper Touchet Basin.

SUMMARY AND CONCLUSIONS

Broodstock Development and Management

WDFW developed both Tucannon and Touchet endemic stocks through trapping of returning natural origin adults at traps within each river system. Broodstock availability has not been a limiting factor for either program to date. However, due to low returns in the Tucannon River, broodstock levels to reach full program needs may be limited in future years.

In-Hatchery Performance

Over the course of each program, spawn timing has remained consistent. Pre-spawning mortality has remained low, egg-to-smolt survival rates have been variable but within acceptable limits, and have not affected overall program performance. No major outbreaks of disease have occurred in either program, but detection of IHNV in female broodstock limited production in the Tucannon stock for one year. Bacterial coldwater disease sometimes occurs, but has not prevented either program from achieving smolt release goals. Smolt releases (target number) have generally be met, but size at release has often fallen short, especially early on in each program. Problems with late spawning, multiple egg takes, high fright response when feeding, etc..., has prompted new rearing techniques and strategies, which have generally overcome problems seen early on in the programs.

Survival and Adult Return Performance

For the Tucannon River stock, we determined that smolt-to-adult survival was above the minimum goal set, and further releases of Lyons Ferry stock into the Tucannon River would not be supported by NOAA Fisheries. As such, and in order to maintain a harvest mitigation program in the Tucannon River for summer steelhead and despite straying problems for all stocks in the Tucannon, WDFW implemented expansion of the Tucannon endemic stock program. While facility modifications need to occur, we expect to reach full program levels by the 2015 brood.

For the Touchet River stock, we have determined that smolt-to-adult survival has been below the goal set for the program. In addition, many of the returning adults are not returning to the Touchet River. The natural population appears to be stable, despite loss of habitat and having a hatchery mitigation program present in the basin. Local fish management and evaluation staffs have recommended that this program, as originally intended as a harvest mitigation program to replace the Lyons Ferry stock, be terminated. A formal policy decision from WDFW and agreement with our co-manager under US v. OR are pending.