Capture, Transportation and Reintroduction of Lower Columbia River Fall Chinook Salmon into the Upper White Salmon River

U.S. FISH AND WIDLIFE SERVICE COLUMBIA RIVER FISHERIES PROGRAM OFFICE

A Conservation Measure in Preparation for Condit Dam Removal

Rod Engle and Joe Skalicky

Final Draft - March 13, 2009

Summary

In September 1999, a Settlement Agreement was signed by PacifiCorp and State, Federal, Tribal and non-governmental organizations to remove Condit Dam and reopen the upper White Salmon River to fish passage. One of the key conservation measures proposed by PacifiCorp and FERC is the capture of adult LCR fall Chinook salmon before Condit Dam is removed, and rearing their progeny for release back into the White Salmon River after the removal process is complete (NMFS 2006). The breaching of Condit Dam and draining of Northwestern Lake is expected to temporarily eliminate anadromous spawning in the lower river by inundating the spawning area with reservoir sediments (NMFS 2006). In the spring 2008, a decision was made by the White Salmon Working Group to perform adult fall Chinook salmon outplanting upstream of Condit Dam during the year of dam removal in lieu of adult collection and subsequent hatchery propagation.

To assess the feasibility of capturing and outplanting LCR fall Chinook, biologists tested several capture methods in the lower White Salmon River. In September of 2008 a total of 99 hatchery origin and 64 natural origin LCR fall Chinook salmon were captured on the lower White Salmon River. During the first week of sampling no LCR Fall Chinook fish were observed in the lower White Salmon area by the sampling crews and catch efforts resulted in only one adult steelhead. The majority of Chinook were caught during the second week of sampling. Early efforts with gill netting the second week of capture did collect some fish but beach seines were quickly adopted based on catch efforts and the difficulties in both deploying and maintaining the gill nets. The third week of capture was also successful but catch decreased significantly near the end of the week and recapture of previously released natural-origin fish increased. A total of 99 hatchery origin LCR fall Chinook salmon were captured from the lower White Salmon River and 90 were transported and released upstream of Condit Dam. A total of 333 fish were collected from Spring Creek NFH, transported and then released upstream of Condit Dam. The total number of fish released above Condit Dam was 423.

A total of 35 radio transmitters (34 females and 1 male) were affixed to hatchery origin LCR fall Chinook salmon that were transported upstream of Condit Dam and released into the upper White Salmon River. A total of 25 LCR fall Chinook salmon were released from the Northwester Lake release site and 10 were released from the Husum Falls Release Site. Northwestern Lake radio tagged releases were from both Spring Creek NFH and the lower White Salmon River captures. Only captures from the lower White Salmon River were tagged and released at the Husum Falls release site.

Three separate redd surveys were conducted on September 29, October 3 and October 17, 2008. Redd surveys were performed from Husum Falls at RM 7.6 to Northwestern Lake Boat Ramp at RM 4.9. A total redd population estimate of 80 was derived by summing the maximum reach counts for each of the three survey dates. We estimated an adult to redd ratio of 5.3 adults/redd and 2.7 females/redd.

Acknowledgements

The authors would like to acknowledge Bill Brignon, Jeff Hogle, Trevor Conder, Brian Davis, Ken Lujan, Mark Bagdovitz, Doug Olson, David Wills, David Hines, Chuck Hamstreet, Matt Cooper of the U.S. Fish and Wildlife Service, Joe Zendt and Jeanette Burkhardt of the Yakama-Klickitat Fisheries Program, Frank Shrier of PacifiCorp, John Meduna, Mark Doulos, Chris Hankin and Scott Zirjacks of Spring Creek National Fish Hatchery, and the Washington Department of Fish and Wildlife Hatchery Specialists Jesse Miller, John Alan and Frank Blouin of Skamania and Washougal Hatcheries for assistance in completing this project. Wet Planet Whitewater in Husum, Washington that included Jaco Klinkenberg, Todd Collins, Hootie Boucher, Drew Parker, and Andy Round provided property access and assisted with redd surveys. This project was supported by funding from PacifiCorp with assistance from the U.S. Fish and Wildlife Service, Washington Department of Fish and Wildlife, the Yakama-Klickitat Fisheries Program, NOAA-Fisheries, the U.S. Forest Service and the U.S. Geological Survey – Biological Resources Division.

Table of Contents

List of Figures

List of Tables

Introduction

In September 1999, a Settlement Agreement was signed by PacifiCorp and State, Federal, Tribal and non-governmental organizations to remove Condit Dam and reopen the upper White Salmon River to fish passage (PacifiCorp 1999). In preparation for removal of Condit Dam, the potential impacts of removal have been investigated and evaluated for terrestrial and aquatic species through Environmental Impact Statements by the Federal Energy and Regulatory Commission (FERC 2002) and Washington Department of Ecology (WDOE 2007). Formal Endangered Species Act consultations on bull trout by the U.S. Fish and Wildlife Service (USFWS 2002 and 2005) found that the dam removal action is not likely to jeopardize the continued existence of bull trout in the Lower Columbia Recovery Unit or in the Columbia River Distinct Population Segment and is not likely to destroy or adversely modify designated critical habitat. The National Marine Fisheries Service has determined that the proposed action is not likely to jeopardize the continued existence of Endangered Species Act (ESA) listed lower Columbia River (LCR) Chinook salmon, lower Columbia coho salmon, Columbia River chum salmon or mid-Columbia River steelhead in the White Salmon River, or destroy or adversely modify designated critical habitat due to the limited time and space of the action (NMFS 2006).

One of the key conservation measures proposed by PacifiCorp (2004) and FERC (2002) is the capture of adult LCR fall Chinook salmon before Condit Dam is removed, and rearing their progeny for release back into the White Salmon River after the removal process is complete (NMFS 2006). The breaching of Condit Dam and draining of Northwestern Lake is expected to temporarily eliminate anadromous spawning in the lower river by inundating the spawning area with reservoir sediments (NMFS 2006). Spawning habitat in the lower 3 miles of the White Salmon River will be negatively affected, but recovery is expected to begin within the first year. The NMFS (2006) Biological Opinion stated that the proposed salvage operation of LCR fall Chinook salmon that are preparing to spawn downstream of Condit Dam just prior to breaching will conserve production that would otherwise be lost when redds and gravel are smothered by sediments released from the reservoir.

In 2005, the USFWS initiated a cooperative study with U.S. Geological Survey-Biological Resources Division (USGS-BRD) and Abernathy Fish Technology Center primarily to identify potential interactions of Spring Creek National Fish Hatchery (NFH) hatchery produced fall Chinook salmon with natural populations, and secondarily identify source stocks for restoring natural populations of Chinook salmon in the White Salmon River post dam removal. Results of the cooperative study have determined that Chinook salmon are being produced in the White Salmon River downstream of Condit Dam (Allen and Connolly 2006) and these fry are genetically similar to LCR fall Chinook salmon during March and early April, and upriver bright fall Chinook salmon during May (Smith et al. 2007). Additionally, the LCR fall Chinook salmon from Spring Creek NFH are similar to the LCR fall Chinook salmon fry being captured in the White Salmon River (Smith et al. 2007). This information has guided discussions within the White Salmon River/Condit Dam Removal Working Group (Working Group) that includes PacifiCorp, Washington Department of Fish and Wildlife (WDFW), Yakama Nation, NOAA-Fisheries, USGS-BRD and the USFWS on how to best pursue restoration of fish populations once Condit Dam is removed.

Originally, the proposal by PacifiCorp to capture adult LCR fall Chinook salmon assumed the use of the White Salmon Ponds, a Spring Creek NFH dormant brood stock collection facility, and to rear and release progeny of collected adults into the White Salmon River the spring following Condit Dam removal. In spring 2008, a decision was made by the Working Group to perform adult fall Chinook salmon outplanting upstream of Condit Dam during the year of dam removal in lieu of adult collection and subsequent hatchery propagation. This decision was based on a number of factors including the recent numbers of LCR adult fall Chinook salmon annually spawning in the White Salmon (Normandeau Associates 2004 and Joe Hymer and Kelly Jenkins, WDFW, personal communication), genetic stock analysis of emergent fry (Smith et al. 2007) and the juvenile Chinook salmon production information being collected through the previously mentioned cooperative study (Allen and Connolly 2006). The Working Group endorses adult outplanting of captured LCR fall Chinook salmon upstream of the dam because of these factors and the increased emphasis on recolonization of LCR fall Chinook into the White Salmon River by natural spawning. Additionally, the Working Group believes a capture and transport effort of LCR fall Chinook salmon a year prior to Condit Dam removal would streamline and improve the restoration action during the fall of actual dam removal.

This project and report was a cooperative effort between members of the Working Group for collection and transportation of adult LCR Chinook salmon during the year of removal of Condit Dam and includes standard hatchery and field protocols for those actions. This project and actions outlined within this document addresses the Reasonable and Prudent Measures, Terms and Conditions #2 in the NMFS (2006) Biological Opinion, *"Minimize direct take of listed species during adult salvage operation by following standard hatchery protocols for collecting, holding, and spawning brood stock."* This project and the actions outlined within the document also addresses the Reasonable and Prudent Measures, Terms and Conditions #5 in the USFWS (2002) Biological Opinion, *"Develop and implement a bull trout protection plan, in consultation with the Service, that addresses handling and relocation protocols in the event bull trout are trapped and collected during the fish salvage efforts."*

Methods

Adult Capture Goal

The White Salmon Working Group established 500 LCR fall Chinook salmon as a reasonable pilot study goal for seeding spawning habitat in the White Salmon River and testing capture methods. The goal of 500 LCR Chinook pertains to the White Salmon River from Northwestern Lake upstream to Husum Falls. During the year of actual dam removal these action would serve to mitigate for the impacts (sedimentation) on spawning grounds below Condit Dam. This was the target goal to be met with either active or passive capture methods in the White Salmon River, or from collection and transport of LCR hatchery fall Chinook salmon from Spring Creek NFH located on the Columbia River approximately one mile downstream from the mouth of the White Salmon River.

To capture, transport, and then release adult LCR fall Chinook returning to spawn in the lower White Salmon River to locations above Condit Dam, we proposed to test the efficacy of the following capture methods in September and October of 2008: a) active and passive capture using beach seines and gill nets, b) passive capture using the White Salmon Ponds on the White Salmon River and c) passive capture using a fyke trap. One or a combination of these methods were thought to be the most effective method for actual LCR fall Chinook salmon salvage and reintroduction operations during Condit Dam removal. Capture methods were to be tested for the LCR fall Chinook salmon returning to spawn in the White Salmon River over four weeks in 2008, starting on September 8th and ending on October 2nd. This time period was also based on annual hatchery origin LCR fall Chinook salmon returns to Spring Creek NFH (Figure 1).

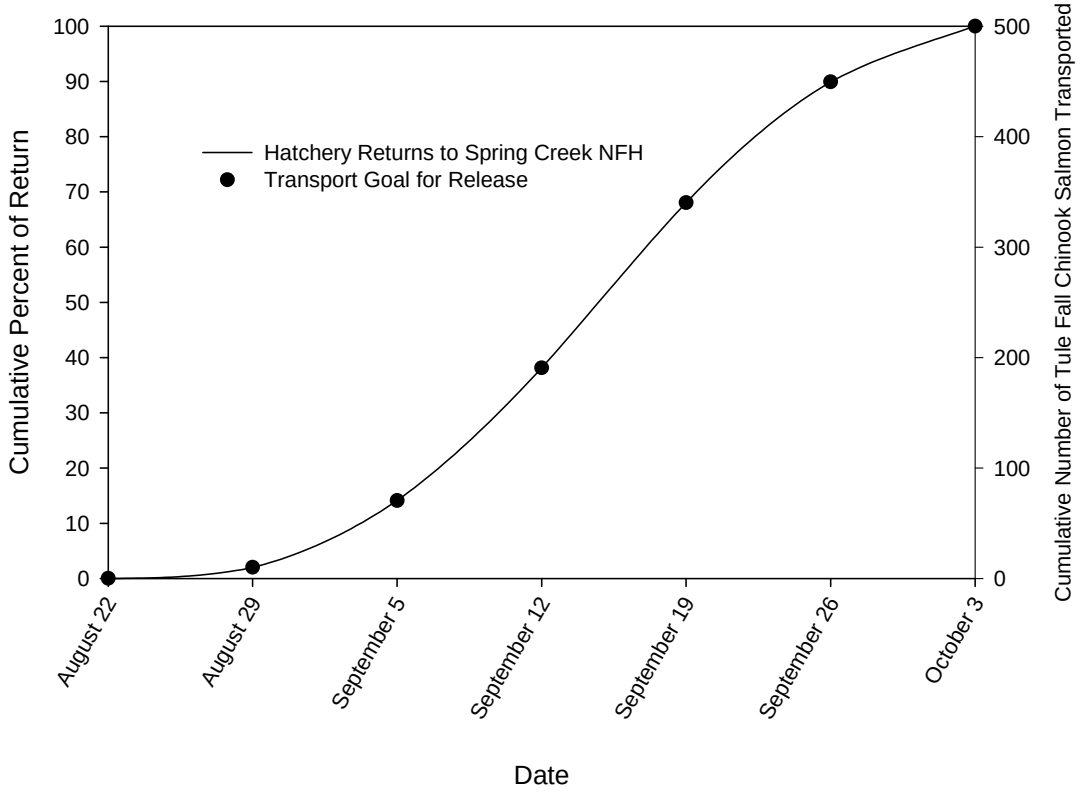


Figure 1. Cumulative average percent return of fall Chinook salmon to Spring Creek NFH from 2001 through 2007 by date of return. The proposed cumulative number of fall Chinook salmon transported upstream of Condit Dam by date of return for 2008 is also presented (second y-axis). Number of transported adults by date could vary based on adult return timing, sex ratio and capture success.

Active and Passive Capture Using Beach Seines, Trammel Nets, Gill Nets, and a Fyke Trap

We tested the efficacy of beach seines deployed in simple arc and fast-pursuit sets for the capture of LCR fall Chinook salmon (Figure 2). The study tested both fixed and free-drifting 50-m nylon gill nets with 3.5 inch square panel and 6.5 inch stretch. Variable lengths of seines were fished through aggregations of adults staging below and on spawning grounds throughout the lower White Salmon River extending from RM 0.5 to RM 1.4. The nylon gill nets were fished similar to the seine with arc sets and fast pursuit sets and were fished through aggregations of adults staging or on spawning grounds. Daily seining and gill netting effort was adjusted to account for run size, capture success, and logistical considerations. Researchers proposed to take advantage of a backwater to fish a custom designed fyke across the entire stream channel near the upstream interface of the backwater. This fyke was to integrate several of the seines that were used in our active capture operation plus a crowding area.

