Coho Life Cycle Monitoring in Palouse and Larson Creeks
OWEB 208-2098
Project Completion Report

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Coos Watershed Association
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BACKGROUND

The Coho Life Cycle Monitoring project in Palouse and Larson Creeks is a continuation of a long-term monitoring study initiated in 2004 to examine coho salmon survival, production and habitat use in tide gated coastal lowland streams. Tide gates are tidal flood control structures designed to open and close with each tidal cycle to limit tidal influence on upstream agricultural areas. The basic function of tide gates creates a partial barrier to fish passage. Coastal lowland streams are critical for the sustainability of Oregon Coastal coho, but it is unclear how tide gates may affect coho movement, habitat use and survival. Displaced fishers were employed by the Coos Watershed Association (CoosWA) with funding from Oregon Watershed Enhancement Board (OWEB) Grant 208-2098 during fall 2008 through fall 2009 to assist with implementation of the Life Cycle Monitoring project and related sampling efforts in the lowland coastal subbasins.

The objective of the Life Cycle Monitoring project is to estimate the size of juvenile and adult coho salmon populations in the Palouse and Larson subbasins and to assess marine and freshwater survival rates. The Life Cycle Monitoring project in each stream basin consisted of adult coho spawner monitoring in the late fall and winter, and juvenile coho smolt and fry sampling in the late winter and spring. CoosWA staff and fisher technicians operated fence weir traps and conducted weekly spawning surveys in each subbasin during late the fall and winter season in 2008-2009 and 2009-2010 to estimate adult coho spawner abundance. Fisher personnel assisted with operation of rotary screw traps in Palouse and Larson Creeks, which were used to estimate outmigrant coho smolt abundance in each subbasin. Estimates of adult coho spawner abundance and outmigrant coho smolt population size were used to calculate freshwater and marine survival in each subbasin based on Oregon Department of Fish and Wildlife (ODFW) Life Cycle Monitoring methods (Suring 2009). The results of Life Cycle Monitoring efforts will augment the existing ODFW coho Life Cycle Monitoring database and will be important for understanding patterns of coho salmon production and survival on the Oregon coast.

In conjunction with the Life Cycle Monitoring project, efforts to capture and mark juvenile coho salmon in a variety of lowland stream habitats were initiated in 2008 in Palouse and Larson subbasins to identify patterns of juvenile coho movement and seasonal habitat use in freshwater and upper estuarine areas. The juvenile coho salmon collection efforts were conducted on a seasonal basis, during spring, summer and winter periods to identify differences in size and growth among juvenile coho exhibiting seasonal patterns of movement and habitat use. Juvenile coho were captured using beach seine, pole seine, and electrofishing methods in mainstem and tributary areas upstream of the tide gate in each stream and marked with uniquely identifiable passive integrated transponder (PIT) tags to track fish movement, size and growth. Data from

these efforts will help describe the various freshwater- and estuarine-rearing life histories exhibited by juvenile coho salmon within lowland coastal streams and their upper estuarine zones, and will augment Life Cycle Monitoring efforts in each subbasin by providing an alternate means to monitor freshwater and marine survival of coho salmon.

FISHER PERSONNEL AND TRAINING

Displaced fishermen were hired under Oregon Watershed Enhancement Board (OWEB) Grant 208-2098 to assist with operation of Life Cycle Monitoring sites and related sampling efforts on Palouse and Larson Creeks. A total of four displaced fishermen were employed during the period of fall 2008 through fall and winter 2009. Fishermen employed by the OWEB grant assisted with nearly every aspect of the project: fisher duties consisted of operation and maintenance of weir traps designed to capture adult coho salmon spawners, conducting coho salmon spawner surveys, operation and maintenance of rotary screw traps to capture juvenile salmonids, assistance with seasonal efforts to capture, sample and mark juvenile coho in Palouse and Larson Creeks, construction and maintenance of PIT antenna arrays and data entry tasks.

