FINAL Meeting Notes
Lewis River License Implementation
Aquatic Coordination Committee (ACC) Meeting
September 14, 2006
Ariel, WA

ACC Participants Present (19)

Craig Burley, WDFW
Clifford Casseseka, Yakama Nation (via teleconference 11:30 – 1:00pm)
John Clapp, Lewis River Citizens-at-large (via teleconference 11:20am)
Diana Gritten-MacDonald, Cowlitz PUD
Adam Haspiel, USDAFS
LouEllyn Jones, USFWS (via teleconference)
George Lee, Yakama Nation (via teleconference 11:30 – 1:00pm)
Curt Leigh, WDFW (via teleconference)
Erik Lesko, PacifiCorp Energy
Kaitlin Lovell, Trout Unlimited
Jim Malinowski, Fish First (via teleconference)
Kimberly McCune, PacifiCorp Energy
Kate Miller, Trout Unlimited
Bryan Nordlund, NMFS (via teleconference)
Todd Olson, PacifiCorp Energy
Frank Shrier, PacifiCorp Energy
Karen Thompson, USDAFS
Richard Turner, NMFS (via teleconference)
Shannon Wills, Cowlitz Indian Tribe (9:00am – 1:00pm)

Calendar:

Sept. 18, 2006	Hatchery Engineering Subgroup Kick-off Meeting	Merwin Hydro
Sept. 25, 2006	Merwin Engineering Subgroup Meeting	Merwin Hydro
Oct. 11, 2006	TCC Meeting	Merwin Hydro
Oct. 12, 2006	ACC Meeting	Merwin Hydro
Oct. 31, 2006	Merwin Engineering Subgroup Meeting	Merwin Hydro

Assignments from September 14th Meeting:	**Status:**
Shrier: Email revised Merwin trap data to ACC.	**Complete – 9/18/06**
George Lee: Discuss the tribes ceremonial and subsistence needs in more detail with the appropriate tribal staff person to determine the fish number they need annually and get information to Craig Burley (WDFW).	**Pending**
Burley: Email preliminary WDFW results to ACC relating to the *Hatchery & Supplementation Plan Spring Chinook, Coho, and Steelhead* discussion. (provided verbally at 10/12/06 ACC meeting)	**Complete – 10/12/06**
McCune: Email to the ACC requesting comment on the *Fish Handling Process Diagram* on or before September 22, 2006.	**Complete – 9/18/06**

Assignments from July 13th Meeting:	Status:
Keown: Create a draft HGMP by the end of August or early September 2006 so the ACC can review prior to submitting the final version to NMFS.	**ACC can expect to receive draft by approx. 10/31/06**

Opening, Review of Agenda and Meeting Notes

Frank Shrier (PacifiCorp Energy) called the meeting to order at 9:15 a.m. He conducted a review of the agenda for the day and requested a round table introduction for those attendees participating via teleconference. Shrier asked if attendees had any changes to the Agenda; no changes were requested. Shrier requested comments and/or changes to the ACC 8/10/06 draft ACC meeting notes. The following changes were requested:

LouEllyn Jones (USFWS) requested the removal of Attachment E – Draft Notes relating to the Bull Trout Limiting Factors Analysis and Craig Burley (WDFW) requested a revision and clarification relating to Assumption 5, page 3 to read as follows:

Assumption 5 – Did not have agreement on this assumption by all ACC participants present.

Kimberly McCune (PacifiCorp Energy) will make the changes and finalize the August 10, 2006 meeting notes and post to the Lewis River website. The ACC attendees present accepted the August 10 meeting notes with the requested changes at 9:25am.

ATE Model and Merwin Tailrace Behavior Study - Presentation

Shrier led a discussion on the results of a sensitivity analysis of salmon population size above the Lewis River projects to differences in adult and juvenile trapping efficiency for upstream passage. The analysis was prepared by *Cramer Fish Sciences, Inc.*, relating to *Adult Passage Modeling* (Attachment A). Cramer provided analyses for two passage alternatives:

Analysis 1: Collection of juveniles and adults at all 3 dams.
Analysis 2: Collection of juveniles only at Swift and of adults only at Merwin.

Shrier also advised the ACC attendees that an Adult Trap Efficiency (ATE) Subgroup has been formed and the following attendees met for their first meeting on September 7, 2006. The attendees were:

Michelle Day, NMFS
Janne Kaje, Steward & Assoc.
Frank Shrier, PacifiCorp Energy
Curt Leigh, WDFW
Clifford Casseseka, Yakama Nation
George Lee, Yakama Nation
LouEllyn Jones, USFWS
John Weinheimer, WDFW

The ATE Subgroup is not ready to finalize an ATE value, but proposed the following question to the Engineering Subgroup:

Given an ATE target of 95% for the Merwin Trap, what facility concepts/designs can be used to attain this target?

This question was provided to Sean Flak (PacifiCorp Engineer) so the engineering team could address at the next Engineering Subgroup meeting (September 25, 2006).

The Cramer analysis only assumes up-river production. Shrier provided the following Merwin Trapping Data as additional information to consider when formulating the ATE:

Total fish counts at the Merwin Trap for 2004 to 2006
(trap count incomplete for coho and summer steelhead for 2006)

Stock	Low	Mean	High
S. Chinook	622	3,453	5,380
S Coho	7,674	9,782	11,891
N Coho	6,782	6,965	7,148
Winter Steelhead	1,366	1,940	2,259
Summer Steelhead	11,298	12,566	13,959
Total	27,742	34,696	40,637

*Trapping more fish than Cramer model assumes.

Malinowski expressed concern that the models being used for those forecasts were producing unrealistically low forecasts and questioned the wisdom of using forecasts from flawed models to plan for upper basin recovery programs.

Merwin Tailrace Behavior Study – Presentation by MaryLou Keefe, R2 Resources

MaryLou Keefe (R2 Resources) led the discussion on the PowerPoint presentation (Attachment B) summarizing the following five (5) objectives:

1. Estimate the abundance of adult salmonids entering the tailrace daily.
2. Estimate the number of trap entry attempts made by adult salmonids in the tailrace.
3. Estimate the number of adult fish that enter the trap and become captive.
4. Determine what (if any) tailrace conditions impede fish movement into the trap.
5. If tailrace conditions preclude trap entry or cause migration delay what locations would be preferred for a new trap entrance?

Keefe further communicated the following conclusions based upon their study:

1. No evidence that operation treatment resulted in delay. Total time in the tailrace was between treatment groups for each stock tested.
2. All stocks changed their use pattern associated with operation of Unit 1, indicating that additional trap entrances located near Unit 2 and 3 discharges may be attractive to fish.
3. Current trap has limitations with respect to attraction for coho and chinook salmon and with entry for all species.

The Draft report "September 5, 2006" was submitted to the ACC representatives on September 6, 2006. **Comments on the draft are due to PacifiCorp by October 6, 2006**.

Break <11:05am>
Reconvene <11:15am>

Aquatic Fund – Need for revision to Strategic Plan and Administrative Procedures?

Todd Olson (PacifiCorp Energy) noted that the 2006/07 Aquatic Funding process was initiated on September 5, 2006. With the initiation of the process, Olson wanted to check in with ACC members to identify any changes that should be considered and appropriately adopted to the Plan and Procedures. Olson reviewed the Plan schedule of Table 4.1 (see below) with the ACC attendees. He identified some modifications with respect to the activities of notifying FERC and subsequent contracting.

Olson also requested the ACC attendees to tell any other potential project owners about the availability of funds for aquatic related projects in the Lewis River Basin and the opportunity to submit proposals for Resource Project funding. The deadline for the Pre-Proposals is October 6, 2006.

Table 4.1. Funding Process Timeline

Activity	Target Milestone Date
Submit Request For Pre-Proposal Forms	Early September
Pre-Proposal Forms due	Early October
Pre-Proposal Listing and Evaluation Report Submitted to ACC	Early November
Pre-Proposal Report Comments due from ACC	Late November
Finalize List of Selected Projects for Additional Consideration *(Include FERC in distribution)*	Early December
Submit Request For Proposals to Selected Applicants	Early December
Proposals due	Late January
Proposal Evaluation Report Submitted to ACC (30 day review)	Mid February
Proposal Report Comments due	Mid March
Finalize List of Selected Projects *(and Notify Project Funding Recipients – remove)*	Early April
Contract Procurement	April
Submit Report To FERC	May
Funding Available for Invoicing	April
Proposed changes:	
Submit Report To FERC	*Mid April*
Notify Project Funding Recipients	*May (Post FERC approval)*
Contract Procurement	*May/June*
Funding Available for Invoicing	*June*

Karen Thompson (USDAFS) suggested submitting Pre-Proposals to FERC as a heads up to allow them additional time for review. Olson communicated that he could copy FERC then when PacifiCorp submits the final proposals we ask for a 30-day turnaround.

Adam Haspiel (USDAFS) suggested we have a deadline date for submittal of Pre-Proposals and push the mid January date for final proposals be changed to Late January. Olson indicated that PacifiCorp could change the submittal date for final proposals to late January.

Shrier asked how the ACC feels about entertaining scientific study proposals as in addition to habitat improvement projects.

Jim Malinowski (Fish First) communicated that he preferred *not* including scientific studies. He also stated that we have limited funds and should focus on the on-the-ground projects, not studies given those limited resources. Craig Burley (WDFW) indicated that he wants consistency with the Settlement Agreement (SA) but if there is appropriate work consistent with the SA that we should consider it. Burley is not comfortable with categorically excluding all scientific studies.

Olson said that on the ground work receives higher points in the evaluation per the aquatic fund criteria established by the ACC in 2005.

Clifford Casseseka (Yakama Nation) suggested that the ACC investigate acquiring funds from Skamania County. Diana Gritten-MacDonald (Cowlitz PUD) communicated that it is the responsibility of the project proponent to pursue matching funds as part of their proposal(s).

General discussion took place regarding requesting funds from Skamania County, the Skamania County Vision Plan, which is open for public comment, clustering and housing density.

Olson will make the requested modifications to the *Funding Process Timeline* (Table 4.1).

ACC participants in attendance did not request any other changes to the *Strategic Plan and Administrative Procedures* document.

Review of Hatchery & Supplementation Plan Spring Chinook, Coho, and Steelhead Spreadsheets (Attachment C)

Olson asked the ACC attendees if they had reviewed the timeline. Olson has received some comments on the Spring Chinook (SPCH) but not on the balance of the spreadsheets. He communicated that the intent of the timeline was to start in 2006 and go out ten years. If the ACC attendees could agree on the activities and associated schedule within the tables, PacifiCorp would accordingly propose language in an updated H&S Plan.

General discussion took place regarding SPCH – No Wild timeline, keeping track of non-adipose fish, always looking for wild fish, rearing fish for juvenile supplementation program, timeline of returning fish, integrating fish in brood stock program, naturalized fish, surplus SPCH in the upper watershed, review of Tribal needs on an annual basis, accelerate condition of fish, limited production of SPCH in lower river, enhancement of Habitat Preparation Plan fish, and SPCH residualization.

George Lee (Yakama Nation) will discuss their ceremonial and subsistence needs in more detail with tribal staff person to determine the number they need annually and get that information to Craig Burley (WDFW).

Olson communicated that PacifiCorp is still in the review process and discussion will be considered as we proceed with creation of an updated Hatchery & Supplementation Plan. Olson will review the Steelhead spreadsheet with Rich Turner (NMFS), review the requested modifications and add clarity.

Lunch <1:00pm>
Reconvene <1:10pm>

Swift Design Handling Criteria

In review of the criteria, Shrier informed the ACC attendees that the estimated juvenile bull trout number provided by R2 Resources derived from checking with the Baker Floating Surface Collection project and the use of a best educated guess.

Olson expressed that PacifiCorp's Engineering team needs ACC approval of the fish estimates and the handling process to direct the engineers as they prepare the 30% design

Shrier presented a brief overview with more detailed explanation of the Fish Handling Process Diagram and the process flow relating specifically to adults, smolts and fry. The peak number could be as high as 48,000 fish in one day.

Concern was expressed about anesthetizing a large quantity of fish in order to select out the stocked hatchery rainbow trout.

PacifiCorp will follow up with an email to the ACC requesting final comment on or before September 22, 2006 relating to the Biological Criteria and Process Diagram.

The ACC attendees present approved the information within the *Biological Criteria For Swift Sorting and Transport Design* (Table 1 of the Tech Memo) and the *Fish Handling Process Diagram* to be used for design of the Swift Downstream Fish Collector. Three comments on the documents were provided and have been forwarded to the Engineering Design team. The first is the request that the design should consider the location/installation of additional tag monitoring mechanisms. The second is developing an alternative fish separator. The third is consideration of collecting and returning hatchery rainbow back into Swift Reservoir. These items will be addressed by the design team.

Study Updates

Shrier provided the following study updates:

Yale Entrainment Study – R2 Resources are currently working on completing the report and PacifiCorp will send it out for ACC review as soon as available.

Bull Trout Limiting Factors Analysis – Field work to begin week of 9/18/06 and will start out with Swift Creek. Four adult Bull Trout were found this summer in Swift Creek. Crews will gather habitat data then move on to evaluating other streams.

Speelyai Hatchery Expansion – Water supply line has been separated with gate valve, currently in permitting and hopeful this phase will not hold up the schedule. The Hatchery Subgroup is meeting on Monday, September 18, 2006 at Merwin from 1:00pm – 3:00pm.

Agenda items for October 12, 2006

- Aquatic Fund – Pre-Proposal Brief Overviews
- Further review of H&S Actions Spreadsheets
- Decision points on ATE
- Decision points on Design Criteria
- Study Updates

Next Scheduled Meetings

October 12, 2006	November 9, 2006
Merwin Hydro Facility	Merwin Hydro Facility
Ariel, WA	Ariel, WA
9:00am – 3:00pm	9:00am – 3:00pm

Meeting Adjourned at 2:15p.m.

Handouts

- Final Agenda
- Draft Meeting Notes 8/10/06
- Cramer Fish Sciences, Inc Memorandum – Adult Passage Modeling, April 7, 2006 (Attachment A)
- Merwin Tailrace Behavior Study – PowerPoint (Attachment B)
- Aquatic Fund – Strategic Plan and Administrative Procedures – September 2005
- Timeline of H&S Actions Spreadsheets – (Attachment C)

DRAFT

Attachment A

CRAMER FISH SCIENCES, INC.
600 NW FARISS ROAD
GRESHAM OR 97030

To: Frank Shrier, PacifiCorp

From: Ray Beamesderfer

Date: April 7, 2006

Re: Adult Passage Modeling

This memo summarizes results of a sensitivity analysis of salmon population size above the Lewis River projects to differences in adult and juvenile trapping efficiency for upstream passage. Analyses were completed using as simple life cycle population model described in a 2004 Lewis River Fish Planning Document prepared by S.P. Cramer and Associates. Analyses were completed for two passage alternatives:

Analysis 1: Collection of juveniles and adults at all 3 dams.

Analysis 2: Collection of juveniles only at Swift and of adults only at Merwin.

Contents

#1: Three Dam Trap & Transport – Collection Efficiency Sensitivity Analysis

Summary

- The modeled passage scenario included juvenile and adult trap and transport at all three dams. Juvenile downstream migrants trapped at each dam were released downstream from Merwin Dam. Adults upstream migrants were trapped at each dam and released immediately upstream from each dam. Natural production occurred in tributaries to all three reservoirs although most habitat occurs upstream from Swift.
- Default passage assumptions (95% adults, 70% juveniles) result in estimated equilibrium spawner numbers of 1,200 spring chinook, 9,300 coho, and 1,400 steelhead.
- Projections were based on habitat capacity for spawning and rearing in Merwin, Yale, and Swift reservoir tributaries previously estimated with the EDT model, long term average marine survival rates, and projected future fishing rates.
- Projected average adult population sizes are quite sensitive to assumed adult trapping efficiencies. For instance, a reduction of adult trapping efficiency from 95% to 80% is projected to reduce fish numbers by half or more.

Species	Adult trapping efficiency			
	0.95	**0.80**	**0.70**	**0.60**
Spring Chinook	1,200	500	100	1
Coho	9,300	4,700	2,300	400
Steelhead	1,400	700	400	200

- Default passage assumptions including a 95% adult trapping efficiency result in an average net 78% adult passage survival to spawning. A 70% juvenile collection efficiency results in an average net 77% juvenile passage survival to spawning. The combined project effect is equivalent to an average 60% survival or a 40% impact. Net project impacts increase rapidly with declining passage efficiencies.

Methods

Simulations were conducted with the same salmon life cycle population modeling approach previously used during 2004 analyses of passage alternatives. The model was used tô evaluate the sensitivity of equilibrium population numbers to a range of assumed adult trap efficiencies (60%, 70%, 80%, 95%) for spring chinook, coho, and steelhead. Original analyses were completed only for an assumed a 95% adult trap efficiency. Additional analyses are needed to consider the possibility of lesser rates. Sensitivity analyses also included a range of juvenile passage assumptions so that various combinations of adult and juvenile collection efficiencies could be evaluated. Other inputs and assumptions were as in the previous analyses.

Juvenile stock-recruitment relationships for each species were based on rearing capacity and productivity previously estimated with the EDT model for current habitat conditions. Juveniles were potentially produced from natural spawning in tributaries of all three reservoirs. Smolts passing each reservoir were subject to a reservoir passage mortality. A portion of the juveniles reaching each dam were collected, transported, and released downstream from Merwin Dam. The proportion was determined by an assumed collection efficiency of juvenile bypass system. Transported juveniles were subject to transport mortality. Uncollected juveniles passed through dam turbines where they were subject to mortality. Survivors then entered the downstream reservoir were they were again subject to the same series of risks and routes. Juveniles were thus presented with a variety of potential passage routes including transport from one of the three dams or turbine passage through all three dams.

Numbers of returning adults were based on the number of juveniles surviving passage, an assumed average marine smolt-to-adult survival rate, and average fishery impact rates in combined ocean and freshwater fisheries. SAR's and fishing rates were species-specific. SAR's were based on assumed long term averages rather than recent averages which are assumed to be less than normal. Adults reaching Merwin dam were subject to an assumed trapping rate. Trapped fish were subject to trapping mortality and reservoir mortality after release. Pre-spawning mortality was also assumed. For the purposes of this analysis, adults unable to pass a dam were not assumed to contribute future production because local-origin spawners are assumed to fully seed the available habitats.

Model input parameters and assumptions are identified in Table 1. Sample calculations for default assumptions are summarized in the appendix for spring chinook, coho, and steelhead.

Table 1. Summary of default passage assumptions and population parameter used in Lewis River passage simulations.

