Nooksack Salmon Enhancement Association's

2005
Salmon Spawner Survey

March 2006

Nooksack Salmon Enhancement Association
2445 E. Bakerview Road
Bellingham, WA 98226
(360) 715-0283

Introduction

The Nooksack Salmon Enhancement Association (NSEA), under the direction of Washington Department of Fish and Wildlife (WDFW), conducted a spawning grounds survey program for late-run Chinook, coho and chum salmon. Surveys were done on twelve streams located in seven lower Nooksack River sub-basins. Thirteen reaches were surveyed on these twelve streams. Six sub-basins were downstream of the South Fork – North Fork Nooksack River confluence and one was located in the lower South Fork Nooksack River. Surveys were also done on Terrell Creek, an independent drainage of the Strait of Georgia. Surveys were conducted between October 4, 2005 and January 25, 2006.

Four stream reaches were surveyed in the Deer Creek/Tenmile Creek sub-basin, including two on Deer Creek and one each on Tenmile Creek and a tributary to Tenmile Creek, Silver Springs. Three stream reaches were surveyed in the Smith Creek sub-basin between Nugent's Corner and Deming; one each on Smith Creek, McCauley Creek, and Mitchell Creek. One stream reach each was surveyed on Bertrand Creek, Fishtrap Creek, Schell Creek and Anderson Creek in the lower Nooksack basin and on Tinling Creek in the South Fork Nooksack drainage. Preliminary surveys were done on:

- Landingstrip Creek, South Fork Nooksack River tributary
- Toss Creek, South Fork Nooksack River tributary
- Larrabee Springs, Deer Creek tributary, and
- Unnamed tributary to Anderson Creek.

All surveys were conducted by NSEA surveyors with the assistance of Bellingham Technical College (BTC) students, volunteers and WDFW personnel.

Surveys were conducted to provide data to augment those produced annually by Nooksack Basin fisheries co-managers and to provide year-to-year consistency with the past six years of NSEA survey efforts. Spawning ground surveys in the Nooksack River basin are also conducted by Nooksack River basin fisheries co-managers; Washington Department of Fish and Wildlife, the Lummi Nation, and the Nooksack Indian Tribe. Coastal stream surveys are conducted by the City of Bellingham.

Methods

This year marks the seventh year that NSEA has conducted spawning ground surveys in lower Nooksack River tributaries. With the exception of a few stream reaches dropped or added through the years, and some stretches adjusted for ease of surveying, stream reaches have stayed consistent since 1999. Stream survey reaches were originally chosen from accessible spawning habitat on lower Nooksack River basin tributaries, including some sites where restoration efforts were planned or in place. This year, surveys were done in the same reaches as previous years, with a few exceptions. A survey on Schell Creek was added, and lower Fishtrap Creek was dropped due to unusually high levels of turbidity throughout the entire survey season, which made consistent surveys not feasible.

Reaches were targeted for survey every seven to ten days. Actual survey periodicity for each reach was determined by three main considerations: viewing conditions, stream flow and turbidity. Survey teams generally consisted of two people. Standard spawner survey techniques consistent with Nooksack basin co-manager protocols were maintained to maximize survey data utility for co-managing governments. Survey data categories include: stream name, Water Resource Inventory Area (WRIA) basin and stream number, live counts by species, dead counts by species, redd counts by species, and approximate river mile locations for each redd observation. Also recorded was the percentage of the survey reach that was visible given aquatic and streamside vegetation, water turbidity, flow conditions, weather, accessibility, and any number or combination of these factors. The start and finish times, viewing conditions, flow conditions, and other pertinent field notes were taken for each survey. Streams were walked from the lower end (downstream) to the upper end (upstream) of the survey reach to minimize turbidity which could impede surveyor's vision.

This year, NSEA and the City of Bellingham participated in a coho pre-spawn mortality study conducted by Washington Trout. Those results can be viewed in the report on file with Washington Trout.

Supplemental surveys were conducted on stream reaches with recent or current stream restoration work. These supplemental surveys were done on Landingstrip Creek, a tributary to Anderson Creek, Toss Creek and Larrabee Springs. These streams are good candidates for future consistent surveying. Data from these surveys are on file at NSEA.

Redd Documentation

Redds were counted and recorded only after spawning and redd construction was complete. A 'redd date' was assigned to each completed redd on the day of the survey upon which each redd was first noted as completed. Completed redds were flagged to avoid trampling by future surveyors. Redd data recorded in the field included redd date, species type, approximate river mile and surveyors initials.

Carcass Documentation

Carcass documentation involved species identification, fork-length measurement, sex identification, adipose fin presence/absence, and coded-wire tag presence/absence. Scale samples were taken from all Chinook and coho carcasses. Completed scale cards and heads from carcasses with coded-wire tags were sent to WDFW for analysis. Results from these scale and coded-wire tag analyses can be obtained from the Bellingham WDFW office.

Additional measurements were taken for the pre-spawn mortality study. All coho carcasses were checked for percentage spawned, and any visible wounds that may have contributed to an early death. This protocol was developed by Washington Trout and consisted of checking the carcass for wounds that penetrated the body cavity, and opening the body cavity to look for milt or eggs. Any remaining milt was used to classify male coho as one of three options: 100% spawned, partially spawned, or unspawned. Any remaining eggs were collected to be measured. If the number of individual eggs appeared under 100, they were hand counted. A volume measurement was taken if over 100 individual eggs were present. A random sampling of five eggs was measured for width using calipers, to use with volume to estimate the number of eggs when over 100.

When sampling and measurements were finished, the caudal fin was cut from all carcasses to avoid re-counting and re-sampling. Carcasses were then returned to the location in or by the stream where they were found.

Live Counts

Live fish were identified to species, when possible, and counts recorded. To minimize over-counting live fish, each fish flushed upstream had to be replaced by a fish going downstream before counting resumed. For instance, if one fish was seen swimming upstream, and two fish were seen swimming downstream, only two fish would be recorded (instead of three, which would equal the number of sightings), with the assumption that one fish swimming downstream was the same fish seen swimming upstream earlier. This was an attempt to keep our live counts accurate in streams where fish were easily spooked. A minimum wait time of seven days between surveys was enacted in an effort to prevent recounting the same fish on separate surveys.

Survey Reaches

Table 1 lists survey reaches by name, WRIA stream number, WRIA river miles surveyed, and the number of times each reach was surveyed. Figure 1 indicates the location in the Nooksack Basin of each survey reach.

Table 1. Stream reach identifiers and number of surveys completed for each reach.

Stream/Reach Surveyed	WRIA #	River Miles Surveyed	# Surveys Completed
Schell Creek	01-0110	2.25-2.75	10
Tenmile Creek	01-0163	9.0 – 9.2	8
Deer Creek, lower	01-0165	0.5 - 1.1	11
Deer Creek, upper	01-0165	3.2-3.7	5
Silver Springs Creek	01-0184	0.0 – 1.1	13
Bertrand Creek	01-0201	8.4-9.7	8
Fishtrap Creek, upper	01-0210	8.5 – 10.0	10
Fishtrap Creek, lower	01-0210	3.0-4.1, 4.5-5.8	1
Anderson Creek	01-0228	2.7 – 4.0	9
Smith Creek	01-0234	2.5-3.5	13
McCauley Creek	01-0235	1.0 – 1.5	14
Mitchell Creek	01-0236	0.3 – 1.0	14
Tinling Creek	01-0250	2.0-2.25	15
Terrell Creek	01-0089	4.9 - 5.3	9
Baker Creek	01-0554	0.0 - 0.3	3
Squalicum Creek	01-0552	0.0 – 1.5	3
Padden Creek	01-0624	0.0 – 0.9	5
Chuckanut Creek	01-0626	.3 – 2.2	3

Italicized creeks surveyed by City of Bellingham.