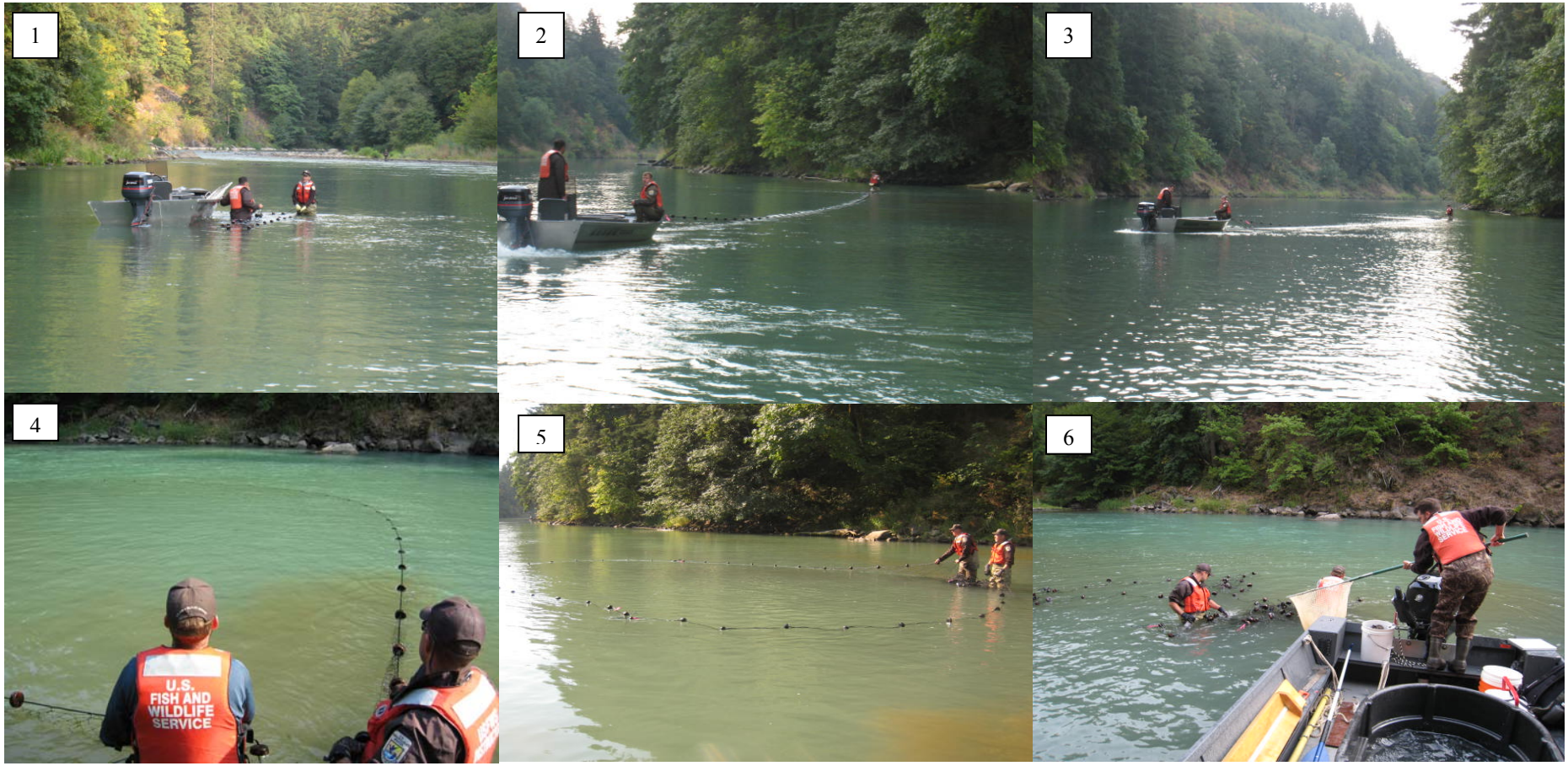


Figure 2. Pictures documenting a modified arc-seining method employed during 2008 by the U.S. Fish and Wildlife Service to collect fall Chinook salmon in the White Salmon River. 1) Seine is held in the shallow water, slow moving water. 2) The seine pulled straight and upstream by boat crew and 3) then traversed perpendicular to the faster current and back downstream. 4) The seine is connected back to the point of deployment by boat from the faster water to form a closed circle. 5) The seine is pulled in slowly by hand to gradually collapse the net upon itself. 6) Fish become tangled in the net as it closes on itself and are transferred to a sorting tub in the boat to determine hatchery or natural origin. The entire process, as shown, took approximately 15 minutes.

Passive Capture Using White Salmon Ponds

Spring Creek NFH staff operated the historical "hill-side" brood stock collection pond in a manner to allow for a small 2-foot opening into the ponds from the river. Through a graduated placement of dam boards, laddered steps facilitated entrance into the adult holding area of the "hill-side" pond (Figure 3). Note that both ponds had water but only the "hill-side" Pond was accessible and that this is not how the ponds were historically operated. This passive operation was initiated on September 8th for a combination of continuous overnight and daytime operations throughout the four weeks of sampling. Flows of the White Salmon River during the operational period, and for periods of active capture, were 595-804 cfs. With one pond in operation, approximately 1.7 cfs was diverted from the White Salmon River. Three female Spring Creek NFH adults were placed in the hill-side pond in an attempt to attract other adult LCR fall Chinook salmon into the ponds through scent. These fish were tagged with a yellow floy tag on each side of the dorsal fin for discrimination and separation from any adult LCR fall Chinook salmon that entered the ponds volitionally.

Hatchery vs. Natural Origin LCR Fall Chinook Salmon in 2008 and Adult Capture Methods:

During the 2008 return year for LCR fall Chinook salmon, all age 2, 3, and 4 year old Spring Creek NFH origin adults were either adipose fin clipped or would have a coded-wire tag present in their snout. Therefore, it was possible to identify fish within those potential ages and corresponding sizes as either hatchery or natural origin during any of the capture techniques evaluated. As a conservation measure, natural origin LCR fall Chinook salmon that were captured during either active or passive efforts were not transported upstream of Condit Dam during 2008. Figure 4 outlined the weekly goals for capture and transfer of adult hatchery-origin LCR fall Chinook salmon in the White Salmon River during the 2008 pilot study. These goals are based on historical timing and abundance of Spring Creek NFH returns during the 2001-2007 return years.

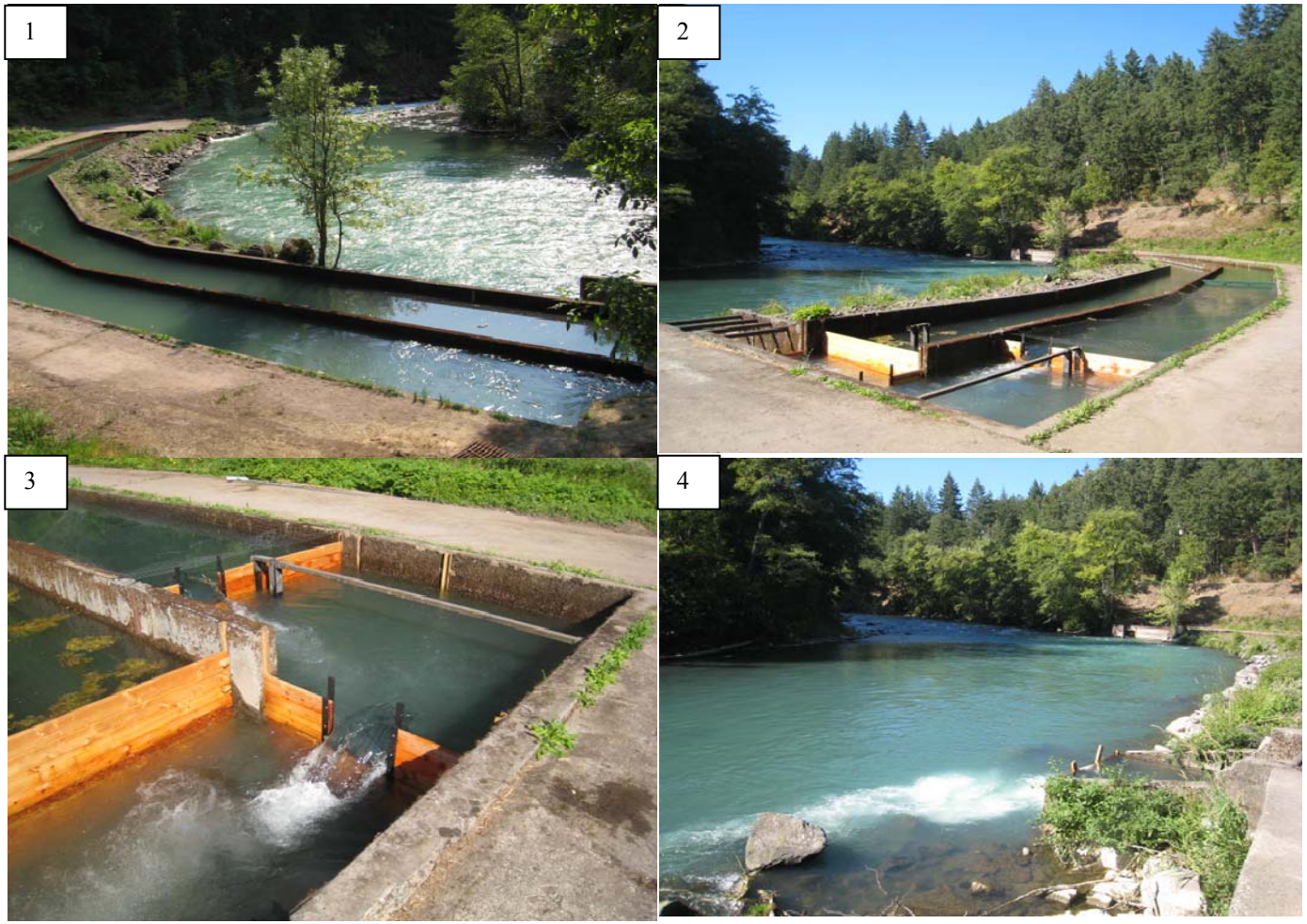


Figure 3. Pictures of the White Salmon Ponds, a historical brood stock collection facility that was operated by the Spring Creek NFH and put into modified operation for 2008. The ponds were filled, and run with approximately 1.7 cfs of flow (1), and boards were placed in the hillside pond to create a collection area for Lower Columbia River Fall Chinook salmon that would enter volitionally (2, 3). Small entrances were cut from dam boards and water from the ponds and finger weirs were affixed. Ladder steps facilitated fish entry (3) into the holding area covered by a fine mesh net that would be periodically checked by capture crews and hatchery staff during September 2008. The entrance to the ponds was at the furthest downstream point of the ponds (4) and not the upstream end of the ponds as it was historically implemented. Historically, a weir across the White Salmon River at the furthest upstream point of the ponds was used to collect adults.

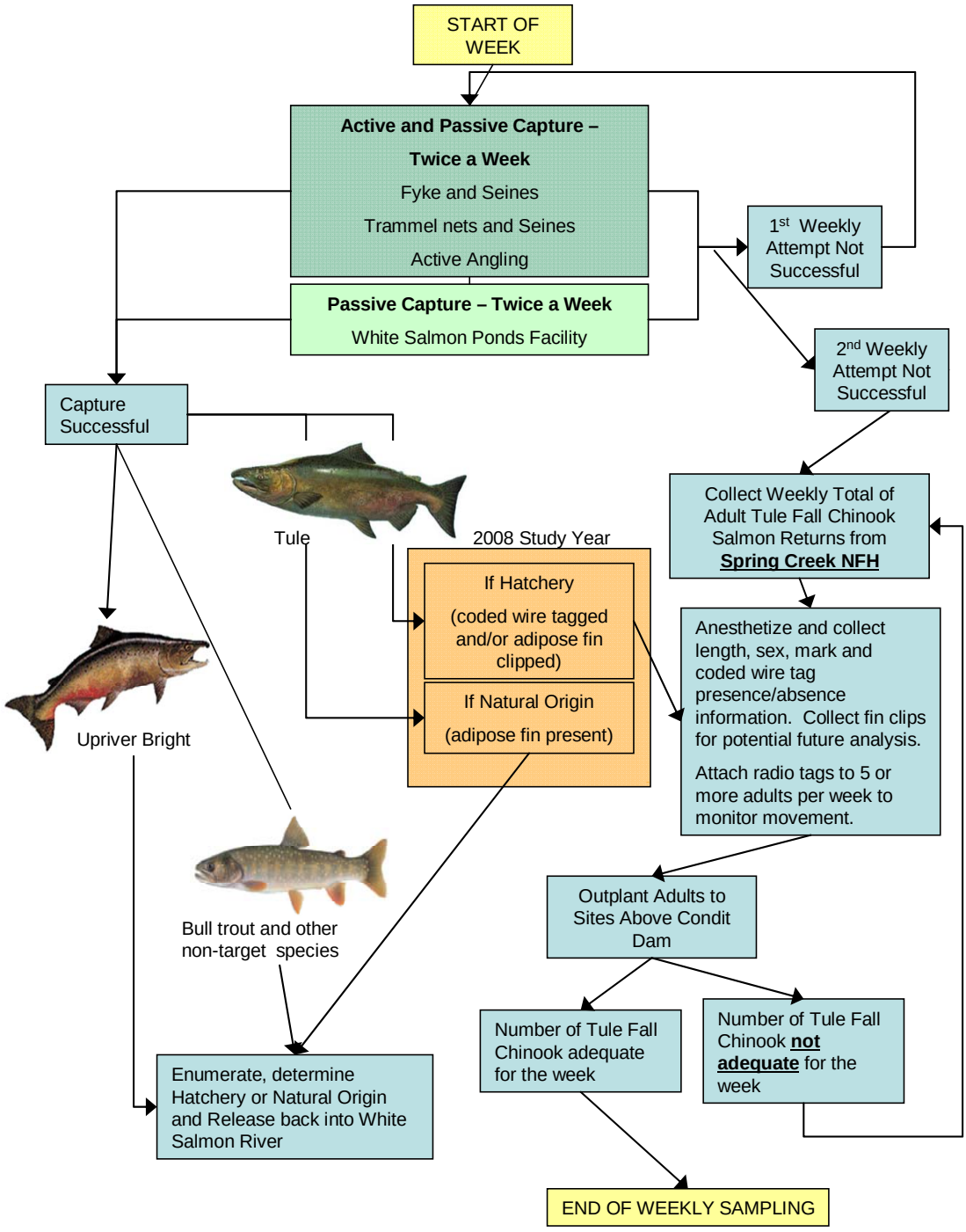


Figure 4. Flow chart depicting potential decisions and methods for the 2008 effort that led to transporting adult Lower Columbia River (LCR) fall Chinook salmon upstream of Condit Dam during September of 2008.

Adult Handling & Transportation

In the process of capturing and transporting adult LCR fall Chinook, field crews minimized capture stresses, handling duration, and transit times. Fish caught by active capture techniques were removed from nets either by hand (gillnets) or by dip net and then transferred immediately to a 150-gallon tote with fresh river water located within a boat (Figure 2). Captured fish were identified to species, race and sex, examined for coded wire tag presence or an adipose fin clip, and were either released immediately (natural origin Chinook salmon) or retained (hatchery origin Chinook salmon). All natural origin Chinook salmon had a small amount of the caudal fin removed to identify future recapture. Any incidentally captured species that was not a Chinook salmon was enumerated and released immediately. Retained Chinook salmon were then transported to a floating barge with mostly submerged 150-gallon totes open to river flow just downstream at RM 0.7, usually within 5 minutes of capture (Figure 5). Retained Chinook salmon were then held and staged at the barge one to three hours depending on daily catch, radio-tagging activities, or until a suitable number were available for transport ($\geq$ 4 salmon). Fish were removed from holding containers with a dip net, by hand, with the use of a transport sleeve or by a combination of the preceding methods and placed into 150-gallon totes on boats and then transported to the Underwood In-Lieu Site at RM 0.1. At the In-Lieu site a transport truck staffed by hatchery personnel from WDFW was waiting. Water temperature in the transport truck were 48°F and river temperatures at the floating barge were 47°F so no additional temperature buffer was required. Fish were transferred at no greater density than one fish per 4.5 ft^3 of water, or 34 gallons.

Bonneville Pool Elevation Request

During the proposed capture dates, the U.S. Fish and Wildlife Service requested a stable Bonneville Pool elevation from the Bonneville Power Administration to reduce the number of variables affecting the proposed capture methods and to stabilize the distribution of depths and velocities which could potentially affect the location of salmon. The request did not specify a specific Bonneville Pool elevation, but rather a stable elevation of +/- 0.5 feet from hours 07:00 to 18:00 hours.

Figure 5. Staging barge constructed for the holding of captured Lower Columbia River fall Chinook salmon in the lower White Salmon River during 2008. The frame and floating pontoons were modified from a rotary screw trap. Three 150-gallon totes were submerged and 10 -3" holes were placed in each tote for water exchange. Two additional totes were mounted to each side of the barge to allow for fish processing determining hatchery or natural origin fish, and to contain anesthesia for affixing radio tags. Lids were placed on totes to provide shade, protection and to prevent escape. Barge constructed by John Meduna, Spring Creek NFH.