	Spring Chinook	Coho	Steelhead
Smolt Passage Assumptions			
Reservoir Survival	0.92	0.92	0.92
Guidance Efficiency	0.70[2]	0.70[2]	0.70[2]
Turbine Survival	0.70	0.70	0.70
Bypass Survival	0.98	0.98	0.98
Transport Survival	0.98	0.98	0.98
Net juvenile passage rate[1]	0.77	0.78	0.77
Adult Passage Assumptions			
Trap attraction	0.95[2]	0.95[2]	0.95[2]
Trap Survival	0.99	0.99	0.99
Res Survival (Merwin)	0.98	0.98	0.98
Res Survival (Yale)	0.98	0.98	0.98
Res Survival (Swift)	0.95	0.95	0.95
Net adult passage rate[1]	0.78	0.80	0.78
Population Parameters			
Egg-Smolt Survival (Merwin)	--	0.051	0.046
Egg-Smolt Survival (Yale)	0.054	0.057	0.043
Egg-Smolt Survival (Swift)	0.068	0.077	0.036
Smolt capacity (Merwin)	--	49,068	2,965
Smolt capacity (Yale)	26,945	80,842	2,588
Smolt capacity (Swift)	68,172	226,879	29,920
Proportion Female	0.5	0.5	0.5
Eggs per Female	4,000	2,600	5,000
Smolt to Adult Survival	0.045	0.075	0.090
Fishery Impacts	0.20	0.15	0.03
Pre-spawning Survival	0.95	0.95	0.95

[1] *Net passage rates are the model-derived effect of all passage assumptions.*
[2] *Varied for purposes of sensitivity analysis.*

Results

Spring Chinook

- Default passage assumptions (95% adults, 70% juveniles) result in an estimated equilibrium number of 1,200 spring chinook spawners (Figure 1, Table 2).
- Spawner numbers decline to 500 at an 80% adult trap efficiency and 100 at 70%.
- Default passage assumptions including a 95% adult trapping efficiency result in a net 78% adult passage survival to spawning (Table 3). A 70% juvenile collection efficiency results in a net 77% juvenile passage survival to spawning. The combined project effect is equivalent to a 60% survival or a 40% impact.

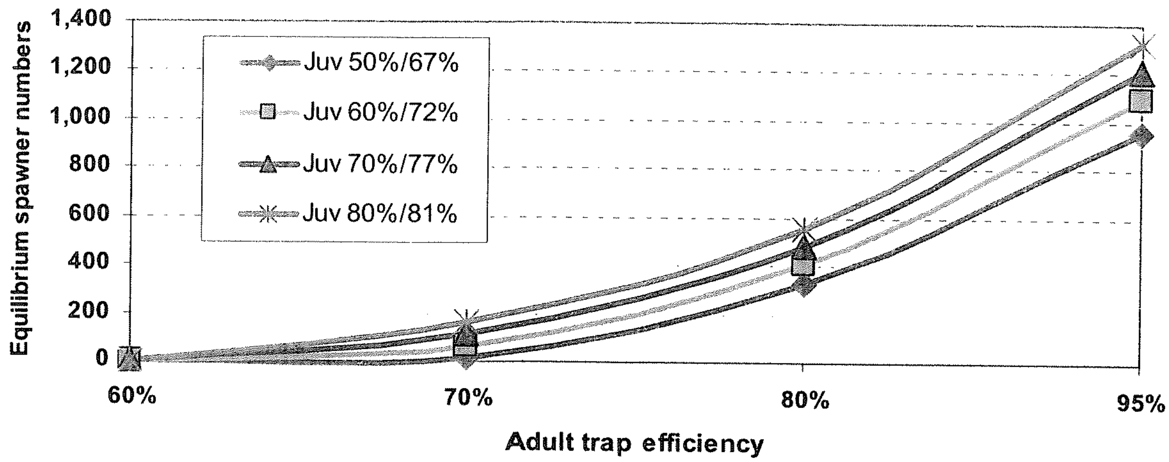


Figure 1. Sensitivity of expected spawner numbers to adult trap efficiency and juvenile collection efficiency. Juvenile labels refer to the collection efficiency and the corresponding net juvenile passage rate.

Table 2. Effects of adult and juvenile trap and collection efficiencies on potential future spawning population size of spring chinook. Net rates refer to the corresponding juvenile and adult passage rates through the three projects associated with average per project trap and collection efficiencies in concert with other passage assumptions.

Guidance	Juveniles	⇨	50%	60%	70%	80%
Adults	Net	⇨	67%	72%	77%	81%
⇩	⇩					
60%	23%		0	1	1	1
70%	34%		20	65	117	160
80%	49%		326	410	487	554
95%	78%		960	1,094	1,214	1,323

Table 3. Effects of adult and juvenile trap and collection efficiencies on total project passage of spring chinook (product of net juvenile and net adult passage rates).

Guidance	Juveniles	⇨	50%	60%	70%	80%
Adults	Net	⇨	67%	72%	77%	81%
⇩	⇩					
60%	23%		15%	16%	17%	18%
70%	34%		23%	25%	26%	28%
80%	49%		33%	36%	38%	40%
95%	78%		52%	57%	60%	64%

Coho

- Default passage assumptions (95% adults, 70% juveniles) result in an estimated equilibrium number of 9,300 coho spawners (Figure 2, Table 4).
- Spawner numbers decline to 4,700 at an 80% adult trap efficiency and 2,300 at 70%.
- Default passage assumptions including a 95% adult trapping efficiency result in a net 80% adult passage survival to spawning (Table 5). A 70% juvenile collection efficiency results in a net 78% juvenile passage survival to spawning. The combined project effect is equivalent to a 62% survival or a 38% impact.

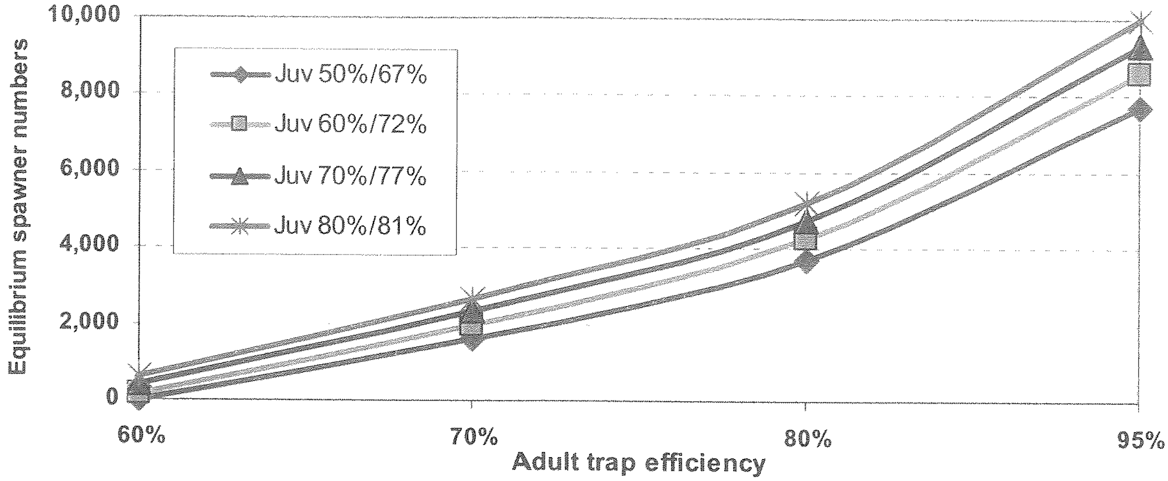


Figure 2. Sensitivity of expected spawner numbers to adult trap efficiency and juvenile collection efficiency. Juvenile labels refer to the collection efficiency and the corresponding net juvenile passage rate.

Table 4. Effects of adult and juvenile trap and collection efficiencies on potential future spawning population size of coho. Net rates refer to the corresponding juvenile and adult passage rates through the three projects associated with average per project trap and collection efficiencies in concert with other passage assumptions.

Guidance	Juveniles	⇨	50%	60%	70%	80%
Adults	Net	⇨	68%	73%	78%	82%
⇩	⇩					
60%	26%		10	160	399	615
70%	38%		1,591	1,985	2,339	2,660
80%	52%		3,707	4,251	4,745	5,190
95%	80%		7,730	8,575	9,337	10,022

Table 5. Effects of adult and juvenile trap and collection efficiencies on total project passage of coho (product of net juvenile and net adult passage rates).

Guidance	Juveniles	⇨	50%	60%	70%	80%
Adults	Net	⇨	68%	73%	78%	82%
⇩	⇩					
60%	26%		18%	19%	20%	21%
70%	38%		26%	28%	29%	31%
80%	52%		36%	38%	41%	43%
95%	80%		54%	58%	62%	65%

Steelhead

- Default passage assumptions (95% adults, 70% juveniles) result in an estimated equilibrium number of 1,400 steelhead spawners (Figure 3, Table 6).
- Spawner numbers decline to 700 at an 80% adult trap efficiency and 400 at 70%.
- Default passage assumptions including a 95% adult trapping efficiency result in a net 78% adult passage survival to spawning (Table 7). A 70% juvenile collection efficiency results in a net 77% juvenile passage survival to spawning. The combined project effect is equivalent to a 60% survival or a 40% impact.

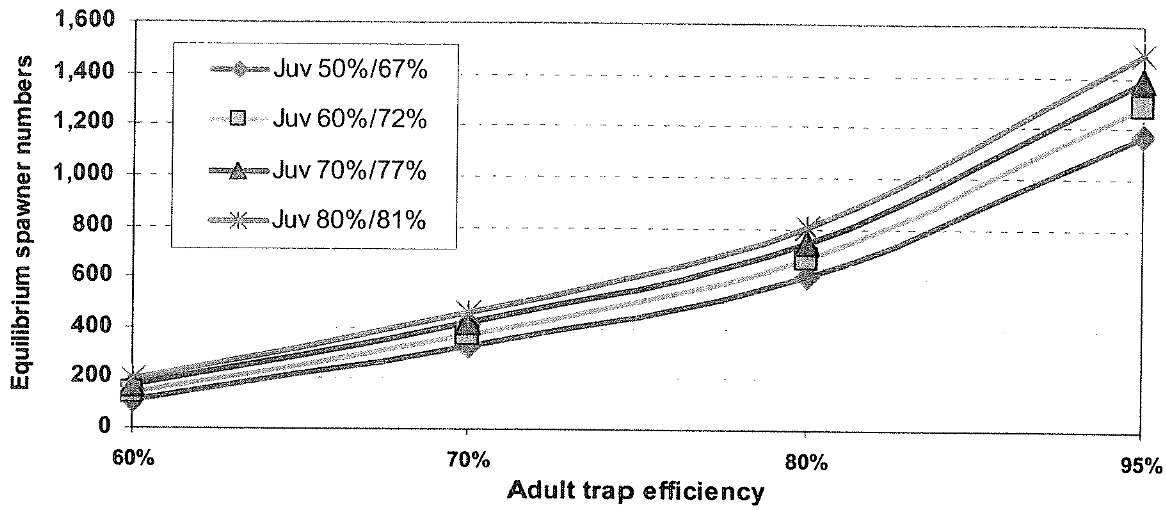


Figure 3. **Sensitivity of expected spawner numbers to adult trap efficiency and juvenile collection efficiency. Juvenile labels refer to the collection efficiency and the corresponding net juvenile passage rate.**

Table 6. **Effects of adult and juvenile trap and collection efficiencies on potential future spawning population size of steelhead. Net rates refer to the corresponding juvenile and adult passage rates through the three projects associated with average per project trap and collection efficiencies in concert with other passage assumptions.**

Guidance	Juveniles	⇨	50%	60%	70%	80%
Adults	Net	⇨	67%	73%	77%	81%
⇩	⇩					
60%	24%		110	142	170	198
70%	35%		325	375	420	460
80%	50%		606	679	744	802
95%	78%		1,169	1,287	1,393	1,487

Table 7. **Effects of adult and juvenile trap and collection efficiencies on total project passage of steelhead (product of net juvenile and net adult passage rates).**

Guidance	Juveniles	⇨	50%	60%	70%	80%
Adults	Net	⇨	67%	73%	77%	81%
⇩	⇩					
60%	24%		16%	18%	19%	20%
70%	35%		24%	26%	27%	29%
80%	50%		33%	36%	38%	40%
95%	78%		53%	57%	60%	64%

Example Calculations

Table 8. Spring Chinook example summary of equilibrium numbers and parameter rates from Lewis River passage simulations. This example is for a 70% juvenile collection efficiency and a 95% adult trapping efficiency.

	Total	Swift	Yale	Merwin
Egg-parr surv (BH productivity)		0.068	0.054	0
Parr capacity (BH capacity)		68,172	26,945	0
N Adults	1214	870	344	0
Female proportion	0.5			
Eggs/fem	4000			
N Eggs	2,428,000	1,740,190	687,810	0
N Parr	58,870	43,254	15,616	0
Parr-smolt S	1.0			
N Smolts	58,870	43,254	15,616	0
N Smolt entering Swift	43,254	43,254		
Smolt Reservoir S	0.92	0.92		
N Smolts to dam	39,793	39,793		
Fish Guidance Efficiency	0.70	0.70		
N Smolts collected	27,855	27,855		
N Smolts through turbines	11,938	11,938		
Turbine S	0.70	0.70		
N Smolts entering Yale	23,973	8,357	15,616	
Smolt Reservoir S	0.92	0.92	0.92	
N Smolts to dam	22,055	7,688	14,367	
Fish Guidance Efficiency	0.70	0.70	0.70	
N Smolts collected	15,438	5,382	10,057	
N Smolts through turbines	6,616	2,306	4,310	
Turbine S	0.70	0.70	0.70	
N Smolts entering Merwin	4,632	1,614	3,017	0
Smolt Reservoir S	0.92	0.92	0.92	0.92
N Smolts to dam	4,261	1,485	2,776	0
Fish Guidance Efficiency	0.70	0.70	0.70	0.70
N Smolts collected	2,983	1,040	1,943	0
N Smolts through turbines	1,278	446	833	0
Turbine S	0.70	0.70	0.70	0.70
N smolts passing Merwin	895	312	583	0
N Smolts collected	46,276	34,277	12,000	0
Bypass S	0.98	0.98	0.98	0.98
Transport S	0.98	0.98	0.98	0.98
N smolts released below Merwin	44,444	32,919	11,525	0
Total smolts below Merwin	45,339	33,231	12,107	0
Net Juv Passage S	0.77	0.77	0.78	0.00
Smolt to adult S (natl)	0.045	0.045	0.045	0.045

	Total	Swift	Yale	Merwin
N adults	2,040	1495	545	0
Exploitation rate	0.20	0.20	0.20	0.20
N adult harvest mortality		299	109	0
N adults @ Merwin	1,632	1196	436	0
Trap efficiency	0.95	0.95	0.95	0.95
N adults collected	1,551	1137	414	0
Trap survival	0.99	0.99	0.99	0.99
N adults released above dam	1,535	1125	410	0
Reservoir S	0.98	0.98	0.98	0.98
N adults upstream		1103	402	0
N adults @ Yale	1,504	1103	402	
Trap efficiency	0.95	0.95	0.95	
N adults collected	1,429	1048	382	
Trap survival	0.99	0.99	0.99	
N adults released above dam	1,415	1037	378	
Reservoir S	0.98	0.98	0.98	
N adults upstream	1,387	1016	370	
N adults @ Swift	1,016	1016		
Trap efficiency	0.95	0.95		
N adults collected	965	965		
Trap survival	0.99	0.99		
N adults released above dam	956	956		
Reservoir S	0.95	0.95		
N adults upstream	908	908		
Adult escapement	1,278	908	370	0
Net adult survival	0.78	0.76	0.85	0.00
Adult prespawn S	0.95	0.95	0.95	0.95
Spawners	1214	863	352	0

Table 9. Coho example summary of equilibrium numbers and parameter rates from Lewis River passage simulations. This example is for a 70% juvenile collection efficiency and a 95% adult trapping efficiency.

	Total	Swift	Yale	Merwin
Egg-parr surv (BH productivity)		0.077	0.057	0.051
Parr capacity (BH capacity)		226,879	80,842	49,068
N Adults	9337	5937	2116	1284
Female proportion	0.5			
Eggs/fem	2600			
N Eggs	12,138,100	7,718,511	2,750,276	1,669,312
N Parr	248,662	164,198	53,337	31,127
Parr-smolt S	1.0			
N Smolts	248,662	164,198	53,337	31,127
N Smolt entering Swift	164,198	164,198		
Smolt Reservoir S	0.92	0.92		
N Smolts to dam	151,062	151,062		
Fish Guidance Efficiency	0.70	0.70		
N Smolts collected	105,743	105,743		
N Smolts through turbines	45,319	45,319		
Turbine S	0.70	0.70		
N Smolts entering Yale	85,060	31,723	53,337	
Smolt Reservoir S	0.92	0.92	0.92	
N Smolts to dam	78,255	29,185	49,070	
Fish Guidance Efficiency	0.70	0.70	0.70	
N Smolts collected	54,779	20,430	34,349	
N Smolts through turbines	23,477	8,756	14,721	
Turbine S	0.70	0.70	0.70	
N Smolts entering Merwin	47,561	6,129	10,305	31,127
Smolt Reservoir S	0.92	0.92	0.92	0.92
N Smolts to dam	43,756	5,639	9,480	28,637
Fish Guidance Efficiency	0.70	0.70	0.70	0.70
N Smolts collected	30,629	3,947	6,636	20,046
N Smolts through turbines	13,127	1,692	2,844	8,591
Turbine S	0.70	0.70	0.70	0.70
N smolts passing Merwin	9,189	1,184	1,991	6,014
N Smolts collected	191,151	130,120	40,985	20,046
Bypass S	0.98	0.98	0.98	0.98
Transport S	0.98	0.98	0.98	0.98
N smolts released below Merwin	183,582	124,967	39,362	19,252
Total smolts below Merwin	192,770	126,151	41,353	25,266
Net Juv Passage S	0.78	0.77	0.78	0.81
Smolt to adult S (natl)	0.075	0.075	0.075	0.075
N adults	14,458	9461	3101	1895
Exploitation rate	0.15	0.15	0.15	0.15

	Total	Swift	Yale	Merwin
N adult harvest mortality		1419	465	284
N adults @ Merwin	12,289	8042	2636	1611
Trap efficiency	0.95	0.95	0.95	0.95
N adults collected	11,675	7640	2504	1530
Trap survival	0.99	0.99	0.99	0.99
N adults released above dam	11,558	7564	2479	1515
Reservoir S	0.98	0.98	0.98	0.98
N adults upstream		7412	2430	1485
N adults @ Yale	9,842	7412	2430	
Trap efficiency	0.95	0.95	0.95	
N adults collected	9,350	7042	2308	
Trap survival	0.99	0.99	0.99	
N adults released above dam	9,257	6971	2285	
Reservoir S	0.98	0.98	0.98	
N adults upstream	9,071	6832	2240	
N adults @ Swift	6,832	6832		
Trap efficiency	0.95	0.95		
N adults collected	6,490	6490		
Trap survival	0.99	0.99		
N adults released above dam	6,425	6425		
Reservoir S	0.95	0.95		
N adults upstream	6,104	6104		
Adult escapement	9,828	6104	2240	1485
Net adult survival	0.80	0.76	0.85	0.92
Adult prespawn S	0.95	0.95	0.95	0.95
Spawners	9337	5799	2128	1410

Table 10. Steelhead example summary of equilibrium numbers and parameter rates from Lewis River passage simulations. This example is for a 70% juvenile collection efficiency and a 95% adult trapping efficiency.