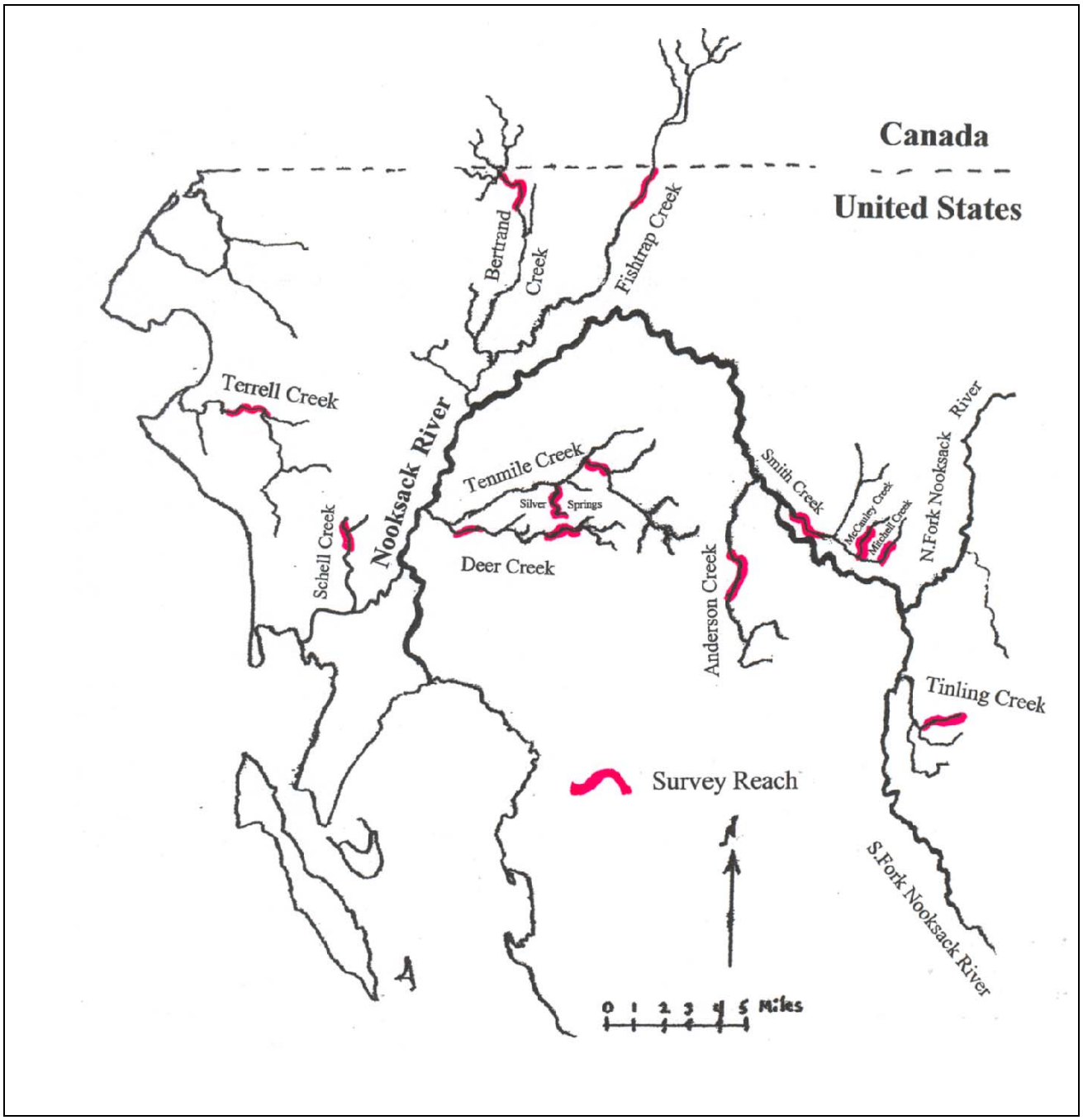


Figure 1. Map of survey reaches in relation to the Nooksack River.

Results

Results are presented below in three parts titled as follows: survey conditions and effort, results by species and results by survey reach. Project archive information is discussed at the end of this section.

Survey Conditions and Effort

Spawner surveys for the 2005-2006 season began on October 2005 and continued through the end of January. The spawning season was characterized by two lengthy periods of rain that impacted stream flows significantly (see fig. 2). Increased rainfall caused water levels to rise from November 2 to November 26 and again from December 23 through the end of the spawning season. Surveys efforts were precluded as a result of heavy flooding during the weeks of October 31-November 6, December 12-18 and December 26 through the end of the survey season. Larger streams such as Bertrand Creek, Fishtrap Creek, Smith Creek, Anderson Creek, Deer Creek and Tenmile Creek could not be surveyed during high flows due to increased turbidity and dangerously strong current. Smaller streams such as Tinling, McCauley, Mitchell and Schell Creeks could be surveyed during most of the high flow events if turbidity levels stayed low. The periods before and between these rainfall events were dry. Water levels were low enough in some of the smaller streams to prevent salmon passage upstream.

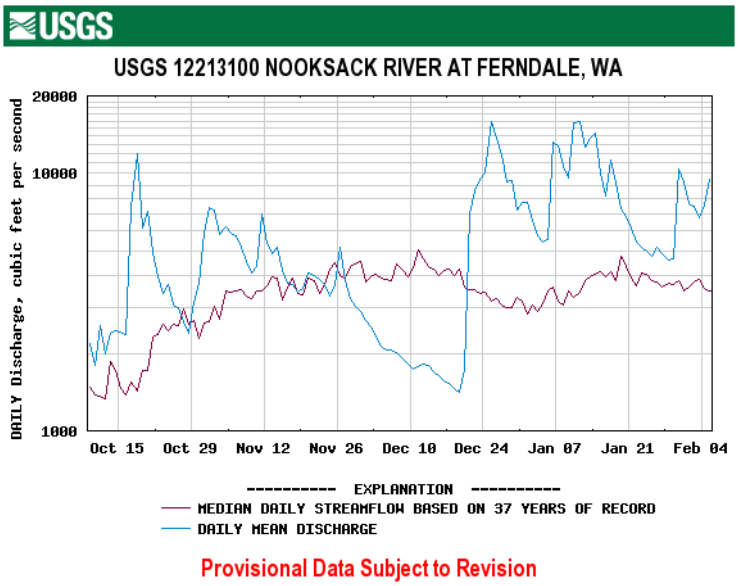


Figure 2. Nooksack River discharge in cubic feet per second (cfs) from October 10, 2005 through February 6, 2006 as recorded at the Ferndale US Geological Survey gauging station.

Results by Species

Three salmon species, Chinook, coho and chum, were observed spawning in the lower Nooksack River tributary sub-basins and coastal streams during the fall and winter of 2005-2006 between the dates of October 4, 2005 and prior to January 25, 2006. Live counts for the 12 streams surveyed by NSEA this season were 135 Chinook, 290 coho and three chum. Live counts, carcasses and redds of chinook, coho and chum in Baker Creek, Padden Creek, Squalicum Creek, Chuckanut Creek and Whatcom Creek are listed in table 3. The first four of these streams were surveyed by the City of Bellingham and Whatcom Creek was surveyed by students in the Bellingham Technical College hatchery program. The results from these five surveys are not included in the written results section, the discussion or the conclusion.

Table 2. Number of live, dead and redds observed for each NSEA stream reach, by species.