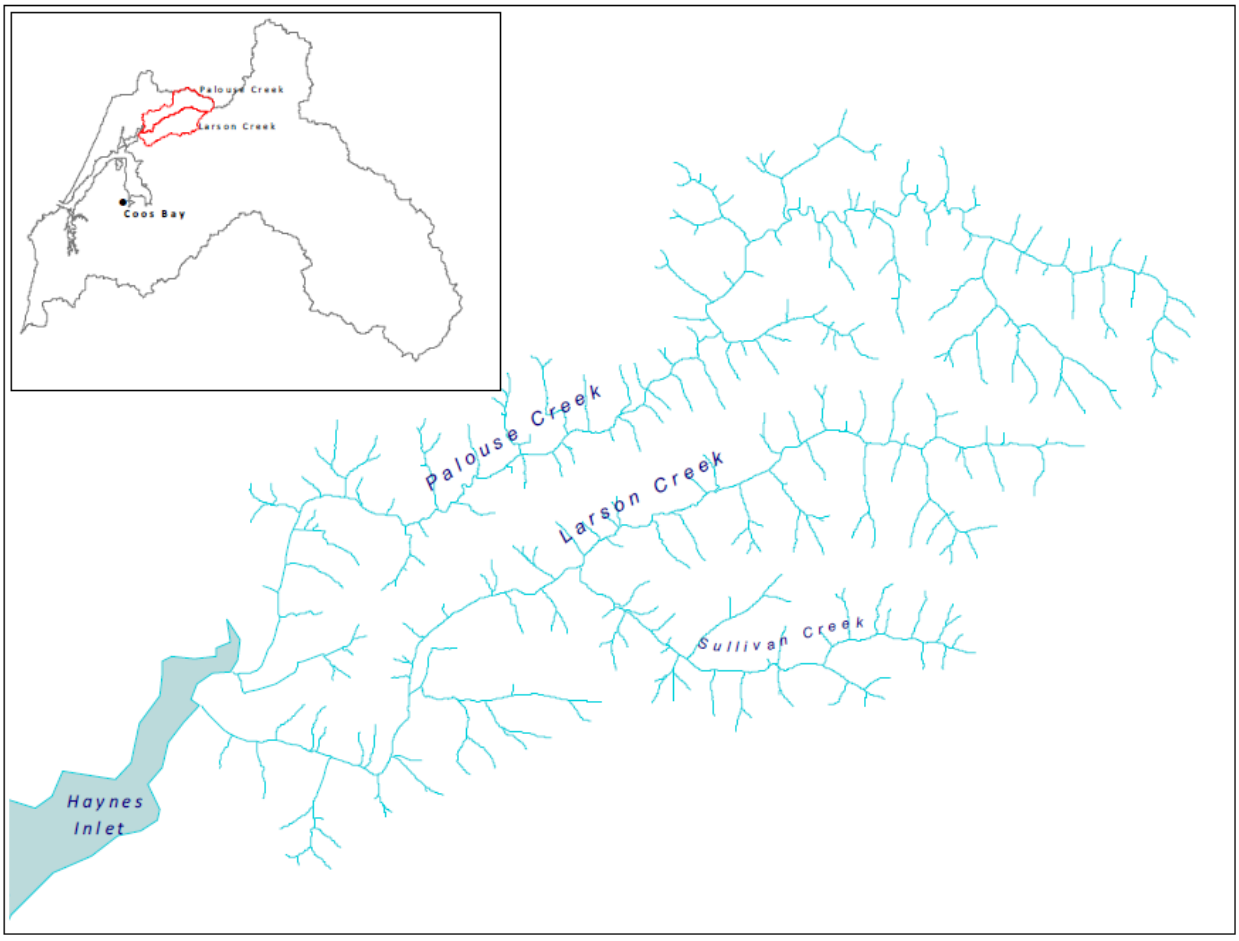

Figure 1. Location of Palouse and Larson subbasins within the Coos Bay estuary.

Tasks associated with operation of the adult picket weir traps consisted of daily cleaning of trap fences, identification of adult salmonids to species, marking adult coho using Floy tagging methods, and collection of otolith samples from jack and adult coho carcasses (Table 1, Figure 2). Salmon spawning survey activities consisted of enumerating spawning adult and jack salmon, redds and spawner carcasses in Palouse and Larson Creeks during foot surveys of each stream. Salmon carcasses were sampled during spawning surveys to collect otoliths, sex and length data, and to scan individual fish for the presence of PIT tags. As part of operation of rotary screw traps, fishers identified juvenile fish to species, anesthetized and marked juvenile salmonids, and were responsible for maintaining proper operation and function of trap components (Figure 3). Seasonal efforts to capture and sample juvenile coho included assisting with collection of fish from a variety of mainstem and tributary habitat types in Palouse and Larson subbasins using beach seine, pole seine and electrofishing techniques (Figure 4). Captured juvenile coho were measured for length and weight, assessed for presence and extent of externally visible parasites, and a subset of captured coho were marked with individually identifiable PIT tags. Fishers also assisted with collection of habitat metrics including stream unit physical dimension and water quality measurements. Passive integrated transponder antenna arrays were established in Palouse and Larson subbasins to detect movement of tagged juvenile coho during each seasonal period; fishers assisted with construction, maintenance and regular downloading of data collected by PIT transceivers at each site.

Table 1. Displaced fishers employed as part of OWEB Grant 208-2098, including the tasks performed and the number of hours worked.

Fisher	Hours Worked	Work Accomplished
Jay Blodgette	495	1) Installed and operated adult traps; measured and marked adult fish for mark-recapture effort, collected otoliths from coho carcasses, and performed daily maintenance of traps. 2) Installed and operated rotary screw traps; identified juvenile salmonids to species, measured and marked juvenile fish, and performed daily maintenance of screw trap. 3) Assisted with capture, sampling and PIT tagging juvenile coho salmon in Palouse Creek. 4) Assisted with maintenance of PIT antenna arrays in Palouse Creek.
Brad Blodgette	15	1) Helped install adult traps.
Dave Nelson	854	1) Installed and operated adult traps; measured and marked adult fish for mark-recapture effort, collected otoliths from coho carcasses, and performed daily maintenance of trap. 2) Installed and operated rotary screw traps; identified juvenile salmonids to species, measured and marked juvenile fish, and performed daily maintenance of screw trap. 3) Assisted with capture, sampling and PIT tagging juvenile coho salmon in Palouse and Larson Creeks. 4) Assisted with construction and maintenance of PIT antenna arrays in Palouse and Larson Creeks. 5) Performed data entry and management tasks
Scott Howard	34	1) Assisted with capture, sampling and marking juvenile coho salmon in Palouse Creek.
Total	***1,397***	

Table 2. Displaced fishers employed as part of OWEB Grant 208-2098 during 2008-2009, county of residence and connection to commercial fishing.

