EVALUATION OF THE ABUNDANCE, CONDITION, AND RETURNS FROM STEELHEAD KELTS PASSING JOHN DAY DAM, 2003

Monitoring Report

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EXECUTIVE SUMMARY

Salmonids such as steelhead (*Oncorhynchus mykiss*), cutthroat trout (*O. clarki*), Atlantic salmon (*Salmo salar*), and sea trout (*S. trutta trutta*) are iteroparous, having the ability to spawn multiple times. There is a paucity of information on the genetic contribution of repeat spawners to steelhead population's of the Columbia River basin that are listed as Endangered (upper Columbia River) or Threatened (Snake and mid-Columbia rivers) under the United State's Endangered Species Act (ESA, NMFS 2004). It has been observed that obstacles to downstream migration seriously reduce the numbers of returning respawners (Whitt 1954). Because dams are recognized to negatively affect iteroparity rates, (NWPPC 1986; ISG 1996) studies were initiated to provide information on the abundance, passage through hydroelectric facilities, return rates, and return timing of steelhead kelts.

In a continuation of past studies, objectives for 2003 were to determine the abundance, condition, sex, and origin of post-spawn steelhead (referred to as kelts) passing through the John Day Dam Juvenile Bypass System. In addition, Passive Integrated Transponder (PIT) technology was employed to assess kelt return success to the Columbia River.

At McNary Dam, from 1 April to 10 June of 2003 the Juvenile Fish Facility separator was in operation every other day. Biological technicians at the Juvenile Fish Facility visually identified 331 adult steelhead as kelts and 459 as pre-spawn steelhead. Of the 331 kelts, 57% were wild and 60% were in good or fair condition.

At John Day Dam, sampling was conducted from 1 April to 3 June of 2003; ultrasound images of steelhead visceral anatomies were used to distinguish pre-spawned from post-spawned steelhead. We estimate 2,299 kelts traveled through the bypass system. We sampled 719 steelhead and based on ultrasound identified 93% of them as kelts. Of our sampled kelts 68% were female, 73% were unclipped (presumed to be of natural origin), and 51% in good or fair condition. Kelts from all condition categories were PIT-tagged (n = 449) and returned to the bypass system.

From the kelts released at John Day Dam (n=449) in 2003, return percentages as enumerated by adult PIT detections systems are; 2.9% (13/449) in Bonneville Dam fishladders, 0.9% (4/449) at McNary Dam, and 0.2% (1/449) at Lower Granite Dam. Of the 13 that returned, kelts from natural origins returned in higher proportions (92%) than kelts originating from hatcheries (8%). Proportions of good, fair, and poor condition kelts detected at Bonneville Dam were 85% (11/13), 15% (2/13) and 0% respectively.

Despite high reported out-migration success rates for kelts released at Lower Granite Dam in 2003 (Boggs and Perry 2004), kelt return rates were the lowest (for kelts released from both Lower Granite and John Day dams) reported values since the inception of Adult PIT monitoring. These data suggest that as seen with juvenile salmonids, ocean productivity may play a large role in ultimately determining kelts returns.

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INTRODUCTION

Similar to other iteroparous salmonids (e.g., Atlantic salmon *Salmo salar,* sea trout *S. trutta trutta*, cutthroat trout *Oncorhynchus clarki*), steelhead (*O. mykiss*) have the ability to spawn multiple times during their life cycle. Recent studies have revealed the abundance and origins (i.e., hatchery or wild) of kelts in the juvenile bypass systems (JBS) of mainstem dams along the Columbia and Snake rivers (Evans and Beaty 2001; Evans et al. 2004; Wertheimer et al. 2002, 2003). Like juvenile salmonids, kelts must first negotiate past hydroelectric facilities to the ocean before returning on upstream spawning migrations. Return rates of 17% have been documented for kelt steelhead in non-impounded tributaries of the lower Columbia (NMFS 1996), 3.3% from the Klickitat River located above Bonneville (BON) Dam (Howell et al. 1984) and 1.6% from the Yakima River, which lies above McNary (McN) Dam (Hockersmith et al. 1995). Data from upper Columbia River and Snake River stocks suggest that return rates decline with increasing distance from the tributaries to the ocean. A variety of factors besides distance plays a role in this decline. These factors include time of entrance into fresh water, environmental conditions, man-made obstacles, sex, size at maturity, and bio-energetic reserves (Fleming 1998).

Until recently, little was known about kelt passage through hydroelectric facilities. Similarly, little was known regarding return timing or return rates. Recent work (Evans and Beaty 2001; Hatch et al. 2002; Wertheimer et al. 2002, 2003) suggests that kelts sampled at lower Columbia River facilities have higher out-migration success than up-river stocks. Prior to and during early development of the hydro-system, repeat spawning rates from steelhead were estimated via invalidated ageing techniques using scale samples (Long and Griffin 1937; Whitt 1954). The recent advent of adult passive integrated transponder (PIT) detection capabilities at the hydropower dams along the Columbia and Snake rivers is providing important information on the behavior and return success of kelts passing through the hydropower system. In 2001-2002, we used ultrasound, radio telemetry, and PIT technologies to assess the abundance, passage, conversion, and return rates of kelts passing through the lower Columbia River. These studies have shown that kelts are efficiently passed through the dams by spill and surface-orientated routes (Wertheimer et al. 2001, 2002, 2003). Continued research and development to improve surface bypass structures could enhance downstream survival rates, system effectiveness, and increase the return rates of lower Columbia River kelts.

To provide information to managers on the respawning rates of kelts passing lower Columbia River dams in 2003, we continued to collect data on abundance, and condition, and return rates of summer steelhead kelts passing through the John Day (JDA) Dam bypass. Kelts were identified using ultrasound imagery, evaluated for morphological data, PIT-tagged, and allowed to volitionally return to the bypass system. Results from this study are presented here.

METHODS

Study Site

John Day Dam is located at river km 346.9 (Figure 1). The navigation lock is on the Washington shore with the spillway and powerhouse spanning the river to the Oregon shore. The spillway has 20 tainter gates. The powerhouse has 16 turbine units and four skeleton bays. Each turbine unit has three gatewells, which are screened (one 14" diameter orifice per gatewell) to divert downstream migrants into a collection channel and down to a Smolt Monitoring Facility (SMF) located on the Oregon shore. This facility has the capacity to divert juvenile and adult fish to tanks within the lab. There are two fish ladders at the dam, one on each shore.

Figure 1. Location of hydroelectric projects of the Federal Columbia River Power System on the Columbia and Snake rivers. Facilities with adult PIT detection capabilities are in blue.

Kelt Sampling

Fisheries Field Unit (FFU) personnel operated the pneumatic gate at the dry separator to divert steelhead into an adult holding tank located within the JDA SMF. Sampling typically occurred four days a week (Monday - Thursday), between 1 April and 3 June, approximately 12 to 18 hours a day from 0600 to 2100 hours. Sample hours were based upon kelt passage patterns determined from Lower Granite (LGR), McN, and JDA dams (Evans et al. 2004; Wertheimer et al. 2002, 2003). We assumed that proportion of kelts to prespawners during the day was similar to those at night.

Steelhead were guided from the adult holding tank into a pre-anesthetic chamber using a large paddle net. This procedure allowed for sampling a controlled number of fish. Once in the chamber, kelts were individually dip-netted into an anesthetic bath

containing river water and a buffered solution of clove oil at 30 mg/L (Prince and Powell 2000; Pirhonen and Schreck 2003).

Specimens were scanned with an Aloka®[1] ultrasound machine to assess gonadal maturation (pre or post-spawn) and sex (Evans et al. 2004). Fish condition factors were evaluated concurrent with the ultrasound spawning status identification using protocol developed by Evans et al. (2004) (Appendix A). Steelhead were measured to obtain forklength (mm) and scanned with a hand-held PIT detector. Sexually mature steelhead and previously PIT-tagged kelts were placed into recovery tanks. After displaying normal swimming behavior, steelhead were allowed to volitionally return to the bypass system. Post-spawned fish in all condition categories were PIT-tagged unless they appeared moribund.