2005 NSEA Spawner Survey Summary												
	Chinook			**Coho**			**Chum**			**Unknown**		
Survey Reach	**Live**	**Dead**	**Redd**	**Live**	**Dead**	**Redd**	**Live**	**Dead**	**Redd**	**Live**	**Dead**	**Redd**
Anderson	0	0	0	17	7	9	0	0	0	1	1	1
Bertrand	3	2	0	10	12	15	1	2	1	5	1	4
Deer (upper)	0	0	0	17	4	8	0	0	0	0	0	0
Deer (lower)	0	0	0	10	4	6	0	0	0	0	0	0
Fishtrap (upper)	133	70	53	79	20	12	2	5	0	2	5	0
Fishtrap (lower)	26	0	13	0	0	0	0	0	0	0	0	0
McCauley	0	0	0	25	3	15	0	0	0	1	0	0
Mitchell	0	0	0	39	7	21	0	0	0	0	0	0
Schell	0	0	0	4	2	1	0	0	0	0	0	0
Silver Springs	0	0	0	16	4	7	0	0	0	0	0	0
Smith	2	0	1	32	5	11	0	0	0	4	1	2
Tenmile	0	0	0	0	0	2	0	0	0	0	0	0
Tinling	0	0	0	40	0	12	0	0	0	0	0	0
Terrell	0	0	0	1	0	1	0	0	0	0	0	0
Total Redds			67			120			89			7

Table 3. Number of live, dead and redds, by species, observed for each reach surveyed by the City of Bellingham and the Bellingham Technical School Hatchery Program. These results are not included in the written results, discussion or conclusion.

2005 City of Bellingham and Bellingham Technical School Spawner Survey Summary												
	Chinook			**Coho**			**Chum**			**Unknown**		
Survey Reach	**Live**	**Dead**	**Redd**	**Live**	**Dead**	**Redd**	**Live**	**Dead**	**Redd**	**Live**	**Dead**	**Redd**
*Baker**	0	0	0	0	0	0	25	14	10	4	0	0
*Padden**	0	0	0	2	3	0	152	88	28	5	2	0
*Squalicum**	0	0	0	0	1	0	39	60	12	0	0	0
*Chuckanut**	0	0	0	2	0	0	47	176	38	4	4	0
*Whatcom***	27	n/a	n/a	23	n/a	n/a	5515	n/a	n/a	0	n/a	n/a

Indicates independent drainages
* surveyed by the City of Bellingham
** surveyed by Bellingham Techincal School Hatchery Program

Chinook Salmon (*Oncorhynchus tshawytscha*).

Sixty-seven Chinook salmon redds were counted on Fishtrap Creek and Smith Creek. Sixty-five of these redds were observed in October 2005 and two additional redds were counted on Fishtrap Creek in November 2005 after a high rainfall event. Fifty-three Chinook redds were counted on the upper reach of Fishtrap Creek. Thirteen additional redds were documented on the lower reach of Fishtrap Creek. Survey efforts on this reach, however, were terminated after October 4, 2005 due to poor visibility (see figure 7). This number cannot be considered a complete count of Chinook redds for this reach. For this reason data from the lower reach on Fishtrap Creek were not used in the final analysis. Nonetheless, it is important to note that the lower reach on Fishtrap Creek contains important spawning habitat for Chinook, coho and chum salmon. One Chinook redd was observed on Smith Creek.

Seventy-two Chinook carcasses were retrieved. Seventy of these carcasses were found in the upper reach of Fishtrap Creek, and two were found in Bertrand Creek. Of these 72 carcasses, 67 were sampled. Of those sampled, 28 (42%) were female and 38 (57%) were male. One carcass was of unknown sex due to decay. The female Chinook had an average fork length of 73.4 cm, while the males had an average fork length of 65.6 cm. Four coded-wire tags were retrieved from marked carcasses. Four Chinook carcasses (6%) had adipose fins. Three Chinook carcasses (4%) were either partially adipose-clipped or of unknown adipose fin status as a result of predation or decay. The remaining 60 Chinook carcasses (90%) had clipped adipose fins (figure 3).

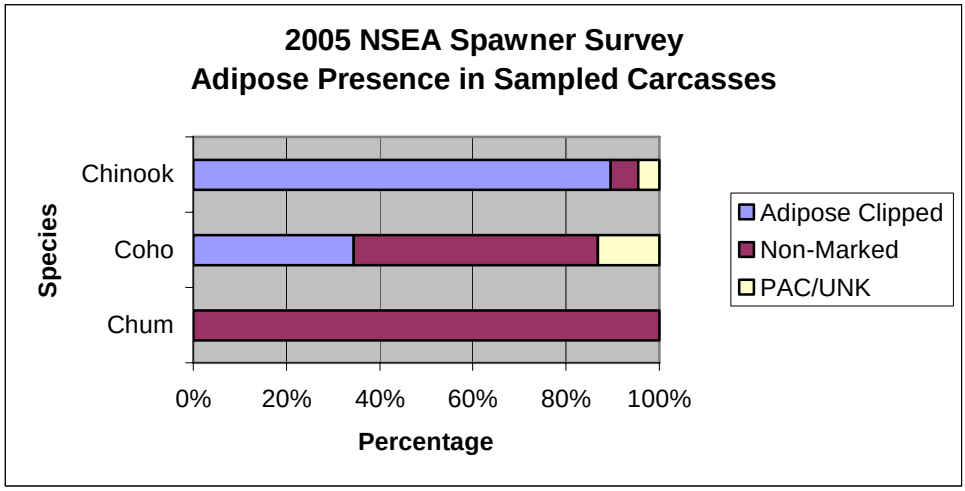


Figure 3. Percentage of adipose-clipped vs. non-marked carcasses.

In Fishtrap Creek and Smith Creek, 161 live Chinook were observed. Chinook were spotted 133 times on the upper reach of Fishtrap Creek and 26 times on the lower reach of Fishtrap Creek. For reasons stated previously, the number of fish observed on the lower reach of Fishtrap Creek should not be considered a complete count and these numbers will not be used in the final analysis. Also, because survey periodicity at this point was every seven days, it is likely that some fish lived through two surveys and were likely counted twice. Two live Chinook were observed on Smith Creek. Peak index days for Chinook occurred in early October.

Coho Salmon *(Oncorhynchus kisutch)*

One hundred-twenty coho salmon redds were observed between October 26, 2005 and January 16, 2006 (see table 2). Coho redds were found in each of the 12 surveyed streams.

In total, 64 coho carcasses were documented. Carcasses were recovered in all streams except Tenmile, Terrell and Tinling Creeks. Sixty-one of the 64 carcasses were sampled. Thirty-two (52%) of these carcasses were non-marked, 21 (34%) were adipose-clipped, and 8 (13%) were partially adipose-clipped or had an unknown adipose fin status due to predation or decay. Thirty-three (54%) of the carcasses were male and 25 (41%) were female. The sex of three carcasses could not be determined due to predation or decay. The average length of female coho carcasses was 55.4 cm and the average length of male coho carcasses was 51.6 cm.

Several of the sampled carcasses had secondary sexual characteristics of the opposite sex. Some female coho were observed with developed kypes and other female coho with undeveloped eggs (figure 4). Another unusual finding was a coho carcass with an extra pelvic fin, found on the upper reach of Fishtrap Creek (figure 5). While these

observations may warrant future studies, they are recorded here as mere occurrences, with no claim to patterns or trends.

Live coho were observed 290 times, with sightings occurring in all streams except Tenmile Creek. Peak index days occurred between early November and early January.

Figure 4. Undeveloped coho eggs inside a female coho on Landingstrip Creek (knife is for scale). Females with undeveloped eggs were spotted in Landingstrip Creek, Fishtrap Creek and Silver Springs.

Figure 5. Abnormal skin tag near pelvic fin on coho found in Fishtrap Creek. Pocket knife is used for scale.

Table 4. 2005-2006 NSEA spawner survey peak index counts and date.