	Total	Swift	Yale	Merwin
Egg-parr surv (BH productivity)		0.036	0.043	0.046
Parr capacity (BH capacity)		29,920	2,588	2,965
N Adults	1393	1175	102	116
Female proportion	0.5			
Eggs/fem	5000			
N Eggs	3,482,500	2,937,344	254,072	291,084
N Parr	27,841	23,321	2,092	2,427
Parr-smolt S	1.0			
N Smolts	27,841	23,321	2,092	2,427
N Smolt entering Swift	23,321	23,321		
Smolt Reservoir S	0.92	0.92		
N Smolts to dam	21,456	21,456		
Fish Guidance Efficiency	0.70	0.70		
N Smolts collected	15,019	15,019		
N Smolts through turbines	6,437	6,437		
Turbine S	0.70	0.70		
N Smolts entering Yale	6,598	4,506	2,092	
Smolt Reservoir S	0.92	0.92	0.92	
N Smolts to dam	6,070	4,145	1,925	
Fish Guidance Efficiency	0.70	0.70	0.70	
N Smolts collected	4,249	2,902	1,347	
N Smolts through turbines	1,821	1,244	577	
Turbine S	0.70	0.70	0.70	
N Smolts entering Merwin	3,702	870	404	2,427
Smolt Reservoir S	0.92	0.92	0.92	0.92
N Smolts to dam	3,406	801	372	2,233
Fish Guidance Efficiency	0.70	0.70	0.70	0.70
N Smolts collected	2,384	561	260	1,563
N Smolts through turbines	1,022	240	112	670
Turbine S	0.70	0.70	0.70	0.70
N smolts passing Merwin	715	168	78	469
N Smolts collected	21,652	18,481	1,608	1,563
Bypass S	0.98	0.98	0.98	0.98
Transport S	0.98	0.98	0.98	0.98
N smolts released below Merwin	20,795	17,749	1,544	1,501
Total smolts below Merwin	21,510	17,918	1,622	1,970
Net Juv Passage S	0.77	0.77	0.78	0.81
Smolt to adult S (natl)	0.09	0.09	0.09	0.09
N adults	1,936	1613	146	177
Exploitation rate	0.03	0.03	0.03	0.03

	Total	Swift	Yale	Merwin
N adult harvest mortality		48	4	5
N adults @ Merwin	1,878	1564	142	172
Trap efficiency	0.95	0.95	0.95	0.95
N adults collected	1,784	1486	135	163
Trap survival	0.99	0.99	0.99	0.99
N adults released above dam	1,766	1471	133	162
Reservoir S	0.98	0.98	0.98	0.98
N adults upstream		1442	131	159
N adults @ Yale	1,572	1442	131	
Trap efficiency	0.95	0.95	0.95	
N adults collected	1,494	1370	124	
Trap survival	0.99	0.99	0.99	
N adults released above dam	1,479	1356	123	
Reservoir S	0.98	0.98	0.98	
N adults upstream	1,449	1329	120	
N adults @ Swift	1,329	1329		
Trap efficiency	0.95	0.95		
N adults collected	1,262	1262		
Trap survival	0.99	0.99		
N adults released above dam	1,250	1250		
Reservoir S	0.95	0.95		
N adults upstream	1,187	1187		
Adult escapement	1,466	1187	120	159
Net adult survival	0.78	0.76	0.85	0.92
Adult prespawn S	0.95	0.95	0.95	0.95
Spawners	1393	1128	114	151

#2: Single Dam Trap & Transport – Contrast with Three Dam Scenario

Summary

- The modeled scenario includes collection of juveniles and adults at only one dam (Swift for juveniles, Merwin for adults).
- At high adult trapping efficiency (95%) and high juvenile collection efficiency (75%), the one dam collection scenario (Merwin for adults, Swift for juveniles) results on a modest reduction in average population size relative to the three dam scenario.

Trapping/Collection		Spring chinook		Coho		Steelhead	
Adults	**Juveniles**	**3 Dam**	**1 Dam**	**3 Dam**	**1 Dam**	**3 Dam**	**1 Dam**
95%	75%	* 1,270	1,019	*9,689	6,689	*1,441	1,285
* 80%	75%	520	* 778	4,973	*5,274	773	*1,030
95%	* 60%	* 1,094	825	*8,575	5,554	*1,287	1,080
* 80%	* 60%	410	* 617	4,251	*4,319	679	*857

- As adult trapping efficiency declines, the one dam collection scenario produces an equal or greater average population size to the three dam scenario, primarily due to compounding adult passage losses at successive dams.
- With modest reductions in juvenile collection efficiencies (60% vs. 75%), average adult population sizes decline for both one dam and three dam collection scenarios but the three dam scenario continues to produce large average population sizes as long as adult trapping efficiency remains high.

Methods

Methods are as in Analysis #1 except out-migrant juveniles were collected and transported only from Swift and returning adults were trapped and transported only from Merwin. Juveniles collected at Swift are transported and released downstream from Merwin as in the three dam collection scenario. However, juveniles that are not collected at Swift must navigate Yale and Merwin reservoirs and dam turbines where they are subject to greater mortality than if a protion had been transported. All adults were released above Swift. Because no adults are passed into Merwin and Yale reservoirs, the limited available spawning and rearing habitat in those portions of the system are not utilized.

Results

Spring Chinook

- At high adult trapping efficiency (95%) and high juvenile collection efficiency (75%), the one dam collection scenario (Merwin for adults, Swift for juveniles) results on a modest reduction in average population size.
- As adult trapping efficiency declines, the one dam collection scenario produces a greater average population size than the three dam scenario, primarily due to compounding adult passage losses at successive dams.
- With modest reductions in juvenile collection efficiencies (60% vs. 75%), average adult population sizes decline for both one dam and three dam collection scenarios but the three dam scenario continues to produce large average population sizes as long as adult trapping efficiency remains high.

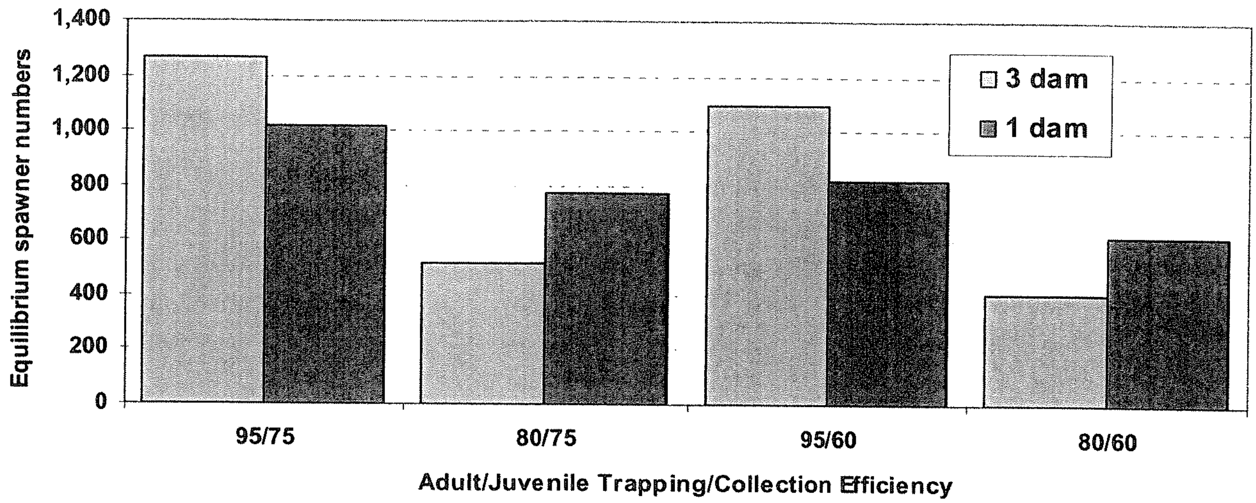


Figure 4. **Effects of one dam vs. three dam collection scenarios on potential future spawning population size of spring chinook at various adult and juvenile trapping and collection efficiencies.**

Table 11. **Effects of one dam vs. three dam collection scenarios on net passage efficiencies and potential future spawning population size of spring chinook. Numbers are as in the preceding figure.**

Trapping/Collection		Three Dam Scenario				One Dam Scenario			
		Net passage				Net passage			
Adults	Juveniles	Adults	Juveniles	Total	Spawners	Adults	Juveniles	Total	Spawners
95%	75%	78%	79%	62%	1,270	89%	73%	65%	1,019
80%	75%	49%	79%	39%	520	75%	73%	55%	778
95%	60%	78%	72%	57%	1,094	89%	64%	57%	825
80%	60%	49%	72%	36%	410	75%	64%	48%	617

Coho

- At high adult trapping efficiency (95%) and high juvenile collection efficiency (75%), the one dam collection scenario (Merwin for adults, Swift for juveniles) results on a modest reduction in average population size.
- As adult trapping efficiency declines, the one dam collection scenario produces a similar average population size than the three dam scenario. The three dam scenario is affected by compounding adult passage losses at successive dams. The one dam scenario suffers from the loss of significant natural coho production.
- With modest reductions in juvenile collection efficiencies (60% vs. 75%), average adult population sizes decline for both one dam and three dam collection scenarios but the three dam scenario continues to produce large average population sizes as long as adult trapping efficiency remains high.

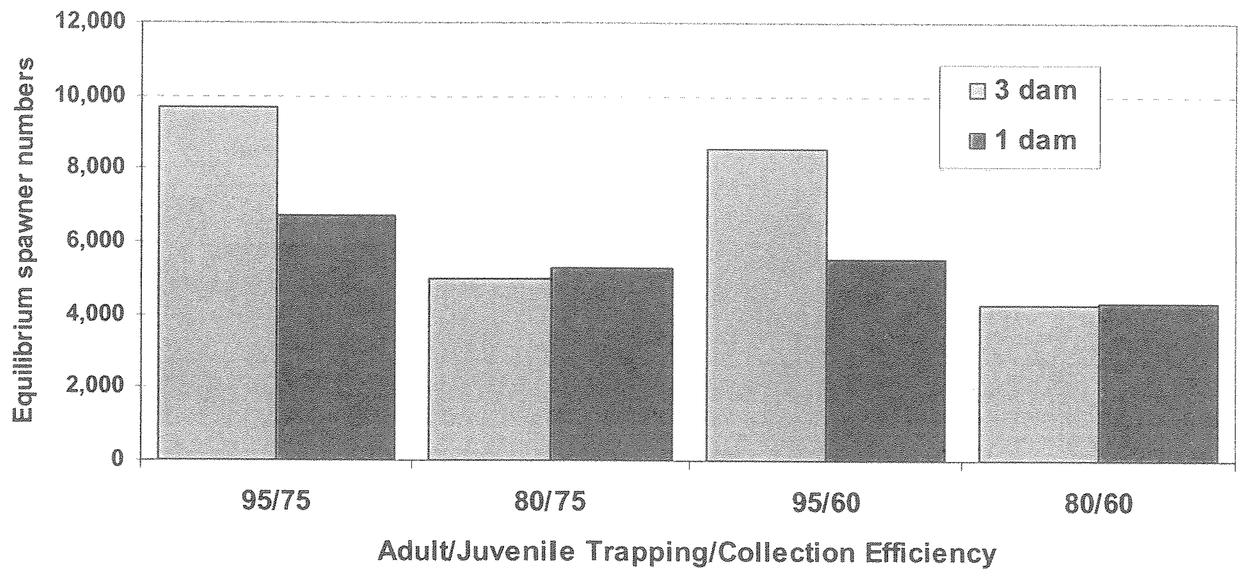


Figure 5. Effects of one dam vs. three dam collection scenarios on potential future spawning population size of coho at various adult and juvenile trapping and collection efficiencies.

Table 12. Effects of one dam vs. three dam collection scenarios on net passage efficiencies and pótential future spawning population size of coho. Numbers are as in the preceding figure.

Trapping/Collection		Three Dam Scenario				One Dam Scenario			
		Net passage				Net passage			
Adults	Juveniles	Adults	Juveniles	Total	Spawners	Adults	Juveniles	Total	Spawners
95%	75%	80%	80%	64%	9,689	89%	73%	65%	6,689
80%	75%	52%	80%	42%	4,973	75%	73%	55%	5,274
95%	60%	80%	73%	58%	8,575	89%	64%	57%	5554
80%	60%	53%	73%	38%	4,251	75%	64%	48%	4,319

Steelhead

- At high adult trapping efficiency (95%) and high juvenile collection efficiency (75%), the one dam collection scenario (Merwin for adults, Swift for juveniles) results on a modest reduction in average population size.
- As adult trapping efficiency declines, the one dam collection scenario produces a greater average population size than the three dam scenario, primarily due to compounding adult passage losses at successive dams.
- With modest reductions in juvenile collection efficiencies (60% vs. 75%), average adult population sizes decline for both one dam and three dam collection scenarios but the three dam scenario continues to produce large average population sizes as long as adult trapping efficiency remains high.

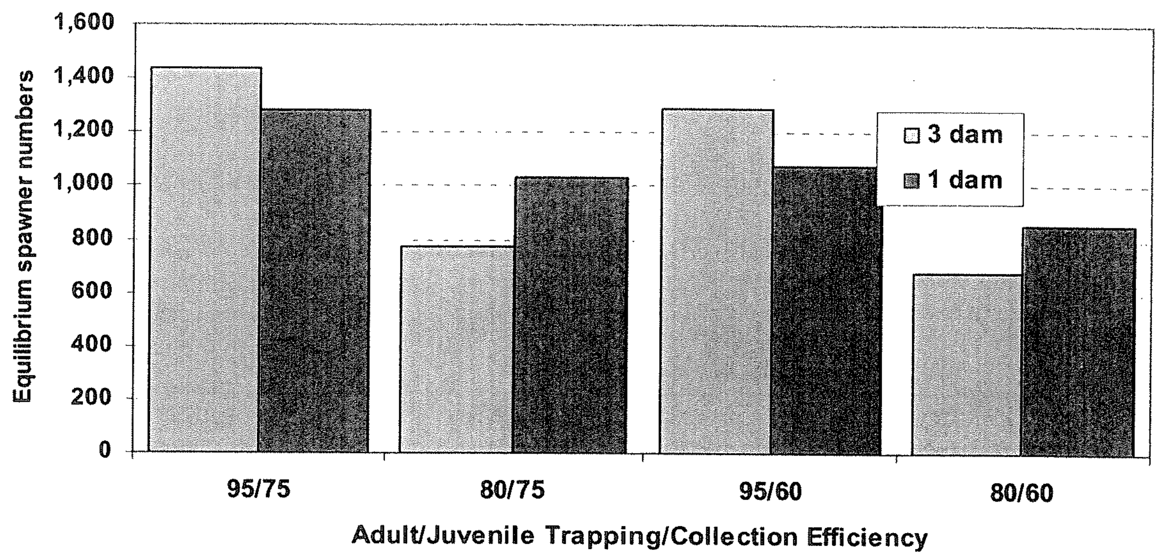


Figure 6. Effects of one dam vs. three dam collection scenarios on potential future spawning population size of steelhead at various adult and juvenile trapping and collection efficiencies.

Table 13. Effects of one dam vs. three dam collection scenarios on net passage efficiencies and potential future spawning population size of steelhead. Numbers are as in the preceding figure.

Trapping/Collection		Three Dam Scenario				One Dam Scenario			
		Net passage				Net passage			
Adults	Juveniles	Adults	Juveniles	Total	Spawners	Adults	Juveniles	Total	Spawners
95%	75%	78%	79%	62%	1,441	89%	73%	65%	1,285
80%	75%	49%	79%	39%	773	75%	73%	55%	1,030
95%	60%	78%	73%	57%	1,287	89%	64%	57%	1080
80%	60%	50%	73%	36%	679	75%	64%	48%	857

Example Calculations

Table 14. Spring Chinook example summary of equilibrium numbers and parameter rates from Lewis River passage simulations contrasting a three-dam versus one-dam collection scenario.

	Three Dam Scenario				One Dam Scenario	
	Total	Swift	Yale	Merwin	Total	Swift
Egg-parr surv (BH productivity)		0.068	0.054	0		0.068
Parr capacity (BH capacity)		68,172	26,945	0		68,172
N Adults	1270	910	360	0	1019	1019
Female proportion	0.5				0.5	
Eggs/fem	4000				4000	
N Eggs	2,540,000	1,820,462	719,538	0	2,038,000	2,038,000
N Parr	59,873	43,962	15,911	0	45,694	45,694
Parr-smolt S	1.0				1.0	
N Smolts	59,873	43,962	15,911	0	45,694	45,694
N Smolt entering Swift	43,962	43,962			45,694	45,694
Smolt Reservoir S	0.92	0.92			0.92	0.92
N Smolts to dam	40,445	40,445			42,039	42,039
Fish Guidance Efficiency	0.75	0.75			0.75	0.75
N Smolts collected	30,334	30,334			31,529	31,529
N Smolts through turbines	10,111	10,111			10,510	10,510
Turbine S	0.70	0.70			0.70	0.70
N Smolts entering Yale	22,989	7,078	15,911		7,357	7,357
Smolt Reservoir S	0.92	0.92	0.92		0.92	0.92
N Smolts to dam	21,150	6,512	14,638		6,768	6,768
Fish Guidance Efficiency	0.75	0.75	0.75		0.00	0.00
N Smolts collected	15,862	4,884	10,979		0	0
N Smolts through turbines	5,287	1,628	3,660		6,768	6,768
Turbine S	0.70	0.70	0.70		0.70	0.70
N Smolts entering Merwin	3,701	1,140	2,562	0	4,738	4,738
Smolt Reservoir S	0.92	0.92	0.92	0.92	0.92	0.92
N Smolts to dam	3,405	1,048	2,357	0	4,359	4,359
Fish Guidance Efficiency	0.75	0.75	0.75	0.75	0.00	0.00
N Smolts collected	2,554	786	1,768	0	0	0
N Smolts through turbines	851	262	589	0	4,359	4,359
Turbine S	0.70	0.70	0.70	0.70	0.70	0.70
N smolts passing Merwin	596	183	412	0	3,051	3,051
N Smolts collected	48,750	36,004	12,746	0	31,529	31,529
Bypass S	0.98	0.98	0.98	0.98	0.98	0.98
Transport S	0.98	0.98	0.98	0.98	0.98	0.98
N smolts released below Merwin	46,820	34,578	12,241	0	30,280	30,280
Total smolts below Merwin	47,415	34,762	12,654	0	33,332	33,332
Net Juv Passage S	0.79	0.79	0.80	0.00	0.73	0.73
Net Juv Passage S (transport)						0.88