Fisher	County of Residence	Connection to Fishing
Jay Blodgette	Coos	Crew, family member
Brad Blodgette	Coos	Boat owner/operator
Dave Nelson	Coos	Crew
Scott Howard	Douglas	Charter boat owner/operator

Figure 2. Fisher checking the Palouse adult trap for fish and clearing debris from the trap.

Figure 3. Dave Nelson removing debris from the Larson Creek rotary screw trap.

Figure 4. Dave Nelson loading a beach seine onto a boat in the Palouse Creek tide gate pool in preparation for beach seining efforts.

METHODS

Methods for Coho Life Cycle Monitoring project on Palouse and Larson Creeks follow ODFW protocols utilized at seven ODFW Life Cycle Monitoring sites on the Oregon Coast (Suring et al. 2007). Coho populations in Palouse and Larson Creeks were monitored during the spawning period in late fall and winter and during the coho smolt outmigration period in late winter and spring. Adult coho were captured in picket fence weir traps at the lower extent of spawning areas in order to measure and tag a portion of the adult spawner population. The total number of spawning coho and proportion of tagged fish were recorded each week throughout the spawning period during spawning surveys. Estimates of adult coho population size were calculated using mark-recapture and area-under-the-curve (AUC) calculations based on the number of fish tagged and weekly spawner counts (Jacobs and Nickelson 1998).

The abundance of coho smolt populations were estimated based on capture of downstream migrant fish at rotary screw traps operated on Palouse and Larson Creeks. The rotary screw traps were located downstream of all spawning and most rearing areas in each stream in order to maximize the ability to capture downstream migrant smolts. The screw trap sampling effort targeted coho smolts, however coho fry, steelhead and cutthroat trout and lamprey were also sampled based on ODFW Life Cycle Monitoring procedures. Fish captured at each screw trap were enumerated, measured for length and a sub-sample was marked and released upstream of the trap to determine the capture efficiency of each trap. Each day a maximum of 25 individuals of each species and age-class were marked with a small fin clip and released upstream of the screw trap into a box equipped with a trap door and a light sensitive trigger switch. The switch automatically released fish at dusk in order to reduce risk of potential predation. Screw trap efficiency was calculated for each trap on a weekly basis and outmigrant smolt population estimates were calculated by extrapolating weekly capture totals based on weekly trap efficiency estimates. Variance and confidence intervals were calculated for yearly smolt population estimates using a bootstrap procedure with 1,000 iterations per calculation (Thedinga et al. 1994).

Freshwater and marine coho survival rates were determined for each brood year based on estimates of egg deposition, outmigrant smolt population size, and the total number of adult coho spawners. Egg deposition was estimated based on coho spawner counts and abundance estimates. The number and average fork length of female spawners was derived from sampled carcasses, or if few carcasses were observed it was assumed that the male: female ratio was 1:1 and an average length obtained from cumulative years was used. An average female coho fecundity rate was applied to the estimated number of female coho to determine the total egg deposition in each stream. The coho freshwater survival rate was calculated as the number of smolts having survived to outmigration from the total number of eggs deposited. Marine survival was calculated as the number of coho adults returned to each stream from the number of outmigrant smolts. A coho brood year represents the first year eggs are deposited during the winter spawning period by adult fish (e.g. fish of the 2008 brood year were derived from adult fish spawning during winter 2008-09).

Beginning in 2008, CoosWA staff and OSU Fisheries staff and students have conducted a cooperative effort to capture and PIT tag juvenile coho salmon to identify juvenile coho movement and habitat use in Palouse and Larson subbasins. In addition to providing data regarding juvenile coho utilization of coastal lowland habitats, the PIT tagged coho will provide a means to

potentially validate freshwater and marine survival estimates developed in association with the Life Cycle Monitoring project. The proportion of coho salmon PIT tagged as subyearling fry that are detected at tide gate PIT antenna arrays as outmigrant yearling smolts will provide an approximate estimate of freshwater survival rates in each basin that can be used to validate Life Cycle Monitoring estimates. Similarly, the proportion of yearling coho smolts recorded outmigrating from each basin that return as subadult jack (2-year old) and adult (3-year old) coho to spawn will provide an indication of marine survival rates.

Juvenile coho salmon habitat use and movement patterns in each stream were assessed based on seasonal capture and marking of juvenile coho in a variety of mainstem and tributary habitats. The juvenile coho sampling effort in the Palouse subbasin was conducted in the mainstem channel from the tide gate at RKm 0.0 to the waterfall at RKm 12.1, and four tributaries, while work in Larson Creek was completed entirely within the mainstem between the tide gate at RKm 0.0 and RKm 8.0 (Table 3). Mainstem and tributary areas were classified into reaches based on hydrology, instream habitat, and channel geomorphology and stream reaches were broadly classified as reservoir, low gradient lowland and moderate gradient upland areas. Capture of juvenile coho was conducted using beach seine methods in the tide gate reservoir and estuarine areas, and electrofish and river seine methods were employed in riverine areas. Sampling efforts in riverine areas were conducted by habitat unit, whereas reservoir areas were conducted within standard 50 meter units because reservoir portions of each subbasin were continuous pool habitats that could not be morphologically distinguished. Sampling of juvenile coho in Palouse Creek tributary sample reaches were conducted in a similar manner as mainstem areas; juvenile coho were captured using seine and electrofish methods and individual fish were tagged using PIT tags based on size at time of tagging.