2005 NSEA Spawner Survey Peak Index Counts						
Survey Reach	**Chinook Peak Index**	**Peak Index Date**	**Coho Peak Index**	**Peak Index Date**	**Chum Peak Index**	**Peak Index Date**
Anderson	0	N/A	6	**12/22/05**	0	N/A
Bertrand	3	**10/5/05**	4	**11/23/05**	2	**12/19/05**
Deer, lower	0	N/A	9	**1/3/06**	0	N/A
Deer, upper	0	N/A	9	**12/28/06**	0	N/A
Fishtrap, upper	88	**10/4/05**	28	**11/16/05**	1	**11/29/05, 12/12/05**
McCauley	0	N/A	10	**12/23/05**	0	N/A
Mitchell	0	N/A	21	**11/8/05**	0	N/A
Schell	0	N/A	2	**11/18/05, 12/29/05**	0	N/A
Silver Springs	0	N/A	11	**12/29/05**	0	N/A
Smith	1	**10/21/05, 10/26/05**	10	**11/8/05**	0	N/A
Terrell	0	N/A	1	**1/3/06**	0	N/A
Tinling	0	N/A	17	**1/2/06**	0	N/A

Chum Salmon *(Oncorhynchus keta)*

One chum salmon redd was observed in Bertrand Creek on December 12, 2005.

Seven chum carcasses were retrieved and measured. Two carcasses were retrieved from Bertrand Creek and five carcasses were retrieved from Fishtrap Creek. All carcasses were males and had an average fork length of 74.4 cm.

One live chum was observed in Bertrand Creek and two live chum were observed in Fishtrap Creek. All observations occurred between November 20, 2005 and December 20, 2005. December 20, 2005 was the last time either Bertrand Creek or Fishtrap Creek could be surveyed due to high flows.

‘Unknown’ Salmonids

A greater effort was made this year to mark fish and redd observations as ‘unknown’ if a positive identification of species could not be made. This is not to suggest that unusual or unidentifiable species were observed during spawner surveys. Rather, observations were marked as unknown when the conditions of that sighting on the particular survey were less than ideal or did not allow for identification (for example if no fish was sighted on or near a redd).

Live fish were marked as unknown if they were not seen for a long enough time to positively identify them. Often these fish swam upstream too quickly or were sighted in deep pools where log jams or poor visibility made it impossible to see indicative markings. Thirteen live fish on five streams were marked as unknown (table 2).

Salmon carcasses were deemed unknown when they were too deteriorated to locate identifying characteristics. Eight carcasses on four streams were marked as unknown (table 2).

Redds were marked as unknown when they were sighted in streams known to have several species of salmonids and no spawning salmon were observed on or near them. A total of seven redds on three streams were marked as unknown (table 2).

Results by Survey Reach

Survey reach results are ordered by location in the lower Nooksack River basin, beginning with the tributary closest to the river mouth and moving upstream.

Schell Creek was surveyed nine times between October 25, 2005 and January 18, 2006. Average visibility in the reach was 75%, due to high turbidity. The creek in this reach is shallow, with riffles and pools. The riparian buffer zone is narrow, but dense with willows and shrubs. While there is a good amount of woody debris and habitat character, this section lacks sufficient gravel and instead has a silt creekbed. Better spawning habitat exists upstream of the reach, but is only accessible through a perched culvert during high flows. High flow in this stream presented itself by flooding the reed canary grass fields surrounding the stream.

Coho were seen at two times in this reach, first in mid-November, and then again in mid-January. Both times, two fish were seen. Two carcasses were recovered the following weeks, and each was an adipose-clipped female. One redd was documented in mid-November at the upper end of the reach were gravel is present.

No Chinook or chum were documented in this reach.

Tenmile Creek was surveyed eight times between October 24, 2005 and January 20, 2006. Visibility was consistently limited, with surveyors estimating a seasonal average of just under 55%. The stream cross-section in this reach is deeply u-shaped and has a narrow and deep channel. Flow was sufficient for salmon passage and surveying most of the season starting in November, and turbidity and vegetation growth restricted light penetration when flow was low. The stream has a dark tannic color which makes visibility poor. Much of the riparian zone in this area is part of a restoration project, but is still covered with reed canary grass, and the young native vegetation provides little shade.

Two completed coho redds were documented on December 21, 2005. These redds were located in the first quarter of the survey in shallow areas where gravel is abundant and large woody debris covers the stream. No live coho were observed in Tenmile Creek.

No Chinook or chum were documented in this reach.

Lower Deer Creek was surveyed 11 times between October 17, 2005 and January 20, 2006. Flow was low to medium until late December when rains caused the stream to flood and made surveys difficult. Visibility was not generally a problem in this reach and the estimated average visibility for the surveys was 73%. This reach is amply shaded, contains abundant spawning gravels, and is full of in-stream woody debris. There are pool and riffle sequences. One large section of land was clear-cut to the stream bank this year, and log jams of cut limbs and tree stumps were common.

Coho were not observed in lower Deer Creek until mid December, after a large rainstorm brought high flows. Peak coho spawning occurred in early January. A total of 10 live coho, four coho carcasses and six coho redds were documented.

Figure 6. Low flow and debris jams made fish passage difficult in the early fall on Lower Deer Creek.

Of the four coho carcasses observed, none were marked, and three had body cavity piercing heron wounds that may have contributed to pre-spawn mortality. Six completed coho redds were recorded between December 5, 2005 and January 20, 2006.

No Chinook or chum were documented in this reach.

Upper Deer Creek was surveyed five times between December 9, 2005 and January 19, 2006. Beaver dams and low water prevented fish passage until late December. Visibility was high, with an average estimated visibility for the season of over 85%. In general, this reach is well-shaded and characterized by a moderate amount of spawning gravels and in-stream woody debris. Creek banks on the downstream end are overgrown with Himalayan Blackberry that limit access and visibility.

Live coho were documented between December 28, 2005 and January 19, 2006, with a total of 17 live coho seen for the season. Eight completed coho redds were recorded between December 28, 2005 and January 19, 2006. No carcasses were recovered in this area.

No Chinook or chum were documented in this reach.

Silver Springs Creek was surveyed 13 times between October 17, 2005 and January 19, 2006. Visibility was most affected by reed canary grass coverage, and averaged around 75%. The first ¼ mile of the reach is bordered by a new restoration site which is situated in an agricultural field. Along with planting, the restoration included gravel and large woody debris placement. The next portion of the survey area is partially shaded with a mixture of shrubs, trees and reed canary grass. The substrate in this reach is sand and fine gravels. The middle section is open pasture and riparian restoration planting. Between the lower and upper sections, the creek is choked in places with dense thickets of invasive plants like reed canary grass and nightshade. This stretch with reed canary grass was not surveyed due to low accessibility and visibility. The upper portion of the survey reach is a heavily wooded wetlands with gravel substrate suitable for coho spawning. There are riffles and pools sufficient for resting and cover. Invasive plants are beginning to take hold in this section, and choked the stream in some places early in the season. This section was only surveyed later in the season, after flows were higher and fish had been spotted in the lower section.

A total of seven coho redds were documented from mid-November until mid-January. Reed canary grass die-back and higher flows in late November allowed coho passage in the middle section where Chinook passage was probably restricted earlier in the fall. Four coho carcasses were documented. All four were females who had completely spawned. Sixteen live coho were observed over the duration of the survey season.

No Chinook or chum were documented in this reach.

Bertrand Creek was surveyed eight times between October 5, 2005 and December 19, 2005. The average estimated visibility during completed surveys was 70%. Low visibility due to high water levels, turbidity, glare, and dense Himalayan blackberry thickets greatly restricted the number of completed surveys. Dangerous flows blocked any surveys from happening past mid-December. Deep pools with clay bottoms made surveying in the stream unsafe during high flows, so much of the surveying was done from higher up the banks. The creek is partially shaded over most of the survey reach with abundant spawning gravels. The upper portion is shaded and contains woody debris, riffles and pools.