	Three Dam Scenario				One Dam Scenario	
	Total	Swift	Yale	Merwin	Total	Swift
Net Juv Passage S (turbines)						0.27
Smolt to adult S (natl)	0.045	0.045	0.045	0.045	0.045	0.045
N adults	2,134	1564	569	0	1,500	1500
Exploitation rate	0.20	0.20	0.20	0.20	0.20	0.20
N adult harvest mortality		313	114	0		300
N adults @ Merwin	1,707	1251	456	0	1,200	1200
Trap efficiency	0.95	0.95	0.95	0.95	0.95	0.95
N adults collected	1,622	1189	433	0	1,140	1140
Trap survival	0.99	0.99	0.99	0.99	0.99	0.99
N adults released above dam	1,605	1177	428	0	1,129	1129
Reservoir S	0.98	0.98	0.98	0.98		
N adults upstream		1153	420	0		
N adults @ Yale	1,573	1153	420			
Trap efficiency	0.95	0.95	0.95			
N adults collected	1,495	1096	399			
Trap survival	0.99	0.99	0.99			
N adults released above dam	1,480	1085	395			
Reservoir S	0.98	0.98	0.98			
N adults upstream	1,450	1063	387			
N adults @ Swift	1,063	1063				
Trap efficiency	0.95	0.95				
N adults collected	1,010	1010				
Trap survival	0.99	0.99				
N adults released above dam	1,000	1000			1,129	1129
Reservoir S	0.95	0.95			0.95	0.95
N adults upstream	950	950			1,072	1072
Adult escapement	1,337	950	387	0	1,072	1072
Net adult survival	0.78	0.76	0.85	0.00	0.89	0.89
Adult prespawn S	0.95	0.95	0.95	0.95	0.95	0.95
Spawners	1270	902	368	0	1019	1019

Table 15. **Coho example summary of equilibrium numbers and parameter rates from Lewis River passage simulations contrasting a three-dam versus one-dam collection scenario.**

	Three Dam Scenario				One Dam Scenario	
	Total	Swift	Yale	Merwin	Total	Swift
Egg-parr surv (BH productivity)		0.077	0.057	0.051		0.077
Parr capacity (BH capacity)		226,879	80,842	49,068		226,879
N Adults	9689	6161	2195	1332	6689	6689
Female proportion	0.5				0.5	
Eggs/fem	2600				2600	
N Eggs	12,595,700	8,009,495	2,853,960	1,732,245	8,695,700	8,695,700
N Parr	251,414	165,863	54,004	31,547	169,459	169,459
Parr-smolt S	1.0				1.0	
N Smolts	251,414	165,863	54,004	31,547	169,459	169,459
N Smolt entering Swift	165,863	165,863			169,459	169,459
Smolt Reservoir S	0.92	0.92			0.92	0.92
N Smolts to dam	152,594	152,594			155,902	155,902
Fish Guidance Efficiency	0.75	0.75			0.75	0.75
N Smolts collected	114,445	114,445			116,927	116,927
N Smolts through turbines	38,148	38,148			38,976	38,976
Turbine S	0.70	0.70			0.70	0.70
N Smolts entering Yale	80,708	26,704	54,004		27,283	27,283
Smolt Reservoir S	0.92	0.92	0.92		0.92	0.92
N Smolts to dam	74,252	24,568	49,684		25,100	25,100
Fish Guidance Efficiency	0.75	0.75	0.75		0.00	0.00
N Smolts collected	55,689	18,426	37,263		0	0
N Smolts through turbines	18,563	6,142	12,421		25,100	25,100
Turbine S	0.70	0.70	0.70		0.70	0.70
N Smolts entering Merwin	44,541	4,299	8,695	31,547	17,570	17,570
Smolt Reservoir S	0.92	0.92	0.92	0.92	0.92	0.92
N Smolts to dam	40,977	3,955	7,999	29,023	16,165	16,165
Fish Guidance Efficiency	0.75	0.75	0.75	0.75	0.00	0.00
N Smolts collected	30,733	2,967	5,999	21,767	0	0
N Smolts through turbines	10,244	989	2,000	7,256	16,165	16,165
Turbine S	0.70	0.70	0.70	0.70	0.70	0.70
N smolts passing Merwin	7,171	692	1,400	5,079	11,315	11,315
N Smolts collected	200,867	135,837	43,262	21,767	116,927	116,927
Bypass S	0.98	0.98	0.98	0.98	0.98	0.98
Transport S	0.98	0.98	0.98	0.98	0.98	0.98
N smolts released below Merwin	192,913	130,458	41,549	20,905	112,296	112,296
Total smolts below Merwin	200,084	131,150	42,949	25,984	123,612	123,612
Net Juv Passage S	0.80	0.79	0.80	0.82	0.73	0.73
Net Juv Passage S (transport)						0.88
Net Juv Passage S (turbines)						0.27
Smolt to adult S (natl)	0.075	0.075	0.075	0.075	0.075	0.075

	Three Dam Scenario				One Dam Scenario	
	Total	Swift	Yale	Merwin	Total	Swift
N adults	15,006	9836	3221	1949	9,271	9271
Exploitation rate	0.15	0.15	0.15	0.15	0.15	0.15
N adult harvest mortality		1475	483	292		1391
N adults @ Merwin	12,755	8361	2738	1656	7,880	7880
Trap efficiency	0.95	0.95	0.95	0.95	0.95	0.95
N adults collected	12,118	7943	2601	1574	7,486	7486
Trap survival	0.99	0.99	0.99	0.99	0.99	0.99
N adults released above dam	11,996	7863	2575	1558	7,411	7411
Reservoir S	0.98	0.98	0.98	0.98		
N adults upstream		7706	2524	1527		
N adults @ Yale	10,230	7706	2524			
Trap efficiency	0.95	0.95	0.95			
N adults collected	9,718	7321	2397			
Trap survival	0.99	0.99	0.99			
N adults released above dam	9,621	7248	2373			
Reservoir S	0.98	0.98	0.98			
N adults upstream	9,429	7103	2326			
N adults @ Swift	7,103	7103				
Trap efficiency	0.95	0.95				
N adults collected	6,748	6748				
Trap survival	0.99	0.99				
N adults released above dam	6,680	6680			7,411	7411
Reservoir S	0.95	0.95			0.95	0.95
N adults upstream	6,346	6346			7,041	7041
Adult escapement	10,199	6346	2326	1527	7,041	7041
Net adult survival	0.80	0.76	0.85	0.92	0.89	0.89
Adult prespawn S	0.95	0.95	0.95	0.95	0.95	0.95
Spawners	9689	6029	2210	1450	6689	6689

Table 16. **Steelhead example summary of equilibrium numbers and parameter rates from Lewis River passage simulations contrasting a three-dam versus one-dam collection scenario.**

	Three Dam Scenario				One Dam Scenario	
	Total	Swift	Yale	Merwin	Total	Swift
Egg-parr surv (BH productivity)		0.036	0.043	0.046		0.036
Parr capacity (BH capacity)		29,920	2,588	2,965		29,920
N Adults	1441	1215	105	120	1285	1285
Female proportion	0.5				0.5	
Eggs/fem	5000				5000	
N Eggs	3,602,500	3,038,559	262,827	301,114	3,212,500	3,212,500
N Parr	28,042	23,494	2,106	2,442	23,770	23,770
Parr-smolt S	1.0				1.0	
N Smolts	28,042	23,494	2,106	2,442	23,770	23,770
N Smolt entering Swift	23,494	23,494			23,770	23,770
Smolt Reservoir S	0.92	0.92			0.92	0.92
N Smolts to dam	21,614	21,614			21,869	21,869
Fish Guidance Efficiency	0.75	0.75			0.75	0.75
N Smolts collected	16,211	16,211			16,402	16,402
N Smolts through turbines	5,404	5,404			5,467	5,467
Turbine S	0.70	0.70			0.70	0.70
N Smolts entering Yale	5,888	3,783	2,106		3,827	3,827
Smolt Reservoir S	0.92	0.92	0.92		0.92	0.92
N Smolts to dam	5,417	3,480	1,937		3,521	3,521
Fish Guidance Efficiency	0.75	0.75	0.75		0.00	0.00
N Smolts collected	4,063	2,610	1,453		0	0
N Smolts through turbines	1,354	870	484		3,521	3,521
Turbine S	0.70	0.70	0.70		0.70	0.70
N Smolts entering Merwin	3,390	609	339	2,442	2,465	2,465
Smolt Reservoir S	0.92	0.92	0.92	0.92	0.92	0.92
N Smolts to dam	3,119	560	312	2,247	2,267	2,267
Fish Guidance Efficiency	0.75	0.75	0.75	0.75	0.00	0.00
N Smolts collected	2,339	420	234	1,685	0	0
N Smolts through turbines	780	140	78	562	2,267	2,267
Turbine S	0.70	0.70	0.70	0.70	0.70	0.70
N smolts passing Merwin	546	98	55	393	1,587	1,587
N Smolts collected	22,613	19,241	1,687	1,685	16,402	16,402
Bypass S	0.98	0.98	0.98	0.98	0.98	0.98
Transport S	0.98	0.98	0.98	0.98	0.98	0.98
N smolts released below Merwin	21,718	18,479	1,620	1,618	15,752	15,752
Total smolts below Merwin	22,263	18,577	1,675	2,012	17,339	17,339
Net Juv Passage S	0.79	0.79	0.80	0.82	0.73	0.73
Net Juv Passage S (transport)						0.88
Net Juv Passage S (turbines)						0.27

	Three Dam Scenario				One Dam Scenario	
	Total	Swift	Yale	Merwin	Total	Swift
Smolt to adult S (natl)	0.09	0.09	0.09	0.09	0.09	0.09
N adults	2,004	1672	151	181	1,561	1561
Exploitation rate	0.03	0.03	0.03	0.03	0.03	0.03
N adult harvest mortality		50	5	5		47
N adults @ Merwin	1,944	1622	146	176	1,514	1514
Trap efficiency	0.95	0.95	0.95	0.95	0.95	0.95
N adults collected	1,846	1541	139	167	1,438	1438
Trap survival	0.99	0.99	0.99	0.99	0.99	0.99
N adults released above dam	1,828	1525	138	165	1,424	1424
Reservoir S	0.98	0.98	0.98	0.98		
N adults upstream		1495	135	162		
N adults @ Yale	1,630	1495	135			
Trap efficiency	0.95	0.95	0.95			
N adults collected	1,548	1420	128			
Trap survival	0.99	0.99	0.99			
N adults released above dam	1,533	1406	127			
Reservoir S	0.98	0.98	0.98			
N adults upstream	1,502	1378	124			
N adults @ Swift	1,378	1378				
Trap efficiency	0.95	0.95				
N adults collected	1,309	1309				
Trap survival	0.99	0.99				
N adults released above dam	1,296	1296			1,424	1424
Reservoir S	0.95	0.95			0.95	0.95
N adults upstream	1,231	1231			1,352	1352
Adult escapement	1,517	1231	124	162	1,352	1352
Net adult survival	0.78	0.76	0.85	0.92	0.89	0.89
Adult prespawn S	0.95	0.95	0.95	0.95	0.95	0.95
Spawners	1441	1169	118	154	1285	1285

Discussion

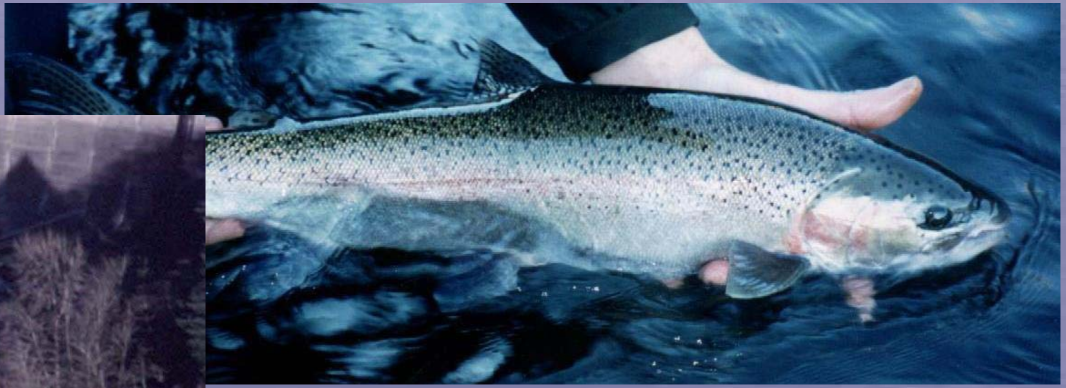
Simulation results highlight the sensitivity of projected fish numbers to adult trapping efficiency. Relatively small reductions in trap efficiency of adults will substantially reduce fish numbers in the three dam adult collection scenario because effects are compounded at each successive facility. While uncollected juveniles had other passage opportunities, uncollected adults had little opportunity to contribute to future production. This adult assumption would be met where non-local origin spawners were unable to locate tributary spawning sites or continued to attempt unsuccessful passage. Production benefits would be marginal even if untrapped adults were assumed to spawn because of limited spawning and rearing capacity in Merwin and Yale reservoirs.

In the one dam scenario, reductions in adult trapping rate actually result in an average population size that may be equal to or greater than that observed for the three dam scenario. Net adult survival actually increases in the one dam scenario because adults are not subject to multiple trapping, handling, and reservoir effects. As adult trapping efficiencies declines, the survival benefit of transport offsets the loss of natural production in Yale and Merwin, and the decline in net juvenile survival because migrants at Yale and Merwin must pass through turbines rather than being collected. This result is a function of most of the salmon production occurring above Swift. The effect is less pronounced for coho than for spring chinook or steelhead because there is proportionately more natural production of coho in the lower two reservoirs than for the other two species.

Simulation results illustrate the compounding effects of juvenile and adult passage limitations. Passage limitations have a multiplicative effect on fish numbers. Even modest limitations in passage of adults when coupled with modest limitations in passage of juveniles result in poor net passage survival. For instance, the combined effect of a 70% adult trapping efficiency and a 70% juvenile collection efficiency across three dams results in just a 27% net passage survival rate.

These simulation results are generally comparable to those completed for the 2004 report where similar parameter assumptions were made. Minor differences in absolute numbers result from small differences in assumed passage patterns. Simulations provide robust and directly comparable estimates of the relative changes in survival and fish numbers in response to changes in trapping and collection efficiencies.

Lewis River Implementation: Merwin Tailrace Behavior Study



Objectives

1. Estimate adult salmonids entering the tailrace daily.
2. Estimate trap attempts.
3. Estimate successful trap captures.
4. Determine tailrace conditions that might impede fish movement into the trap.
5. If conditions preclude trap entry or cause migration delay what locations would be preferred for a new trap entrance?

Objective 1. Estimate the abundance of adult salmonids entering the tailrace daily.

- Hydroacoustic counts = net loss fish daily
- DIDSON comparison showed hydroacoustics missing fish on bottom
- No good method for daily counts
- Added radiotelemetry study

Summary Statistics

Stock	No. Tagged	No. Recaptured	No. in Analysis	Video Records
StS	97	83	56	>14K
Co	100	90	60	>14K
StW	100	84	60	--
ChS	100	57*	52	--

* Final mobile survey data outstanding

Objective 2 Estimate the number of trap entry attempts made by adult salmonids in the tailrace

Behavior	Description
Roll	A fish with part of its body out of water but not jumping
Early Jump	A jump short of trap entrance
Hit	A strikes against the cement wall surrounding trap entrance
Corner	A directional movement toward a corner area on either side of the trap
Surf/Velocity	Horizontally swim along a wave face but no swimming into the trap
Entry	A fish jumps/swims into the entrance of the trap and is captured
Fall back	A fish jumps/swims into the entrance of the trap but drops back into the tailrace

Summer Steelhead

		Unit 1 OFF Observations	
Behavior Category	**Behavior**	**Count**	**Percent (%)**
Exploratory Behavior	Roll	2614	52
	Early Jump	2421	48
	Total Exploratory Behavior	**5035**	
Attempts	Surf/Velocity	1615	19
	Corner	1269	15
	Hit	123	1
	Entries	5306	64
	Total Attempts	**8313**	
Fall Backs	Fall Back	1301	**25**
	Est. Capture	**4005**	**48**

		Unit 1 OFF Observations		Unit 1 ON Observations	
Behavior Category	**Behavior**	**Count**	**Percent (%)**	**Count**	**Percent (%)**
Exploratory Behavior	Roll	695	100	4235	100
	Total Exploratory Behavior	**695**		**4235**	
Attempts	Early Jump	385	13	536	8
	Surf/Velocity	769	25	1173	17
	Corner	320	10	405	6
	Hit	18	1	86	1
	Entries	1568	51	4901	69
	Total Attempts	**3060**		**7101**	
Fall Backs	Fall Back	397	**25**	1382	**28**
	Est. Capture	1171	**38**	3519	**50**

Objective 3. Estimate the number of adult fish that enter the trap and become captive.