Following emergence in early spring, coho salmon fry 48-60 mm in fork length were tagged with 8.5 mm PIT tags, while coho parr and smolts 61 mm and larger were tagged with 12 mm PIT tags. The total number of fish caught were enumerated by species, measured for fork length to the nearest 1 mm, and weighed to the nearest 0.1g. Juvenile coho captured during monthly seine efforts were anesthetized with buffered MS-222 prior to sampling and were allowed to recover prior to release at the location of capture.

Movement patterns of PIT tagged juvenile coho were assessed based on recaptured fish during capture efforts at sample units, and with detections of PIT tagged coho at stationary PIT antenna arrays. Coho recaptured at sample units were scanned for presence of PIT tags using a small portable PIT antenna. Stationary PIT antennas, consisting of at least two antennas each were installed at four locations in Palouse Creek and at the Larson Creek tide gate (RKm 0.0) (Figure 5). Each antenna array was configured in parallel such that the directional movement of tagged fish could be ascertained and arrays were screened with fine mesh on the channel margins to consolidate fish passage through the antennas to improve detection efficiency. In Palouse Creek, stationary antenna arrays were placed at the tide gate opening (RKm 0.0), at the upstream extent of the reservoir reach (RKm 3.2), at the upstream extent of Reach 2 (RKm 4.1), and at the upstream extent of Reach 3 (RKm 7.3) (Figure 5).

Table 3. Mainstem and tributary reaches in Palouse and Larson Creeks.

Subbasin	Reach Number	Stream Section	Length (Km)	Reach Type
Palouse	1	Palouse	3.3	Tide gate reservoir
	2	Palouse	1.4	Mainstem lowland
	3	Palouse	2.8	Mainstem lowland
	4	Palouse	4.0	Mainstem lowland
	5	Palouse	1.2	Mainstem upland
	1	Tributary A	0.3	Lowland tributary
	1	Tributary B	0.4	Lowland tributary
	1,2	Bear Creek	0.7	Upland tributary
	1,2	Tributary C	0.8	Upland tributary
Larson	1	Larson	2.0	Tide gate reservoir
	2*	Larson	3.0	Mainstem lowland
	3	Larson	2.3	Mainstem lowland
	4	Larson	0.7	Mainstem upland

* Access to Larson Creek Reach 2 was denied by the landowner and was consequently not sampled.

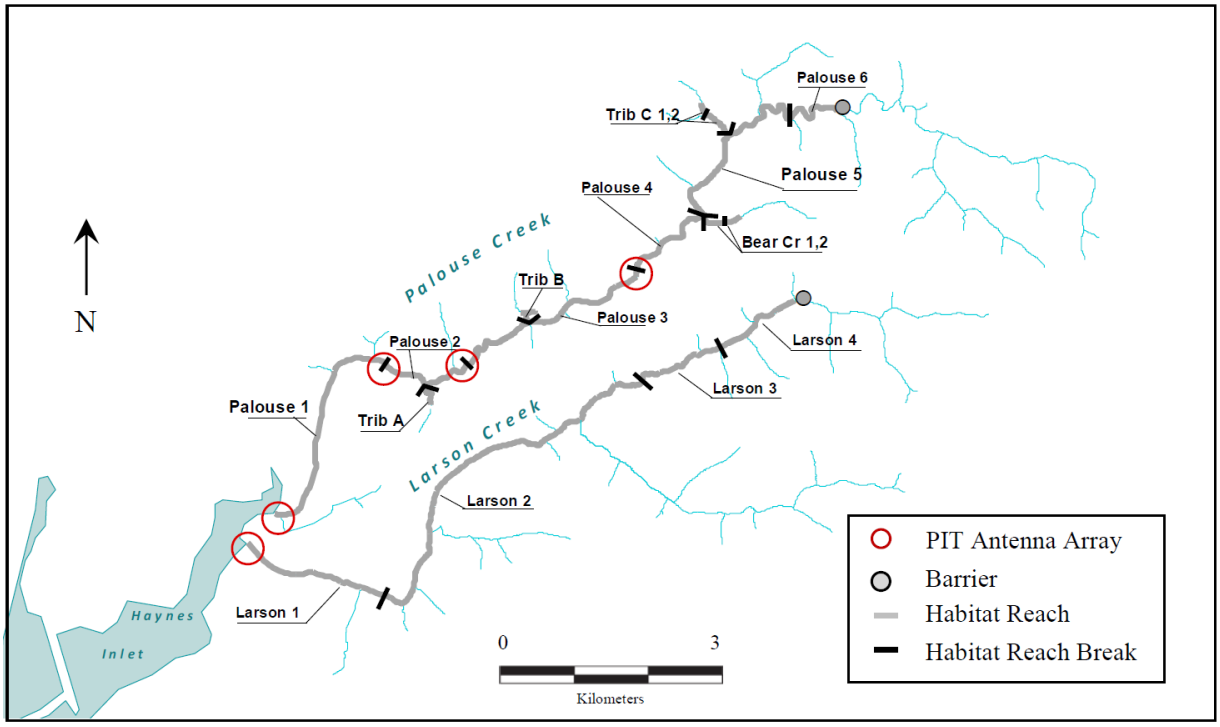

Figure 5. Location of PIT antenna arrays on Palouse and Larson Creeks.