Three live Chinook were seen in early October, and two carcasses were documented, but no Chinook redds were observed.

Fifteen completed coho redds were observed in Bertrand Creek from late October through mid-December. In the same time frame, 12 coho carcasses were found. Ten were retrieved for measurements and sampling. Ten live coho were seen in this reach.

One chum redd was recorded for this stretch. One live chum and two carcasses were documented on December 19, 2005. Both chum carcasses were retrieved for measuring.

Lower Fishtrap Creek was surveyed once on October 4, 2005. Visibility after this survey was decreased due to a drainage ditch that brought highly turbid water into the stream (see figure 7). No additional surveys were possible. The creek in this reach is well shaded and contains abundant spawning gravels. There are abundant areas of both riffles and pools for resting. In years past, this section has been an important spawning area.

Figure 7. Drainage culvert upstream of Bender Road bridge on Fishtrap Creek. Turbid water entering creek from culvert made surveys unfeasible.

On October 4, 2005, 26 live Chinook, and 13 Chinook redds were documented.

No coho or chum were documented in this reach on the October 4th survey.

Upper Fishtrap Creek was surveyed 10 times between October 5, 2005 and December 20, 2006. Average estimated visibility for this reach for the season was just over 85%, when low flows made the stream accessible. This stretch is a mix of shallow, wide areas with abundant gravel, and fast flowing, deep channels. There is little woody debris in the channel. The creek is mostly shaded by a thin riparian buffer. The creek is channelized in this section and the narrow riparian corridor is surrounded by commercial berry fields. This year some areas which were previously covered by blackberries were cleared and piled into a berm in an attempt by the landowner to alleviate flooding problems. Over 300 willow stakes were planted by NSEA in this berm to reduce future runoff and erosion.

Fifty-three Chinook redds were documented in this reach. Redds were constructed between mid-October and late November. In this same time period, 133 live Chinook were counted. Seventy carcasses were found, and 65 were measured and sampled.

From late October through mid-December, 12 coho redds were documented. Twenty coho carcasses were noted and 19 were measured. Seventy-nine live coho were counted between October 25, 2005 and December 20, 2005.

No chum redds were found in this reach. Five chum carcasses were found and measured. Two live chum were spotted.

In addition, four live fish which could not be identified to species were observed. One carcass which had been too heavily preyed upon to confirm species, and seven redds of unknown origin were documented.

Anderson Creek was surveyed nine times between November 3, 2005 and January 5, 2006. Visibility in this survey reach was relatively good with an average estimated visibility of 70% for the completed surveys. The creek in this reach is heavily wooded with ample shade, has a high width-to-depth ratio, and has abundant spawning gravels and in-stream woody debris. Beaver dams and debris jams were a constant presence. During rainy periods, increased turbidity and flow made surveys unsafe.

Nine completed coho redds were documented between November 3, 2005 and January 5, 2005. Seven coho carcasses were found and measured. Seventeen live coho were spotted, with a peak index of sic observed on December 22, 2005.

One fish, one carcass and one redd of an unknown species were observed on Anderson Creek.

No Chinook or chum were observed in this reach.

Smith Creek was surveyed 13 times between October 7, 2005 and January 25, 2006. When flows were not too high visibility was good with an estimated average of just under 80% for completed surveys. The water was often slightly tannic. In the survey reach, the creek is partially shaded, and has a combination of wide and shallow areas and deep pools. The middle and upper sections of the reach contain abundant spawning gravels and some woody debris. Interestingly, salmon tend to spawn in the upper section of the reach, bypassing some ideal spawning habitat along the way. The lower end of the reach is a mostly deep, u-shaped channel with fewer spawning areas.

One completed Chinook redd was documented on October 26, 2005. One Chinook carcass was found in late October. Two live Chinook were observed in the reach.

Eleven completed coho redds were documented from early November through early January. Five coho carcasses were recovered, and 32 live fish were observed during the same time period as the redds.

In addition, four unidentified fish, one unidentified carcass and two unidentified redds were documented. All redds, Chinook, coho and unidentified, were located in the last quarter of the reach, just downstream of the Mt. Baker Highway (SR 542) bridge.

No chum were documented in this stretch.

McCauley Creek was surveyed 14 times between October 11, 2005 and January 23, 2006. Visibility in this shallow stream was excellent with a seasonal estimated average of 95%. The creek in the survey reach is partially shaded, with the lower half of the stream surrounded by reed canary grass, and the upper portion covered by thick forest.

The streambed is wide and shallow and contains abundant gravels of varied sizes. There is very little woody debris, and few pools of large enough dimensions to offer much protection. A dredging project in the middle of the reach (just upstream of the bridge) cleared the streambed of gravels, allowing silt to collect downstream and bury spawning gravels.

From early November through late December, coho were active in this stretch. Fifteen coho redds were documented. Three coho carcasses were found and sampled. Twenty-five live coho were observed. One fish unidentifiable by species was observed.

No chum were documented in this reach.

Mitchell Creek was surveyed 14 times between October 20, 2005 and January 3, 2006. Visibility was good with a seasonal estimated average of 85% for completed surveys. The creek in the survey reach is well shaded and narrow, with a low width to depth ratio, and contains abundant small spawning gravels, a little woody debris, and some small pools which may offer protection. A new road project across the creek increased sediment load during rainstorms.

Twenty-one completed coho redds were recorded on Mitchell Creek from early November through mid January. Seven coho carcasses were found and measured. Thirty-nine live coho were observed in this reach.

No Chinook or chum redds were observed in this reach.

Tinling Creek, a major tributary of Black Slough in the lower Nooksack River South Fork, was surveyed 15 times between October 7th and January 9th. Visibility was excellent, with a seasonal estimated average of 98%. The creek in the survey reach is well shaded and diverse in character. It has a high width to depth ratio throughout, with most of the reach being wide and shallow. Substrate in this reach is primarily boulder-cobble, but several nice pockets of spawning gravels occur. At the lower end of the survey reach, the creek braids and separates into multiple channels as finer gravels accumulate to form a fluvial fan where the creek enters a flat, heavily forested wetland zone.

Twelve completed coho redds were recorded from early November through mid January. No coho carcasses were found. Forty live coho were noted from mid-November through mid-January.

No Chinook or chum were observed in this reach.

Terrell Creek, a tributary to the Strait of Georgia, was surveyed nine times between October 18, 2005 and January 3, 2006. Terrell Creek is a low-gradient stream with ample shade, pools and riffles, abundant woody debris, and mixed-gravel substrate. The average visibility was estimated for the survey season to be 70%. This visibility is partly due to a dark brown tannic tint that characterizes water in Terrell Creek.

One coho redd and one live coho were documented in this reach on December 3, 2005. No carcasses were found.

No Chinook or chum were observed in this stretch.

Project Archives

NSEA 2005 spawner survey project field notes are archived in paper and electronic files at NSEA. Scale cards are archived at WDFW in Olympia. Results from scale cards are available from the local WDFW office and archived on paper at NSEA. Data spreadsheets and report for this survey season can be accessed at the Nooksack Salmon Enhancement Association office in Bellingham.

Computer files include 14 reach files, each of which consist of several worksheets for each species. These include general survey results, details about carcasses recovered, and redd documentation. Two summary files contain 1) summarized survey information and, 2) details about carcasses. Additionally, there are a number of digital photos of streams, carcasses, live fish and redds electronically stored at NSEA. Past spawner survey results and reports are also available in the NSEA library.

Discussion

With a few exceptions, NSEA tributary spawning grounds surveys have covered the same reaches from 1999 through 2005. The data collected are one source of information about lower Nooksack River basin salmonid populations. While these surveys alone are not extensive enough to show trends in overall basin populations, they do allow us to investigate the roles that specific streams play in salmonid life history by comparing yearly data from survey streams. Additionally, these numbers can be used by Nooksack River co-managers in combination with other spawner survey results to estimate basin-wide populations.