Release Sites

Fish were released at one of two sites in the upper White Salmon River above Condit Dam. The first site (Site 1) was located at the head of Northwestern Lake at the public boat ramp which is located at RM 4.9. The second site (Site 2) is located at RM 7.5 and is just downstream of Husum Falls at a whitewater rafting "take-out" site (Figure 6). Access to the river was attained by an unimproved roadway and by the permission of the private landowner. These two release sites were chosen to provide some contrast in the event that LCR fall Chinook demonstrated higher survival or site fidelity as a condition of either release site.

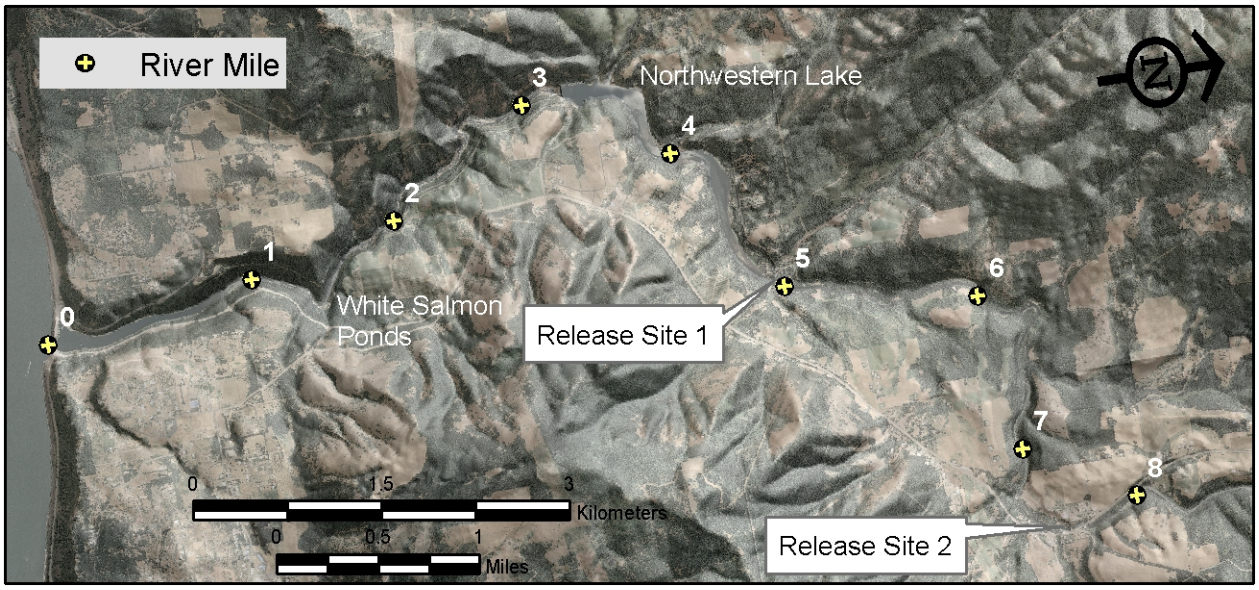


Figure 6. Release sites for LCR fall Chinook captured downstream of Condit Dam.

Radio Tracking

To ascertain the location and fate of transported LCR fall Chinook salmon, 35 radio tags (LOTEK Model #MCFT-3A) were affixed externally and dorsally using methods outline in Engle et al. (2006). With the exception of a single male, only female Chinook salmon were tagged and then transported and released at one of the two release sites. External tagging would presumably increase spawning success for female transported fish by not introducing a foreign body into the abdomen. Radio tagged fish were monitored both with four fixed telemetry arrays and with an active or mobile telemetry system. Mobile telemetry occurred at least twice a week and involved a regular search pattern along public access sites or along direct lines of sight between Husum Falls (RM 7.8) and Condit Dam RM (3.3). Mobile radio tracking also occurred during redd surveys from rafts, facilitating a more detailed survey of the river not possible by motor vehicle. With the telemetry data, we intended to described the spatial and temporal movement patterns, along with the fates (observed spawning, believed to have spawned, presumed mortality, observed mortality) of each radio tagged fish and make inferences about the population of fish transported.

Fixed-Telemetry Locations

Four battery-operated fixed monitoring arrays were installed along shorelines to monitor both spatial and temporal fish movements and to determine the fates of tagged fish (Figure 7). The first site was installed on the upstream face of Condit Dam at RM 3.2 and the second was installed at Northwestern Lake Park at RM 4.9. Both sites included a single directional antennae and the antennae on the Northwester Lake site was oriented upstream to avoid detection of tags when outplanting activities occurred. Both of these sites were on PacifiCorp property. The third site was installed at RM 6.4 near Fordyce Road and operated two separate antennas for determining upstream and downstream fish movements. The fourth site was located at RM 8.1 upstream of Husum Falls (RM 7.9) to determine if any radio tagged LCR fall Chinook ascended Husum Falls. Husum Falls is believed to be a partial or complete barrier to LCR fall Chinook salmon (Washington Department of Ecology 2007). These fixed radio-tracking sites were selected to determine the spatial movement patterns and three gross potential spawning location fates: upstream of Husum, Northwestern Lake to Husum and downstream or within Northwestern Lake (unsuccessful spawn).

Active Tracking

An active mobile tracking system log of radio-tagged LCR fall Chinook salmon was maintained on a twice-weekly basis by individuals donating time from agencies within the Working Group, by volunteers from the Mid-Columbia Fisheries Enhancement Group, and by project staff proceeding all after adult capture and transport activities. A LOTEK brand mobile receiver was used to detect tagged LCR Chinook salmon and document their locations within the area of the upper White Salmon River. When a radio tagged LCR Chinook salmon was detected, their location was referenced on a map or their location was recorded with a GPS. When radio tagged salmon were visually identified, their behavior (spawning, holding, dead or unknown) and grouping (solitary or with 1 or more LCR Chinook salmon) was recorded. Individual movement data by individual tag code was summarized to show movement from outplant locations and by origination (capture in White Salmon or collected at Spring Creek NFH).

Redd, Adult and Carcass Surveys

The objective of the redd, adult and carcass surveys was to enumerate the total number of LCR fall Chinook salmon redds present throughout the study site and count both live fish and carcasses. Individual redds were visually identified from the surface by one or more survey crew members. The surveys were conducted between RM 12.4 down to Husum falls RM 7.8 on one occasion (October 3rd) and then from Husum Falls down to Northwester Lake at RM 4.9 on three separate occasions (September 29th, October 3rd and 17th). The redd surveys were conducted from inflatable, whitewater rafts and guided by a rafting guide contracted through Wet Planet Whitewater of Husum, WA. The 2.9 mile reach downstream of Husum Falls was subdivided into 4 reaches based on landmarks and observations were enumerated accordingly. When carcasses were encountered, the caudal fin was removed to mark carcasses as "observed" for that respective survey. Observations were recorded on data sheets and all redds were placed on maps for later enumeration. When radio tagged fish were encountered, their actions and grouping was

recorded in the same manner as active mobile tracking and carcasses were examined to determine the amount of eggs remaining.

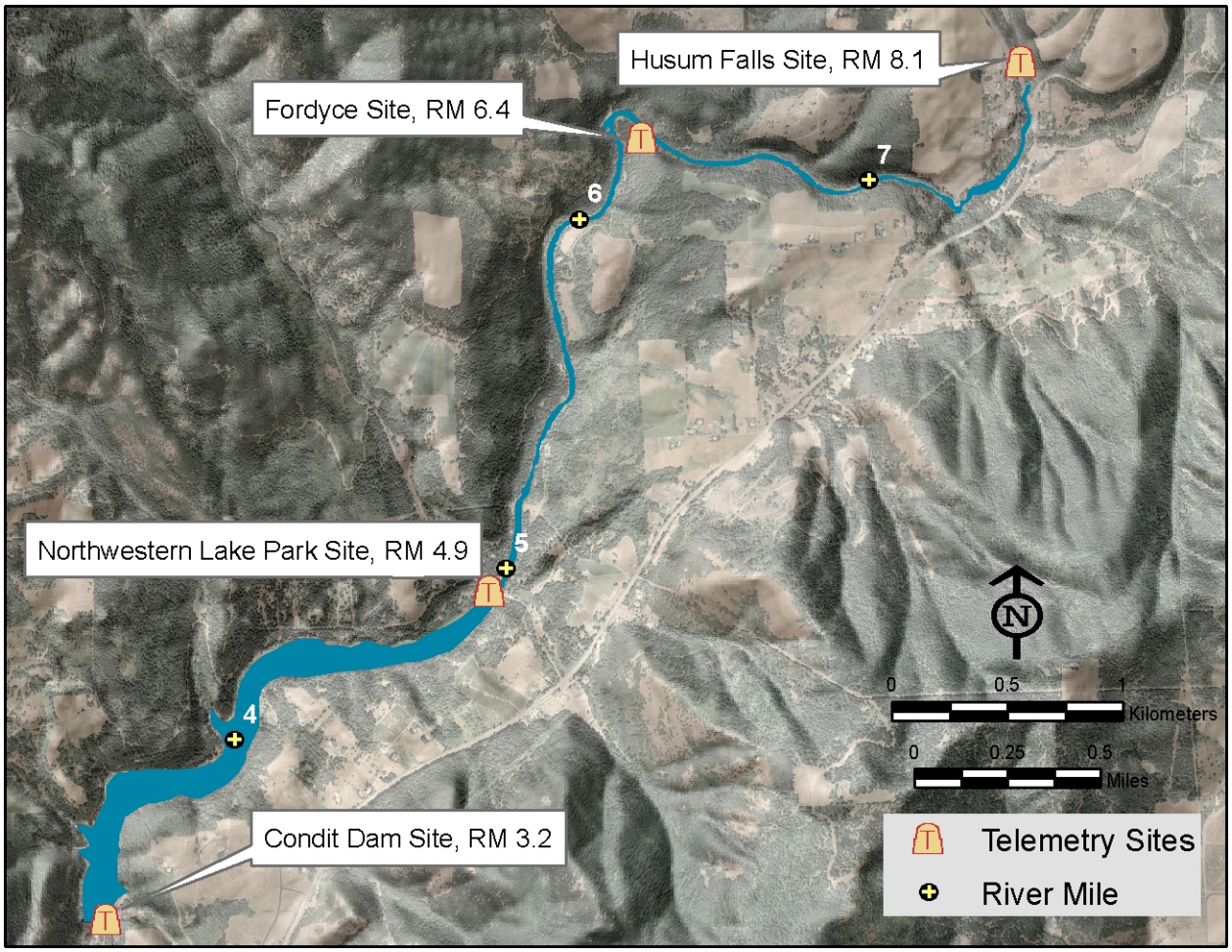


Figure 7. Fixed radio telemetry sites in the upper White Salmon River upstream of Condit Dam for tracking radio tagged Lower Columbia River fall Chinook salmon during 2008. Both Condit Dam and Northwestern Lake Park fixed sites are on PacifiCorp property. The Fordyce and Husum Falls sites are located on U.S. Forest Service Property. The Husum Falls site was placed at RM 8.1 upstream of the falls to determine if any radio tagged LCR fall Chinook could successfully pass the falls.

Results

Adult Capture

A total of 99 hatchery origin and 64 natural origin LCR fall Chinook salmon were captured during active capture activities for the four weeks of sampling in the lower White Salmon River (Table 1). During the first week of sampling (September 8-10) no LCR Fall Chinook salmon were observed in the lower White Salmon by the field crews and catch efforts resulted in only one adult steelhead. Efforts were suspended until September 15 when salmon were observed in the White Salmon River. Early efforts with gill netting the 2nd week of capture (September 15-18) did collect some fish but beach seines were quickly adopted based on catch efforts and the difficulties in both deploying and maintaining nylon gill nets. The 3rd week of capture, September 22-25, was also successful, but catch decreased significantly near the end of the week and recapture of previously marked and released natural-origin fish increased. In addition, the number of spawned out fish that we captured and observed increased significantly.

Installation and operation of the proposed fyke trap was not attempted based the extensive amount of crew effort required for installation and the amount of effort required to concurrently evaluate other techniques. In addition evaluation of the other techniques required the use of the same seines for active capture that would have been used in the fyke trap design. High water turbidities would have also made installation very difficult. Finally, with the truncated return of LCR fall Chinook salmon into the White Salmon, a narrow time period for evaluation existed and the other methods proposed were prioritized above evaluation of the fyke trap.

A total of 3 upriver bright fall Chinook salmon and 3 coho salmon (1 with an adipose fin present) were captured during the capture period in the lower White Salmon River. Also, 14 adult steelhead (5 with their adipose fins present) were captured during the fishing efforts in the lower White Salmon River.

Seining and gillnetting efforts were focused in approximately 0.3 river miles of the lower White Salmon River from RM 0.5 to 0.7 (Figure 8). Some initial efforts were also made to sample and capture downstream of these areas but sport fishermen were often present fishing and the number snags (logs) in the area was high and problematic. Efforts to sample upstream of river mile 0.7 were attempted but captured fish were not recorded or retained for transport since active spawning and redd construction was visible after September 15th. Since natural origin fish LCR fall Chinook salmon were likely present and spawning in the area, capture and transport of fish in this area was not attempted.

Table 1. Total catch of Lower Columbia River (LCR) Fall Chinook salmon (*Oncorhynchus tshawytscha)* by date of capture. Origin (Natural or Hatchery), adult steelhead (*O. mykiss*), upriver bright fall Chinook salmon and coho salmon (*O. kisutch*) are also provided. Numbers in parentheses represent the number of fish with adipose fins present. Fish were captured using active capture techniques of fixed or drifting gills nets and adult seines. Lower Columbia River Chinook salmon deemed "spawned out" or recaptured are included in totals for LCR fall Chinook salmon. Hatchery origin and natural origin LCR fall Chinook salmon were identified by dark coloration, absence or presence of an adipose fin and scanned for coded wire tags placed within the head. Upriver bright fall Chinook were identified by coloration at time of capture. Captures of *O. mykiss* and *O. kisutch* were not scanned for coded wire tags and only examined for an adipose clip to determine origin.