RESULTS

The apparent trend in adult coho salmon spawner abundance in Palouse and Larson subbasins has been upward in 2008 and 2009, following a low return year in 2007 (Figure 6). Adult coho abundance based on AUC estimates were 422 and 491 in the Palouse subbasin during the 2008 and 2009 return years, respectively (Table 4). Spawning survey coverage in spawning Reach 1 of Larson Creek was incomplete during the 2008 and 2009 return years due to limited landowner access; consequently, adult escapement was estimated based on the regression of previous AUC estimates of escapement in spawning survey segments of Larson and Sullivan Creeks (Figure 7). Based on these methods, adult coho escapement in the Larson subbasin was estimated to be 272 and 366 in 2008 and 2009, respectively (Table 4). Estimates of adult spawner abundance based on mark-recapture methods were not possible in 2008 and 2009 due to low and variable capture rates at fence weir traps in Palouse and Larson Creeks. A total of 12 fish were marked with external Floy tags in the Palouse subbasin in both 2008 and 2009, while 8 fish were Floy tagged in the Larson subbasin during those years.

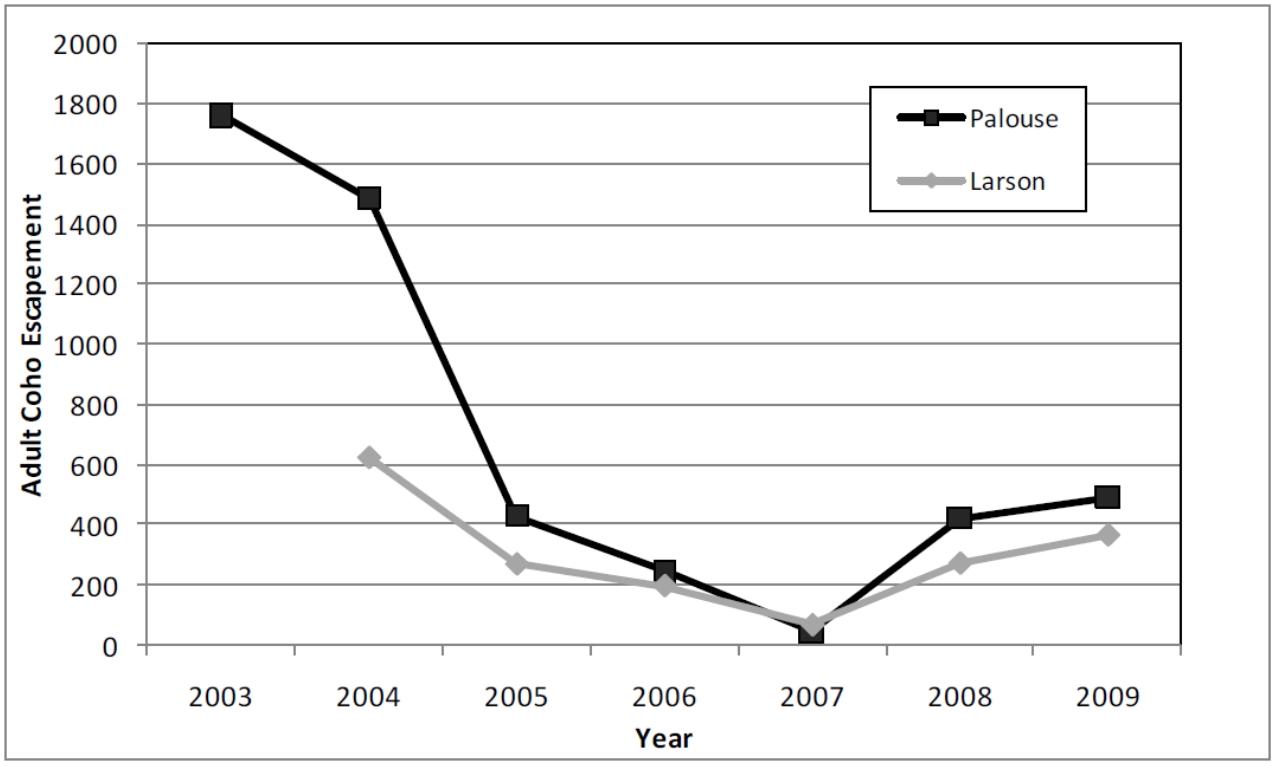

Figure 6. Estimated adult coho salmon escapement in Palouse and Larson subbasins during Life Cycle Monitoring efforts in each subbasin.

Table 4. Estimated adult and jack spawning population sizes by return year in Palouse and Larson subbasins.

	Larson Subbasin		Palouse Subbasin	
Return Year	Adult	Jack	Adult	Jack
2003[1]	n/a	n/a	1,763	243
2004	624	158	1,484	164
2005	269	38	429	52
2006	197	30	245	23
2007	67	22	43	14
2008[2]	272	n/a	422	39
2009[2]	366	n/a	491	69

[1] Spawning survey coverage in Larson subbasin did not include Sullivan Creek.

[2] Spawning survey frequency and coverage in the Larson subbasin during 2008-09 was incomplete; adult population size was estimated based on regression of previous AUC abundance estimates.