Kelt Abundance Estimates

At JDA Dam, adult fish are enumerated as they pass through the separator by an electronic counting device. Weekly estimates of total steelhead passing the JBS were generated using a weighted approach (Zar 1996). We assumed that the proportions of steelhead entering the JBS facility during a particular week (Sunday to Saturday) were similar for sampled and non-sampled hours (Wertheimer et al. 2002). An abundance estimate of total number of kelts passing the JBS was calculated by multiplying the proportion of identified kelts in the sample to the estimate of total steelhead in the bypass.

PIT Tags

Passive integrated transponder (PIT) tags (134.2 KHz) were inserted by syringe into the musculature anterior to the pelvic girdle of steelhead kelts. The PIT tag code and fundamental information for each kelt were recorded. The tag files were submitted to the Pacific States Marine Fisheries Commission (PSMFC) PIT Tag Information Systems (PTAGIS) regional database via e-mail using methods described in the PIT-tag Specification Document (Stein et al. 2004).

Adult PIT Detection

In the spring of 2003, adult PIT detection was expanded to hydroelectric facilities in the upper Columbia and Snake rivers. PIT detection devices were installed in both ladders of Priest Rapids (PRA) and Rock Island (RIA) dams. At Ice Harbor (ICH) Dam, PIT detectors were activated March 2003 in both ladders; thus, full detection was provided through these areas. These new installations and the existing Adult PIT detection capabilities at BON, McN and LGR dams are described on the internet (PTAGIS 2005). The location of these projects can be seen in Figure 1. Information from these detection systems was acquired through queries to the PTAGIS database. System description, specific documentation, and PTAGIS software are available online (PTAGIS 2005).

[1] Use of trade name does not imply endorsement by the U.S. Army Corps of Engineers.

RESULTS

Project Operations

The volume of water through the Columbia River in April through June of 2003 averaged flows of 226.1, 226.0, and 244.7 thousand cubic feet per second (kcfs) at JDA, The Dalles (TDA), and BON dams respectively. Spill occurred at all three projects starting on 14 April and continued through the end of June. The ten-year (1995 – 2004) averages for April through June were 265.2, 261.1, and 272.3 kcfs at JDA, TDA, and BON dams, respectively.

McNary: Abundance and Condition

From 1 April through 8 July 2003, 331 visually identified kelts and 459 pre-spawned steelhead were recorded at the McN Juvenile Fish Facility. Of the 331 kelts observed, 57% were wild and 60% were in good or fair condition. Tests being conducted at McN during this time restricted the separator operation to an every other day schedule from 1 April to 25 June.

John Day: Abundance and Sample Characteristics

Sampling was conducted at the JDA SMF from 1 April through 3 June 2003. During this 10-week period, 719 of the estimated 2,467 steelhead passing through the facility were sampled, and of these bypassed steelhead, an estimated 2,299 (93.2%) were kelts.

Using Ultrasound imagery, we classified six hundred seventy-two steelhead as kelts and 42 individuals as pre-spawned; five steelhead were unclassified (Appendix B-1). The percentage of steelhead sampled over the ten-week period did not fall below 13% (Figure 2). Sixty-eight percent (460/672) of the sample steelhead identified as kelts were discernibly female. The sexual composition of the sample from week one through ten

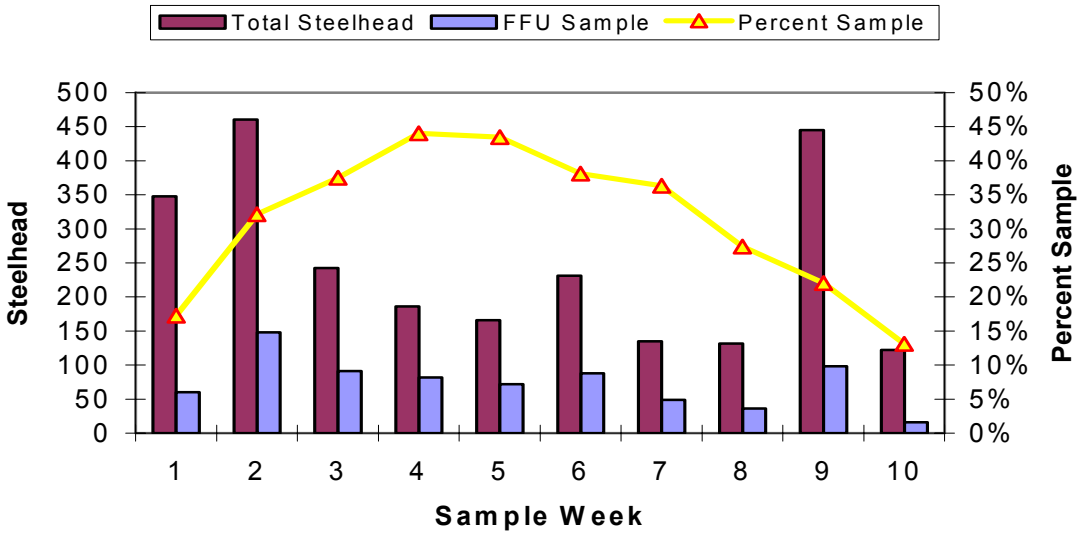

Figure 2. Weekly proportion of the estimated total steelhead population sampled at the John Day Dam Smolt Monitoring Facility in 2003. Week #1 began 31 March and week #10 ended 7 June.

can be seen below (Figure 3). The majority of the sample, 73% (489/672), were presumed naturally produced (wild) due to the presence of the adipose fin. Hatchery (determined by the absence of the adipose fin) kelts constituted 45% of the sample during the first week, but decreased to 25% of the sample by the third week, and remained below this percentage for most of the season (Figure 4). Just over half of 2003 kelts (51%; 340/672) were in good or fair morphological condition, and 88% (593/672) were

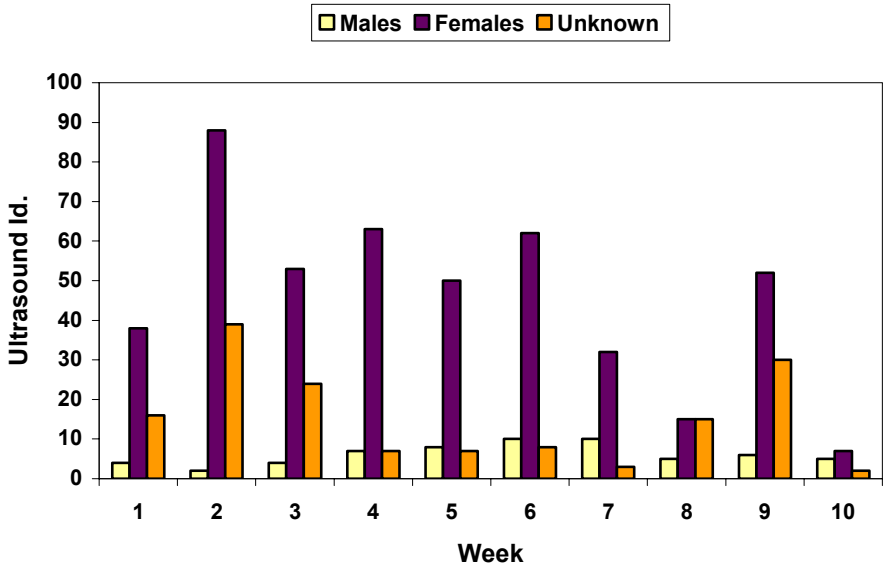

Figure 3. The number of steelhead identified using ultrasound equipment as male or female and sexually unidentified kelts each week at the John Day Dam Smolt Monitoring Facility from 1 April to 3 June, 2003.