Date	Natural Origin LCR Fall Chinook Salmon	Hatchery Origin LCR Fall Chinook Salmon	*O. mykiss*	Upriver Bright Fall Chinook Salmon	*O. kisutch*	Recaptured Natural Origin Fall Chinook Salmon
08-Sep-08	0	0	0	0	0	0
09-Sep-08	0	0	1	0	0	0
10-Sep-08	0	0	0	0	0	0
15-Sep-08	2	4	0	0	0	0
16-Sep-08	10	13	1	0	0	0
17-Sep-08	11	24	2	1	0	1
18-Sep-08	5	21	2	1	0	0
22-Sep-08	13	23	3	0	2	5
23-Sep-08	10	6	1	1	1	2
24-Sep-08	6	5	4	0	0	5
25-Sep-08	7	3	0	0	0	3
TOTAL	64	99	14 (5)	3	3 (1)	16

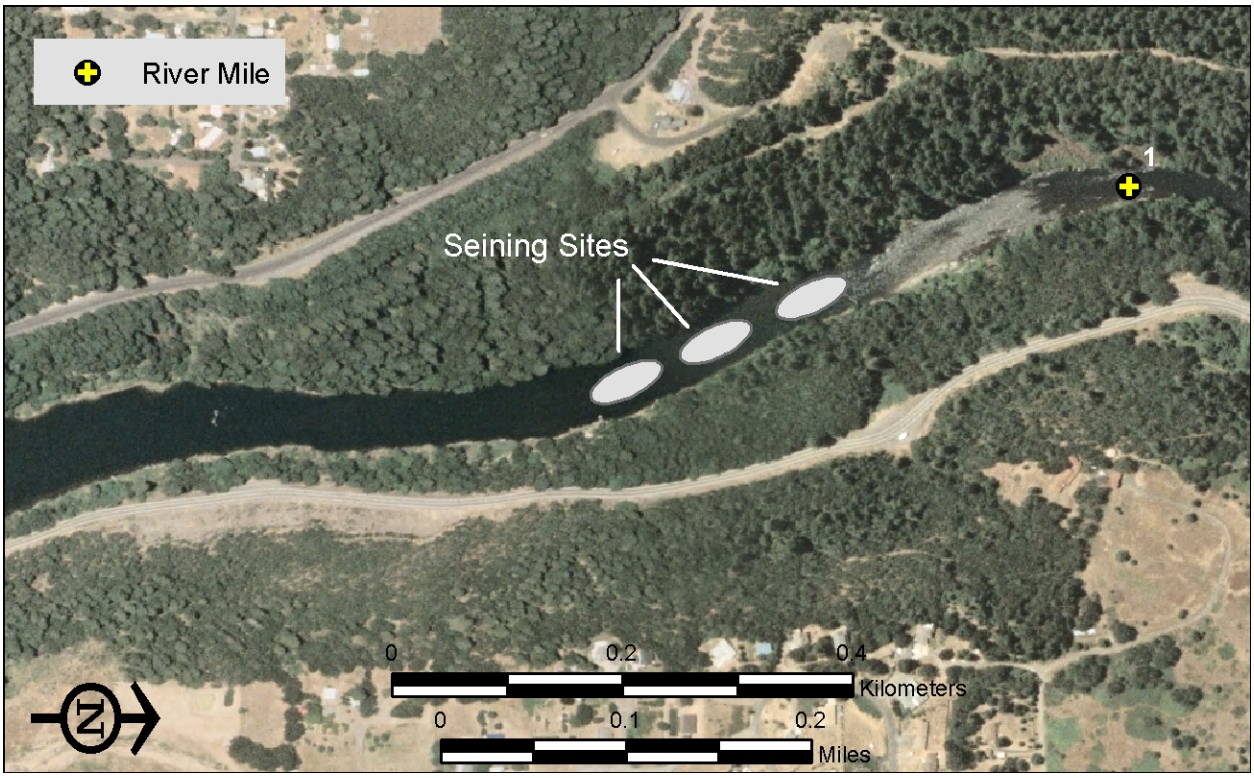


Figure 8. Seining and gill netting locations in the lower White Salmon River used by U.S. Fish and Wildlife Service staff during the capture effort for Lower Columbia River fall Chinook salmon during September 2008. Some netting was attempted both upstream and downstream of identified locations in the map but was not consistently employed during the entire sampling period due to active sport angling or presence of spawning LCR fall Chinook salmon.

Passive Capture Using the White Salmon Ponds

The White Salmon adult ponds collected 3 hatchery origin and 1 natural origin LCR Chinook during the passive capture period (Table 2). More fish may have entered the pond but turbidity levels did not allow for accurate counts of fish entry daily or even weekly. After the first week of operation, an effort was made to crowd the holding area to determine if fish had indeed entered the ponds. The crowding effort yielded one of the scent-fish placed in the ponds when operations were initiated. In addition, we speculated that the other two fish which had been placed in the ponds to attract fish from the river, had either left the ponds down the ladder openings or escaped to the other adjacent pond or outside the holding area by jumping through the protective cover. During the week of September 22nd, turbidity levels in the ponds decreased significantly and two mortalities, one natural origin and one hatchery origin, were observed in the pond not connected to the ladder that had likely jumped from the ladder or the holding area. One adult male had entered the ponds but was not immediately removed by staff and left later that week. Another male entered the ponds shortly thereafter. Both of these fish were hatchery origin. None of the fish that entered the ponds were transferred upstream of Condit Dam and at the end of the active capture period (September 25th). The remaining natural origin male was removed from the ponds and released into the White Salmon River.

Table 2. Summary of catch by type of method employed by U.S. Fish and Wildlife Service staff during September 2008 within the White Salmon River for Lower Columbia River Fall Chinook salmon. Catch is summarized for the weeks of September 15th – September 25th, with the week of September 8th removed from consideration as LCR fall Chinook had not moved into the lower White Salmon River.

Method	Type (Active or Passive)	Unit of Deployments	Number of Deployments	NOR Fall Chinook	HOR Fall Chinook	TOTAL Fall Chinook	Total Catch/ Unit Effort (hours)
Gill Nets (2) 2.5" mesh diamond panel 300' x 10'	Active	1 set (approx. 6 hours or 1 working day)	4[a]	2	10	12	0.50
Seines 2.5-3.0" mesh diamond panel	Active	1 Set (15 minutes)					
75' x 6'			4	3	2	5	5.00
175'x6'			9	1	6	7	3.10
200'x 6'			79	56	78	134	6.78
225'x 6'			7	2	3	5	2.86
White Salmon Ponds	Passive	Days (24 hour cycle)	19[b]	1	3	4	0.01[c]

a - Actual number of deployments was 12 times during September 15th-18th as nets were reset after capture and periodic cleaning or set in more suitable locations after fishing for a period. Gillnetting was suspended after that period and when fish were observed actively avoiding net.
b – Ponds were attempted to be checked daily but turbidity in the White Salmon River affected visibility in the Ponds. Ponds had to be checked by dewatering to a level to allow a crowder or stick-seine to be placed in the area and pushed by staff. This occurred on a 3 occasions during September until water clarity occurred the week of September 22, 2008. Ponds were then checked by visual inspection.
c – This is considered an estimate since the actual number of fish that entered the ponds is unknown due to turbidity and the ability of fish to enter the ladder or ponds and then jump to an adjacent pond that was connected to the ladder entrance and therefore, not periodically checked. Fish were observed escaping from the ponds once they entered so the actual number of fish that entered the pond could be higher than the reported catch.

Adult Transport

Of the 99 hatchery origin LCR fall Chinook salmon captured from the lower White Salmon River, 90 were transported and released upstream of Condit Dam (Table 3). Fish transported from the lower White Salmon River correlate with capture for that day. Several factors precluded transfer of every captured fish. One 5-year old male LCR fall Chinook salmon died during transport from the staging barge to the Underwood In-Lieu site, likely from a combination of handling stresses during capture and physical decay from spawning activities. Three fish did escape from the staging barge during efforts to transport them and were not recovered. The remaining fish were selectively removed from transport due to fish health concerns or were identified to have partially or fully spawned at the time of capture.

A total of 333 fish were collected from Spring Creek NFH, transported and then released upstream of Condit Dam (Table 3). Each transfer from the hatchery to the release sites took approximately one hour depending on the number of fish that needed to be loaded and the release site location. The number of Spring Creek NFH and hatchery origin LCR fall Chinook salmon transported upstream of Condit Dam by release site is provided Table 4.

Table 3. Collection and transport of hatchery origin Lower Columbia River fall Chinook salmon from Spring Creek National Fish Hatchery (NFH) and from captures in the lower White Salmon River and transport upstream of Condit Dam during 2008. Chinook salmon from Spring Creek NFH were collected from the entrance channel on the same day of entry except for fish collected on September 25 and 30 which were collected from the brood stock collection ponds that comprised several days of adults that returned to the hatchery.

	Spring Creek NFH Transfers		White Salmon River Transfers	
Date	Males	Females	Males	Females
08-Sept-08	1	2	0	0
10-Sept-08	15	15	0	0
15-Sept-08	0	0	2	3
16-Sept-08	14	12	6	6
17-Sept-08	0	0	12	12
18-Sept-08	30	30	6	12
22-Sept-08	0	0	6	13
23-Sept-08	0	0	3	3
24-Sept-08	40	40	1	4
25-Sept-08	55	62	1	0
30-Sept-08	7	10	0	0
TOTAL	162	171	37	53

Table 4. Transported hatchery origin fall Chinook salmon upstream of Condit Dam by origin and by release site during 2008. Release sites are at Northwestern Lake Park or on private property near Husum Falls at river mile 7.6 on private property. All fish were transported via adult transport truck and driver provided by WDFW.

Release Site	Spring Creek NFH Males	Spring Creek NFH Females	White Salmon Males	White Salmon Females
Northwestern Lake Boat Ramp	95	92	19	43
Near Husum Falls	73	73	18	10
TOTAL	**168**	**165**	**37**	**53**

Bonneville Pool Elevation Request

The requested Bonneville Pool operation for a stable daytime pool elevation was successful in stabilizing the distribution of depths and velocities within the White Salmon study site (Figure 9).

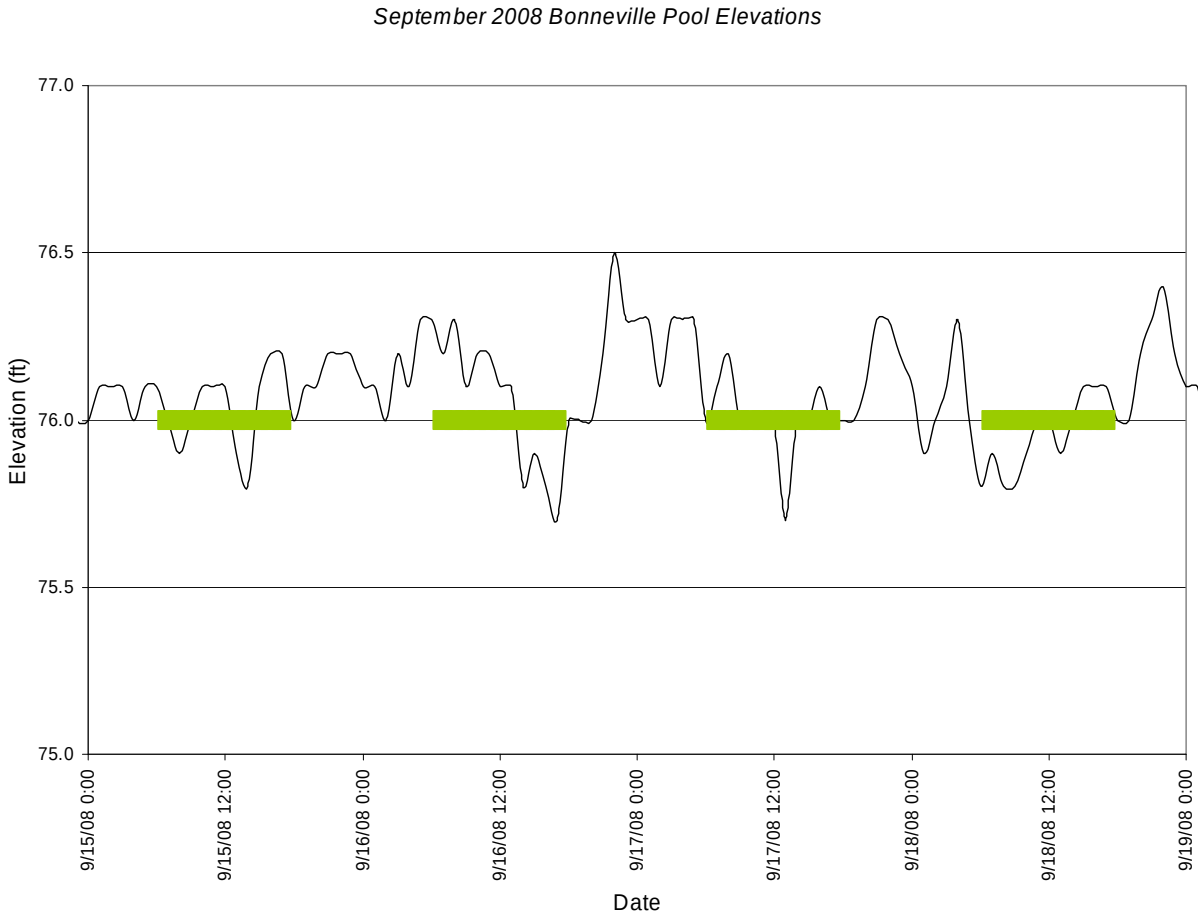


Figure 9. Elevations of Bonneville Pool during a representative week of active field sampling. Green bars depict the daytime sampling periods during this week.

Radio Tracking and Telemetry

During capture efforts a total of 35 radio transmitters (34 females and 1 male) were affixed to hatchery origin LCR fall Chinook salmon that were transported upstream of Condit Dam and released into the upper White Salmon River. A total of 25 LCR fall Chinook salmon were released from the Northwester Lake release site and 10 were released from the Husum Falls Release Site. Northwestern Lake radio tagged releases were from both Spring Creek NFH and the lower White Salmon River captures. Only captures from the lower White Salmon River were tagged and released at the Husum Falls release site.

Mobile and fixed site telemetry of the radio tagged LCR fall Chinook salmon revealed a small amount of movement from the majority of the fish from the release sites but several fish from both release sites were documented moving larger distances (Table 5). Fixed telemetry stations were 100% effective in detecting tagged releases past sites based on comparisons and detections histories between mobile and fixed site data but one radio tag (tag code 70) was never detected either during mobile tracking or at a fixed telemetry site suggesting it stopped producing a signal. The Husum Falls fixed site at RM 8.1 never logged a radio tagged fall Chinook salmon during the entire period it was operated and mobile tracking suggested that fish never moved upstream of Husum Falls.

Table 6 presents the last known location of each tagged release and Appendix A provides individual tag detections and locations as well as recovery information. Of the 10 tagged releases from the Husum Falls release site, only one was documented moving down to the face of Condit Dam, after spending some time in the riverine section of the upper White Salmon River near river mile 5.3 (tag code 30, see Appendix A). Two other tagged releases from Husum Falls were documented moving down to the Fordyce telemetry site at RM 6.4 (tag codes 63 and 34). Three of the radio tagged LCR fall Chinook salmon released from Northwestern Lake Boat Ramp were detected upstream of the Fordyce telemetry site (RM 6.4) and 2 of those moved beyond the site closer to the town of Husum, WA. (tag codes 110 and 68). A total of 16 of the 25 radio tagged LCR fall Chinook salmon released at Northwestern Lake Boat Ramp were logged at the Condit Dam fixed site (RM 3.3) showing some downstream or exploratory behavior. Two tagged fish released from the Northwestern Lake Boat Ramp likely died shortly after release based on radio tracking and recovery information (tag codes 24 and 61) and no changes in location.

Not all tags were recovered due to some fish remaining active after the final mobile tracking effort, the tag or fish location precluding recovery, water depth or clarity limiting recovery, and finally time constraints of the project. A total of 10 fish with radio tags were physically recovered during tracking, redd surveys, or concerted efforts on October 17th to recover known carcasses. Each tagged recovery was examined to determine if it successfully spawned (few eggs remaining and signs of redd building such as loss of skin and scales on the caudal area and fin). Of the 10 recovered, 8 successfully spawned, 1 was a partial spawn with approximately 50% of the eggs remaining and physical signs of redd construction on the caudal fin, and 1 was pre-spawn mortality with eggs still somewhat firm in the abdomen and no signs of spawning (Figure 10).

Table 5. Number of radio-tagged Lower Columbia River Fall Chinook salmon that were detected by fixed telemetry sites from either the Husum Falls or Northwestern Lake release site.

Outplant Site	Fixed Telemetry Sites			Tagged LCR Fall Chinook
	Condit Dam Site RM 3.3	Northwestern Lake Park RM 4.9	Fordyce Site RM 6.4	
Husum Falls RM 7.6	NO	NO	NO	7
	NO	NO	YES	2
	YES	YES	YES	1
Northwestern Lake Boat Ramp RM 4.85	NO	NO	NO	1
	NO	YES	NO	5
	NO	YES	YES	3
	YES	NO	NO	1
	YES	YES	NO	15

Table 6. Lower Columbia River Fall Chinook salmon were affixed with a radio tag during September 2008 and released upstream of Condit Dam. Outplant locations are provided as well as Sex (M=male, F=Female), Frequency, Code and Capture Location. Fork Length (in mm) is also provided.