In addition to limitations in the size and scope of our survey, certain methodological constraints should be considered when interpreting spawner survey data. The frequency of surveys and the likelihood of seeing salmon that are present in the streams is dependent upon viewing conditions, stream accessibility and timing. Late fall and early winter commonly receive large amounts of rainfall in the Pacific Northwest. The severity and timing of these rainfall events can have large effects on migrating salmon and the likelihood that they are seen be surveyors. While heavy rains often bring salmon up streams, they also prohibit human access to streams, potentially leaving many fish and redds uncounted. Carcasses are often washed downstream and redds can be scoured or filled over beyond recognition. Each year's surveys will have slightly different timing and frequency based on rainfall patterns, which will affect fish and redd counts each year. In an effort to compensate for limited access some years, we look at trends in both raw redd counts and the average number of redd counts per surveys completed. One limitation to using survey effort, however, is that at some point, all redds will be observed and completion of more surveys only lessens the weight of each redd. Therefore, we can look at both trends, one that is based solely on the number of redds seen, and one that is based on the amount of effort that went into seeing each redd. If a time comes when survey frequency evens out, it will be more helpful to look at observed counts, without complicating it with survey effort. Until then, it is still useful to look at both observed average, and average per survey effort.

Another methodological constraint to NSEA spawner surveys is the training and experience of surveyors who gather field data. Training can make a large difference, as fish appearance varies between streams and redds change in appearance over time. We have attempted to alleviate this concern by training new surveyors with experienced surveyors and always having two surveyors in the field to discuss questionable circumstances. We also bring cameras into the field so that unusual fish can be identified later. Despite our efforts to reduce human error in redd and fish identification, these problems will exist unless the same crew conducts surveys year after year.

While we collect data on both live and dead fish observed, we have chosen to use the number of documented redds as an indicator of effective spawning. Using live fish observed as a population indicator has the distinct possibility of leading to miscounts and recounts, as many fish stay in the system for over a week and other fish are only present for a few days. Using carcasses as an indicator of populations could decrease population

estimates in some areas. In streams like Tinling Creek that have wooded settings, very few carcasses were found. Predators such as eagles, herons, bears, otters and raccoons remove the carcasses before we see them. In contrast to live and dead fish, redds may remain visible for a longer time and give us an estimate of the fecundity of a population. For example, 67 Chinook redds were documented in three survey reaches this year (figure 3). If we assume that a pair was present to make a completed redd, we would say that there were at least 134 spawners in the reaches surveyed. This conservative number gives us an estimate of effective spawners, as opposed to escapement estimates, which show us how many individuals were able to make it back to the spawning grounds to reproduce. During past spawner surveys as well as this year's work with Washington Trout, we have observed that many adults returning to spawn fail to reproduce (see Appendix D, and Hovezak, 2004). If we are interested in the fecundity of a population, then using redds as a marker is more important than live or dead counts. As with past NSEA surveys, we will use redd counts as a way of discussing this years data in comparison to past year surveys. It should be noted that WDFW uses a variety of methods for determining population size.

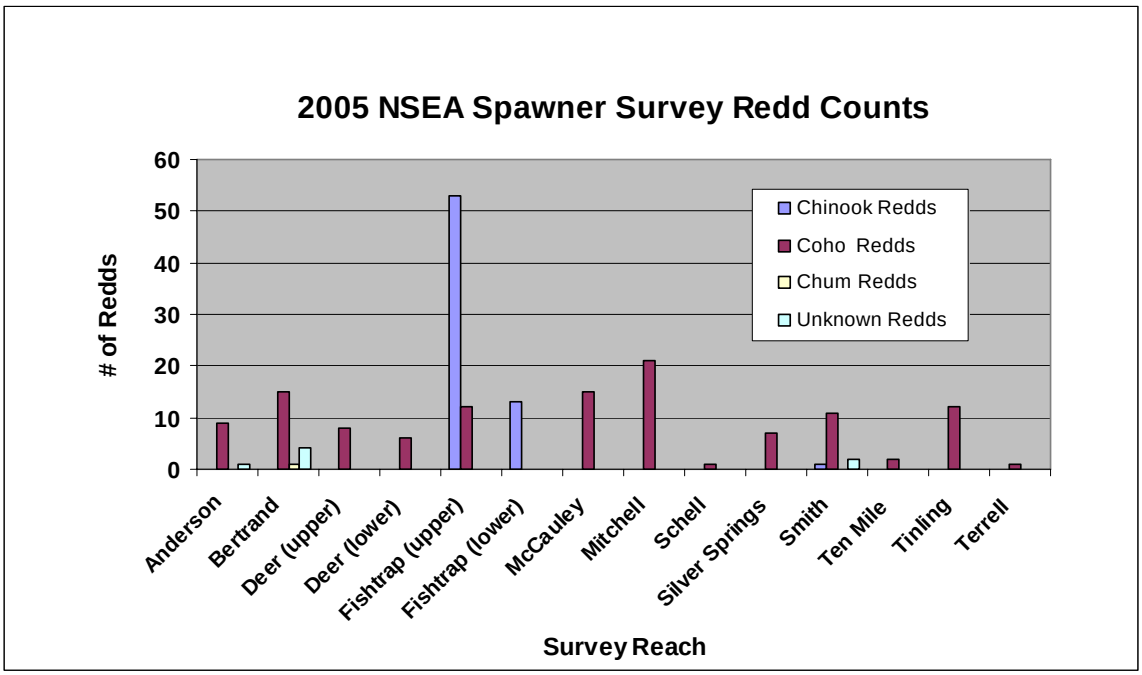


Figure 8. 2005 NSEA spawner survey redd counts by species by survey reach.

Trends in NSEA spawner surveys: Chinook, coho and chum

This year, the number of observed Chinook redds increased 19% over the seven-year average of observed Chinook redds. However, looking at the number of Chinook redds observed vs. survey effort over the years, a 20% decrease in Chinook redds is apparent (Appendix C). These differences in trend can be attributed to methodology as discussed on the previous page.

Table 5. Two tables comparing the number of redds per species for year, and the number of redds per species per year with survey effort taken into account (see Appendix C. for survey effort calculations).

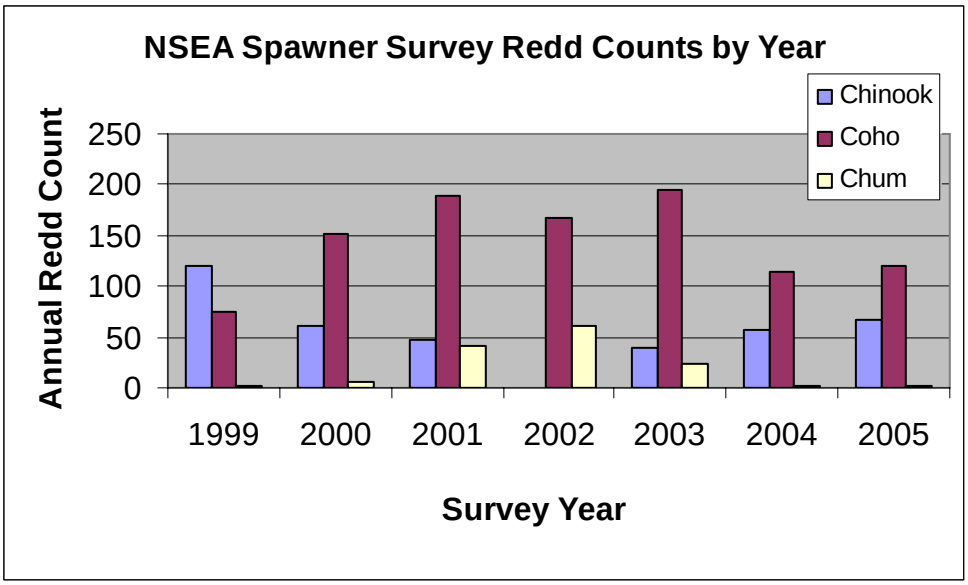
Number of Redds per Species for Each Year			
	Chinook	**Coho**	**Chum**
1999	121	75	1
2000	61	151	5
2001	48	189	41
2002	0	167	62
2003	39	194	24
2004	57	114	1
2005	**67**	**120**	**1**
Ave. redds/year	**56**	**144**	**19**
2005 vs. average	**19%**	**-17%**	**-95%**