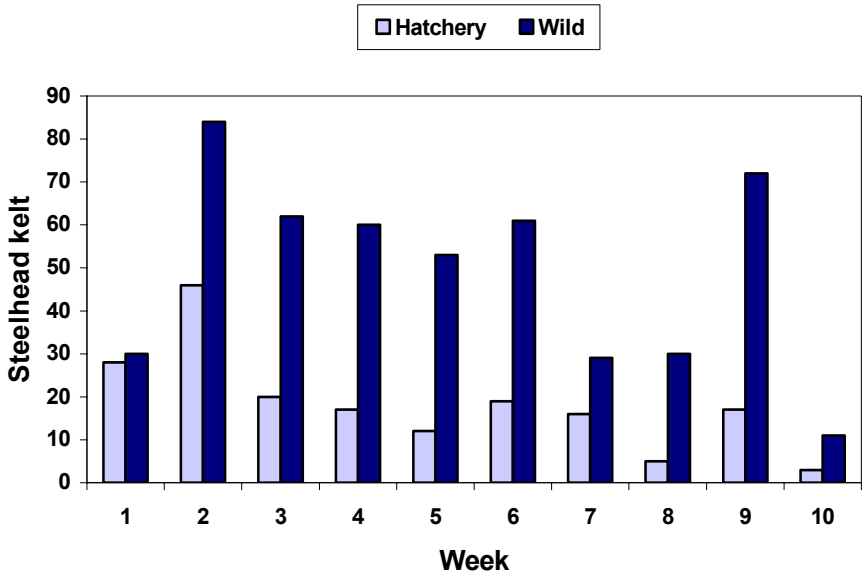

Figure 4. The number of hatchery and wild kelts sampled each week from 1 April to 3 June, 2003, at the John Day Dam Smolt Monitoring Facility.

of bright or intermediate coloration (Table 1). Head burn, "exfoliation of the skin and underlying connective tissue of the jaw and cranial region of salmonids" (Elston 1996), and other head injuries from sampled steelhead are listed in Table 2. A total 449 of sampled kelts were PIT-tagged and released at JDA (Appendix B-2).

Table 1. Condition and coloration of pre- and post-spawned steelhead sampled at the John Day Dam Smolt Monitoring Facility in 2003.

	Pre-Spawned Coloration				Kelt Coloration			
Condition	Bright	Intermediate	Dark	Total	Bright	Intermediate	Dark	Total
Good	8	3	2	13	135	54	0	189
Fair	1	1	0	2	50	90	11	151
Poor	4	12	9	25	68	175	58	301
Dead	0	1	1	2	3	18	10	31
Total	13	17	12	42	256	337	79	672

*Spawning status was not determined for five steelhead.

Table 2. Percentage of the steelhead sample with head injuries (n = 719) at John Day Dam in 2003.

Condition	Pre-spawned	Kelt	Total
Head burn	16 (2.2%)	129 (17.9%)	145 (20.2%)
Head fungus	8 (1.1%)	40 (5.6%)	48 (6.7%)
Head burn & fungus	8 (1.1%)	24 (3.3%)	32 (4.4%)
Head scrape	0 (0.0%)	0 (0.0%)	0 (0.0%)
Eye problem	0 (0.0%)	25 (3.5%)	25 (3.5%)
Total	32 (4.5%)	218 (30.3%)	250 (34.8%)

Recaptures

During sampling, 13 previously PIT-tagged steelhead were recaptured. Of these, two were kelts tagged in 2002 and one was tagged in 2001 by the FFU. These three kelts had detection histories indicative of repeat spawning migrations. Six recaptured kelts were PIT-tagged as kelts in 2003 at LGR Dam on the Snake River and two were kelts PIT-tagged at the Chandler trap on the Yakima River. One recaptured kelt had been PIT and radio-tagged during upstream migration by the Idaho Cooperative Fish & Wildlife Research Unit (ICFWRU) in 2002 at the BON Adult Fish Facility (AFF). An additional recaptured kelt was tagged as a juvenile by the Idaho Fish and Game Department. Individual detection histories from PTAGIS can be found in Appendix C-1.

Returns

Tag contacts in the Bonneville fish ladders indicate the number of returning kelts attempting upstream migrations. The Bonneville return rate for kelts PIT-tagged in 2001, as reported by Wertheimer et al. (2002), was 7.8%. These steelhead migrated upriver with only one ladder at BON Dam interrogating for adults. In 2002 and 2003, PIT detection capabilities were expanded providing coverage of all ladders at BON Dam. Of the PIT-tagged kelts released by the FFU in 2002, 6.9% (84/1210) of them have been interrogated at BON fishways.

Three returning kelts from 2002 were collected on the Yakima River at the Chandler Bypass of Prosser Dam during seaward migration, and found of suitable condition for placement in a study of kelt reconditioning (Bill Bosch, Yakama Nation,

personal communication). If successful (i.e., if these kelts spawn again), these fish will be taking part in at least their third spawning event. Detection histories from these fish can be observed in Appendix C-2.

Fourteen previously PIT-tagged kelts were recaptured by ICFWRU personnel at the BON AFF in 2003. Recaptured kelts were tagged with a gastric radio tag to record their migration to upriver reaches. Detection histories from these fish and associated codes are located in Appendix C. Radio-telemetry data provided by the ICFWRU documented passage for seven of these kelts at the JDA south fish ladder. Two out of the seven were interrogated upstream in the McN ladders (Capaul and Peery 2004).

Currently, 2.9 % (13) of the 449 PIT-tagged kelts released in 2003 at JDA Dam have been interrogated at BON fish ladders (Table 3). Eight returns occurred in the fall of 2003. At the time of tagging, seven of these were in good condition and one was in fair condition. All eight returns were wild; five were identified as female and three were of unknown sex. These early returns ranged in length from 58 to 73cm with a mean of 64.1cm. Five additional kelts were detected at BON Dam in the summer and fall of 2004. At the time of tagging, four of the five were in good condition and one was in fair condition. Four of the five were wild; two were female and three of unknown sex. These five ranged in length from 54 to 72 cm with a mean of 61.8 cm.

Table 3. Detections of returning PIT-tagged steelhead at the Federal Columbia River Power System projects in 2001 to 2003.

		UPSTREAM ADULT LADDER INTERROGATIONS						
TAG YR.	n	BON	McN	ICH	LGR	PRA	RIA	WEA
2001	563	41	5	*	4	*	*	*
2002	1,207	84	33	7	11	5	2	3
2003	449	13	4	1	1			
Totals	2,219	138	42	8	16	5	2	3

*Adult PIT detection capabilities not available

When the data from 2001-2003 is combined, preliminary analysis shows a statistically significant difference between the mean fork lengths of annual and biennial kelt spawners (62.5 versus 59.6 cm; t-Test assuming unequal variances, DF = 133, P = 0. 004). The mean fork length at the time of tagging for annual spawners was greater than that of biennial spawners.

The characteristics of returning kelts from 2003 releases were similar to that of kelts released in 2001 and 2002. Kelts in good or fair condition returned in greater proportion than kelts in poor condition (Appendix D). None of the kelts tagged in dark coloration (regardless of condition) have returned from release years 2001 to 2003 (Table 4). Due to insufficient sample size of condition and coloration return data, statistics were not calculated for 2003 releases. Similar to previous years; wild kelts have returned at higher rates than hatchery kelts. Currently, 12 (3.5%) of the 345 wild kelts and 1 (0.9%) of the 117 hatchery kelts tagged or recaptured in 2003 have returned. Returns by origin for 2001 through 2003 are below (Table 5).

Table 4. Returns from bright, intermediate and dark colored fish (in good or fair condition) PIT-tagged at McNary and John Day dams in 2001 to 2003.

Tag	JOHN DAY						MCNARY					
	Bright		Intermediate		Dark		Bright		Intermediate		Dark	
Year	(n)	Returns	(n)	Returns	(n)	Returns	(n)	Returns	(n)	Returns	(n)	Returns
2001	280	27 (9.6%)	213	9 (4.2%)	3	0 (0.0%)	27	3 (11.1%)	41	4 (9.8%)	0	0 (0.0%)
2002	293	40 (13.7%)	449	23 (5.1%)	68	0 (0.0%)	282	18 (6.4%)	114	3 (2.6%)	6	0 (0.0%)
2003	229	10 (4.4%)	203	3 (1.5%)	17	0 (0.0%)	-	-	-	-	-	-
Totals	802	77 (9.6%)	865	35 (4.0%)	88	0 (0.0%)	309	21 (6.8%)	155	7 (4.5%)	6	0 (0.0%)

Table 5. Returns from hatchery and wild kelts (in good, fair, & poor condition) PIT-tagged at McNary or John Day dams in 2001 to 2003.