Tag Date	Outplant Location	Sex	Code	Capture Location	Fork Length	Last known or recorded location
9/10/08	Northwestern Lake	F	026	Spring Creek NFH	78	RM 3.2 Condit Dam 9/14
9/10/08	Northwestern Lake	F	028	Spring Creek NFH	82	RM 4.6 Recovered Spawned 10/15
9/10/08	Northwestern Lake	F	032	Spring Creek NFH	91	RM 4.9 9/14
9/10/08	Northwestern Lake	F	110	Spring Creek NFH	90	RM 5.3 Recovered Part. Spawned 10/3
9/10/08	Northwestern Lake	F	114	Spring Creek NFH	78	RM 6.4 Recovered Spawned 9/30
9/15/08	Husum Falls	F	025	White Salmon	82	RM 7.5 near Husum Falls 9/23
9/15/08	Husum Falls	F	030	White Salmon	-	RM 3.2 Condit Dam 10/9
9/15/08	Husum Falls	F	034	White Salmon	82	RM 6.4 Fordyce Road 9/16
9/18/08	Husum Falls	F	063	White Salmon	87	RM 6.5 Fordyce Road 10/6
9/18/08	Husum Falls	F	064	White Salmon	85	RM 7.0 Recovered Spawned 10/17
9/18/08	Husum Falls	F	067	White Salmon	83	RM 7.5 Near Husum Falls 10/6
9/18/08	Husum Falls	F	071	White Salmon	80	RM 7.4 Near Husum Falls 10/6
9/18/08	Husum Falls	F	074	White Salmon	93	RM 6.8 Recovered Spawned 10/3
9/18/08	Husum Falls	F	079	White Salmon	87	RM 7.3 Near Husum Falls 10/6
9/18/08	Husum Falls	F	080	White Salmon	86	RM 7.4 Near Husum Falls 10/6
9/22/08	Northwestern Lake	F	022	White Salmon	76	RM 5.3 9/26
9/22/08	Northwestern Lake	F	023	White Salmon	73	RM 3.2 9/24
9/22/08	Northwestern Lake	M	036	White Salmon	89	RM 4.9 10/10
9/22/08	Northwestern Lake	F	037	White Salmon	87	RM 5.2 10/3
9/22/08	Northwestern Lake	F	070	White Salmon	74	Unknown - No Detections – Faulty Tag
9/22/08	Northwestern Lake	F	072	White Salmon	88	RM 4.9 10/9
9/22/08	Northwestern Lake	F	073	White Salmon	81	RM 5.1 Recovered Spawned 10/3
9/22/08	Northwestern Lake	F	077	White Salmon	85	RM 4.8 10/3
9/22/08	Northwestern Lake	F	078	White Salmon	84	RM 5.2 10/3
9/24/08	Northwestern Lake	F	062	White Salmon	81	RM 5.0 Recovered Spawned 10/17
9/24/08	Northwestern Lake	F	068	White Salmon	83	RM 6.4 Fordyce Road 10/4
9/24/08	Northwestern Lake	F	075	White Salmon	77	RM 5.0 Recovered Pre-Spawn Mort 10/17
9/24/08	Northwestern Lake	F	076	White Salmon	83	RM 4.8 10/3
9/25/08	Northwestern Lake	F	015	Spring Creek NFH	81	RM 4.7 Otter Den 10/15
9/25/08	Northwestern Lake	F	024	Spring Creek NFH	78	RM 3.2 Pre-Spawn Mort 10/10
9/25/08	Northwestern Lake	F	061	Spring Creek NFH	82	RM 3.2 Pre-Spawn Mort 10/15
9/25/08	Northwestern Lake	F	065	Spring Creek NFH	79	RM 4.5 Recovery Spawned 10/15
9/25/08	Northwestern Lake	F	066	Spring Creek NFH	86	RM 4.9 9/26
9/25/08	Northwestern Lake	F	069	Spring Creek NFH	82	RM 4.8 10/3
9/25/08	Northwestern Lake	F	106	White Salmon	78	RM 5.3 Recovered - Spawned

Figure 10. Pictures of recovered carcasses of radio tagged Lower Columbia River fall Chinook salmon recovered during redd surveys. 1) Tag code 075 a pre-spawn mortality recovered at river mile 5.0 with eggs present within the body cavity. 2) Tag code 064 a spawned recovery at river mile 7.0 showing signs of spawning with loss of scales and a heavily eroded caudal fin.

Redd, Adult Salmon and Carcass Survey Results

Three separate redd surveys were conducted on September 29, October 3 and October 17, 2008. Redd surveys were performed from Husum Falls at RM 7.6 to Northwestern Lake Boat Ramp at RM 4.9. Four reaches were identified within the upper White Salmon River as index reaches. Reach 1 was from Husum Falls to a bend in the river at RM 7.1 called "Deadmans Corner". Reach 2 was from RM 7.1 to the entrance of Spring Creek at RM 6.6. Reach 3 was from RM 6.6 to the crossing point for a natural gas pipeline at RM 5.6. Reach 4 was from RM 5.6 to the Northwestern Lake Park at RM 4.9. The White Salmon River from RM 12.0 to Husum Falls at RM 7.6 was surveyed on October 3rd to determine if any spawning had occurred upstream of Husum Falls and no redds or salmon were observed. As a result, this area was not subsequently surveyed. The White Salmon River from Husum Falls to Northwestern Lake was surveyed for redds and carcasses on all surveys, but live counts were conducted on only the last two surveys (Table 7). In addition to the White Salmon River, the lower 50 m of Buck Creek was surveyed on October 3 from reports of fish spawning by local fisherman but no redds were found. A total redd population estimate of 80 was derived by summing the maximum reach counts for each of the three survey dates. We estimated an adult to redd ratio of 5.3 adults/redd and 2.7 females/redd. Maps of redd locations by reach are provided in Appendix B (1-5).

Table 7. Distribution and counts of Chinook redds, live adults and carcasses observed by date and reach between Husum Falls and Northwestern Lake.

Date	Reach	Redd Count	Total Count	Previously Counted Carcasses	New Carcasses or New Marks	Live Count
9/29/2008	1	8	69	NA	0	no counts
	2	11			2	
	3	19			0	
	4	31			5	
10/3/2008	1	18	59	0	2	17
	2	4		0	2	6
	3	17		2	7	36
	4	20		4	20	24
10/17/2008	1	19	66	0	3	5
	2	6		2	2	1
	3	16		2	9	6
	4	25		13	29	5

Discussion

Adult Capture and Success of Capture Methods

When LCR fall Chinook salmon did move into the White Salmon River, we found the use of seines to be the most successful method for the collection and capture of Lower Columbia River Fall Chinook salmon. Trial and error was a large part of the seining and experimentation with sizes and lengths did occur. Use of the 75 foot seine allowed a determination on how to capture salmon in riffle or extremely shallow river sections, which were primarily avoided due to spawning activities. We determined that the longer seines were the most successful, while the shorter seines were largely inadequate in the larger, faster flowing areas. The use of jet boats and 3 or 4 person crews was instrumental in deploying the large seines (200 & 250 feet). A number of factors contributed to successful adult salmon capture using the larger seines but capture was mainly based on their ease of use by the crew, particularly in sections where adult Chinook salmon congregated. In the lower section of the White Salmon River, the current and depth did allow for some holding of fish in deeper sections. Setting seines in these areas provided an opportunity to capture them where other methods, such as a gill net, were not as efficient. With the heavier construction and net size that was used, the seine seemed to handle tangles easily and would adequately move along the river substrate in current forcing fish to respond to its movement. The presence of eddies at either side of the shoreline facilitated seine deployment with an initial upstream deployment (with the eddy), then across the river perpendicular, then downstream and finally across the river again and back into the eddy to the starting point. We solely focused on seining and experimenting with seining when it became apparent that it was effective in almost every set of capturing fish. For the most part, seining occurred in the same areas where the influence of Bonneville Pool transitions into the riverine lower White Salmon River and into an immediate riffle (RM 0.6-0.7). Even with successive passes using the seine in the same location, catch of at least one salmon or steelhead was usually achieved when fish were present. Catch was higher in the morning and tapered off by afternoon. Unfortunately, by the time the decision to focus on seining fish for capture was made during the second full week of the capture period (September 22nd) the LCR fall Chinook salmon run was nearly over.

The seine catch reported in 2008 for this study could also be viewed conservatively. On most sets, some fish were lost or escaped through the net. The designs of the seines used for this study allow for a perpendicular profile in the water when set and did not have “cod” end sewn into them. Fish were lost when one, or a number of fish would hit one side of the seine and lift it from the bottom. Fish not yet within the collapsed seine would then dart underneath. A deeper seine, perhaps 8’ or 10’ that is tied up to fish at 6’ feet depth or with addition lead weighting, would allow for fish to strike a side but not pull it from the bottom. An additional cod collection point in the middle of the seine would also likely collect fish and not allow for a number of escapees.

Initially, gill nets were thought to be the most success in capture of Lower Columbia River fall Chinook salmon. However, we observed many fish actively avoiding gill nets when they were set in the Lower White Salmon River during daylight hours. At first gill nets were floated downstream with the thought that nets would actively float through congregations of fish.

We found that fish sensed the nets and would either move to an open area or simply avoid the net and move downstream. Also, the nets tended to easily snag on the substrate or woody debris, decreasing their effectiveness. As a result we "set" nets with anchor points across the entire section of the lower White Salmon River, effectively blocking passage except for two 6-7 foot sections in the margins of the river. Captures of adult salmonids did occur using this method but we also observed fish coming within feet of the net and then holding immediately behind it or moving to the sides for upstream passage. Often with these sets, debris moving in the current would float into the net, stretch it in the current, and lift it from the substrate and allow for passage or potentially allowing it to be easily detected by fish. Small debris (6-12") would snag nets and consume crew time with their removal or tangle and reduce the effective size of the net. When fish were captured in the net, their removal also was labor intensive, in part because of the panel size that was chosen and the knotless mesh that was used. We chose a 2.5-3" diamond mesh panel, made of nylon fabric rather than monofilament line, to avoid capturing fish around their opercle and presumably cause less stress and damage to captured fish. The net would easily become tangled in the teeth of most fish as well as fins, externally lacerating them or damaging the net by breaking the panel since it was not as strong as a monofilament net. It would often take several minutes to remove fish from the net with it being raised out of the water to untangle the net, potentially increasing stress from handling and capture activities.

We did note that when the seines were employed and when another boat was scouting an area to deploy nets or seines, fish actively avoided the boats and were forced into the gill nets. We did try actively hazing fish into the net without success but did observe other incidental captures when another boat was either transferring fish or when moving to the net to remove debris. These methods did not produce consistent capture results.

Gillnets could have been used during evening or night hours on the White Salmon River with potential success. We did discuss this with the crew members and it was determined unacceptable for 2008 due to concerns with crew safety, fish mortality if we captured large groups at one time, lack of lighting on boats, disruption of the sport fishery in the mouth of the White Salmon and disruption of tribal fisherman using the Underwood In-lieu site.

The use of the White Salmon Ponds (hillside pond) as designed in 2008 was not effective and beneficial to capture, transport and reintroduction of LCR fall Chinook salmon. The water depths in combination with the turbidity in the early portions of the capture period did not enable a visual check of the ponds to determine if fish moved in overnight. When they were checked, fish that were planted there for attractant moved out of the ponds and fish that did enter the containment area escaped to sections of the ponds not checked and were subsequently found when the turbidity declined. Fish were observed in the area of the White Salmon ponds spawning and there were entries into the White Salmon ponds from the river so some active movement into the ponds under this operation did occur. From 2001 to 2005, an estimate of 33-50% of spawning tule fall Chinook salmon in the White Salmon River were upstream of the White Salmon Ponds (Joe Hymer, WDFW, personal communication – electronic correspondence to Rod Engle 11/25/2008) indicating some historical spawning upstream of the White Salmon Ponds has occurred. Historically, the White Salmon Ponds used a weir across the river to improve entrance to the White Salmon Ponds. Additionally, up to 6 cfs was historically used as attractant for fish to enter the ponds, nearly 4 times the number used in 2008.

The Washington Department of Fish and Wildlife was able to estimate a 2008 White Salmon River adult spawning escapement of 775 LCR fall Chinook salmon of which 296 were of hatchery origin (either coded wire tag recoveries or adipose fin clipped) and 479 were not externally marked (Quinten Daugherty, WDFW, personal communication – electronic correspondence to Rod Engle, 2/23/2009). Due to mass marking at Spring Creek NFH (adipose fin clipping), age 2, 3, and 4 hatchery origin returning adults should have been identifiable on spawning grounds based on adipose fin absence or presence of a coded wire tag. Only age 5 adult returns of LCR fall Chinook to the White Salmon during 2008 could not be identified as either hatchery or natural origin. In 2008, only 5 LCR fall Chinook salmon were identified as age 5 by WDFW during the spawning escapement surveys leaving a large number as potentially hatchery origin. Approximately 865 LCR fall Chinook salmon escaped to the White Salmon River with the addition of the 90 LCR fall Chinook captured and transported in during this study. A potential capture efficiency of 18.8% (163/865) was observed in this study for both hatchery and natural origin LCR fall Chinook salmon that escaped to the White Salmon River.

Bonneville Pool Elevation

In terms of capture success of LCR fall Chinook salmon, the Bonneville Pool elevation request for a consistent elevation of +/- 0.5 feet likely removed variables affecting catch in the lower White Salmon River and was beneficial to our capture using seines but cannot be validated. The area that was seined with the most success would likely be little affected by pool elevation changes of +/-1 foot and the seines used in 2008 were effectively fished in 4-11 feet of water with the help of boats. If additional methods of salmon capture are used during the year of dam removal, variable pool elevation may be more beneficial.

2008 Lower Columbia River Fall Chinook Salmon Return

The return of LCR Fall Chinook salmon was slightly later and returned over a shorter period this year based on previous Spring Creek NFH returns and therefore, fish were less available for capture in the White Salmon River. Ideally, capture would have been more effective in the first and second weeks of September but from the first week of active capture results (September 8th -10th); fish had yet to move into the lower White Salmon River. When fish did move into the river, it appeared that there was a 9 day window of capture before higher numbers of recaptures occurred (September 15th-23rd) and the return of fish had moved past the capture area.

Adult Transport and Handling

Transport of captured fish to the holding area by jet boat was very effective and usually without incident with the relatively large, 150-gallon totes of water. Lids on the totes were used on some occasions when catch was high and when the boat was actively seining or transporting

fish to the staging barge. Fish sleeves were fabricated by the Spring Creek NFH staff and were highly effective for holding or moving fish from nets and in and out of totes.

One larger problem that was overcome at the beginning of the study was the use of the staging barge. Initially, the barge was to be pulled down to the Underwood In-Lieu Site to offload all the fish for transfer. Holes in the submerged totes were used to allow constant water exchange. Water temperatures at the locations where salmon were being captured in the White Salmon River were 48°F, but at the Underwood In-Lieu Site temperatures were considerably higher at 68 °F. This precluded the use of the barge in a transport manner since fish would likely die from thermal shock. Consequently captured salmon were transported by the seining boats using the 150-gallon totes and the barge was anchored in the lower White Salmon River as a staging area for transporting salmon.

Holding captured salmon in the staging barge for 1-3 hours could have been improved with better coordination and additional capture or transport staff. With only two seine crews for the study, one crew would remain and attempt capturing fish while the other transported fish to the waiting transfer truck. One person from the crew would also help perform the transfer with WDFW drivers for safety and to assist with backing down the truck, laying grip-strut, and fastening the half-tube for releasing fish at the Husum Falls outplanting site. This left two crew members at the boat ramp to wait for their return or likely, to go back and transfer fish from the other seine crew back to the staging barge. At least a 3-person crew was needed for deployment of the large seines and gill nets. A larger crew of 7-8 people would have remedied the situation along with dependable two-way radio, or cell phone communication with seine crews and the transport truck driver, which didn't always exist. Often when the transport truck returned, the WDFW driver would be enlisted to help capture and move salmon. This provided seining crews with another person to handle fish, record data, and would lead to direct communication about upcoming transfers but the crews would again be short handed when fish transfers occurred. Fish did escape from totes on the staging barge during a fright response when crew would open lids on the barge quickly. After observing this behavior, it was subsequently remedied by slowly opening lids on the staging barge.