- Locating and find the trap was determined by:

  ATE_{pop} = No. fish captured in the trap/Total no. detected in tailrace (array and in trap)

- Trap capture efficiency was determined by:

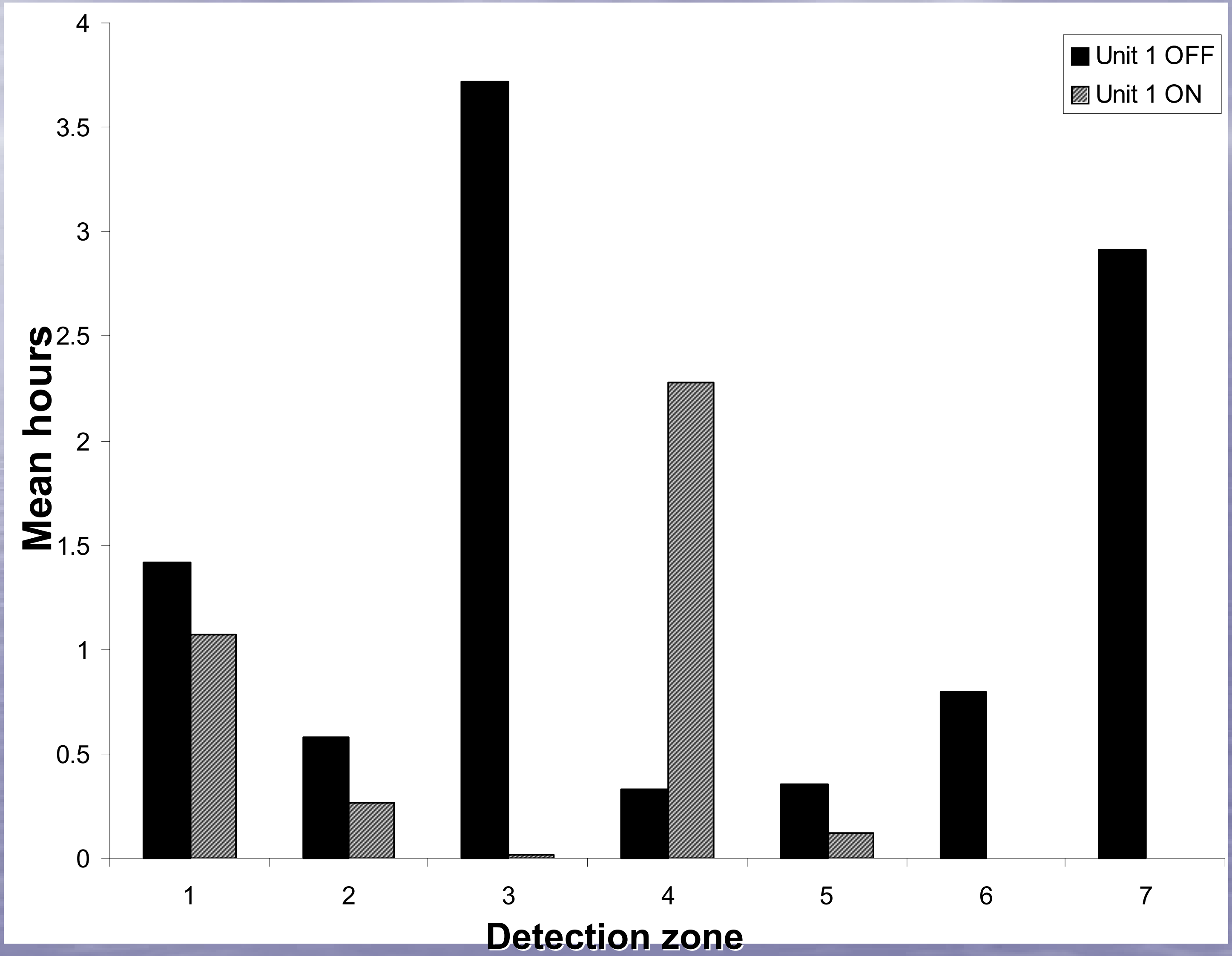
  ATE_{mig} = No. estimated trap captures/ No. total trap attempts

Stock	ATE_{pop} (%)			ATE_{mig} (%)		
	-on	-off	total	-on	-off	total
StS	72	69	71	--	--	48
Co	14	44	34	50	38	46
StW	67	25	65	--	--	--
Chs	35	90	59	--	--	--

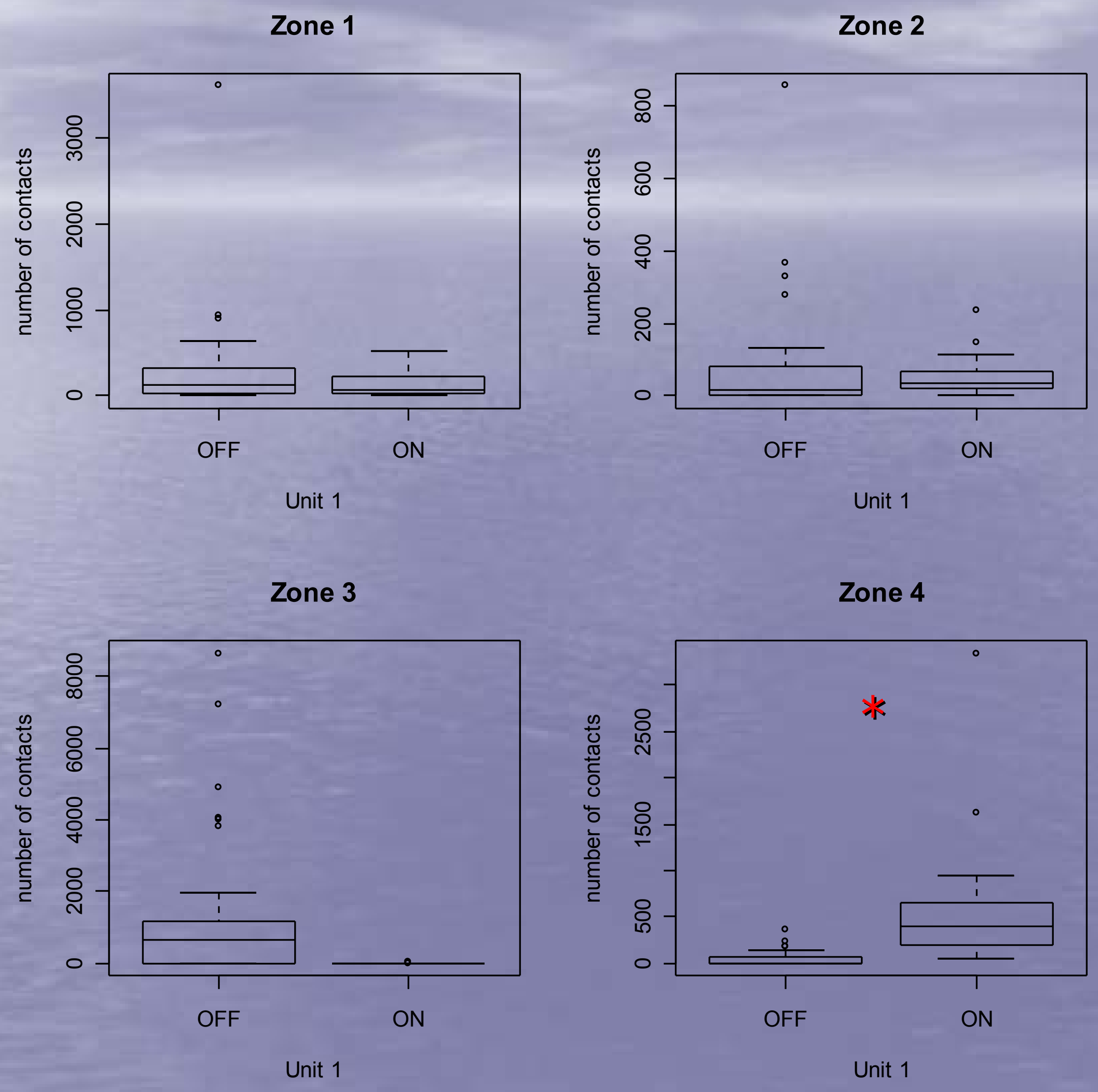
Objective 4. Determine what (if any) tailrace conditions impede fish movement into the trap.

- Time in tailrace detection zones = no. contacts
- Transitions among tailrace detections zones

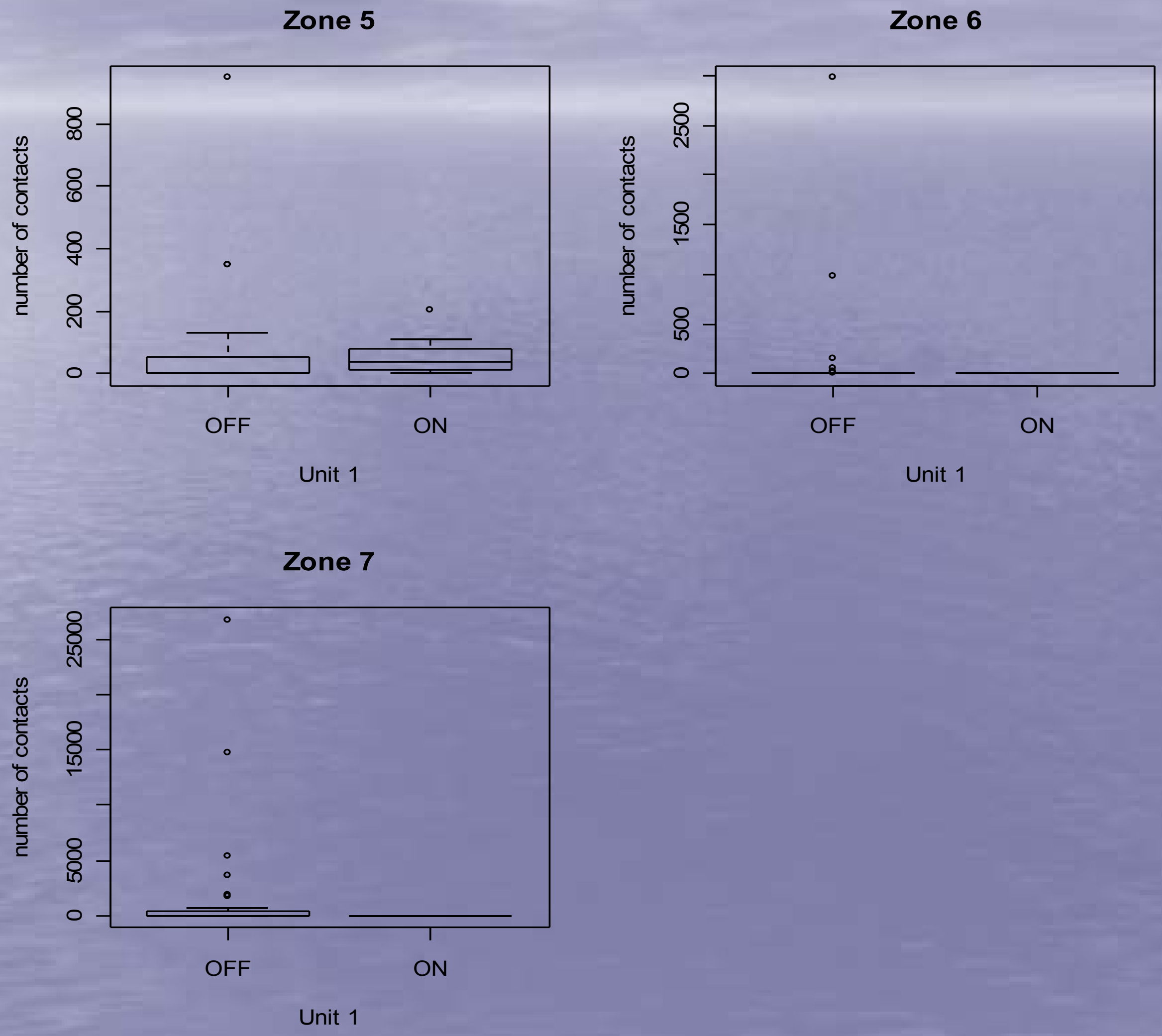
Summer Steelhead Time in Detection Zones