Tag	JOHN DAY				MCNARY			
	Hatchery		Wild		Hatchery		Wild	
Year	(n)	Returns	(n)	Returns	(n)	Returns	(n)	Returns
2001	105	3 (2.9%)	390	33 (8.5%)	15	3 (20%)	53	4 (7.5%)
2002	337	20 (5.9%)	484	43 (8.9%)	131	3 (2.3%)	280	18 (6.4%)
2003	117	1 (0.8%)	345	12 (3.5%)	-	-	-	-
Totals	559	24 (4.3%)	1219	88 (7.2%)	146	6 (4.1%)	333	22 (6.6%)

*No kelts were PIT-tagged at McNary in 2003. Includes recaptured steelhead from 2001 to 2003.

Since 2001, tagged kelts have displayed two distinct behavior patterns differentiated by the number of days from release to upstream return timing at BON Dam (Figure 5). The first group of upstream migrations past BON start approximately 80 days post release. These kelts are assumed to be respawning in successive seasons (annually). The second group begins to return around 400 days post release. These kelts are assumed to be respawning biennially. Overall returns from 2001 to 2003 PIT-tagged steelhead kelts can be found in Appendix D.

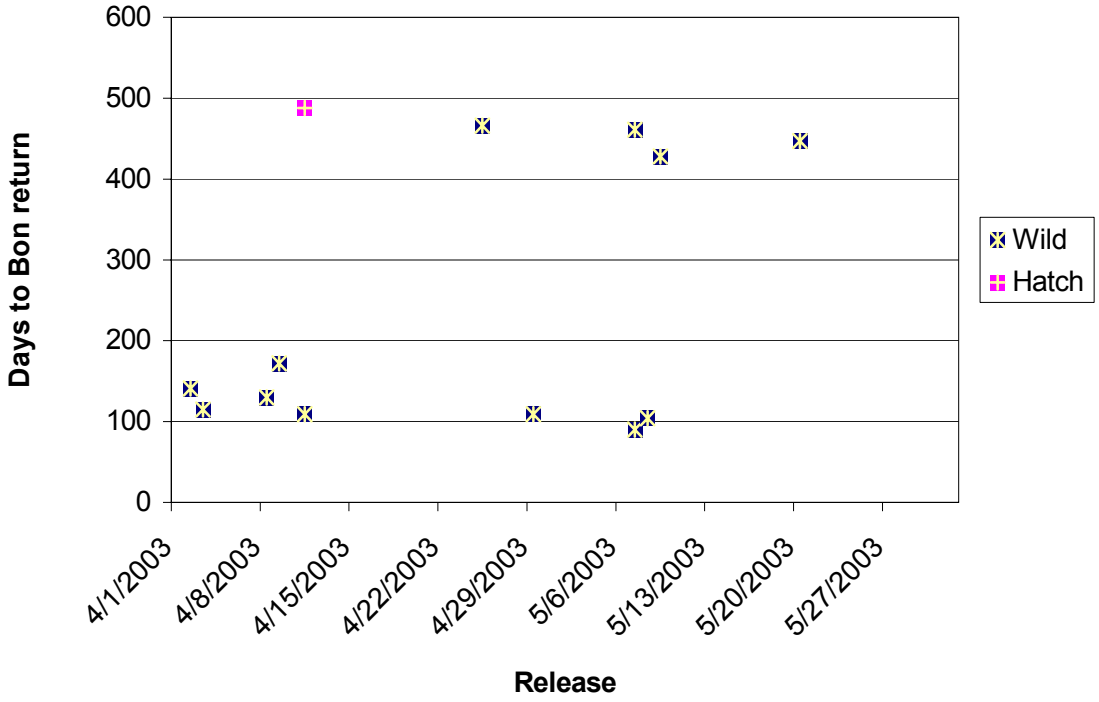

Figure 5. The number of days from release at John Day Dam in 2003 to upstream return detections at Bonneville Dam for wild and hatchery origin PIT-tagged kelts.

DISCUSSION

Sample and Abundance

In 2003, 93% of steelhead sampled from the bypass were identified as kelts. Kelt proportions increased to nearly 100% of the sample population through the months of April and May. Abundance estimates for kelts are comparable to previous years. Wertheimer et al. (2002, 2003) reported estimates for kelt bypass abundance of 2,022 in 2001 and 2,233 in 2002 at JDA Dam, similar to the 2003 estimate of 2,299. The appearance of an imploded abdomen was characteristic of 97.3% of identified female kelts. Male steelhead proved more problematic to visually identify as 33% percent were emaciated in appearance but retained pre-spawned testis size (≥ 1.25 cm^2). Some male kelts (post-spawned testis size ≤ 1.25 cm^2) were visually categorized as fat medium. Since sampling began in 2001 the proportion of good and fair sampled kelts has declined from 76% in 2001 to just over 50% during both 2002 and 2003 sample seasons. Flows for these years varied from drought-like conditions in 2001 when flows were 47% of the ten-year average to flow years at 98% and 85% of the ten-year average in 2002 and 2003, respectively.

As seen in other anadromous iteroparous populations (Fleming 1998; Niemel et al. 2000), our sample was comprised of predominately female kelts. This is consistent with reported data from studies of other steelhead populations (Whitt 1954; Bali 1959; Withler 1966; Leider et al. 1986; Evans and Beaty 2001; Hatch et al. 2002). During the seventh to eighth weeks of sampling, the percentage of males peaked accounting for almost 50% of the sample. Males and females generally appear in streams in similar numbers during initial reproduction. Competition with other males and the tendency to remain longer on the spawning bed increases exposure to injury, diseases, and possible stranding, and ultimately reduce the number of males that attempt emigration (Fleming 1998; Chapman 1958).

Kelts of natural origin were represented in greater numbers than kelts of hatchery origin throughout the sample season at John Day Dam. In contrast, a study at LGR Dam on the Snake River identified a larger proportion of hatchery kelts early in the out-migration season. At JDA Dam, hatchery kelts constituted 48% of the sample during the first week but decreased to 24% by the third week (figure 4), whereas at LGR Dam hatchery kelts increased from 48% to 60% into the fourth week of study (Boggs and Perry 2004). This difference may be a result of naturally produced John Day River steelhead representing a large portion of the JDA Dam sample. However, despite the fact that the John Day River is managed for wild salmon and steelhead, it has reported hatchery steelhead stray rates of 8.5, 7.4 and 8.3% for 2002, 2003, and 2004, respectively (Tim Unterwegner, ODFW, personal communication). Some of these strays may have contributed to the spawning population as early run timing of hatchery kelts was maintained at JDA Dam. It is of particular concern that hatchery steelhead are spawning in the wild in such large numbers in the Columbia Basin, and their genetic interactions with their wild counterparts merits future investigation.

Near the end of the kelt passage season (Appendix B-1), sample numbers increased as rain-storms in the John Day River basin brought heavy flows of silt laden run-off through the Juvenile Bypass System. The effect was a five-fold increase in the number of kelts sampled during this event. Once water clarity improved, kelt sample numbers dropped off. Similar to juvenile steelhead, kelt out-migration behavior may be triggered by proximal activity, such as a sudden increase in river discharge, that is associated with spring freshets (Hoar 1976; Wedemeyer et al. 1980). This large pulse of fish concurrent with heavy run-off from the John Day River supports the assumption that our bypass sample at JDA Dam may be disproportionately represented by John Day River kelts, especially, during periods of heavy run-off from the John Day River basin.