The handling and movement of adult Chinook salmon was very good with only the one observed mortality of a male that died in transport to the Underwood In-lieu Site. That mortality was potentially a combination of poor fish health due to spawning activities and capture factors. Collection of fish from Spring Creek NFH was flawless in terms of logistical considerations but improved communications between capture crews and hatchery staff would have tightened the transport schedule, especially when White Salmon River catches declined. The WDFW transport truck operators were excellent, as was the vehicle for maneuvering into the release sites. The action of taking fish from the totes in the jet boats through the entire process of releasing fish at the release sites was overall very good

Radio Tracking and Telemetry

Markedly different movements of radio-tagged Chinook salmon were observed between the two release sites. Radio tagged Chinook salmon at the Husum Falls Site demonstrated a

strong fidelity to that area with 7 of the 10 outplanted adults remaining at or near the outplant site at RM 7.7. Radio-tagged fish released at the Northwestern Lake site showed a large, variable amount of movement with most (15 of 25) showing a large exploratory movement period between the upper and lower portions of Northwestern Lake. These large differences in movement could have been due to the differences in physical site conditions between both sites. The Husum Falls release site is located in a narrow, confined channel with higher water velocities, while the site near the upstream end of Northwestern Lake is much wider and has significantly slower water velocities. Overall, the telemetry efforts showed that the majority of fish dispersed after being released, however, some mortality did occur. For most of the LCR Chinook tagged, mortality was low and what little was observed was likely the result of extra stress imposed while tagging. However, we do not believe tagging and transporting and any associated mortality of LCR Chinook to be an issue if implemented during the year of actual dam removal.

Since a number of fish from both outplant locations moved large distances, the ability of LCR fall Chinook to move within the White Salmon River after a transport did not apprear to be restricted. Some thought may be given to providing an additional outplanting site somewhere in the middle of upper White Salmon to further distribute LCR fall Chinook salmon through the upper White Salmon basin.

Redd and Adult Salmon Surveys

Redd observations in the upper White Salmon study site were widely distributed and individual redds appeared to be located in suitable spawning habitat for fall Chinook salmon. Redd superimposition was not observed in any of the sites, for each of the three redd surveys. This suggests that the number of females moved during this study year was below the carrying capacity of the upper White Salmon and that additional fish could have been transported.

From RM 6.0-7.0 only 18 redds were observed, which is a lower density and suggests that either suitable habitat was not utilizes or the habitat is less suitable. Based on a low redd density and our actual observations of seemingly suitable habitat, we thought this section was underutilized. In addition, since the radio tag data indicated reduced movement through this area we suggest that a third release site be added.

Recommendations For Capture Transport and Reintroduction During Year of Condit Dam Removal.

Based on the results of the 2008 study, and in cooperation, guidance and input from members of the Working Group, we conclude that an adult capture, transport, and reintroduction effort that was conducted in 2008 could meet the Reasonable and Prudent Measures, Terms and Conditions #2 in the NMFS (2006) Biological Opinion that states,

> *"Minimize direct take of listed species during adult salvage operation by following standard hatchery protocols for collecting, holding, and spawning brood stock"*

Several key considerations of a capture, transport and reintroduction plan need further discussion within the Working Group to successfully meet the previously mentioned requirements and the goal of capturing, transporting and reintroducing 500 LCR fall Chinook salmon, something that was not achieved within the 2008 study. Also outstanding is the bull trout handling and protection plan. The following is put forth within the White Salmon River Working group for discussion and eventual recommendation to meet these needs.

Bull Trout Handling and Protection Plan

Bull trout were not encountered during 2008 in the lower White Salmon River using any of the capture methods employed for LCR fall Chinook salmon. Based on statements within the 2002 and 2005 U.S. Fish and Wildlife Service Biological Opinions on Condit Dam Removal, the potential for capture of a bull trout downstream of Condit Dam area and in the White Salmon River is unlikely. Should a bull trout be captured during efforts to capture and transport LCR fall Chinook salmon during the year of dam removal the U.S. Fish and Wildlife Service would require the following actions to be taken.

1. The bull trout should be anesthetized and handled to collect fork length (mm), weight (g) and a photograph with a size reference visible.
2. A genetic fin clip from the upper caudal area no smaller than 1 mm x 1 mm be taken and placed in a vial of 100% ethyl-alcohol. The clip would be analyzed by Abernathy Fish Technology Center for genetic relatedness to know bull trout populations with the Columbia River Basin and Bull Trout Distinct Population Segments.
3. A 12 mm Passive Integrated Transponder (PIT) tag be placed in the fish within the dorsal sinus (if larger than 165 mm) or within the abdominal cavity (less than 165 mm).
4. The bull trout be transported, allowed to recover full from anesthesia and properly acclimated temperatures within the Bonneville Pool immediately upstream of the White Salmon River and released.
5. The collected information and genetic vial be provided to the Columbia River Fisheries Program Office.

These actions would meet the Reasonable and Prudent Measures, Terms and Conditions #5 in the USFWS (2002) Biological Opinion that states,

"Develop and implement a bull trout protection plan, in consultation with the Service, that addresses handling and relocation protocols in the event bull trout are trapped and collected during the fish salvage efforts"

Capture Efforts to Meet 500 LCR Fall Chinook Salmon for Transport

Option 1 - Use of Seines for Capture

The use of only seines during the year of dam removal would likely result in a catch from one to perhaps three times the number caught in 2008 (depending on the amount of effort expended to capture LCR fall Chinook salmon and run size. Likely increases in catch would occur if fish were actively captured from the areas immediately upstream of the first riffle in the lower White Salmon River. There would not be a need to actively protect spawning in this area and fish that had potentially started or were actively building redds could be removed by additional seining.

Additional increases in catch could occur if two shifts of seining crews worked throughout the daylight hours. During 2008, most captures of LCR Fall Chinook salmon occurred from 6:00 AM through 3:30 PM. An additional crew, or crews, working from the mid afternoon through the evening would likely increase catch efforts. Most of the White Salmon River upstream of the White Salmon Ponds is inaccessible to boat and vehicle making efforts to capture and transport fish from other areas unlikely. If LCR Fall Chinook were affected by seining activities during the day to the point of harassment, fish could actively move at night and would not be open to active capture efforts. Likely, a large number of fish do move at night in the White Salmon River.

Cost of this option would likely increase substantially from the 2008 study year with nearly 100% increase in the number of staff required to implement this strategy. Additional equipment may also be required, particularly jet boats use since overlap between crews would likely occur. Also, time would be spent maintaining and filling boats with fuel and maintaining nets gear from day to day.

Option 2 - Use of Seines and White Salmon Ponds for Capture

The use of a temporary weir, either at the ponds or at the seining site is likely the best and most efficient method to conduct an efficient salvage operation in the lower White Salmon River. With the infrastructure in place at the White Salmon Ponds for capture and holding of larger numbers of LCR Fall Chinook, implementation of a weir would be more beneficial than use of seines alone and likely exceed the 500 LCR fall Chinook salmon capture goal. Use of the seines in combination with a weir would also be very beneficial in a low adult return to better represent both spatial and temporal distribution of spawning in the White Salmon River. During 2001-2005, WDFW estimated that one-third to one-half of returning LCR fall Chinook salmon in the White Salmon River spawned upstream of the White Salmon Ponds (J. Hymer, WDFW, personal communication).

Several options of a temporary weir could be investigated. From discussions with WDFW a weir is currently in use on Cedar Creek, WA with success. Also potential options exist with either an electrified barrier immediately upstream of the White Salmon Ponds, similar to electric weirs in place at Northwest hatcheries for collection of brood stock, or implementation of a weir similar to that used by the U.S. Fish and Wildlife Service possibly from Alaska.

Option 3 - Use of Seines, Ponds and Hatchery Origin Fish.

The potential and additional use of SCNFH fall Chinook would be the most comprehensive and account for any unknowns encountered for not meeting or exceeding the capture of 500 LCR fall Chinook salmon for transport and reintroduction into the White Salmon River. Use of the Spring Creek NFH returning adults in 2008 seemed to work effectively with a large number of redds being counted in the upper White Salmon River. From previous discussions within the Working Group, emphasis should be placed on the capture, transport and reintroduction of natural origin LCR fall Chinook salmon.

References

Allen, B. and P. Connolly. 2005. Assessment of the White Salmon watershed using the Ecosystem Diagnosis and Treatment Model. U.S. Geological Survey-Biological Resources Division. Cook, Washington.

Allen, B. and P. Connolly. 2006. Assessment of current use and productivity of fish in the lower White Salmon River prior to the removal of Condit Dam. U.S. Geological Survey-Biological Resources Division. Cook, Washington.

Ashbrook, C.E., K.W. Hassel, J.F. Dixon and A. Hoffman. 2007. Tangle nets. Pages 341-362 in D.H. Johnson, B.M. Shrier, J.S. O'Neal, J.A. Knutzen, X. Augerot, T.A. O'Neil, and T.N. Pearsons. Salmonid field protocols handbook: techniques for assessing status and trends in salmon and trout populations. American Fisheries Society, Bethesda, Maryland.

Engle, R., D. Olson, L. Marchant, and M. Ahrens. 2006. Assessments to Determine the Effect of Current and Alternate Ladder Operations on Brood Stock Collection and Behavior of Tule Fall Chinook Salmon at Spring Creek National Fish Hatchery During 2003-05. Columbia River Fisheries Program Office. Vancouver, Washington.

Federal Energy Regulatory Commission (FERC). 2002. Final Supplemental Final Environmental Impact Statement - Condit Hydroelectric Project, Washington (FERC Project No. 2342).

Hahn, P.K.J., R. Bailey, and A. Ritchie. 2007. Beach seining. Pages 267-324 in D.H. Johnson, B.M. Shrier, J.S. O'Neal, J.A. Knutzen, X. Augerot, T.A. O'Neil, and T.N. Pearsons. Salmonid field protocols handbook: techniques for assessing status and trends in salmon and trout populations. American Fisheries Society, Bethesda, Maryland.

Kernohan, B.J., R.A. Gitzen and J.J. Millspaugh. Analysis of animal space use and movements. Pages 125-166 *In* J. Millspaugh and J. Marzluff, editors. Radio Tracking and Animal Populations. Academic Press, San Diego, California, USA.

NMFS (National Marine Fisheries Service). 1996. Coastal salmon conservation: working guidance for comprehensive salmon restoration initiatives on the Pacific coast. National Marine Fisheries Service, Seattle, Washington.

NMFS. 2006. Biological Opinion for ESA Section 7 Consultation for the Condit Hydroelectric Project (FERC No. 2342) NOAA Fisheries Consultation No. 2002/00977. National Marine Fisheries Service, Northwest Region, Seattle, Washington. October 12.

Normandeau Associates. "White Salmon Subbasin Plan". In Draft Intermountain Subbasin Plan, prepared for the Northwest Power and Conservation Council. Portland, Oregon, May 2004.

Northwest Environmental Services. 2007. Preliminary Design Study – Fish Screening and Related Improvements for Big White Pond Facility on the White Salmon River. Oregon City, Oregon.

PacifiCorp. 1999. Condit Hydroelectric Project Settlement Agreement. Submitted for signature September, 1999.

Smith, C.T., A. LaGrange, W. Arden, R. Engle and D. Olson. 2007. Genetic Analysis of Juvenile Chinook salmon (Oncorhynchus tshawytscha) collected in the White Salmon River. U.S. Fish and Wildlife Service. Abernathy Fish Technology Center. Longview, Washington.

U.S. Fish and Wildlife Service (USFWS). 2002. Endangered Species Act Consultation on Bull Trout (*Salvelinus confluentus*) for the Condit Hydroelectric Project (P-2342). USFWS, Western Washington Office, Lacey Washington. September 6.

USFWS. 2005. Reinitiation of Consultation on Bull Trout and Consultation on Bull Trout Critical Habitat for Condit Dam Removal and Operation. USFWS, Western Washington Office, Lacey Washington. November 30.

Washington Department of Ecology. 2007. Condit Dam Removal Final State Environmental Policy Act (SEPA) Supplemental Environmental Impact Statement. Department of Ecology, Yakima, Washington. Ecology Publication #07-06-012.

Appendix A- Summary of radio tagged Lower Columbia River Fall Chinook salmon released upstream of Condit Dam during 2008 pilot transport study. Outplant location (Northwestern Lake or Husum Falls), radio tracking date, location of detection by river mile (0.1 miles), type of tracking record – either fixed station, mobile detections during bi-weekly surveys (MOBILE) or recovery information is also provided.

White Salmon Radio Tracking 2008
LCR Fall Chinook Salmon Adult Females

Code	Cap Location	Outplant Location	Radio Tracking Date	River Mile	Fixed Site, Mobile, or Recovery	Events
106	White Salmon	Northwestern Lake 9/25/08				
			9/25/2008	3.2	CONDIT DAM	11
			9/26/2008	3.2	CONDIT DAM	15
			9/26/2008	4.9	NORTHWESTERN LAKE	3
			9/27/2008	3.2	CONDIT DAM	16
			9/27/2008	4.9	NORTHWESTERN LAKE	1
			10/3/2008	5.3	MOBILE	1
			10/17/2008	5.0	RECOVERY - SPAWNED	1
110	SCNFH	Northwestern Lake 9/10/08				
			9/10/2008	4.9	NORTHWESTERN LAKE	391
			9/11/2008	4.9	NORTHWESTERN LAKE	617
			9/12/2008	4.9	NORTHWESTERN LAKE	323
			9/13/2008	6.4	FORDYCE ROAD	9
			9/16/2008	7.6	MOBILE	1
			9/29/2008	6.6	MOBILE	1
			10/3/2008	5.1	MOBILE	1
			10/3/2008	5.3	RECOVERY - PARTIAL SPAWNED	1
114	SCNFH	Northwestern Lake 9/10/08				
			9/10/2008	4.9	NORTHWESTERN LAKE	83
			9/17/2008	6.4	FORDYCE ROAD	49
			9/18/2008	6.4	FORDYCE ROAD	53
			9/19/2008	6.4	FORDYCE ROAD	2
			9/29/2008	6.4	FORDYCE ROAD	146
			9/29/2008	6.5	MOBILE	1
			9/30/2008	6.4	FORDYCE ROAD	71
			9/30/2008	6.4	RECOVERY - SPAWNED	1
15	SCNFH	Northwestern Lake 9/25/08				
			9/25/2008	4.9	NORTHWESTERN LAKE	3
			9/26/2008	5.3	MOBILE	1