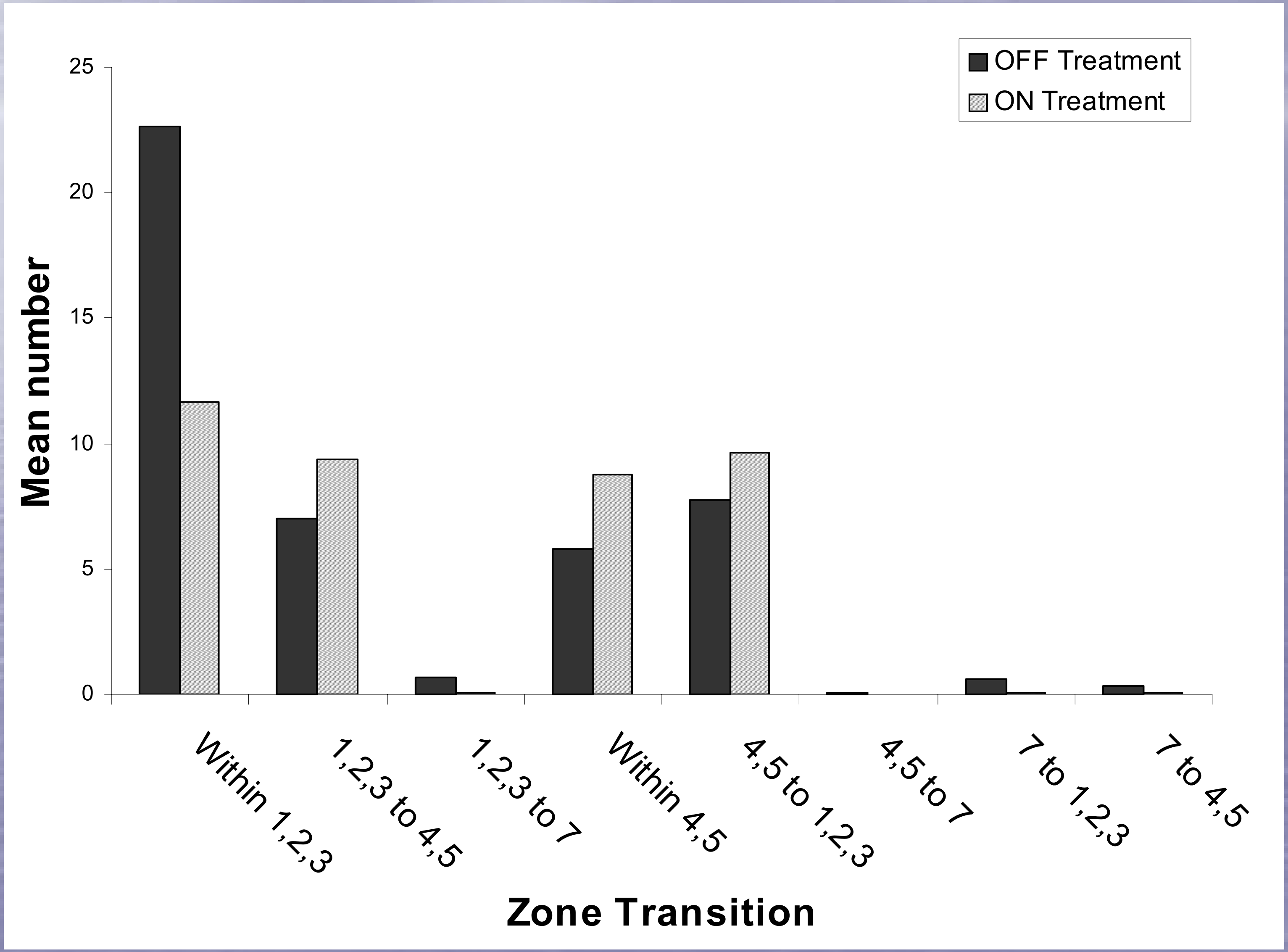
Summer Steelhead Time in Zones



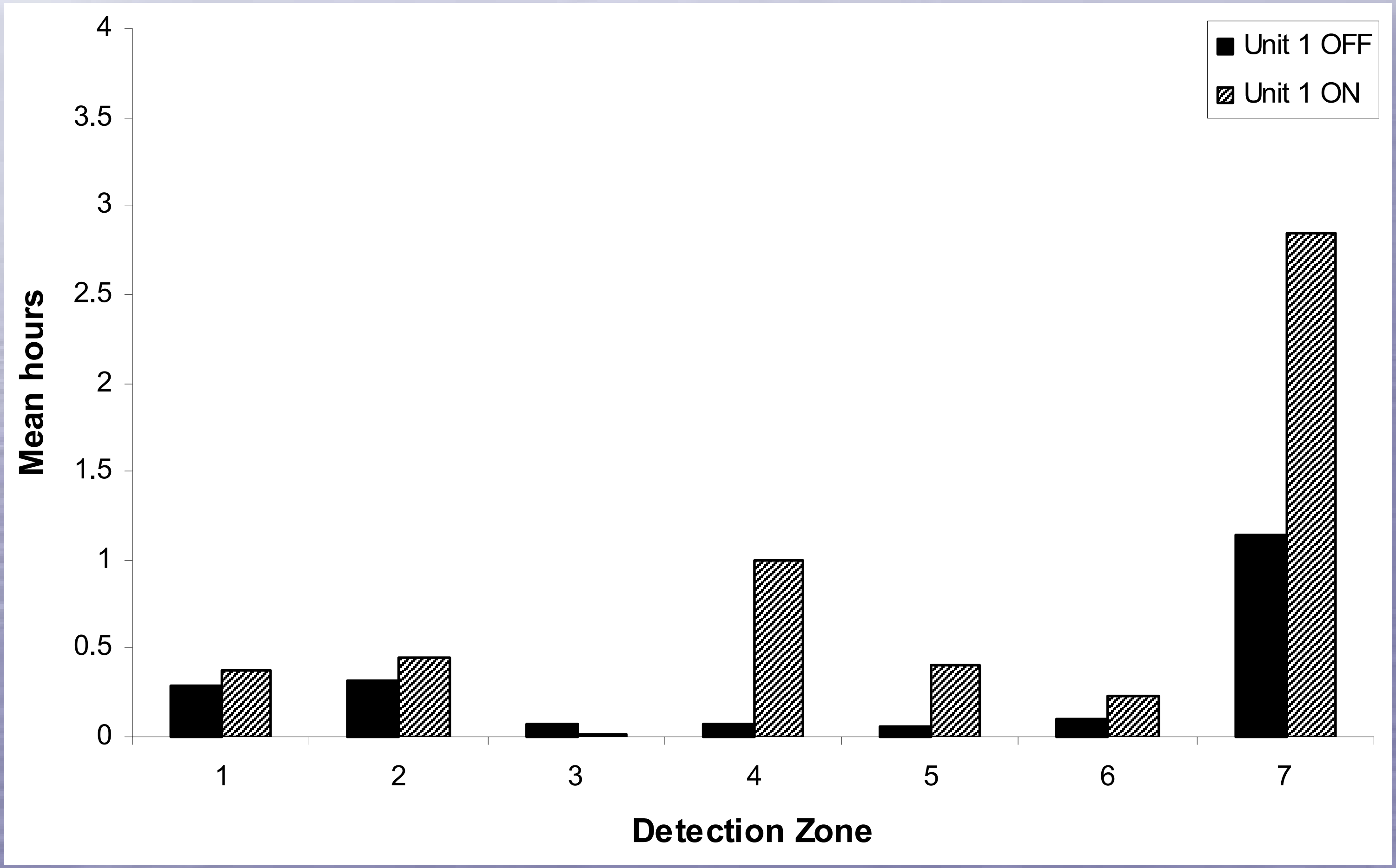
Summer Steelhead Time in Zones



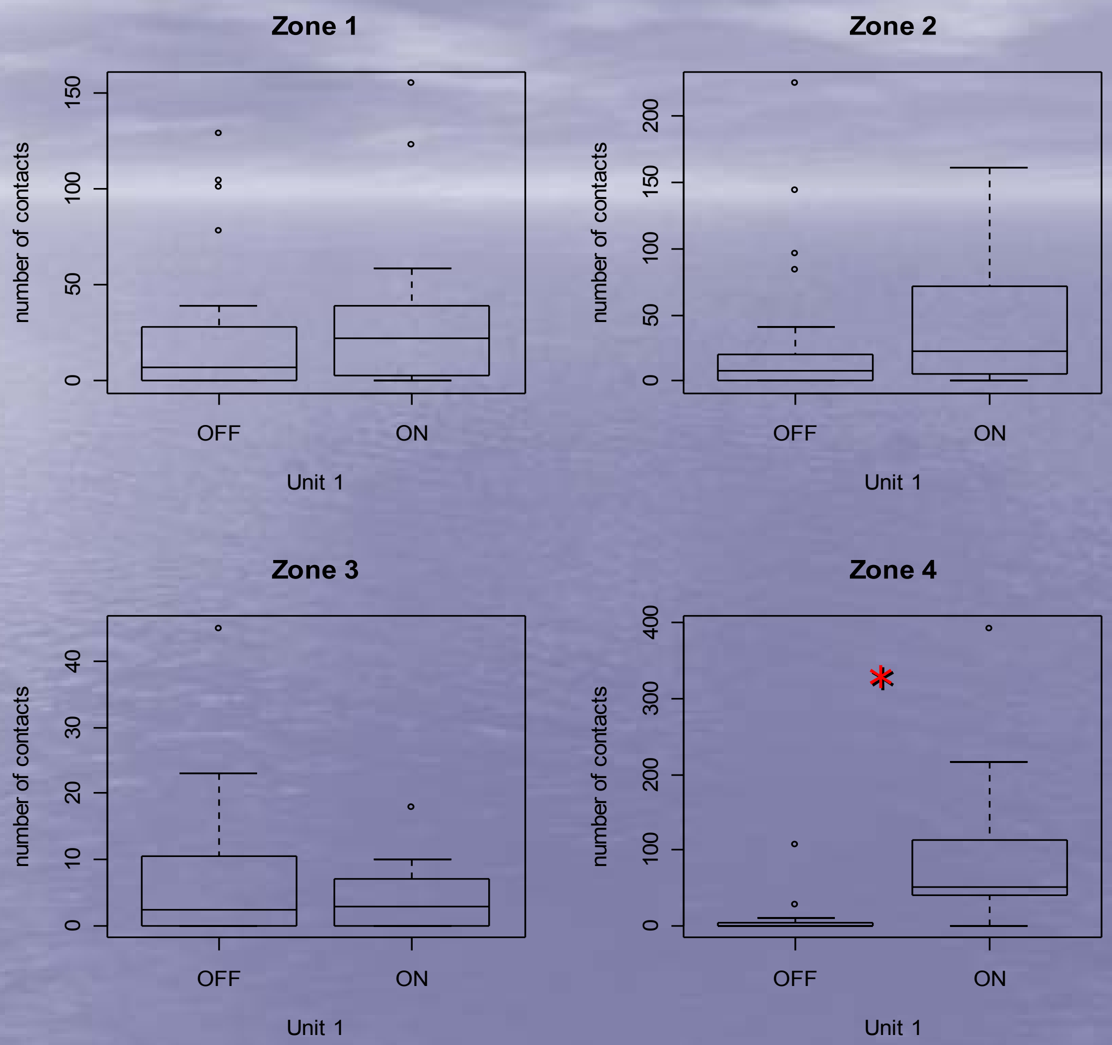
Summer Steelhead Movement Among Zones



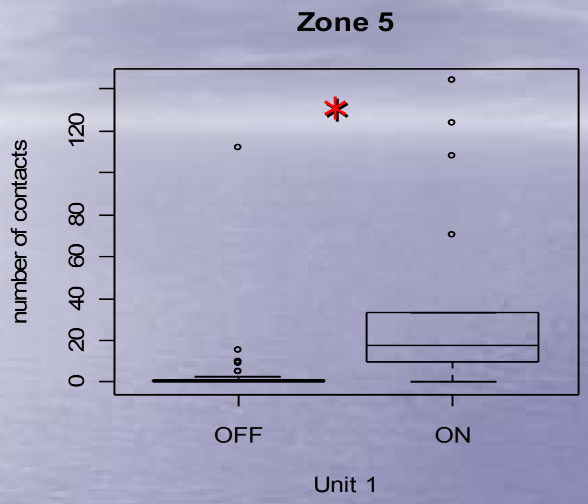
Coho salmon Time in Zones

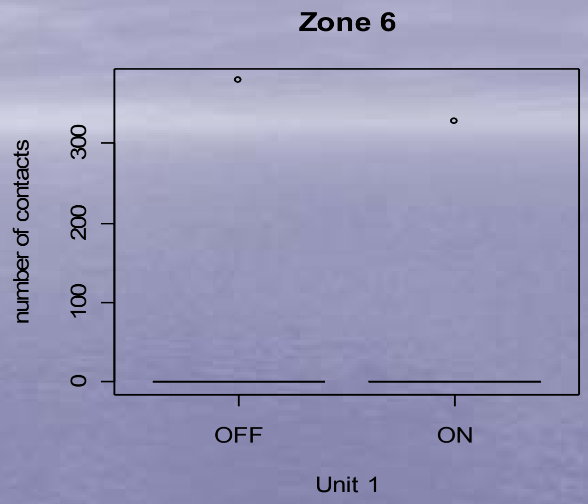


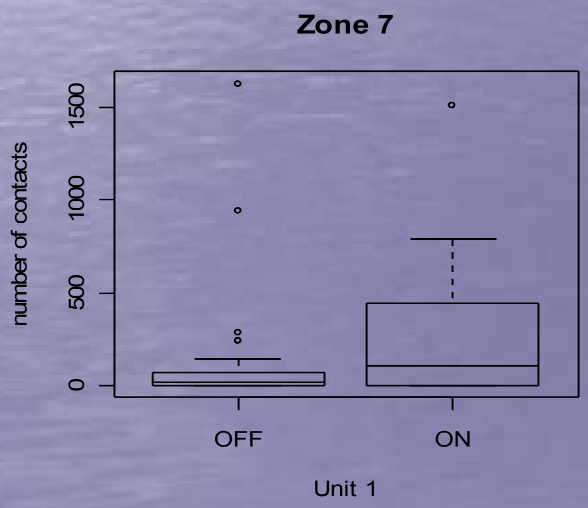
Coho salmon Time in Zones



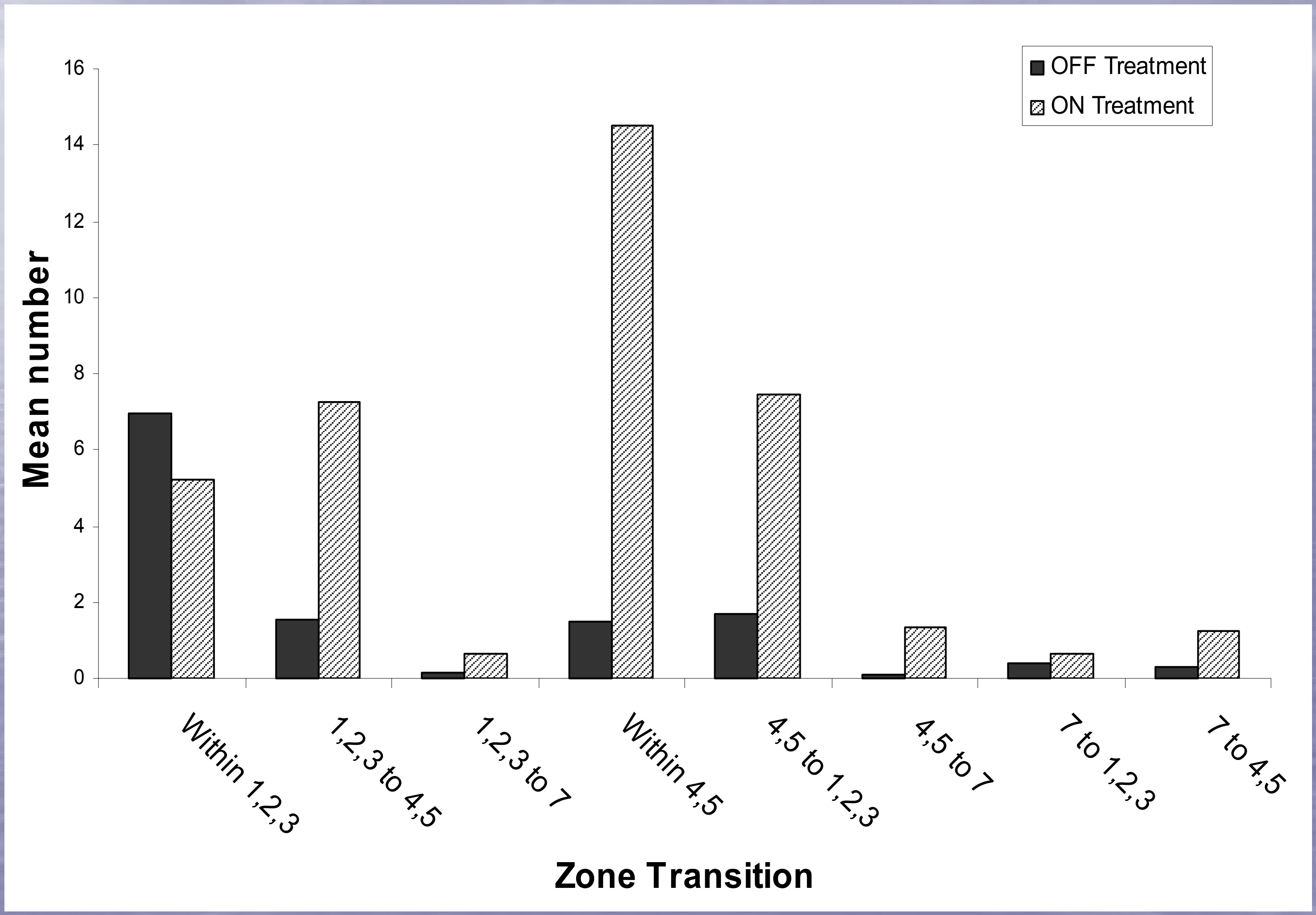
Coho salmon Time in Zones



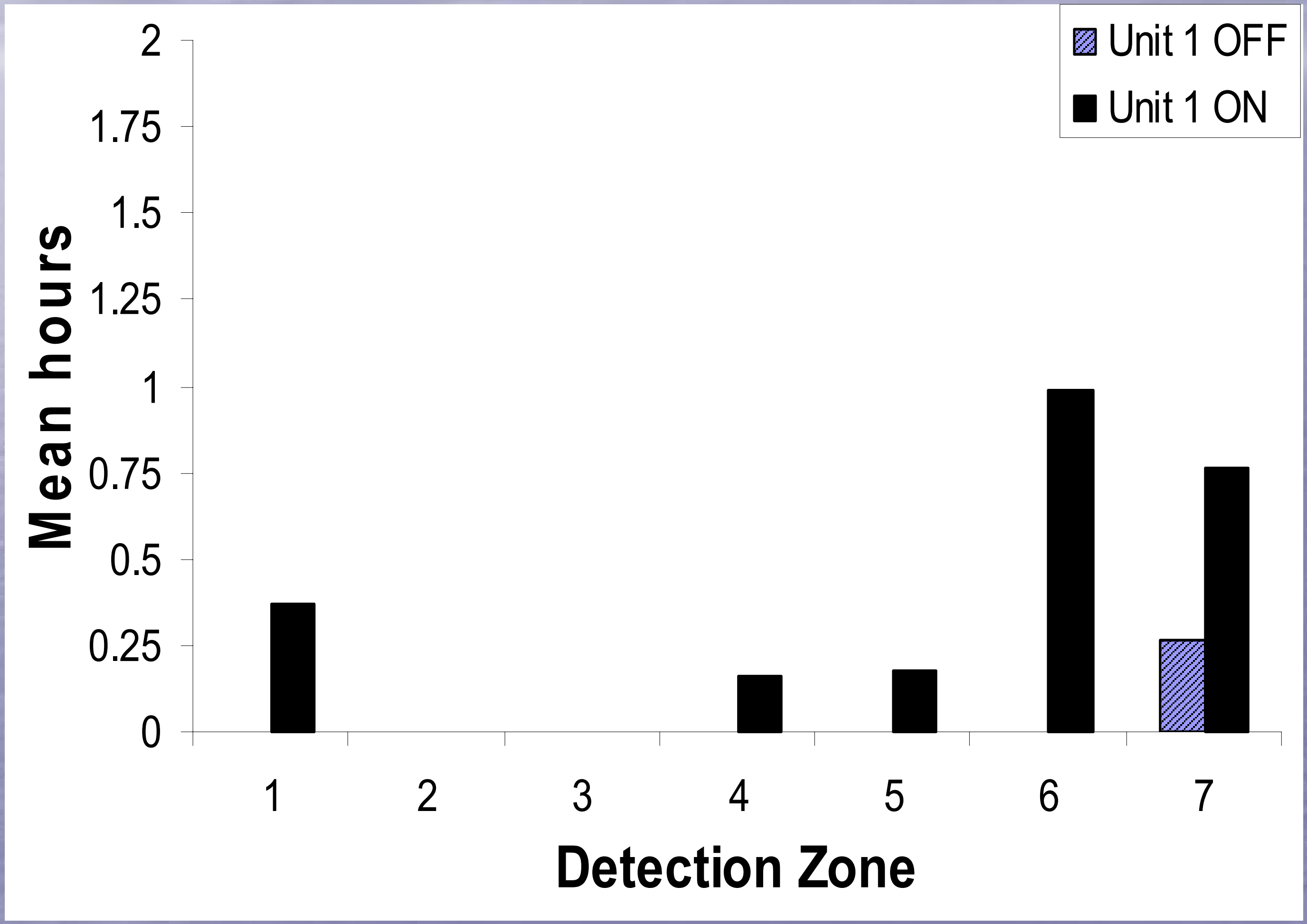




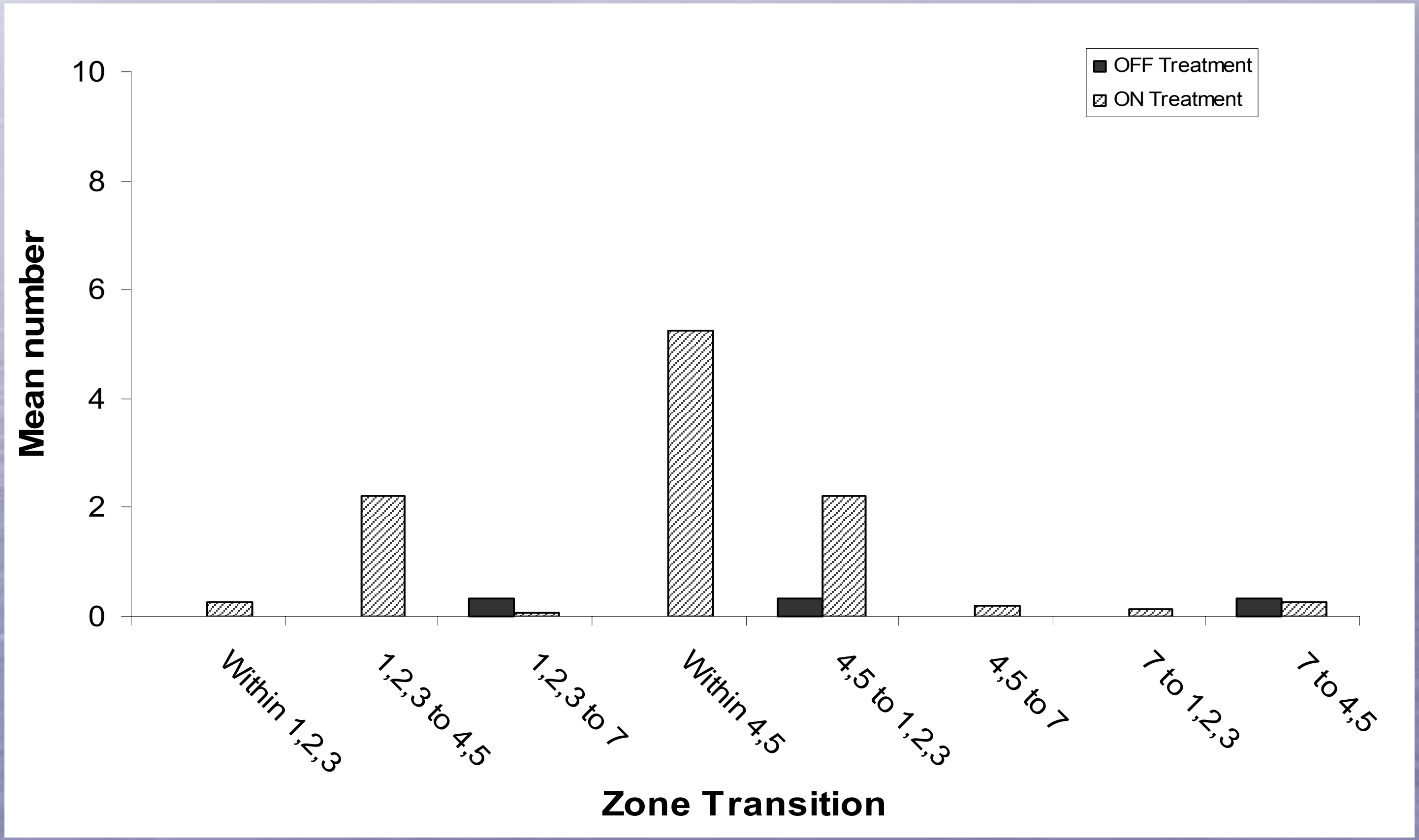
Coho salmon Transitions



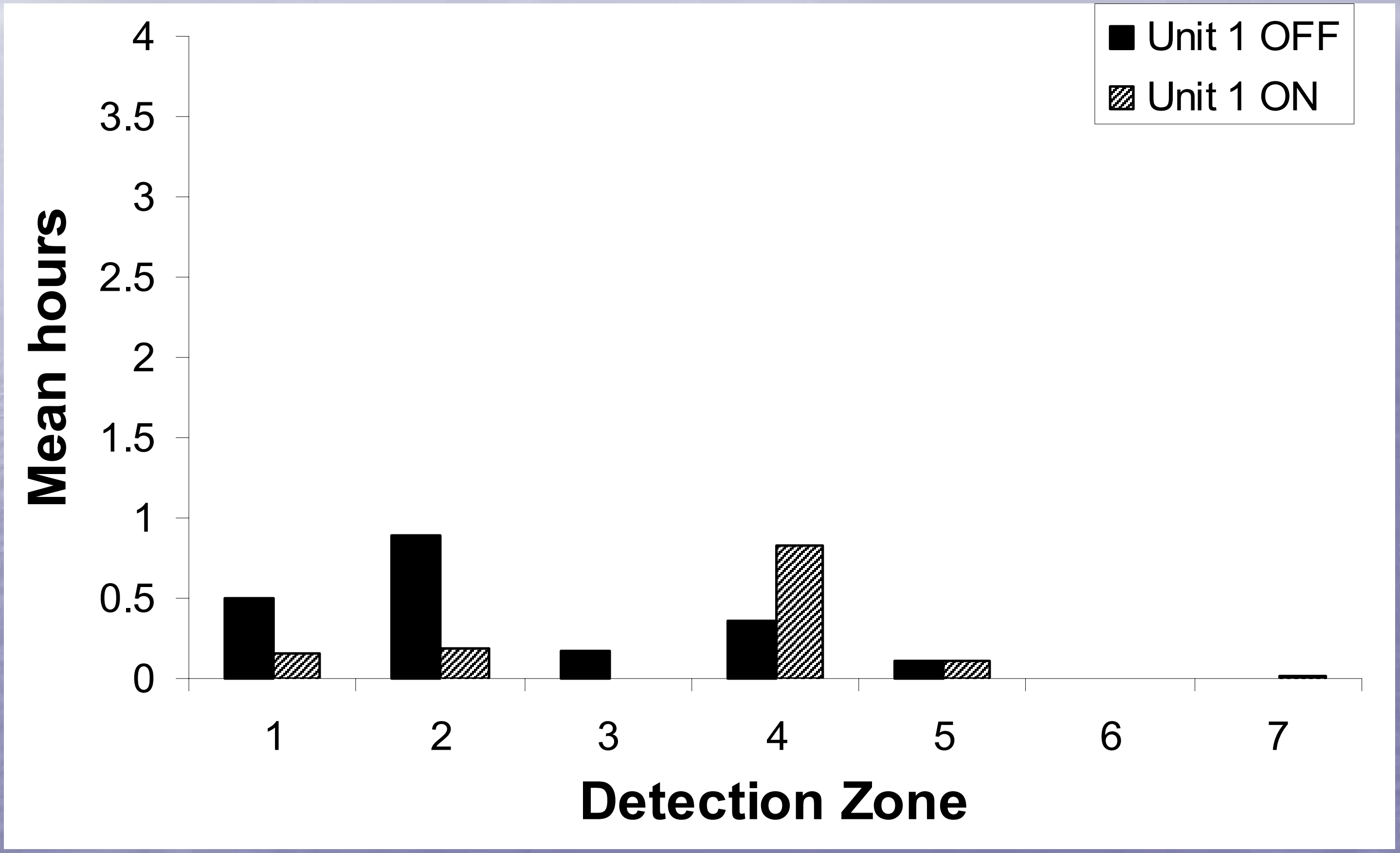
Winter Steelhead Time in Zones



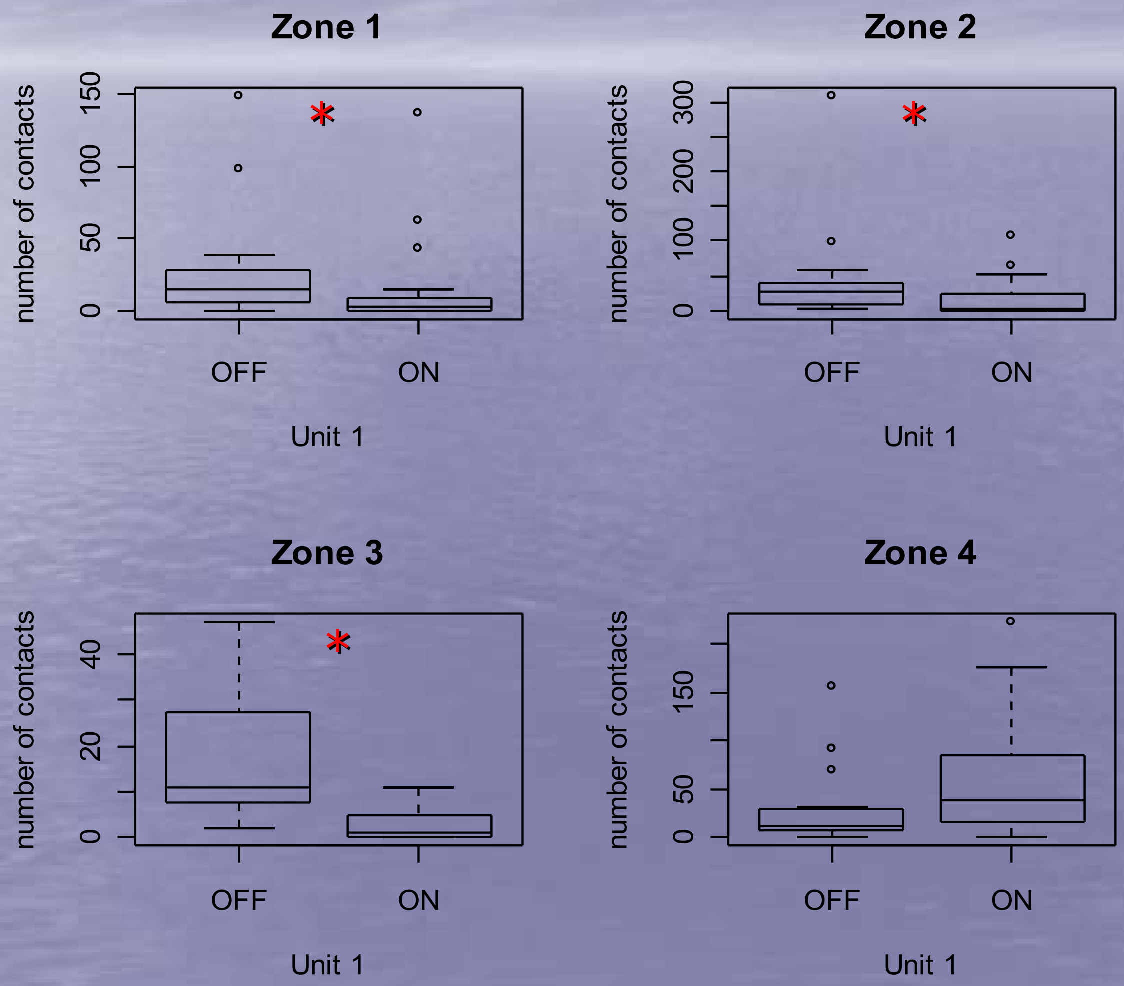
Winter Steelhead Transitions



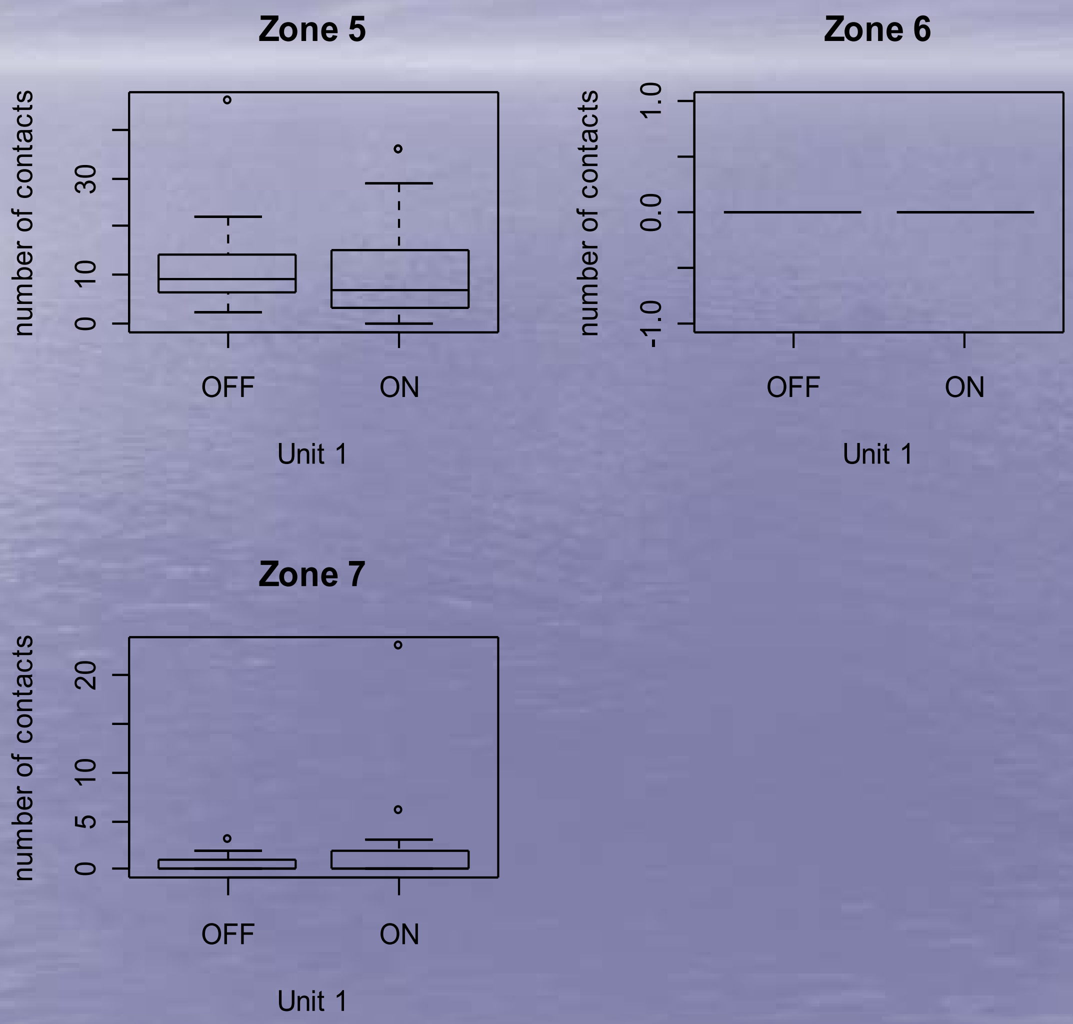