Returns

Returns of steelhead kelts from the 2003-tagging year have been few (~3.0%). Kelt return rates from 2001 to 2003 are between 3.0 – 8.0%. There is no way of knowing the exact cause of such low return rates for the 2003 emigration. A variety of factors including sample mortality, tag loss, predation, and disease may have contributed to lack of documented return success. The increase in fishing pressure through extended seasons and increased bag limits of sport and commercial fisheries in the Columbia River may have taken a toll on emigrating kelts in 2003. However, migration success for 2003 kelts from LGR to the I-205 Bridge was the highest it has been (34%) since telemetry studies began at LGR in 2001 when downstream migration rates were 4.1%. Although downstream migration success was favorable for LGR releases in 2003, return rates of less than one percent did not reflect this success (Boggs and Perry 2004). These data suggest that ocean conditions or other unmeasured factor(s) may have been a limiting factor in return success for 2003 kelts.

There is an approximate 70% reduction in upstream detections from BON to McN Dam. Presumably, a large number of the kelts dropping out of the sample are returning to the John Day River. The large number of wild kelts passing through the bypass after the rainstorm on the John Day River supports this hypothesis. Since there are no detection capabilities at TDA or JDA dams, we are not able to determine where these fish are exiting out of the hydrosystem. Installation of adult PIT detectors at TDA and JDA dams could provide additional information from returning kelts and virgin spawners.

A higher percentage of tagged kelts in good condition return than kelts tagged in the other condition categories. Only two of the kelts rated in poor condition and tagged from 2001 – 2003 were interrogated on upstream migrations through Bonneville Dam fishways. This suggests that fish in poor condition do not have the bio-energetic reserves to sustain them during their emigration. Belding (1934) found that Atlantic salmon kelts that drop close to 40% of their body weight usually succumb to starvation. The affects of distance from spawning grounds to the ocean, and within-river obstacles may accelerate the approach to this threshold leaving kelts susceptible to predation, disease, starvation and environmental factors. In 1954, Whitt stated, “Obstacles to downstream migration seriously reduce the numbers of returning spawners.”

Returns from the past several years of study have followed two distinct behavior patterns, which are characterized by the number of days from release to the return timing at Bonneville Dam. Detections at BON Dam fish ladders begin approximately 80 days post release. These kelts are generally longer (62.5cm mean fork length) and are assumed to be recrudescing in the estuary, the ocean, or a combination of the two environs. Most of the kelts that returned within the same calendar year were tagged in the early component of the out-migration (i.e., March-April). The smaller kelts (59.6cm mean fork length) have shown a propensity to over-winter and return to BON the following summer/fall. Most of the kelts that spent an additional sea-winter before returning were tagged in the mid and later components of the out-migration (i.e., May-June). The relation of length and temporal distribution of the out-migration to return timing is preliminary and bears further investigation. Acoustical technologies could provide missing data that would enlighten these questions. Continued PIT-tagging and monitoring of returns will aid in understanding the contribution of repeat spawners to steelhead stocks of the Columbia and Snake River basins. A better understanding of these factors may aid development of more adaptive management practices for the specific stocks.

Migration success and return information from kelts sampled in 2003 suggest that factors other than migratory conditions heavily influence the return rates from kelts. We speculate that as is the case with smolts, ocean conditions may be one of the primary determinants of kelt return success. However, the behaviors and physiological mechanisms allowing access into the estuarine environment and migratory patterns of steelhead kelts in the estuary and ocean are unknown and merit future investigation.

ACKNOWLEDGMENT

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REFERENCE

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Appendix A

Supplemental Sheet/Key for Morphological Data

Criteria		Description	Notation
Abdomen	Fat*	Fish will have a rounded abdomen with substantial girth. A bulge just posterior to the pectoral fin is very noticeable. Abdomen will often feel soft to the touch. Head is often smaller relative to abdomen. Fish are almost always female pre-spawners.	F
	Fat - Medium	Similar to fat specimens, these fish clearly have a rounded abdomen and girth. However, the difference is subtle and the abdomen will appear uniform in size between the pectoral and pelvic fins. Dorsal flanks will be slightly smaller than the ventral flanks in girth.	FM
	Slim - Medium	Abdomen will appear slightly concave when viewed from the side. Abdomen no longer looks perfectly rounded.	SM
	Slim	Fish will appear atretic and emaciated with a snake-like appearance. Abdomen is often hard and imploded. Head is typically as wide as abdomen.	S
Condition	Good	Overall appearance of the specimen is excellent. These fish will lack major scars, often have no or very little fin-wear, and do not have noticeable fungus. No other damage is evident.	Good
	Fair	Overall appearance is still good; however, fish will have some fin-wear, small scars or lesions, and/or minor fungus.	Fair
	Poor	Overall appearance is poor. These fish will have substantial fin-wear, fungus infections, and/or major scars and lesions. Fish with missing eyes, substantial head-burn, etc. are considered in poor overall condition.	Poor
Coloration	Bright	Fish has an overall silvery appearance. The abdomen is dominated by a white color.	B
	Intermediate	Fish is a mixture of silver and dark-grey blotches. Grey blotches are often below the lateral line.	I
	Dark	Fish has dark complexion on both the dorsal and ventral flanks. Dark blotches are also on the ventral surface.	D

*These fish are often pre-spawners and if ultrasound exam concurs, they should be released immediately. In general, assessment of abdonimal appearance is more difficult with males.

Appendix B

Table B-1 Summary of the sample date, sample size (n), mean, standard deviation (SD) and range of fork lengths (cm), sex, origin, ultrasound diagnostic of steelhead (including recaptures) at John Day Dam in the spring of 2003.

JDA		FORK LENGTH (cm)			SEX			ORIGIN		ULTRASOUND		KELT
DATE	n	AVE	SD	MEAN	MALE	FEMALE	UNK	WILD	HATCH	KELTS	PRE	G & F
03/31/2003	1	69.0	0.0	69 - 69	0	1	0	1	0	1	0	0
04/01/2003	9	65.8	7.4	59 - 81	1	7	1	4	5	7	2	2
04/02/2003	20	64.3	9.6	54 - 86	2	12	6	9	11	16	4	9
04/03/2003	22	68.3	10.5	53 - 91	1	12	9	14	8	20	2	16
04/04/2003	15	63.5	5.6	53 - 73	3	12	0	5	10	14	1	6
04/07/2003	11	74.5	10.3	55 - 89	0	7	4	7	4	9	1	4
04/08/2003	24	67.5	8.5	56 - 92	3	13	8	15	9	22	2	13
04/09/2003	40	66.6	6.9	52 - 80	1	31	8	32	8	37	2	17
04/10/2003	46	67.3	8.9	54 - 88	1	31	14	28	18	42	4	21
04/11/2003	22	66.0	9.2	53 - 84	1	14	7	11	11	19	3	10
04/14/2003	11	62.9	7.2	54 - 77	0	9	2	10	1	10	1	7
04/15/2003	32	65.7	7.2	54 - 78	0	22	10	23	9	30	2	18
04/16/2003	25	66.4	6.5	53 - 79	3	15	7	21	4	22	3	15
04/17/2003	13	69.0	9.2	56 - 84	0	10	3	8	5	12	1	3
04/18/2003	11	64.4	6.4	55 - 74	2	6	3	8	3	7	3	4
04/21/2003	5	64.4	6.0	58 - 73	0	5	0	4	1	5	0	1
04/22/2003	17	65.9	6.6	53 - 78	0	14	3	14	3	17	0	3
04/23/2003	23	62.5	6.0	53 - 71	4	19	0	18	5	22	1	7
04/24/2003	22	61.6	6.6	51 - 77	3	17	2	17	5	20	2	6
04/25/2003	13	67.9	9.3	54 - 83	0	11	2	10	3	13	0	6
04/29/2003	17	63.1	7.3	50 - 78	1	14	2	16	1	17	0	7
04/30/2003	14	64.9	9.9	53 - 88	2	10	2	11	3	14	0	5
05/01/2003	20	60.5	6.9	45 - 71	5	12	3	14	6	18	2	7
05/02/2003	17	64.3	7.4	54 - 80	1	16	0	14	3	16	1	7
05/06/2003	12	65.6	9.8	51 - 87	1	11	0	11	1	12	0	5
05/07/2003	29	62.1	6.5	51 - 72	4	22	3	16	13	27	2	14
05/08/2003	22	59.8	8.4	48 - 80	2	19	1	19	3	22	0	10
05/09/2003	19	64.1	10.0	50 - 82	3	12	4	15	4	19	0	12
05/12/2003	4	63.5	9.0	51 - 72	2	2	0	1	3	4	0	2
05/13/2003	8	60.3	8.0	51 - 71	2	6	0	4	4	8	0	4
05/14/2003	15	65.6	9.6	53 - 86	4	11	0	9	6	15	0	10
05/15/2003	14	60.6	5.7	48 - 72	2	9	3	11	3	13	1	4
05/16/2003	5	66.4	7.4	56 - 73	0	5	0	5	0	5	0	1
05/19/2003	4	64.8	7.3	58 - 72	0	3	1	2	2	4	0	3
05/20/2003	15	65.7	8.7	54 - 85	2	5	8	13	2	15	0	6
05/21/2003	7	63.7	7.9	55 - 73	1	3	3	6	1	7	0	3
05/22/2003	9	64.6	6.8	53 - 72	2	4	3	9	0	9	0	5
05/28/2003	23	65.8	11.2	52 - 86	3	18	2	19	4	23	0	16
05/29/2003	54	67.6	9.9	51 - 88	1	27	26	43	11	50	2	34
05/30/2003	15	67.0	8.8	57 - 88	2	9	4	12	3	15	0	9
06/02/2003	1	83.0	0.0	83 - 83	0	1	0	1	0	1	0	0
06/03/2003	13	65.5	9.6	54 - 80	5	6	2	10	3	13	0	8
TOTALS	719				70	493	156	520	199	672	42	340