Number of Redds per Species per Effort for Each Year			
	Chinook	**Coho**	**Chum**
1999	1.370	1.280	0.000
2000	0.600	2.230	0.070
2001	0.600	2.450	0.640
2002	0.000	2.400	0.840
2003	0.510	2.290	0.270
2004	0.540	0.850	0.010
2005	**0.490**	**0.880**	**0.010**
Ave. redds/year	**0.587**	**1.769**	**0.263**
2005 vs. average	**-17%**	**-50%**	**-96%**

As in years past, Fishtrap Creek was an important stream for Chinook spawning this year. In previous years, Chinook were observed in Tenmile, Bertrand, Smith and Anderson sub-basins. This year, Chinook were observed in Fishtrap, Smith and Bertrand Creeks, with all but one redd in Fishtrap Creek. Despite this decrease in spatial diversity, more Chinook redds were counted in Fishtrap Creek than have been counted survey-wide since 1999.

Of the Chinook carcasses sampled in Fishtrap Creek, 90% were adipose clipped. This is an interesting observation, and leads one to question where the naturally spawned population was this year. A drought in the fall of 2002 may have played a role in few naturally spawning salmon in the Fishtrap Creek system. No Chinook redds were observed in any surveys that year. Three coded-wire tagged Chinook were sent to WDFW for analysis, which will give us an idea as to where these supplemental fish are coming from.

Data from the previous years suggests that Fishtrap Creek should be a stream of high priority for restoration projects. Although much of the stream runs through degraded habitat and agricultural fields, it is still used by Chinook, and is often one of the few surveyed streams with enough water in the fall to support returning adult Chinook.



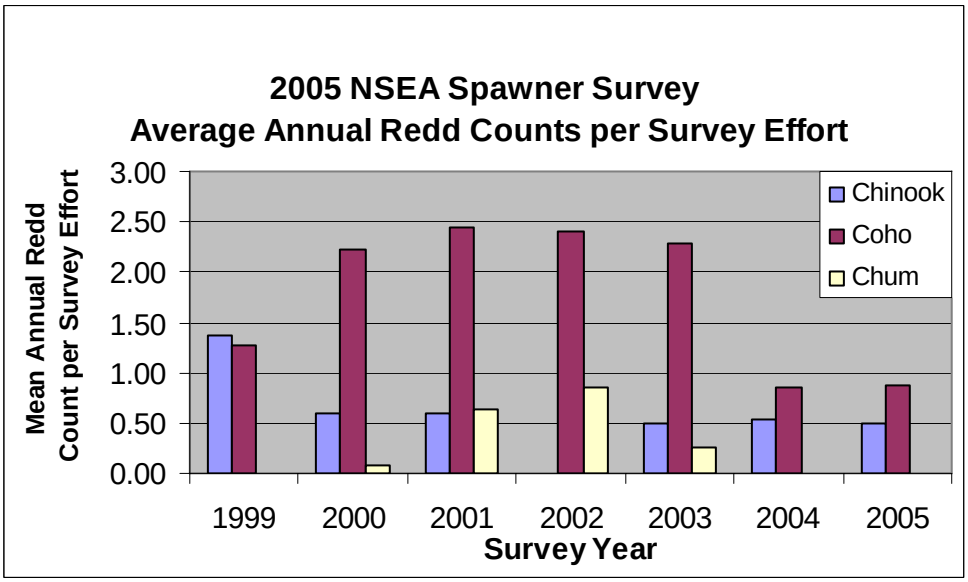


Figure 9. Number of redds documented per species per year during NSEA spawner surveys in top chart. Number of redds documented per species per year per survey effort during NSEA spawner surveys on bottom chart. Survey effort was determined by number of surveys per reach (Appendix B).

The number of coho redds observed in streams increased from 2004 data. More redds, however, were seen with less effort from 2000-2003. Coho redds were observed in greater numbers than last year in Bertrand, Anderson, McCauley, Smith and Tinling Creeks. Coho redd numbers were down from last year's counts in Deer, Fishtrap, Silver Springs and Tenmile Creeks. This year, coho arrived in two distinct groups, following two rain events. A first event in mid-November brought fish into Fishtrap, Bertrand and the Smith creek system. Beaver dams and log jams kept coho out of streams in the Deer-Tenmile Creek system and Anderson Creek until rainfall increased in mid-December. As with Chinook, Fishtrap Creek was an important system for coho, and, had it been possible, surveying the lower reach would most likely have increased the number of coho

redds observed. The Tenmile/Deer Creek system had particularly low numbers of both observed fish and redds as compared to previous years. In 2004, 33 redds were seen in Deer Creek, 11 were observed in Silver Springs, and seven were seen in Tenmile. This year, 14 redds were seen in Deer Creek, seven in Silver Springs, and two in Tenmile. The first coho observed in Deer Creek was a month later than the first coho observed in Deer Creek last year. In many streams, spawning began up to a month later than previous years and continued to occur into late January. This factor may have contributed to the low numbers of observed redds.

Chum numbers remained low this year, with a severe downward trend from past years' surveys. As with last year, only one documented chum redd was observed in Bertrand Creek. The City of Bellingham (COB) spawner surveys observed higher numbers of chum returning, however, with 38 chum redds alone in Chuckanut Creek. The seven-year trend for chum show a steady increase from one documented redd in 1999 to 62 in 2002, and then a steady decrease back to one in 2004 and 2005. There are many possible explanations for this. Considering that chum generally return after four to seven years at sea, there wasn't a large spawning population four and five years ago to stock this year's returning population. There are many additional factors including decreased visibility in December and January, which may play a role in this observed dramatic decline. One consideration may be that our streams are higher in the Nooksack Basin than the coastal streams monitored by the COB. If chum populations are low, or steady, they may choose to spawn in lower systems than the streams we monitor.

Each species of observed salmon in the tributaries surveyed by NSEA saw a decrease in the numbers of both fish and redds documented per survey effort. In addition, some streams, such as Fishtrap Creek saw distinct decreases in the ratio of wild to hatchery origin fish. While some of our numbers are low, this is not a complete story of salmonid health in the Nooksack River basin. By combining data from other sources and surveys, one might be able to paint a more accurate picture of salmonid health for this areas stock populations.

Future Work:

We recommend that spawner surveys be continued each year so that assessment of lower Nooksack River basin salmonid populations can advance. We also recommend that care be taken to ensure that future surveys follow protocols from past years. The following is a list of changes and/or additions to the spawner survey protocol that we believe would improve the effectiveness of the survey or address new questions in salmon population monitoring.

1) Consider relocating the Tenmile Creek survey reach. There is very little spawning gravel in this reach and visibility is often too poor to see salmon if they are present.

2) Incorporate supplemental reaches on recently restored streams into the spawner survey protocol. (See appendix C for a list of these streams). Better define the

river miles for these survey sections and perform them with the same consistency as the regular stream reaches.

3) Continue to monitor for pre-spawn mortality of Chinook, coho and chum carcasses found in reaches. (See appendix D for details regarding methods and recording of data.)

4) Continue to survey Schell Creek, and expand the survey reach upstream past the culvert under Douglas Drive to capture more desirable habitat.