Code	Cap Location	Outplant Location	Radio Tracking Date	River Mile	Fixed Site, Mobile, or Recovery	Events
			9/27/2008	4.9	NORTHWESTERN LAKE	1
			10/6/2008	4.7	MOBILE	1
			10/15/2008	4.7	UNKNOWN - OTTER DEN	1
22	White Salmon	Northwestern Lake 9/22/08				
			9/22/2008	3.2	CONDIT DAM	10
			9/23/2008	3.3	MOBILE	1
			9/23/2008	3.2	CONDIT DAM	17
			9/24/2008	3.2	CONDIT DAM	12
			9/25/2008	3.2	CONDIT DAM	16
			9/25/2008	4.9	NORTHWESTERN LAKE	5
			9/26/2008	4.9	NORTHWESTERN LAKE	3
			9/26/2008	5.3	MOBILE	1
23	White Salmon	Northwestern Lake 9/22/08				
			9/23/2008	4.9	NORTHWESTERN LAKE	4
			9/23/2008	3.2	CONDIT DAM	5
			9/23/2008	3.7	MOBILE	1
			9/24/2008	4.9	NORTHWESTERN LAKE	1
			9/24/2008	3.2	CONDIT DAM	14
24	SCNFH	Northwestern Lake 9/25/08				
			9/25/2008	4.9	NORTHWESTERN LAKE	2
			9/25/2008	3.2	CONDIT DAM	9
			9/26/2008	3.2	CONDIT DAM	22
			9/27/2008	3.2	CONDIT DAM	24
			9/28/2008	3.2	CONDIT DAM	24
			9/29/2008	3.2	CONDIT DAM	14
			9/30/2008	3.2	CONDIT DAM	10
			10/1/2008	3.2	CONDIT DAM	24
			10/2/2008	3.2	CONDIT DAM	24
			10/3/2008	3.2	CONDIT DAM	22
			10/4/2008	3.2	CONDIT DAM	24
			10/5/2008	3.2	CONDIT DAM	24
			10/6/2008	3.9	MOBILE	1

Code	Cap Location	Outplant Location	Radio Tracking Date	River Mile	Fixed Site, Mobile, or Recovery	Events
			10/6/2008	3.2	CONDIT DAM	23
			10/7/2008	3.2	CONDIT DAM	24
			10/8/2008	3.2	CONDIT DAM	24
			10/9/2008	3.2	CONDIT DAM	22
			10/10/2008	3.2	CONDIT DAM	24
			10/15/2008	3.2	UNKNOWN - MORTALITY	1
25	White Salmon	Husum Falls 9/15/08				
			9/16/2008	7.6	MOBILE	1
			9/20/2008	7.4	MOBILE	1
			9/23/2008	7.5	MOBILE	1
26	SCNFH	Northwestern Lake 9/10/08				
			9/10/2008	4.9	NORTHWESTERN LAKE	90
			9/11/2008	4.9	NORTHWESTERN LAKE	302
			9/12/2008	3.2	CONDIT DAM	808
			9/13/2008	3.2	CONDIT DAM	948
			9/14/2008	4.9	NORTHWESTERN LAKE	3
			9/14/2008	3.2	CONDIT DAM	115
28	SCNFH	Northwestern Lake 9/10/08				
			9/10/2008	3.2	CONDIT DAM	164
			9/11/2008	3.2	CONDIT DAM	830
			9/12/2008	3.2	CONDIT DAM	932
			9/13/2008	3.2	CONDIT DAM	412
			9/14/2008	3.2	CONDIT DAM	438
			9/14/2008	4.9	NORTHWESTERN LAKE	21
			9/15/2008	3.2	CONDIT DAM	4
			9/15/2008	4.9	NORTHWESTERN LAKE	178
			9/16/2008	4.9	NORTHWESTERN LAKE	3
			9/16/2008	5.0	MOBILE	1
			9/16/2008	3.2	CONDIT DAM	4
			9/17/2008	4.9	NORTHWESTERN LAKE	1
			9/17/2008	3.2	CONDIT DAM	10
			9/19/2008	4.9	NORTHWESTERN LAKE	2

Code	Cap Location	Outplant Location	Radio Tracking Date	River Mile	Fixed Site, Mobile, or Recovery	Events
			9/19/2008	3.2	CONDIT DAM	2
			9/20/2008	4.9	NORTHWESTERN LAKE	1
			9/20/2008	3.2	CONDIT DAM	19
			9/20/2008	3.4	MOBILE	1
			10/3/2008	5.3	MOBILE	1
			10/8/2008	4.9	NORTHWESTERN LAKE	3
			10/15/2008	4.6	RECOVERY - SPAWNED	1
30	White Salmon	Husum Falls 9/15/08				
			9/16/2008	7.6	MOBILE	1
			9/19/2008	6.4	FORDYCE ROAD	4
			9/20/2008	4.9	NORTHWESTERN LAKE	4
			9/20/2008	3.2	CONDIT DAM	7
			9/21/2008	4.9	NORTHWESTERN LAKE	1
			9/21/2008	3.2	CONDIT DAM	9
			9/29/2008	5.3	MOBILE	1
			10/3/2008	5.3	MOBILE	1
			10/5/2008	4.9	NORTHWESTERN LAKE	1
			10/6/2008	3.2	CONDIT DAM	3
			10/8/2008	3.2	CONDIT DAM	1
			10/9/2008	3.2	CONDIT DAM	14
32	SCNFH	Northwestern Lake 9/10/08				
			9/10/2008	4.9	NORTHWESTERN LAKE	45
			9/10/2008	3.2	CONDIT DAM	18
			9/11/2008	3.2	CONDIT DAM	917
			9/12/2008	3.2	CONDIT DAM	803
			9/13/2008	3.2	CONDIT DAM	674
			9/13/2008	4.9	NORTHWESTERN LAKE	1
			9/14/2008	3.2	CONDIT DAM	249
			9/14/2008	4.9	NORTHWESTERN LAKE	6
34	White Salmon	Husum Falls 9/15/08				
			9/16/2008	6.3	MOBILE	1
			9/16/2008	6.4	FORDYCE ROAD	2

Code	Cap Location	Outplant Location	Radio Tracking Date	River Mile	Fixed Site, Mobile, or Recovery	Events
36	White Salmon	Northwestern Lake 9/22/08				
			9/22/2008	3.2	CONDIT DAM	8
			9/22/2008	4.9	NORTHWESTERN LAKE	6
			9/23/2008	3.2	CONDIT DAM	11
			9/23/2008	4.9	NORTHWESTERN LAKE	4
			9/29/2008	5.7	MOBILE	1
			10/4/2008	4.9	NORTHWESTERN LAKE	1
			10/10/2008	4.9	NORTHWESTERN LAKE	2
37	White Salmon	Northwestern Lake 9/22/08				
			9/22/2008	4.9	NORTHWESTERN LAKE	5
			9/29/2008	5.0	MOBILE	1
			10/3/2008	5.2	MOBILE	1
61	SCNFH	Northwestern Lake 9/25/08				
			9/25/2008	4.9	NORTHWESTERN LAKE	3
			9/25/2008	3.2	CONDIT DAM	10
			9/26/2008	4.9	NORTHWESTERN LAKE	1
			9/26/2008	3.2	CONDIT DAM	22
			9/27/2008	3.2	CONDIT DAM	21
			9/28/2008	3.2	CONDIT DAM	19
			9/29/2008	3.2	CONDIT DAM	4
			9/30/2008	3.3	MOBILE	1
			9/30/2008	3.2	CONDIT DAM	9
			10/1/2008	3.2	CONDIT DAM	24
			10/2/2008	3.2	CONDIT DAM	24
			10/3/2008	3.2	CONDIT DAM	24
			10/4/2008	3.2	CONDIT DAM	24
			10/5/2008	3.2	CONDIT DAM	24
			10/6/2008	3.9	MOBILE	1
			10/6/2008	3.2	CONDIT DAM	24
			10/7/2008	3.2	CONDIT DAM	24
			10/8/2008	3.2	CONDIT DAM	24
			10/9/2008	3.2	CONDIT DAM	24

Code	Cap Location	Outplant Location	Radio Tracking Date	River Mile	Fixed Site, Mobile, or Recovery	Events
			10/10/2008	3.2	CONDIT DAM	24
			10/15/2008	3.2	UNKNOWN - TAG ON SHORELINE	1
62	White Salmon	Northwestern Lake 9/24/08				
			9/24/2008	4.9	NORTHWESTERN LAKE	4
			9/29/2008	5.7	MOBILE	1
			9/30/2008	6.3	MOBILE	1
			10/17/2008	5.0	RECOVERY - SPAWNED	1
63	White Salmon	Husum Falls 9/18/08				
			9/18/2008	6.4	FORDYCE ROAD	25
			9/19/2008	6.4	FORDYCE ROAD	1
			9/20/2008	6.4	FORDYCE ROAD	236
			9/21/2008	6.4	FORDYCE ROAD	29
			9/22/2008	6.4	FORDYCE ROAD	181
			9/23/2008	6.1	MOBILE	1
			9/23/2008	6.4	FORDYCE ROAD	291
			9/24/2008	6.4	FORDYCE ROAD	32
			9/25/2008	6.4	FORDYCE ROAD	5
			9/27/2008	6.4	FORDYCE ROAD	1
			9/28/2008	6.4	FORDYCE ROAD	1
			9/29/2008	6.4	FORDYCE ROAD	2
			9/29/2008	6.4	MOBILE	1
			9/30/2008	6.4	FORDYCE ROAD	4
			9/30/2008	6.4	MOBILE	1
			10/1/2008	6.4	FORDYCE ROAD	3
			10/2/2008	6.4	FORDYCE ROAD	1
			10/3/2008	6.4	FORDYCE ROAD	2
			10/3/2008	6.6	MOBILE	1
			10/6/2008	6.5	MOBILE	1
64	White Salmon	Husum Falls 9/18/08				
			9/20/2008	7.4	MOBILE	1
			9/23/2008	7.5	MOBILE	1
			9/26/2008	7.3	MOBILE	1

Code	Cap Location	Outplant Location	Radio Tracking Date	River Mile	Fixed Site, Mobile, or Recovery	Events
			9/30/2008	7.2	MOBILE	1
			10/3/2008	7.5	MOBILE	1
			10/6/2008	7.4	MOBILE	1
			10/17/2008	7.0	RECOVERY - SPAWNED	1
65	SCNFH	Northwestern Lake 9/25/08				
			9/25/2008	4.9	NORTHWESTERN LAKE	5
			9/26/2008	5.1	MOBILE	1
			9/29/2008	4.8	MOBILE	1
			10/15/2008	4.5	RECOVERY - SPAWNED	1
66	SCNFH	Northwestern Lake 9/25/08				
			9/25/2008	3.2	CONDIT DAM	9
			9/25/2008	4.9	NORTHWESTERN LAKE	7
			9/26/2008	3.2	CONDIT DAM	10
			9/26/2008	4.9	NORTHWESTERN LAKE	3
67	White Salmon	Husum Falls 9/18/08				
			9/20/2008	7.5	MOBILE	1
			9/23/2008	7.6	MOBILE	1
			9/26/2008	7.6	MOBILE	1
			9/30/2008	7.6	MOBILE	1
			10/3/2008	7.6	MOBILE	1
			10/6/2008	7.5	MOBILE	1
68	White Salmon	Northwestern Lake 9/24/08				
			9/24/2008	4.9	NORTHWESTERN LAKE	3
			9/28/2008	6.4	FORDYCE ROAD	48
			9/29/2008	6.9	MOBILE	1
			9/29/2008	6.4	FORDYCE ROAD	14
			10/4/2008	6.4	FORDYCE ROAD	24
69	SCNFH	Northwestern Lake 9/25/08				
			9/25/2008	4.9	NORTHWESTERN LAKE	3
			9/26/2008	5.2	MOBILE	1
			9/27/2008	4.9	NORTHWESTERN LAKE	2

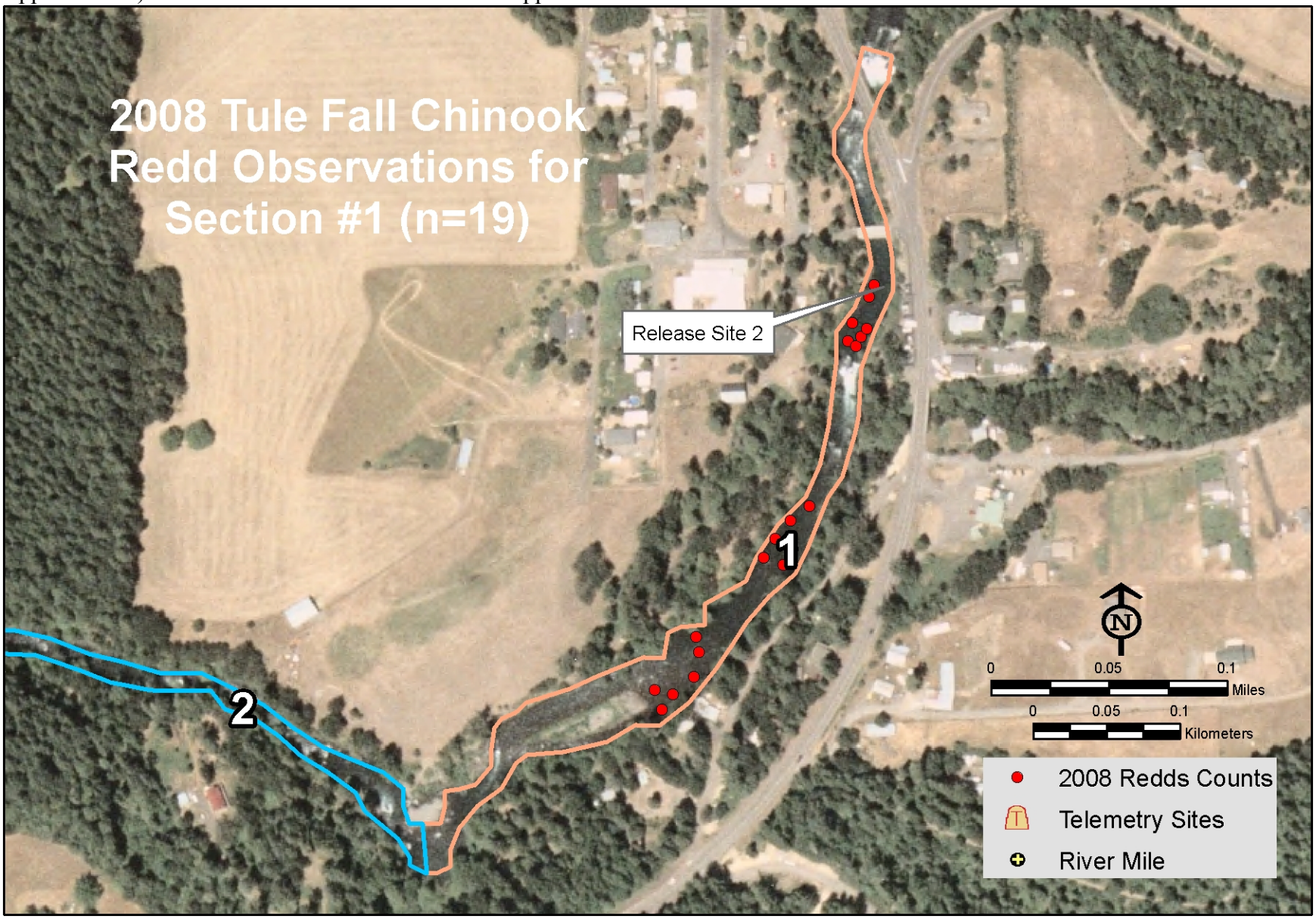
Code	Cap Location	Outplant Location	Radio Tracking Date	River Mile	Fixed Site, Mobile, or Recovery	Events
			9/29/2008	4.8	MOBILE	1
			10/3/2008	4.8	MOBILE	1
71	White Salmon	Husum Falls 9/18/08				
			9/20/2008	7.4	MOBILE	1
			9/23/2008	7.6	MOBILE	1
			9/26/2008	7.5	MOBILE	1
			9/30/2008	7.5	MOBILE	1
			10/3/2008	7.5	MOBILE	1
			10/6/2008	7.4	MOBILE	1
72	White Salmon	Northwestern Lake 9/22/08				
			9/22/2008	3.2	CONDIT DAM	6
			9/22/2008	4.9	NORTHWESTERN LAKE	1
			9/23/2008	3.2	CONDIT DAM	20
			9/23/2008	4.9	NORTHWESTERN LAKE	2
			9/29/2008	5.4	MOBILE	1
			10/3/2008	5.3	MOBILE	1
			10/9/2008	4.9	NORTHWESTERN LAKE	3
73	White Salmon	Northwestern Lake 9/22/08				
			9/22/2008	3.2	CONDIT DAM	4
			9/22/2008	4.9	NORTHWESTERN LAKE	9
			9/23/2008	3.2	CONDIT DAM	14
			9/23/2008	4.9	NORTHWESTERN LAKE	1
			9/29/2008	5.0	MOBILE	1
			10/3/2008	5.1	RECOVERY - SPAWNED	1
74	White Salmon	Husum Falls 9/18/08				
			9/20/2008	7.4	MOBILE	1
			9/23/2008	7.5	MOBILE	1
			9/26/2008	7.3	MOBILE	1
			9/30/2008	7.3	MOBILE	1
			10/3/2008	7.3	MOBILE	1
			10/17/2008	6.8	RECOVERY - SPAWNED	1