Table B-2. Summary of the collection date, sample size (n), sample mean, standard deviation (SD), range of fork lengths (cm), sex, origin, maturation and condition of PIT-tagged steelhead from John Day Dam in 2003.

JDA	PIT Tag	FORK LENGTH (cm)			SEX			ORIGIN		ULTRASOUND		KELTS
Date	n	Mean	SD	Range	M	F	Unk	Wild	Hatchery	Kelt	Pre	G&F
03/31/2003	1	69.00	0.00	69 - 69	0	1	0	1	0	1	0	0
04/01/2003	3	64.00	7.81	59 - 73	0	2	1	2	1	3	0	2
04/02/2003	10	64.10	7.81	54 - 78	0	6	4	5	5	10	0	8
04/03/2003	16	68.88	10.05	53 - 84	0	8	8	11	5	16	0	16
04/04/2003	8	64.13	5.74	57 - 73	2	6	0	4	4	8	0	6
04/07/2003	4	67.25	11.90	55 - 81	0	3	1	3	1	4	0	4
04/08/2003	17	66.82	7.10	56 - 86	0	10	7	11	6	17	0	13
04/09/2003	14	70.00	5.53	54 - 77	0	11	3	11	3	14	0	13
04/10/2003	24	66.83	9.18	54 - 86	0	16	8	15	9	24	0	21
04/11/2003	14	63.71	7.26	53 - 78	0	9	5	7	7	14	0	10
04/14/2003	8	62.50	8.26	54 - 77	0	6	2	8	0	8	0	7
04/15/2003	20	66.10	6.12	54 - 75	0	15	5	15	5	20	0	18
04/16/2003	14	64.50	6.71	53 - 74	2	8	4	11	3	14	0	14
04/17/2003	4	64.75	8.10	57 - 74	0	3	1	3	1	4	0	3
04/18/2003	5	62.20	6.06	55 - 68	1	2	2	2	3	5	0	4
04/21/2003	3	66.33	7.64	58 - 73	0	3	0	3	0	3	0	1
04/22/2003	7	63.57	6.00	53 - 68	0	5	2	6	1	7	0	3
04/23/2003	18	62.78	5.91	55 - 71	3	15	0	13	5	18	0	7
04/24/2003	9	61.22	5.56	55 - 71	2	6	1	7	2	9	0	6
04/25/2003	9	68.00	7.55	56 - 83	0	8	1	8	1	9	0	6
04/29/2003	12	62.42	8.39	50 - 78	1	10	1	11	1	12	0	7
04/30/2003	10	60.80	6.83	53 - 72	1	8	1	7	3	10	0	5
05/01/2003	15	60.33	7.76	45 - 71	4	8	3	9	6	14	1	7
05/02/2003	12	64.08	7.04	54 - 74	1	11	0	10	2	12	0	7
05/06/2003	9	67.33	9.90	54 - 87	0	9	0	8	1	9	0	5
05/07/2003	20	61.75	6.12	51 - 72	3	14	3	13	7	20	0	14
05/08/2003	13	63.38	7.69	52 - 80	2	10	1	12	1	13	0	10
05/09/2003	12	63.92	9.02	50 - 78	2	8	2	10	2	12	0	12
05/12/2003	3	60.67	8.50	51 - 67	2	1	0	1	2	3	0	2
05/13/2003	6	62.00	8.25	53 - 71	2	4	0	4	2	6	0	4
05/14/2003	11	63.36	6.52	53 - 73	4	7	0	7	4	11	0	9
05/15/2003	10	61.70	6.31	48 - 72	2	6	2	8	2	10	0	4
05/16/2003	4	66.00	8.45	56 - 73	0	4	0	4	0	4	0	1
05/19/2003	3	66.67	7.57	58 - 72	0	2	1	2	1	3	0	3
05/20/2003	10	61.80	6.66	54 - 75	2	3	5	8	2	10	0	6
05/21/2003	5	61.80	8.17	55 - 73	1	2	2	5	0	5	0	3
05/22/2003	6	64.33	7.03	53 - 72	1	2	3	6	0	6	0	5
05/28/2003	21	66.76	11.28	52 - 86	2	18	1	17	4	21	0	16
05/29/2003	49	68.33	9.91	51 - 88	1	24	24	39	10	48	0	33
05/30/2003	12	66.42	8.91	57 - 88	1	7	4	10	2	12	0	9
06/02/2003	1	83.00	0.00	83 - 83	0	1	0	1	0	1	0	0
06/03/2003	10	68.40	8.96	57 - 80	3	5	2	7	3	10	0	8
TOTALS	462*				45	307	110	345	117	460	1	332

*Includes recaptured steelhead with PIT tags.

Appendix C

Table C-1. Detection Histories listed for PIT-tagged kelts from the 2003 sample. A summary of codes used can be found in Table C-3.

Type	Flags	length (mm)	Organization	Site	Date	Origin/Condition
3D9.1BF0DEBA25						
TAG		194	IDFG	BARGAC	08/20/1999	WILD/UNK
OBS				GRJ	04/27/2000	
OBS				LMJ	05/01/2000	
OBS				BWL	07/13/2002	
OBS				BO1	09/07/2002	
REC	KL AT FE RE	670	COE	JDARRR	04/22/2003	/GOOD
3D9.1BF10C9E87						
TAG	KL AT	550	COE	JDARRR	05/17/2001	WILD/GOOD
OBS				BO1	07/10/2002	
REC	KL AT FE RE	710	COE	JDARRR	05/07/2003	/FAIR
3D9.1BF11E5F79						
TAG	RF RT AT		ICFWRU		07/29/2002	UNK
OBS				BWL	08/01/2002	
REC	KL AT RT RE	690	COE	JDARRR	05/22/2003	WILD/FAIR
3D9.1BF139F9BB						
TAG	AT KL FE RT	600	YINN	CHANDL	12/10/2002	WILD/UNK
OBS				MCJ	05/06/2003	
REC	KL AT FE RE	610	COE	JDARRR	05/14/2003	/GOOD
3D9.1BF144A108						
TAG			ICFWRU	LGRRR	04/20/2003	WILD/UNK
OBS				MCJ	05/10/2003	
REC	KL AT FE RE	620	COE	JDARRR	05/15/2003	/POOR
3D9.1BF14B019C						
TAG	KL AT	570	COE	JDARRR	05/01/2002	WILD/GOOD
OBS				BWL	08/13/2002	
REC	KL AT RE	590	COE	JDARRR	04/17/2003	/FAIR
3D9.1BF14B4024						
TAG	AT KL FE	620	COE	JDARRR	05/04/2002	WILD/GOOD
OBS				BWL	10/09/2002	
REC	KL AT FE RE	650	COE	JDARRR	04/30/2003	/FAIR