Spring Chinook Salmon Time in Zones



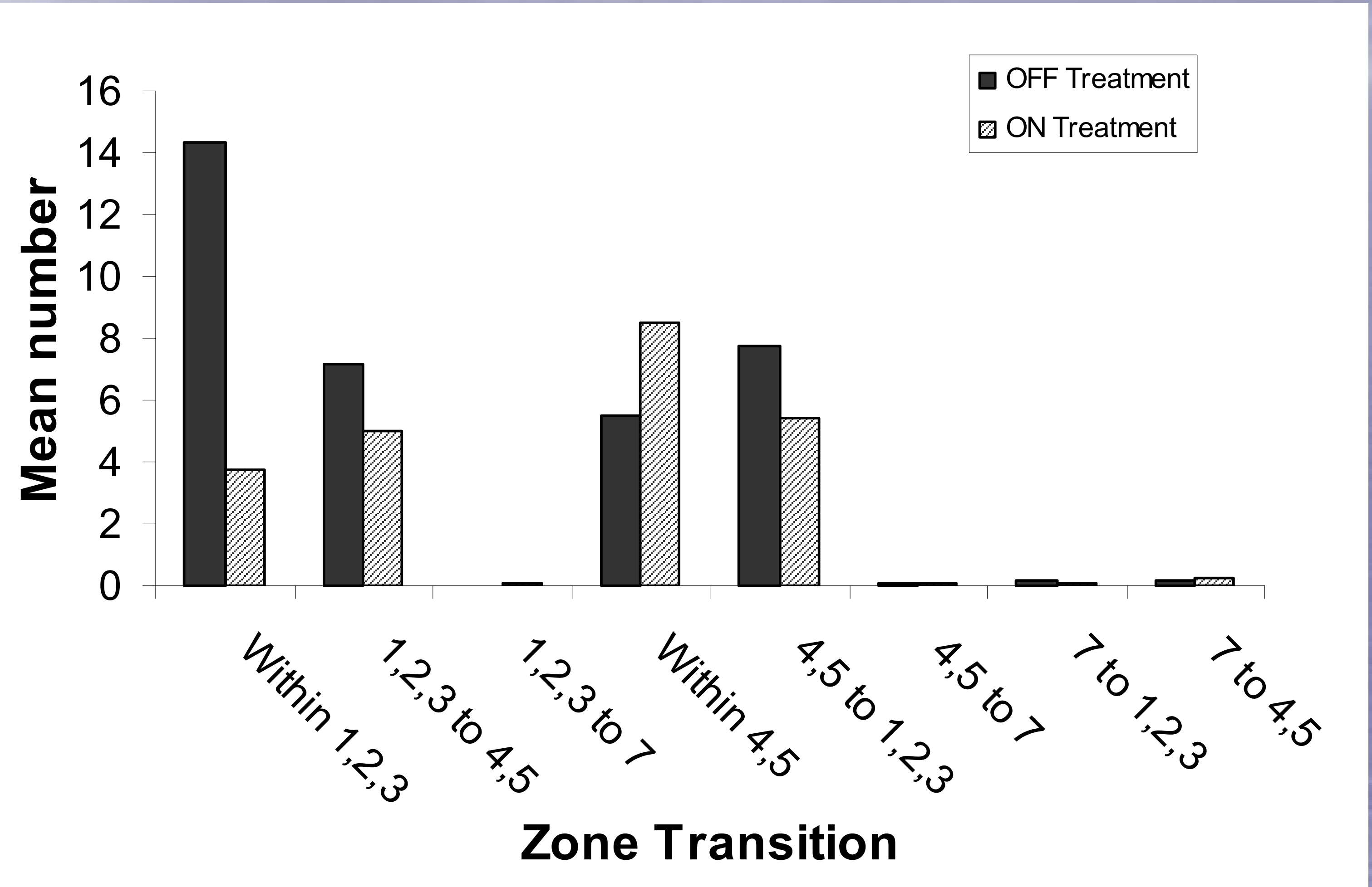
Spring Chinook Salmon Time in Zones



Spring Chinook Salmon Time in zones

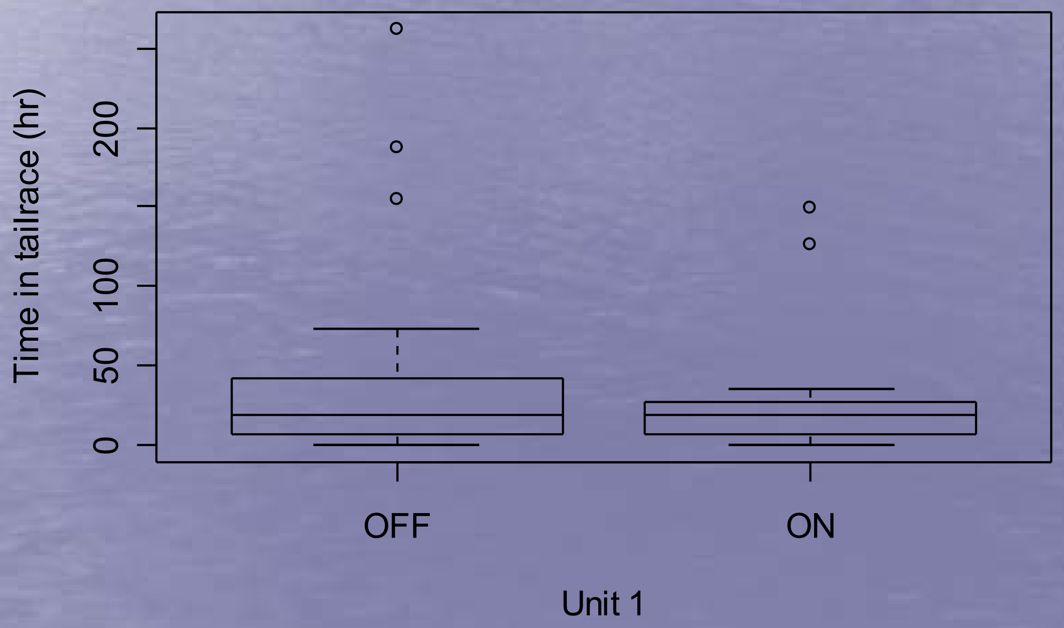


Spring Chinook Salmon Transitions

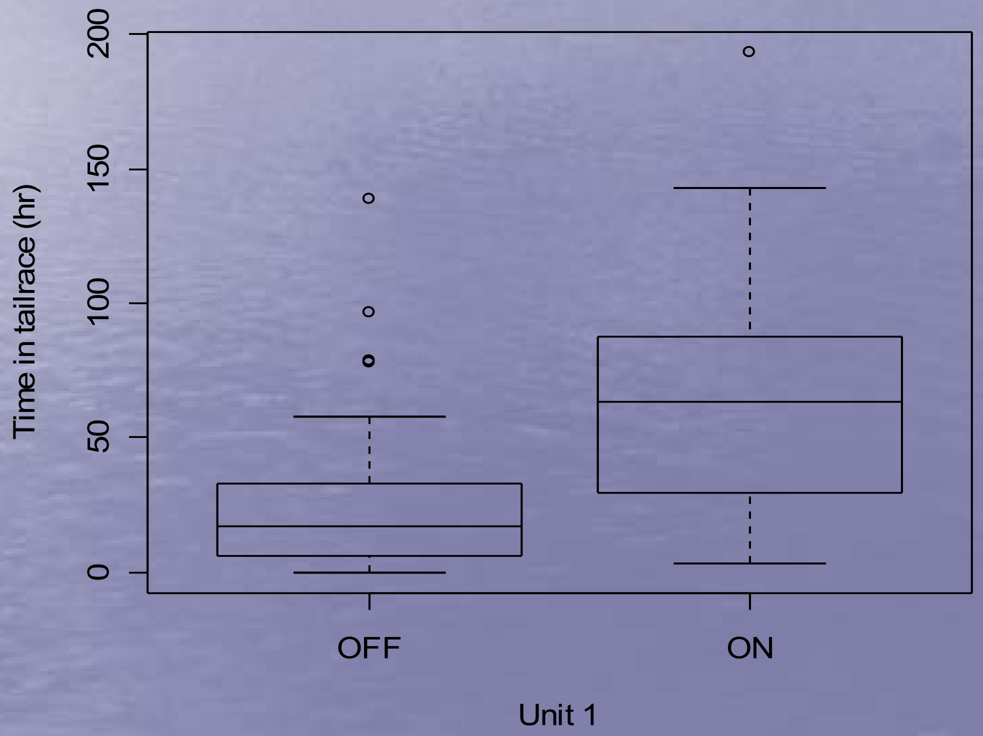


Objective 5. If tailrace conditions preclude trap entry or cause migration delay what locations would be preferred for a new trap entrance?

Summer steelhead



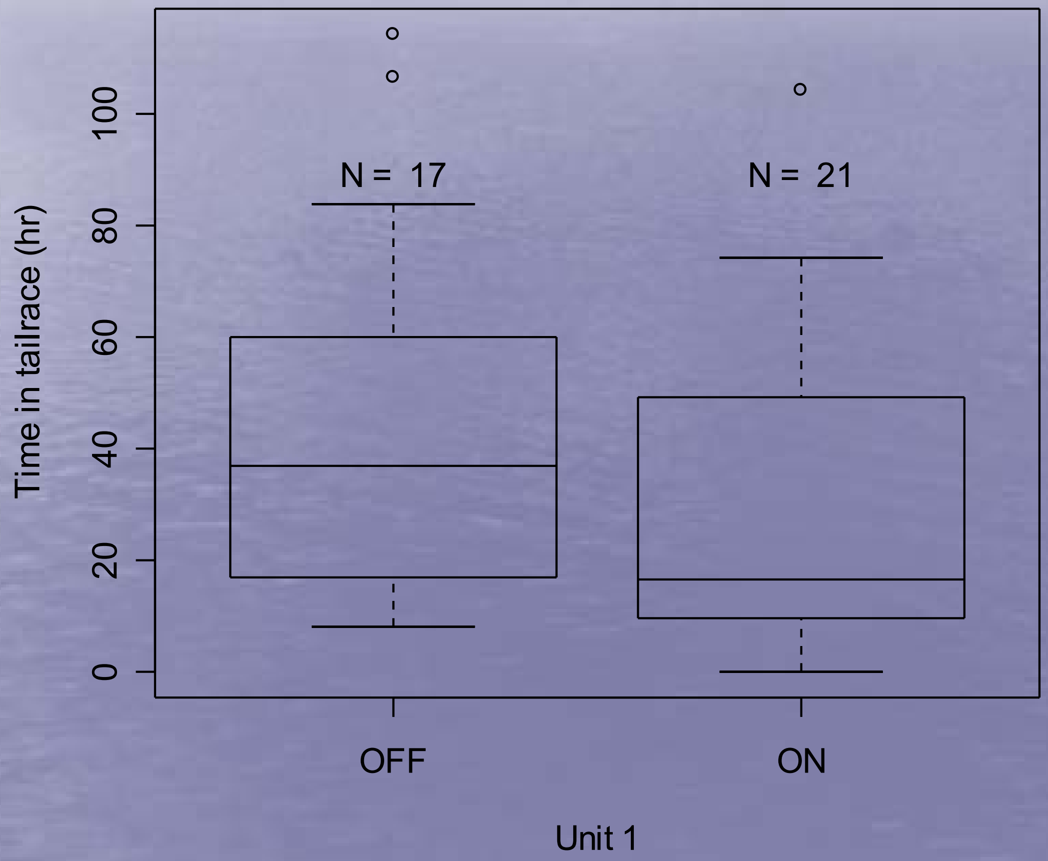
Coho salmon



Winter Steelhead

	Unit 1 ON	Unit 1 OFF
Mean (SE)	26.2 (16.4)	27.5 (5.4)
Median	9.8	18.8

Spring Chinook Salmon



Conclusions

1. No evidence that operation treatment resulted in delay. Total time in the tailrace was between treatment groups for each stock tested.