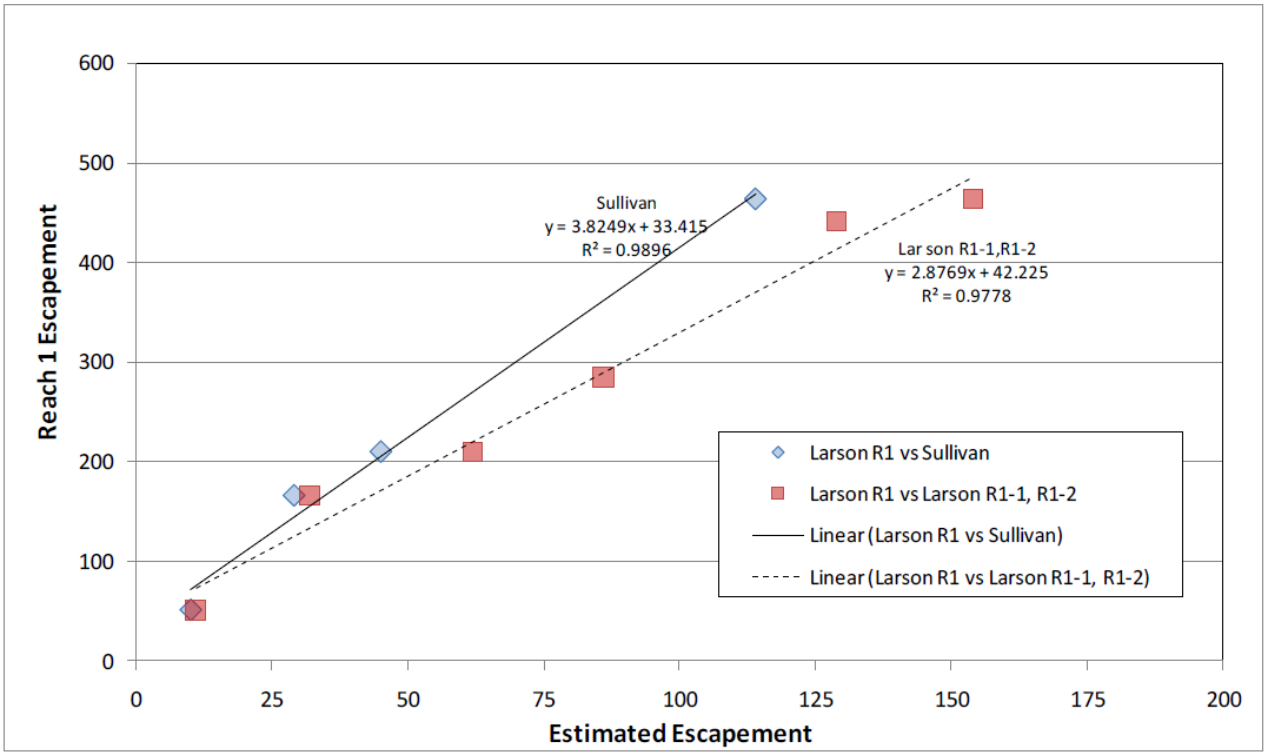

Figure 7. Regression of estimated adult coho escapement in segments of Larson and Sullivan Creeks used to estimate adult coho abundance in spawning Reach 1 of Larson Creek in 2008 and 2009.

Juvenile coho smolt population abundance in both subbasins has ranged between approximately 3,000 and 7,000 smolt outmigrants for each year that population estimates were calculated (Figure 8). Coho smolt abundance during the period of the OWEB Grant 208-2098 was 6,468 smolts (95% CI ±2,399) in Palouse subbasin and 5,828 (95% CI ±10,246) in Larson subbasin. Low capture rates of outmigrant coho and poor capture efficiencies estimated at each trap are likely primary factors contributing to large confidence intervals for each abundance estimate.

Coho salmon freshwater and marine survival was estimated for each brood year in Palouse and Larson subbasins. Each coho brood year represents the first year eggs are deposited during the winter spawning period by adult fish (e.g. the 2008 brood year of coho were derived from adult coho spawning during winter 2008-09). Based on Life Cycle Monitoring estimates of coho smolt abundance, freshwater survival of juvenile coho in Palouse Creek ranged from 0.1% for the 2004 brood year to 11.4% for the 2007 brood year, while in Larson Creek freshwater survival ranged from 0.7% for the 2004 brood year to 6.6% for the 2007 brood (Table 5). Low freshwater survival estimates in both basins for the 2004 and 2005 broods (<1%) are primarily due to high levels of estimated egg deposition in both subbasins. Marine survival in both subbasins was estimated at less than 2% for the 2004 brood year, but were markedly higher for brood years 2005 and 2006 (Table 5).