Type	Flags	length (mm)	Organization	Site	Date	Origin/Condition
3D9.1BF1687D21						
TAG	AT KL FE	600	YINN	CHANDL	12/10/2002	WILD/UNK
REC	KL AT FE RE	580	COE	JDARRR	04/23/2003	/POOR
3D9.1BF1770E69						
TAG	AT KL		ICFWRU	LGRRRR	05/17/2003	WILD/UNK
REC	KL AT FE RE	650	COE	JDARRR	05/30/2003	/GOOD
3D9.1BF17765FD						
TAG	AT KL		ICFWRU	LGRRRR	05/18/2003	WILD/UNK
REC	KL AT RE	740	COE	JDARRR	05/29/2003	/POOR
3D9.1BF177E751						
TAG	AT KL		ICFWRU	LGRRRR	05/02/2003	HATCH/UNK
OBS				IHA	05/08/2003	
OBS				MCJ	05/09/2003	
REC	KL AT MA RE	530	COE	JDARRR	05/14/2003	/FAIR
3D9.1BF1781E92						
TAG	AT KL		ICFWRU	LGRRRR	05/18/2003	WILD/UNK
REC	KL AT FE RE	800	COE	JDARRR	06/03/2003	/POOR
3D9.1BF1784B7F						
TAG	AT KL		ICFWRU	LGRRRR	05/19/2003	HATCH/UNK
REC	KL AT RE	590	COE	JDARRR	05/29/2003	/POOR
3D9.1BF1891B79						
TAG	KL AT	540	COE	JDARRR	04/10/2003	HATCH/FAIR
OBS				B1J	04/13/2003	
3D9.1BF18B5E4C						
TAG	KL AT	730	COE	JDARRR	04/08/2003	WILD/GOOD
OBS				BO3	08/16/2003	
3D9.1BF18B6662						
TAG	KL AT	740	COE	JDARRR	04/02/2003	HATCH/FAIR
OBS				B1J	04/06/2003	
3D9.1BF18B67B3						
TAG	KL AT MA	530	COE	JDARRR	05/22/2003	WILD/GOOD
OBS				B1J	05/26/2003	

Type	Flags	length (mm)	Organization	Site	Date	Origin/Condition
3D9.1BF18B75E6						
TAG	KL AT FE	600	COE	JDARRR	05/07/2003	WILD/GOOD
OBS				MC1	10/17/2003	
OBS				NBA	03/31/2004	
3D9.1BF18F1D42						
TAG	KL AT FE	540	COE	JDARRR	05/20/2003	WILD/FAIR
OBS				BO1	08/09/2004	
3D9.1BF18B899E						
TAG	KL AT	560	COE	JDARRR	04/11/2003	HATCH/GOOD
OBS				BO1	08/11/2004	
OBS				MC1	09/25/2004	
OBS				IHA	09/27/2004	
OBS				GRA	10/05/2004	
3D9.1BF18F1EFA						
TAG	KL AT MA	600	COE	JDARRR	05/30/2003	HATCH/POOR
OBS				B1J	06/01/2003	
3D9.1BF18F23A5						
TAG	KL AT FE	670	COE	JDARRR	04/09/2003	WILD/FAIR
REC	RF RT RE		ICFWRU	0.225	09/28/2003	
OBS				BO3	09/28/2003	
OBS				BO1	09/29/2003	
3D9.1BF18F23A7						
TAG	KL AT	630	COE	JDARRR	04/03/2003	WILD/GOOD
OBS				BO3	07/27/2003	
3D9.1BF18F2F04						
TAG	KL AT FE	580	COE	JDARRR	05/29/2003	HATCH/GOOD
OBS				B1J	05/31/2003	
3D9.1BF1902E2E						
TAG	KL AT	600	COE	JDARRR	04/11/2003	WILD/GOOD
OBS				BO3	07/29/2003	
3D9.1BF1904215						
TAG	KL AT	680	COE	JDARRR	04/02/2003	WILD/GOOD
OBS				BO1	08/21/2003	

Type	Flags	length (mm)	Organization	Site	Date	Origin/Condition
3D9.1BF1904354						
TAG	KL AT FE	720	COE	JDARRR	04/25/2003	WILD/GOOD
OBS				BO2	08/03/2004	
3D9.1BF19044CB						
TAG	KL AT FE	640	COE	JDARRR	05/08/2003	WILD/GOOD
OBS				BO3	08/20/2003	
REC	RF RE AT		ICFWRU	0.225	08/20/2003	
OBS				BO1	08/21/2003	
3D9.1BF1905049						
TAG	KL AT	690	COE	JDARRR	05/07/2003	WILD/GOOD
OBS					08/10/2003	BO3
3D9.1BF1904576						
TAG	KL AT	680	COE	JDARRR	04/11/2003	HATCH/FAIR
OBS				BO3	04/17/2003	
3D9.1BF1905583						
TAG	KL AT	750	COE	JDARRR	05/20/2003	WILD/FAIR
OBS				TWX	05/25/2003	
3D9.1BF1905F20						
TAG	KL AT FE	550	COE	JDARRR	04/30/2003	HATCH/POOR
OBS				B1J	05/03/2003	
3D9.1BF1906B21						
TAG	KL AT MA	590	COE	JDARRR	04/29/2003	WILD/GOOD
OBS				BO3	05/05/2003	
3D9.1BF1906E53						
TAG	KL AT FE	580	COE	JDARRR	04/29/2003	WILD/GOOD
OBS				BO1	08/16/2003	
OBS				MC2	08/25/2003	
REC	RE KL FE		YINN	CHANDL	4/06/2004	
REC	RE KL FE		YINN	CHANDL	11/30/2004	
3D9.1BF18F0C22						
TAG	KL AT FE	580	COE	JDARRR	05/09/2003	WILD/GOOD
OBS				BO3	07/10/2004	
OBS				B02	07/11/2004	
OBS				MC1	09/11/2004	

Table C-2. Detection histories for three returning kelts recaptured and included in the reconditioning program at Prosser Hatchery on the Yakima River in 2003. A summary of codes used can be found in Table C-3.

3D9.1BF14A68A9

Type	Flags	Length (mm)	Organization	Site	Date	Origin/Cond.
TAG	KL AT RT FE	590	COE	MCNTAL	04/18/2002	WILD/GOOD
OBS				BWL	08/11/2002	
OBS				BO1	08/12/2002	
OBS				MC1	10/16/2002	
REC	RE KL FE	640	YINN	CHANDL	03/31/2003	
REC	RE KL FE	600	YINN	YAKIM1	12/08/2003	

3D9.1BF14A7FFC

Type	Flags	Length (mm)	Organization	Site	Date	Origin/Cond.
TAG	KL AT RT FE	640	COE	MCNTAL	04/29/2002	WILD/GOOD
OBS				BO1	09/15/2002	
OBS				MC1	11/03/2002	
REC	RE RF FE	700	YINN	PROSRD	11/15/2002	
REC	RE KL FE	680	YINN	CHANDL	04/02/2003	
REC	RE KL FE	710	YINN	YAKIM1	12/08/2003	

3D9.1BF14A8AB8

Type	Flags	Length (mm)	Organization	Site	Date	Origin/Cond.
TAG	KL AT RT FE	650	COE	MCNTAL	04/17/2001	WILD/GOOD
OBS				BWL	08/16/2002	
OBS				B2A	08/16/2002	
OBS				MC1	10/16/2002	
REC	RE KL FE	700	YINN	CHANDL	03/21/2003	
REC	RE KL FE	740	YINN	YAKIM1	12/08/2003	

Table C-3. Summary of Type and Site codes used in Appendix C-1 and C-2 detection histories. All Detection, organization and site codes are located at http://www.pittag.org/Software_and_Documentation/ **in the 2004 PIT Tag Specification Document.**

Data Record Types	
TAG -	Tagging and Release
REC -	Recapture
OBS -	Observation (Interrogation)

LOCATION CODES									
Bonneville Dam		McNary Dam		Lower Granite Dam		Yakima River			Columbia River Estuary
Adult	Juv	Adult	Juv	Adult	Juv	Prosser Dam		River Mouth	RKm 75
B2A, BO1, BO2, BO3, BWL	B1J	MC1, MC2	MCJ	GRA	GRJ	PROSRD	CHANDL	YAKIM1	TWX

Appendix D

Table D-1. Summary of overall returns by release date, sample mean, standard deviation (SD), and range of fork lengths (cm), sex, origin and condition of steelhead kelts from 2001 – 2003 releases.