2. All stocks changed their use pattern associated with operation of Unit 1, indicating that additional trap entrances located near Unit 2 and 3 discharges may be attractive to fish.

Conclusions

3. Current trap has limitations with respect to attraction for coho and chinook salmon and with entry for all species.

Questions?

Lewis River Spring Chinook				Timeline of H&S Actions	NOTE: KEY ASSUMPTION -- THE RETURNING NOR NUMBERS ARE **SUFFICIENT** TO START SEGREGATED POPULATION ABOVE SWIFT							
	Pre 2002	2002 - 2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016 - Future
Hatchery	All returning fish available for broodstock program at hatchery. No differentiation between hatchery and wild fish	Fish with adipose fin segregated from hatchery fish. Only hatchery-marked fish used for broodstock.	Returning hatchery-origin (HOR) fish available for hatchery broodstock program. Any natural-origin returns (NOR) collected to be released back into river. Begin additional hatchery egg take per table 8.4 of the SA for harvest opportunity	Returning HOR fish available for hatchery broodstock program. Any NORs collected to be released back into river. Additional hatchery egg take per table 8.4 of the SA for harvest opportunity	Returning HOR fish available for hatchery broodstock program. Any NORs collected to be released back into river. Additional hatchery egg take per table 8.4 of the SA for harvest opportunity	Returning HOR fish available for hatchery broodstock program. Any NORs collected to be released back into river. Additional hatchery egg take per table 8.4 of the SA for harvest opportunity. Begin rearing juvenile supplementation fish from hatchery broodstock.	Returning HOR fish available for hatchery broodstock program. Any NORs collected to be released back into river. Additional hatchery egg take per table 8.4 of the SA for harvest opportunity. Rear juvenile supplementation fish from hatchery broodstock.	Returning HOR fish available for hatchery broodstock program. Any NORs collected to be transported above Swift dam. Additional hatchery egg take per table 8.4 of the SA for harvest opportunity. Rear juvenile supplementation fish from hatchery broodstock.	Returning HOR fish available for hatchery broodstock program. Any NORs collected to be transported above Swift dam. Additional hatchery egg take per table 8.4 of the SA for harvest opportunity. Rear juvenile supplementation fish from hatchery broodstock.	Returning HOR fish available for hatchery broodstock program. Any NORs collected to be transported above Swift dam. Additional hatchery egg take per table 8.4 of the SA for harvest opportunity. Rear juvenile supplementation fish from hatchery broodstock.	Returning HOR fish available for hatchery broodstock program. Any NORs collected to be transported above Swift dam. Additional hatchery egg take per table 8.4 of the SA for harvest opportunity. Rear juvenile supplementation fish from hatchery broodstock.	Returning HOR fish available for hatchery broodstock program. Any NORs collected to be transported above Swift dam. Additional hatchery egg take per table 8.4 of the SA for harvest opportunity. Rear juvenile supplementation fish per H&S Plan.
Construction of Fish Passage Facilities				Begin construction of fish passage facilities			Merwin Upstream and Swift Downstream fish collectors, Acclimation Ponds upstream of Swift, and Stress Relief Pond downstream of Merwin are completed and put into operation	Fish passage facilities operational	Fish passage facilities operational	Fish passage facilities operational	Fish passage facilities operational	Fish passage facilities operational
							Test Swift FCE with Hatchery Juveniles	Test Swift FCE with Hatchery Juveniles	Monitoring and Evaluation Program	Monitoring and Evaluation Program	Monitoring and Evaluation Program	Monitoring and Evaluation Program
Supplementation						Begin adult supplementation using available NOR fish	Adult supplementation with available NOR fish; begin juvenile fish supplementation with 100,000 fish from hatchery. Mark X juvenile NOR fish collected at Swift as upper basin origin.	Adult supplementation with available NOR fish; begin juvenile fish supplementation with 100,000 fish from hatchery. Mark X juvenile NOR fish collected at Swift as upper basin origin.	Adult supplementation with available NOR fish; begin juvenile fish supplementation with 100,000 fish from hatchery. Mark X juvenile NOR fish collected at Swift as upper basin origin.	Adult supplementation with available NOR fish; begin juvenile fish supplementation with 100,000 fish from hatchery. Mark X juvenile NOR fish collected at Swift as upper basin origin.	Adult supplementation with available NOR fish; begin juvenile fish supplementation with 100,000 fish from hatchery. Mark X juvenile NOR fish collected at Swift as upper basin origin.	Adult supplementation with available NOR fish; begin juvenile fish supplementation with 100,000 fish from hatchery. Mark X juvenile NOR fish collected at Swift as upper basin origin.
HPP		HPP program - goal x fish	HPP program - goal x fish	HPP program - goal x fish	HPP program - goal x fish					Yale HPP Program - goal X fish	Yale HPP Program - goal X fish	Yale HPP Program - goal X fish

Lewis River Spring Chinook				Timeline of H&S Actions		NOTE: KEY ASSUMPTION -- THE RETURNING NOR NUMBERS ARE **INSUFFICIENT** TO START SEGREGATED POPULATION ABOVE SWIFT						
	Pre 2002	2002 - 2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016 - Future
Hatchery	All returning fish available for broodstock program at hatchery. No differentiation between ad and ad-clipped fish	Fish with adipose fin segregated from hatchery fish. Only hatchery fish used for broodstock.	All returning fish available for hatchery broodstock program. No differentiation between hatchery origin and natural origin fish. Natural origin fish used will be tracked within broodstock program. Begin additional egg take per table 8.4 of the SA for harvest opportunity	All returning fish available for hatchery broodstock program. No differentiation between hatchery origin and natural origin fish. Natural origin fish used will be tracked within broodstock program. Additional egg take per table 8.4 of the SA for harvest opportunity	All returning fish available for hatchery broodstock program. No differentiation between hatchery origin and natural origin fish. Natural origin fish used will be tracked within broodstock program. Additional egg take per table 8.4 of the SA for harvest opportunity	All returning fish available for hatchery broodstock program. No differentiation between hatchery origin and natural origin fish. Natural origin fish used will be tracked within broodstock program. Additional egg take per table 8.4 of the SA for harvest opportunity. Begin rearing juvenile supplementation fish.	All returning fish available for hatchery broodstock program. No differentiation between hatchery origin and natural origin fish. Natural origin fish used will be tracked within broodstock program. Additional egg take per table 8.4 of the SA for harvest opportunity. Rear fish for juvenile supplemention program.	All returning fish available for hatchery broodstock program. No differentiation between hatchery origin and natural origin fish. Natural origin fish used will be tracked within broodstock program. Additional egg take per table 8.4 of the SA for harvest opportunity. Rear fish for juvenile supplemention program.	All returning fish available for hatchery broodstock program. No differentiation between hatchery origin and natural origin fish. Natural origin fish used will be tracked within broodstock program. Additional egg take per table 8.4 of the SA for harvest opportunity. Rear fish for juvenile supplemention program.	Returning NOR fish will be transported upstream with X % retained for hatchery broodstock. Additional egg take per table 8.4 of the SA for harvest opportunity. Rear fish for juvenile supplementation program.	Returning NOR fish will be transported upstream with X % retained for hatchery broodstock. Additional egg take per table 8.4 of the SA for harvest opportunity. Rear fish for juvenile supplementation program.	Returning NOR fish will be transported upstream with X % retained for hatchery broodstock. Additional egg take per table 8.4 of the SA for harvest opportunity. Rear fish for juvenile supplementation program per H&S Plan.
Construction of Fish Passage Facilities				Begin construction of fish passage facilities			Merwin Upstream and Swift Downstream fish collectors, Acclimation Ponds upstream of Swift, and Stress Relief Pond downstream of Merwin are completed and put into operation	Fish passage facilities operational	Fish passage facilities operational	Fish passage facilities operational	Fish passage facilities operational	Fish passage facilities operational
							Test Swift FCE with Hatchery Juveniles	Test Swift FCE with Hatchery Juveniles	Monitoring and Evaluation Program	Monitoring and Evaluation Program	Monitoring and Evaluation Program	Monitoring and Evaluation Program
Supplementation						Begin adult supplementation using hatchery fish	Adult supplementation with hatchery fish; begin juvenile fish supplementation with 100,000 fish from hatchery. Mark X juvenile NOR fish collected at Swift as upper basin origin.	Adult supplementation with hatchery fish; juvenile fish supplementation with 100,000 fish from hatchery. Mark X juvenile NOR fish collected at Swift as upper basin origin.	Adult supplementation with hatchery fish; juvenile fish supplementation with 100,000 fish from hatchery. Mark X juvenile NOR fish collected at Swift as upper basin origin.	Transported adults are mix of hatchery and NOR returns; juvenile fish supplementation with 100,000 fish from hatchery. Mark X juvenile NOR fish collected at Swift as upper basin origin.	Transported adults are mix of hatchery and NOR returns; juvenile fish supplementation with 100,000 fish from hatchery. Mark X juvenile NOR fish collected at Swift as upper basin origin.	Transported adults are NOR returns only; juvenile fish supplementation with 100,000 fish from hatchery. Mark X juvenile NOR fish collected at Swift as upper basin origin.
HPP		HPP program - 154 hatchery fish	HPP program - goal x fish	HPP program - goal x fish	HPP program - goal x fish					Yale HPP Program - goal X fish	Yale HPP Program - goal X fish	Yale HPP Program - goal X fish

Lewis River Coho (Type S)				Timeline of H&S Actions	NOTE: KEY ASSUMPTION -- USE TYPE S HATCHERY STOCK TO START SEGREGATED POPULATION ABOVE SWIFT							
	Pre 2002	2002 - 2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016 - Future
Hatchery	All returning fish available for broodstock program at hatchery. No differentiation between ad and ad-clipped fish	All returning HOR fish available for hatchery broodstock program.	All returning HOR fish available for hatchery broodstock program. Adjust egg take per table 8.4 of the SA for harvest opportunity.	All returning HOR fish available for hatchery broodstock program. Adjust egg take per table 8.4 of the SA for harvest opportunity.	All returning HOR fish available for hatchery broodstock program. Adjust egg take per table 8.4 of the SA for harvest opportunity.	All returning HOR fish available for hatchery broodstock program. Adjust egg take per table 8.4 of the SA for harvest opportunity.	All returning HOR fish available for hatchery broodstock program. NOR fish to be transported above Swift dam. Adjust egg take per table 8.4 of the SA for harvest opportunity.	All returning HOR fish available for hatchery broodstock program. NOR fish to be transported above Swift dam. Adjust egg take per table 8.4 of the SA for harvest opportunity.	All returning HOR fish available for hatchery broodstock program. NOR fish to be transported above Swift dam. Adjust egg take per table 8.4 of the SA for harvest opportunity.	All returning HOR fish available for hatchery broodstock program. NOR fish to be transported above Swift dam. Adjust egg take per table 8.4 of the SA for harvest opportunity.	All returning HOR fish available for hatchery broodstock program. NOR fish to be transported above Swift dam. Adjust egg take per table 8.4 of the SA for harvest opportunity.	All returning HOR fish available for hatchery broodstock program. NOR fish to be transported above Swift dam. Adjust egg take per table 8.4 of the SA for harvest opportunity.
Construction of Fish Passage Facilities				Begin construction of fish passage facilities			Merwin Upstream and Swift Downstream fish collectors, Acclimation Ponds upstream of Swift, and Stress Relief Pond downstream of Merwin are completed and put into operation	Fish passage facilities operational	Fish passage facilities operational	Fish passage facilities operational	Fish passage facilities operational	Fish passage facilities operational
							Test Swift FCE with Hatchery Juveniles	Test Swift FCE with Hatchery Juveniles	Monitoring and Evaluation Program	Monitoring and Evaluation Program	Monitoring and Evaluation Program	Monitoring and Evaluation Program
Supplementation						Begin adult supplementation. Transport 9,000 (minumum) NOR and HOR adult coho to above Swift.	Transport all NORs collected then supplement with HOR adult coho to reach transport of 9,000 (minumum) adults to above Swift. Mark X juvenile NOR fish collected at Swift as upper basin origin.	Transport all NORs collected then supplement with HOR adult coho to reach transport of 9,000 (minumum) adults to above Swift. Mark X juvenile NOR fish collected at Swift as upper basin origin.	Transport all NORs collected then supplement with HOR adult coho to reach transport of 9,000 (minumum) adults to above Swift. Mark X juvenile NOR fish collected at Swift as upper basin origin.	Transport all NORs collected then supplement with HOR adult coho to reach transport of 9,000 (minumum) adults to above Swift. Mark X juvenile NOR fish collected at Swift as upper basin origin.	Transport all NORs collected then supplement with HOR adult coho to reach transport of 9,000 (minumum) adults to above Swift. Mark X juvenile NOR fish collected at Swift as upper basin origin.	Transport all NORs collected then supplement with HOR adult coho to reach transport of 9,000 (minumum) adults to above Swift. Mark X juvenile NOR fish collected at Swift as upper basin origin.
HPP		HPP program - goal 2,000 fish	HPP program - goal 2,000 fish	HPP program - goal 2,000 fish	HPP program - goal 2,000 fish					Yale HPP Program - goal 2,000 fish	Yale HPP Program - goal 2,000 fish	Yale HPP Program - goal 2,000 fish

Lewis River Winter Steelhead				Timeline of H&S Actions		NOTE: KEY ASSUMPTION -- THE RETURNING NOR NUMBERS ARE **INSUFFICIENT** TO IMMEDIATELY START SEGREGATED POPULATION ABOVE SWIFT										
	Pre 2002	2002 - 2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016 - Future				
Hatchery		Collect HOR adults for use as broodstock.	Collect HOR adults for use as broodstock. Adjust egg take per table 8.4 of the SA for harvest opportunity.	Collect HOR adults for use as broodstock. Adjust egg take per table 8.4 of the SA for harvest opportunity.	Collect HOR adults for use as broodstock. Adjust egg take per table 8.4 of the SA for harvest opportunity.	Collect HOR adults for use as broodstock. Adjust egg take per table 8.4 of the SA for harvest opportunity.	Collect HOR adults for use as broodstock. Adjust egg take per table 8.4 of the SA for harvest opportunity.	Collect HOR adults for use as broodstock. Adjust egg take per table 8.4 of the SA for harvest opportunity.	Collect HOR adults for use as broodstock. Adjust egg take per table 8.4 of the SA for harvest opportunity.	Collect HOR adults for use as broodstock. Adjust egg take per table 8.4 of the SA for harvest opportunity.	Collect HOR adults for use as broodstock. Adjust egg take per table 8.4 of the SA for harvest opportunity.	Collect HOR adults for use as broodstock. Adjust egg take per table 8.4 of the SA for harvest opportunity.				
Construction of Fish Passage Facilities				Begin construction of fish passage facilities			Merwin Upstream and Swift Downstream fish collectors, Acclimation Ponds upstream of Swift, and Stress Relief Pond downstream of Merwin are completed and put into operation	Fish passage facilities operational	Fish passage facilities operational	Fish passage facilities operational	Fish passage facilities operational	Fish passage facilities operational				
							Test Swift FCE with Hatchery Juveniles	Test Swift FCE with Hatchery Juveniles	Monitoring and Evaluation Program	Monitoring and Evaluation Program	Monitoring and Evaluation Program	Monitoring and Evaluation Program				
Supplementation			Collect NOR adults for use as supplementation broodstock; take eggs to produce 50,000 smolts (age 1+). Rear then release smolts into Lewis River.	Collect NOR adults for use as supplementation broodstock; take eggs to produce 50,000 smolts (age 1+). Rear then release smolts into Lewis River.	Collect NOR adults for use as supplementation broodstock; take eggs to produce 50,000 smolts (age 1+). Rear then release smolts into Lewis River.	Collect NOR adults for use as supplementation broodstock; take eggs to produce 50,000 smolts (age 1+). Rear then release smolts into Lewis River. Any Enhanced Natural stock returns (rtns from 50,000 smolts) will be transported above Swift dam.	Collect NOR adults for use as supplementation broodstock; take eggs to produce 50,000 smolts (age 1+). Rear then release smolts into Lewis River. Any Enhanced Natural stock returns (rtns from 50,000 smolts) will be transported above Swift dam. Mark juvenile NOR fish collected at Swift as upper basin origin.	Collect NOR adults for use as supplementation broodstock; take eggs to produce 50,000 smolts (age 1+). Rear then release smolts into Lewis River. Any Enhanced Natural stock returns (rtns from 50,000 smolts) will be transported above Swift dam. Mark juvenile NOR fish collected at Swift as upper basin origin.	Collect NOR adults for use as supplementation broodstock; take eggs to produce 50,000 smolts (age 1+). Rear then release smolts into Lewis River. Any Enhanced Natural stock returns (rtns from 50,000 smolts) will be transported above Swift dam. Mark juvenile NOR fish collected at Swift as upper basin origin.	Collect NOR adults for use as supplementation broodstock; take eggs to produce 50,000 smolts (age 1+). Rear then release smolts into Lewis River. Any Enhanced Natural stock returns (rtns from 50,000 smolts) will be transported above Swift dam. Mark juvenile NOR fish collected at Swift as upper basin origin.	Collect NOR adults for use as supplementation broodstock; take eggs to produce 50,000 smolts (age 1+). Rear then release smolts into Lewis River. Any Enhanced Natural stock returns (rtns from 50,000 smolts) will be transported above Swift dam. Mark juvenile NOR fish collected at Swift as upper basin origin.	Collect NOR adults for use as supplementation broodstock; take eggs to produce 50,000 smolts (age 1+). Rear then release smolts into Lewis River. Any Enhanced Natural stock returns (rtns from 50,000 smolts) will be transported above Swift dam. Mark juvenile NOR fish collected at Swift as upper basin origin.				
HPP		None	None	None	None					Yale HPP Program - goal X fish	Yale HPP Program - goal X fish	Yale HPP Program - goal X fish				