Code	Cap Location	Outplant Location	Radio Tracking Date	River Mile	Fixed Site, Mobile, or Recovery	Events
75	White Salmon	Northwestern Lake 9/24/08				
			9/24/2008	3.2	CONDIT DAM	2
			9/24/2008	4.9	NORTHWESTERN LAKE	6
			9/25/2008	4.9	NORTHWESTERN LAKE	2
			9/25/2008	3.2	CONDIT DAM	13
			9/29/2008	5.3	MOBILE	1
			10/3/2008	5.1	MOBILE	1
			10/17/2008	5.0	RECOVERY - PRESPAWN MORT.	1
76	White Salmon	Northwestern Lake 9/24/08				
			9/24/2008	4.9	NORTHWESTERN LAKE	6
			9/25/2008	4.9	NORTHWESTERN LAKE	1
			9/25/2008	3.2	CONDIT DAM	2
			10/3/2008	4.8	MOBILE	1
			10/5/2008	4.9	NORTHWESTERN LAKE	1
77	White Salmon	Northwestern Lake 9/22/08				
			9/22/2008	3.2	CONDIT DAM	7
			9/23/2008	3.2	CONDIT DAM	23
			9/24/2008	3.2	CONDIT DAM	22
			9/25/2008	3.2	CONDIT DAM	21
			9/26/2008	3.2	CONDIT DAM	23
			9/27/2008	3.2	CONDIT DAM	21
			9/28/2008	3.2	CONDIT DAM	24
			9/29/2008	3.2	CONDIT DAM	4
			10/3/2008	4.8	MOBILE	1
78	White Salmon	Northwestern Lake 9/22/08				
			9/22/2008	4.9	NORTHWESTERN LAKE	5
			9/22/2008	3.2	CONDIT DAM	8
			9/23/2008	3.2	CONDIT DAM	14
			9/24/2008	3.2	CONDIT DAM	7
			9/25/2008	4.9	NORTHWESTERN LAKE	3
			9/25/2008	3.2	CONDIT DAM	16
			9/26/2008	5.3	MOBILE	1

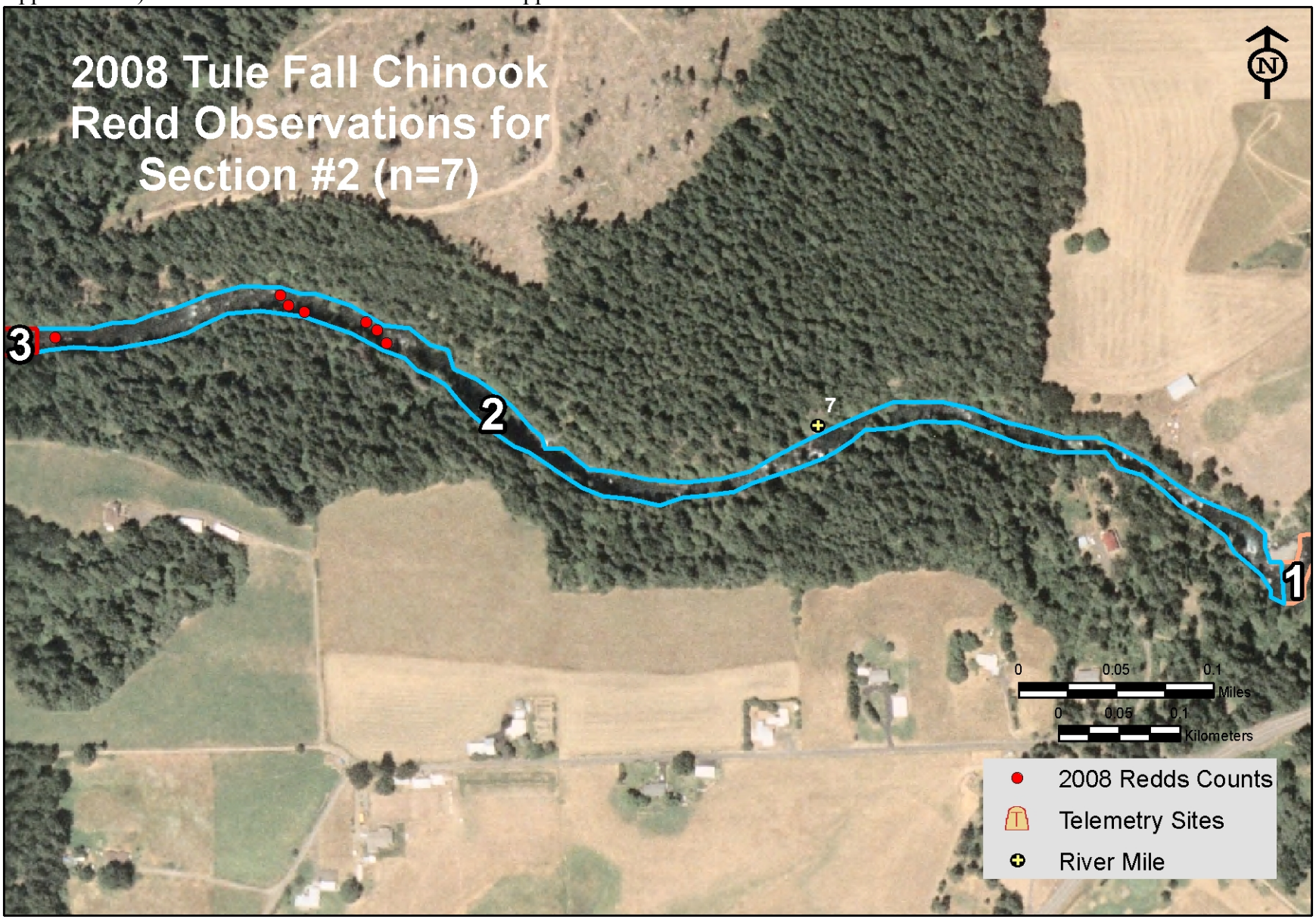
Code	Cap Location	Outplant Location	Radio Tracking Date	River Mile	Fixed Site, Mobile, or Recovery	Events
			9/26/2008	4.9	NORTHWESTERN LAKE	7
			9/27/2008	4.9	NORTHWESTERN LAKE	5
			10/3/2008	5.2	MOBILE	1
79	White Salmon	Husum Falls 9/18/08				
			9/20/2008	7.4	MOBILE	1
			9/23/2008	7.5	MOBILE	1
			9/26/2008	7.3	MOBILE	1
			9/30/2008	7.3	MOBILE	1
			10/3/2008	7.3	MOBILE	1
			10/6/2008	7.3	MOBILE	1
80	White Salmon	Husum Falls 9/18/08				
			9/20/2008	7.5	MOBILE	1
			9/23/2008	7.6	MOBILE	1
			9/26/2008	7.4	MOBILE	1
			9/30/2008	7.5	MOBILE	1
			10/3/2008	7.5	MOBILE	1
			10/6/2008	7.4	MOBILE	1

Appendix B - Redd distribution maps within the White Salmon Basin of outplanted lower Columbia River hatchery-origin fall Chinook salmon during 2008.

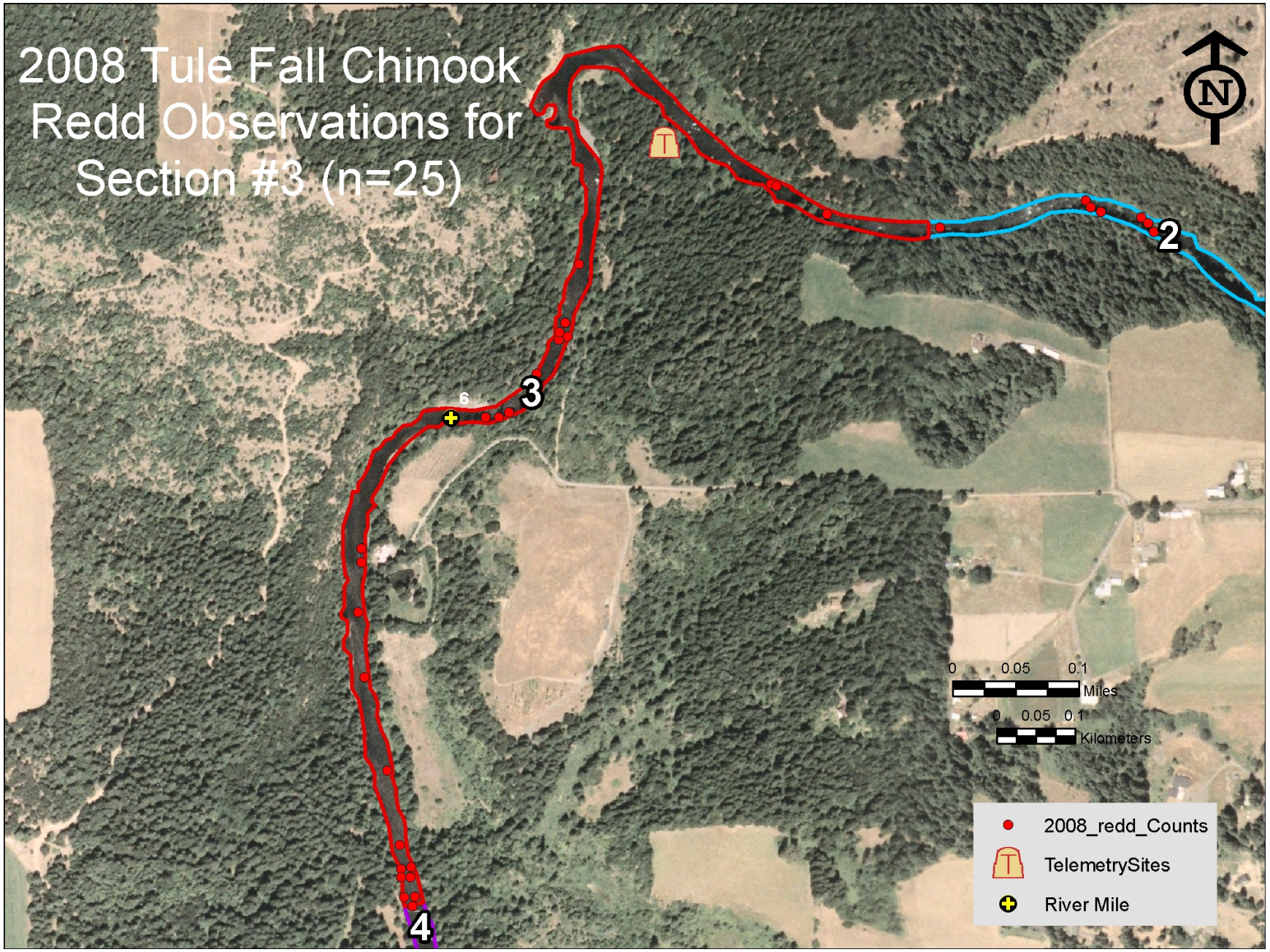
Appendix B.1) Distribution of redds observed and mapped in section 1



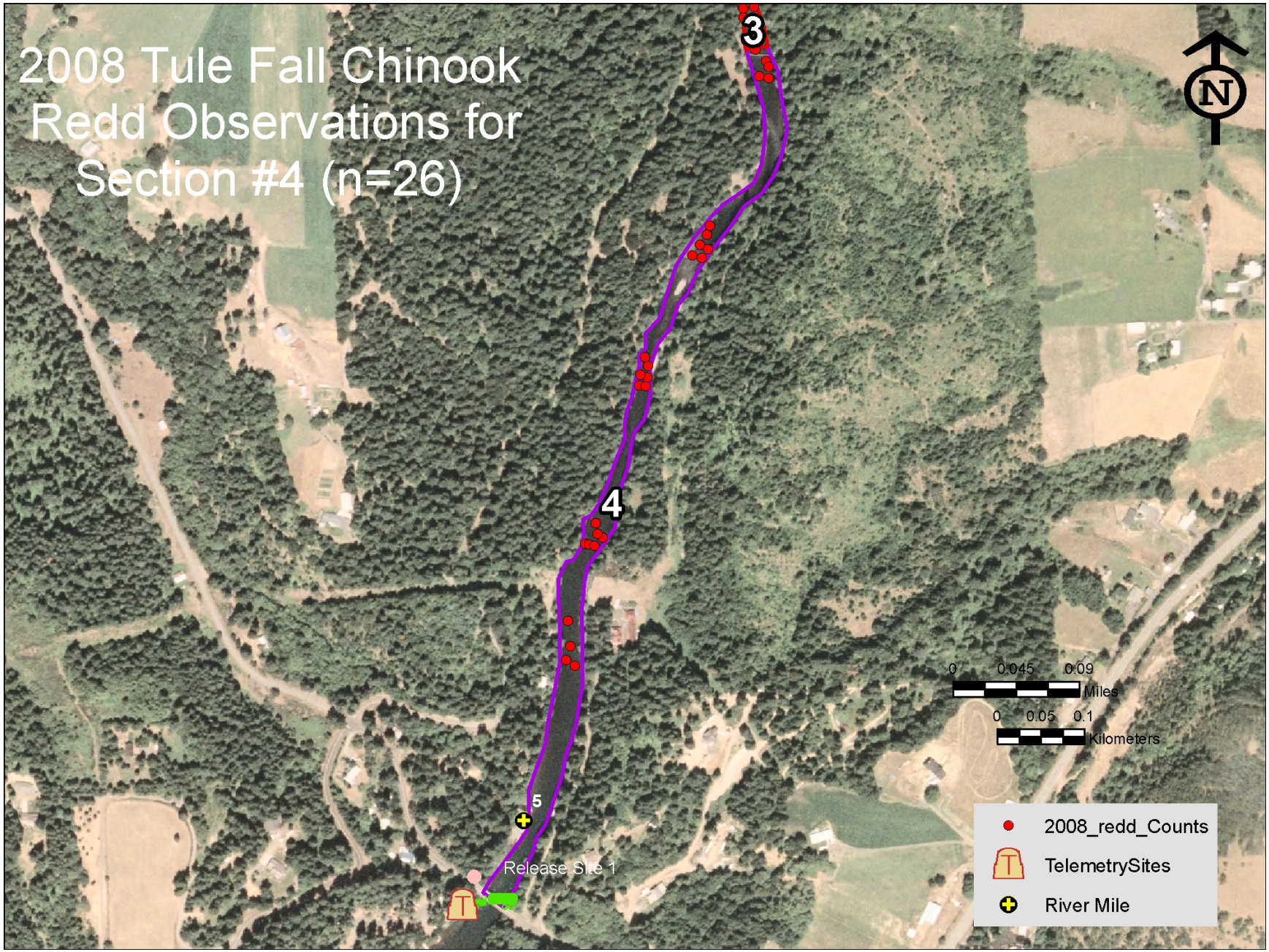
Appendix B.2) Distribution of redds observed and mapped in section 2.



Appendix B.3) Distribution of redds observed and mapped in section 3.



Appendix B.4) Distribution of redds observed and mapped in section 4.


2008 Tule Fall Chinook
Redd Observations for
Section #4 (n=26)
3
4
5
Release Site 1
N
0 0.045 0.09
Miles
0 0.05 0.1
Kilometers
2008_redd_Counts
TelemetrySites
River Mile

Appendix B.5) Distribution of redds observed and mapped in sections 1-4.