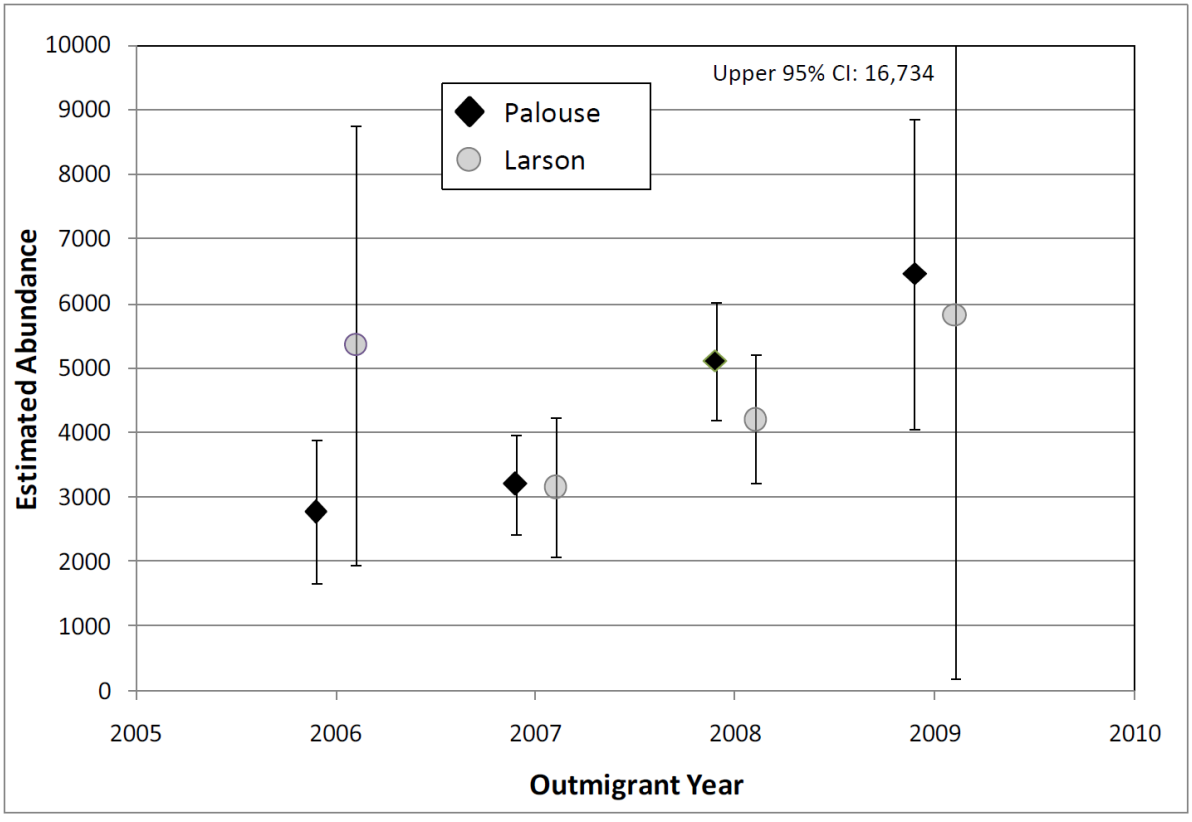

Figure 8. Coho smolt abundance estimates in Palouse and Larson subbasins with 95% confidence intervals.

Table 5. Coho Life Cycle Monitoring parameters for Larson and Palouse Creek Basins, including estimates of adult spawner escapement, egg deposition, outmigrant smolt population size, and freshwater and marine survival rates by brood year.

Basin	Brood Year[1]	Egg Deposition[2]	Smolt Population Size	Adult Spawner Escapement	Adult Female Coho	Freshwater Survival[3]	Marine Survival[4]
Palouse	2000	-	-	1,763	882	-	-
	2001	-	-	1,484	742	-	-
	2002	-	-	429	215	-	-
	2003	2,321,249	-	245	123	-	-
	2004	1,953,904	2,777	43	22	0.1%	1.5%
	2005	564,842	3,200	422	211	0.6%	13.2%
	2006	327,451	5,100	491	246	1.6%	9.6%
	2007	56,616	6,468			11.4%	
	2008	564,018					
Larson	2001	-	-	624	312	-	-
	2002	-	-	269	135	-	-
	2003	-	-	197	99	-	-
	2004	821,588	5,356	67	34	0.7%	1.3%
	2005	354,178	3,153	272	136	0.9%	8.6%
	2006	263,298	4,202	366	183	1.6%	8.7%
	2007	88,215	5,828			6.6%	
	2008	363,538					

[1] Brood year is defined as the first year that eggs are deposited during the fall/winter spawn period (e.g. coho of the 2006 brood year were derived from coho spawning during the 2006-07 spawn period. This brood will return to spawn as adults during the 2009-10 spawn season).

[2] Egg deposition values correspond to the first year in which the eggs were deposited by adult female coho during the spawn period (e.g. eggs deposited by 2004 brood year adult coho during the 2007-08 spawn period correspond with 2007 brood year data).

[3] Freshwater survival was calculated as the proportion of the estimated number of eggs deposited that produce outmigrant coho smolts.

[4] Marine survival is the proportion of coho smolts that return to spawn as adults.

The proportions of subyearling coho fry PIT tagged in the Palouse and Larson subbasins detected outmigrating as yearling coho smolts will be used to approximate freshwater survival in each subbasin; similarly, the number of PIT tagged outmigrant coho smolts that return as jack and adult fish will be used to calculate marine survival rates. In Palouse Creek, a total of 5,146 juvenile coho were marked with PIT tags during 2008 and 2009 sampling efforts, including 1,177 and 2,787 subyearling coho fry of the 2007 and 2008 broods, respectively (Table 6). In Larson Creek, a total of 1,139 juvenile coho were tagged during this time, including 282 and 493 subyearling coho of the 2007 and 2008 brood years, respectively (Table 6). The number of PIT tagged coho smolts from each brood that outmigrated from Palouse and Larson Creeks will be determined by calibrating the known number of tagged fish detected at each tide gate PIT antenna array with estimated antenna array detection efficiencies. Analysis of outmigrant coho smolt data for the 2006

and 2007 broods in each subbasin is in progress and will be reported in association with Palouse and Larson Life Cycle Monitoring grant report (OWEB grant #207-238). A total 8 subadult jack coho were detected returning to Palouse Creek during 2009, while 3 coho originally tagged in Larson Creek in 2008 and 2009 were detected returning as subadult jacks (Table 6). A total of 19 coho originally tagged in Palouse Creek as outmigrant smolts in 2008 were detected as returning adults in 2009 (Table 6).