TOTAL		FORK LENGTH (cm)			GENDER			ORIGIN		CONDITION		
Release	n	average	SD	Range	male	female	unk	wild	hatchery	good	fair	poor
03/31/2001	1	66.00	0.00	66-66	0	0	1	1	0	1	0	0
04/12/2001	1	62.00	0.00	62-62	0	0	1	1	0	1	0	0
04/13/2001	2	64.00	2.45	61-67	0	1	1	2	0	2	0	0
04/16/2001	1	63.00	0.00	63-63	0	0	1	1	0	0	1	0
04/18/2001	2	62.00	4.08	57-67	0	0	2	1	1	2	0	0
04/20/2001	1	64.00	0.00	64-64	0	0	1	0	1	1	0	0
04/23/2001	1	71.00	0.00	71-71	0	0	1	0	1	1	0	0
04/24/2001	1	67.00	0.00	67-67	0	0	1	1	0	1	0	0
04/25/2001	1	57.00	0.00	57-57	0	0	1	1	0	1	0	0
04/26/2001	1	53.00	0.00	53-53	0	1	0	1	0	0	1	0
04/30/2001	3	67.67	1.08	66-69	0	0	3	3	0	3	0	0
05/01/2001	2	67.00	1.63	65-69	0	2	0	2	0	2	0	0
05/02/2001	3	58.67	3.34	55-64	0	2	1	3	0	3	0	0
05/08/2001	2	68.50	0.41	68-69	0	1	1	2	0	2	0	0
05/09/2001	1	61.00	0.00	61-61	0	1	0	1	0	1	0	0
05/10/2001	5	61.80	7.40	50-69	0	4	1	5	0	3	2	0
05/11/2001	1	57.00	0.00	57-57	0	1	0	1	0	1	0	0
05/14/2001	2	63.50	4.49	58-69	0	2	0	2	0	2	0	0
05/15/2001	2	67.50	1.22	66-69	0	1	1	1	1	1	1	0
05/16/2001	1	60.00	0.00	60-60	0	0	1	1	0	0	1	0
05/17/2001	2	62.00	5.72	55-69	0	0	2	2	0	1	1	0
05/21/2001	1	57.00	0.00	57-57	0	1	0	1	0	1	0	0
05/22/2001	2	57.00	5.72	50-64	0	2	0	2	0	2	0	0
05/23/2001	3	57.00	1.41	55-59	0	3	0	3	0	3	0	0
05/31/2001	1	57.00	0.00	57-57	0	1	0	1	0	1	0	0
03/29/2002	1	63.00	0.00	63-63	0	1	0	0	1	0	1	0
04/03/2002	1	67.00	0.00	67-67	0	0	1	0	1	1	0	0
04/04/2002	1	57.00	0.00	57-57	0	0	1	1	0	1	0	0
04/05/2002	5	66.60	8.05	55-81	1	3	1	3	2	4	1	0
04/06/2002	1	60.00	0.00	60-60	0	0	1	0	1	0	1	0
04/08/2002	1	61.00	0.00	61-61	0	1	0	0	1	1	0	0
04/09/2002	1	62.00	0.00	62-62	0	1	0	0	1	0	1	0
04/10/2002	4	57.75	3.49	54-64	0	3	1	1	3	3	1	0
04/11/2002	4	60.00	4.94	54-69	0	1	3	4	0	2	2	0
04/12/2002	1	57.00	0.00	57-57	1	0	0	1	0	1	0	0
04/13/2002	1	50.00	0.00	50-50	0	1	0	1	0	1	0	0
04/15/2002	1	60.00	0.00	60-60	0	1	0	0	1	1	0	0
04/16/2002	3	59.33	2.16	56-62	0	0	3	0	3	3	0	0
04/17/2002	3	65.00	4.24	59-71	0	3	0	3	0	1	2	0
04/18/2002	7	58.14	4.26	49-64	0	6	1	6	1	6	0	1
04/19/2002	2	56.00	0.00	56-56	0	2	0	2	0	1	1	0
04/20/2002	3	62.00	3.54	57-67	0	3	0	1	2	3	0	0
04/23/2002	2	57.50	1.22	56-59	0	2	0	2	0	2	0	0
04/24/2002	1	65.00	0.00	65-65	0	1	0	1	0	1	0	0
04/25/2002	1	55.00	0.00	55-55	0	1	0	0	1	1	0	0

04/27/2002	1	58.00	0.00	58-58	0	1	0	0	1	1	0	0
04/29/2002	1	64.00	0.00	64-64	0	1	0	1	0	1	0	0
04/30/2002	2	57.50	2.04	55-60	0	2	0	2	0	2	0	0
05/01/2002	5	59.40	5.43	54-71	1	3	1	5	0	4	0	1
05/02/2002	2	57.50	0.41	57-58	0	2	0	1	1	2	0	0
05/03/2002	2	57.00	3.27	53-61	0	1	1	2	0	1	1	0
05/04/2002	4	62.00	5.48	52-67	1	3	0	4	0	4	0	0
05/07/2002	1	54.00	0.00	54-54	0	1	0	1	0	1	0	0
05/13/2002	2	70.50	0.41	70-71	0	2	0	2	0	2	0	0
05/14/2002	5	56.20	2.91	52-60	0	5	0	4	1	5	0	0
05/15/2002	3	63.67	2.27	60-66	0	3	0	2	1	2	1	0
05/17/2002	1	71.00	0.00	71-71	0	1	0	1	0	0	1	0
05/18/2002	1	57.00	0.00	57-57	0	0	1	1	0	1	0	0
05/22/2002	2	58.50	0.41	58-59	0	1	1	1	1	0	2	0
05/23/2002	1	69.00	0.00	69-69	0	0	1	1	0	0	1	0
05/24/2002	2	56.50	1.22	55-58	0	2	0	2	0	1	1	0
05/30/2002	1	56.00	0.00	56-56	0	1	0	1	0	1	0	0
05/31/2002	2	67.00	4.90	61-73	0	1	1	2	0	0	2	0
06/01/2002	1	51.00	0.00	51-51	1	0	0	1	0	1	0	0
06/05/2002	1	54.00	0.00	54-54	0	1	0	1	0	1	0	0
04/02/2003	1	68.00	0.00	68-68	0	1	0	1	0	1	0	0
04/03/2003	1	63.00	0.00	63-63	0	0	1	1	0	1	0	0
04/08/2003	1	73.00	0.00	73-73	0	0	1	1	0	1	0	0
04/09/2003	1	67.00	0.00	67-67	0	1	0	1	0	0	1	0
04/11/2003	2	58.00	1.63	56-60	0	0	2	1	1	2	0	0
04/25/2003	1	72.00	0.00	72-72	0	1	0	1	0	1	0	0
04/29/2003	1	58.00	0.00	58-58	0	1	0	1	0	1	0	0
05/07/2003	2	64.50	3.67	60-69	0	1	1	2	0	2	0	0
05/08/2003	1	64.00	0.00	64-64	0	1	0	1	0	1	0	0
05/09/2003	1	58.00	0.00	58-58	0	1	0	1	0	1	0	0
05/20/2003	1	54.00	0.00	54-54	0	1	0	1	0	0	1	0
TOTALS	140				5	92	43	112	28	110	28	2

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