Table 6. The number of juvenile coho salmon tagged in Palouse and Larson subbasins by brood year, with the estimated number of tagged individuals detected as outmigrant smolts and as returning subadult jacks and adult spawners.

		No. of Juvenile Coho Tagged		PIT Tagged Population Size[2]		
Basin	**Brood Year[1]**	**Fry/Parr**	**Smolt**	**Smolt**	**Jack**	**Adult**
Palouse	2006	0	471	NA[3]	0	19
	2007	1,177	711	NA	8	
	2008	2,787				
Larson	2006	0	0	-	-	-
	2007	282	364	NA	3	
	2008	493				

[1] Brood year is defined as the first year that eggs are deposited during the fall/winter spawn period (e.g. coho of the 2007 brood year were derived from coho spawning during the 2007-08 spawn period. This brood will return to spawn as adults during the 2010-11 spawn season).

[2] Estimated number of PIT tagged coho in each subbasin by life stage, based on detections at PIT antenna detections and estimated detection efficiency at each PIT antenna array.

[3] These data are not yet available.

A total of 86 estuarine, stream and off-channel units were sampled in the Palouse subbasin during 2009 by CoosWA staff and fisher technicians in order to capture and sample juvenile coho among the range of coastal lowland habitats. Habitat units were sampled once during late spring and four occasions during summer and early fall in 2009. During the 2009 sampling efforts, a total of 2,787 juvenile coho were marked with PIT tags and 666 PIT tagged coho were recaptured at least once (Table 7). In Larson Creek, a total of 7 habitat units were sampled twice during summer 2009. CoosWA staff and fisher technicians PIT tagged 265 juvenile coho in Larson Creek and recaptured 54 of PIT tagged coho at least once during the 2009 sampling efforts (Table 7). Analyses of these data have been initiated but were not completed for this report; detailed analysis of information regarding juvenile coho movement patterns, habitat use and how these factors may mitigate size and growth in coastal lowland subbasins will be available in association with Palouse and Larson Life Cycle Monitoring grant report (OWEB grant #207-238).

Table 7. Number of coho fry and parr PIT tagged in Palouse and Larson subbasins during April-December 2009 with the number of PIT tagged fish recaptured during stream sampling efforts in each subbasin.

Subbasin	Reach Number	Stream	No. of Coho Captured	No. of Coho PIT Tagged	No. of Coho PIT Recaptures
Palouse	1	Palouse	2,598	422	33
	2	Palouse	1,376	346	75
	3	Palouse	2,012	662	238
	4	Palouse	261	124	40
	5	Palouse	2,316	691	191
	6	Palouse	1,419	261	42
	1	Tributary A	258	79	2
	1	Tributary B	68	9	0
	1,2	Bear Creek	255	108	27
	1,2	Tributary C	188	85	18
		Palouse Total	***10,751***	***2,787***	***666***
Larson	1	Larson	2,169	108	34
	2[3]	Larson	-	-	-
	3	Larson	376	88	7
	4	Larson	200	69	14
		Larson Total	***2,745***	***265***	***54***
		Cumulative Total	***13,496***	***3,052***	***720***

[1] Recaptured fish represent those that were physically captured more than once and scanned for presence of PIT tag, and sampled for length and weight.
[2] Detected fish represent those identified by PIT antenna arrays located at RKm 0.0, 3.2, and 7.3.
[3] Larson Creek Reach 2 was not sampled due to lack of landowner permission.

DISCUSSION

Coho Life Cycle Monitoring efforts were initiated in Palouse and Larson Creek Basins to monitor coho smolt and adult spawner abundance and to calculate freshwater and marine survival rates of coho in each basin. Broad-scale spawner surveys were initiated in 2004 on Larson Creek and in 2003 on Palouse Creek and the first complete season of coho smolt monitoring in each stream was recorded in 2006. Freshwater and marine survival rates derived from monitoring efforts in the Palouse and Larson subbasins will be useful to compare rates calculated from data collected at ODFW Life Cycle Monitoring sites.

Hire-the-Fisher crews were instrumental in the success of the Life Cycle Monitoring project in the Palouse and Larson subbasins. They provided necessary labor and skills to design, install, and

operate the adult and rotary screw traps and to assist with collection and sampling of juvenile coho in a variety of lowland stream habitats. While no additional training was required in handling adult fish, fishers were eager to learn techniques used for mark-and-recapture, otolith recovery, and juvenile salmonid handling and tagging. One outcome of the fisher's involvement in the project is better understanding by the fishermen of the relationship between adult recruitment and juvenile habitats and survival. These fishers also played an important role in outreach to landowners in the areas where the traps were installed, and became effective advocates for watershed protection and restoration.

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