5) With time and money permitting, use GPS (at least sub-meter accuracy) to locate and track redd construction over time.

Past Reports

Hovezak, M.
2004 Lower Nooksack River Basin 2003 Salmon Spawner Survey. Report on file, Nooksack Salmon Enhancement Association, 2445 East Bakerview Road, Bellingham, Washington.

Krancus, L.
2003 Nooksack Salmon Enhancement Association Spawner Survey 2002. Report on file, Nooksack Salmon Enhancement Association, 2445 East Bakerview Road, Bellingham, Washington.

Moore, S.
2000 NSEA Salmon Spawner Survey 1999. Report on file, Nooksack Salmon Enhancement Association, 2445 East Bakerview Road, Bellingham, Washington.

2001 Nooksack Enhancement Association Salmon Spawner Survey 2000. Report on file, Nooksack Salmon Enhancement Association, 2445 East Bakerview Road, Bellingham, Washington.

Roberts, M.
2005 Lower Nooksack River Basin 2004 Salmon Spawner Survey. Report on file, Nooksack Salmon Enhancement Association, 2445 East Bakerview Road, Bellingham, Washington.

Timmer, D.
2002 Salmon Spawner Survey 2001 Yearly Report. Report on file, Nooksack Salmon Enhancement Association, 2445 East Bakerview Road, Bellingham, Washington.

Appendix A. 2005 NSEA Spawner Survey Sampled Carcass Results

Table 6. Sampled Chinook carcass information for 2005 NSEA spawner surveys.

Chinook Sample Index (n=67)					
Stream Name	**WRIA**	**Date**	**Sex**	**FKL (cm)**	**Adipose (NM, AC, PAC)**
Fishtrap, upper	01-0210	10/12/05	M	56	AC
Fishtrap, upper	01-0210	10/12/05	M	81	AC
Fishtrap, upper	01-0210	10/13/05	M	77	AC
Fishtrap, upper	01-0210	10/13/05	M	57	AC
Fishtrap, upper	01-0210	10/13/05	M	53	AC
Fishtrap, upper	01-0210	10/13/05	F	83	AC
Fishtrap, upper	01-0210	10/13/05	F	84	AC
Fishtrap, upper	01-0210	10/13/05	M	65	AC
Fishtrap, upper	01-0210	10/13/05	F	83	AC
Fishtrap, upper	01-0210	10/13/05	M	84	AC
Fishtrap, upper	01-0210	10/13/05	F	82	AC
Fishtrap, upper	01-0210	10/13/05	M	58	AC
Fishtrap, upper	01-0210	10/13/05	M	52	NM
Fishtrap, upper	01-0210	10/13/05	F	52	AC
Fishtrap, upper	01-0210	10/13/05	M	51	AC
Fishtrap, upper	01-0210	10/13/05	F	86	AC
Fishtrap, upper	01-0210	10/13/05	F	81	AC
Fishtrap, upper	01-0210	10/13/05	F	80	AC
Fishtrap, upper	01-0210	10/13/05	F	72	AC
Fishtrap, upper	01-0210	10/13/05	F	84	AC
Fishtrap, upper	01-0210	10/13/05	F	72	AC
Fishtrap, upper	01-0210	10/13/05	M	51	AC
Fishtrap, upper	01-0210	10/13/05	M	65	AC
Fishtrap, upper	01-0210	10/13/05	M	55	AC
Fishtrap, upper	01-0210	10/13/05	M	76	AC
Fishtrap, upper	01-0210	10/13/05	M	65	AC
Fishtrap, upper	01-0210	10/25/05	M	68	AC
Fishtrap, upper	01-0210	10/25/05	M	78	AC
Fishtrap, upper	01-0210	10/25/05	F	58	AC
Fishtrap, upper	01-0210	10/25/05	M	52	AC
Fishtrap, upper	01-0210	10/25/05	M	83	AC
Fishtrap, upper	01-0210	10/25/05	M	48	AC
Fishtrap, upper	01-0210	10/25/05	M	64	AC
Fishtrap, upper	01-0210	10/25/05	M	78	AC
Fishtrap, upper	01-0210	10/25/05	M	85	AC
Fishtrap, upper	01-0210	10/25/05	F	65	AC
Fishtrap, upper	01-0210	10/25/05	unk	unk	AC
Fishtrap, upper	01-0210	10/25/05	M	82	AC

Chinook Sample Index (n=67)					
Stream Name	**WRIA**	**Date**	**Sex**	**FKL (cm)**	**Adipose (NM, AC, PAC)**
Fishtrap, upper	01-0210	10/25/05	F	82	AC
Fishtrap, upper	01-0210	10/25/05	M	45	PAC
Fishtrap, upper	01-0210	10/25/05	F	90	AC
Fishtrap, upper	01-0210	10/25/05	M	unk	AC
Fishtrap, upper	01-0210	10/25/05	M	unk	AC
Fishtrap, upper	01-0210	10/25/05	M	unk	AC
Fishtrap, upper	01-0210	10/25/05	F	unk	AC
Fishtrap, upper	01-0210	10/25/05	M	64	NM
Fishtrap, upper	01-0210	10/25/05	M	unk	AC
Fishtrap, upper	01-0210	10/25/05	M	unk	AC
Fishtrap, upper	01-0210	10/25/05	F	unk	AC
Fishtrap, upper	01-0210	10/25/05	M	unk	AC
Fishtrap, upper	01-0210	10/25/05	M	80	AC
Fishtrap, upper	01-0210	10/25/05	F	90	AC
Fishtrap, upper	01-0210	10/25/05	F	71	AC
Fishtrap, upper	01-0210	10/25/05	M	45	AC
Fishtrap, upper	01-0210	10/25/05	F	unk	AC
Fishtrap, upper	01-0210	10/25/05	M	unk	AC
Fishtrap, upper	01-0210	11/9/05	M	76	AC
Fishtrap, upper	01-0210	11/9/05	F	70	AC
Fishtrap, upper	01-0210	11/9/05	M	73	AC
Fishtrap, upper	01-0210	11/9/05	F	55	AC
Fishtrap, upper	01-0210	11/9/05	F	47	NM
Fishtrap, upper	01-0210	11/9/05	F	68	AC
Fishtrap, upper	01-0210	11/22/05	F	75	NM
Fishtrap, upper	01-0210	11/22/05	M	66	Unk
Fishtrap, upper	01-0210	11/22/05	F	unk	Unk
Bertrand	01-0201	10/5/05	F	58	AC
Bertrand	01-0201	11/16/05	F	73	AC

Table 7. Sampled coho carcass information for 2005 NSEA spawner surveys.

Coho Sample Index (n=60)					
Stream Name	**WRIA**	**Date**	**Sex**	**FKL (cm)**	**Adipose (NM, AC, PAC)**
Anderson	01-0228	11/18/05	F	54	PAC
Anderson	01-0228	11/18/05	M	44	PAC
Anderson	01-0228	11/28/05	F	55	AC
Anderson	01-0228	11/28/05	M	55	NM
Anderson	01-0228	12/5/05	M	80	NM
Anderson	01-0228	12/22/05	F	58	NM
Anderson	01-0228	12/22/05	F	51	NM
Bertrand	01-0201	11/16/05	M	48	AC

Coho Sample Index (n=60)					
Stream Name	**WRIA**	**Date**	**Sex**	**FKL (cm)**	**Adipose (NM, AC, PAC)**
Bertrand	01-0201	11/16/05	M	43	AC
Bertrand	01-0201	11/23/05	M	47	AC
Bertrand	01-0201	11/23/05	F	48	NM
Bertrand	01-0201	11/23/05	M	50	AC
Bertrand	01-0201	11/23/05	M	44	AC
Bertrand	01-0201	12/8/05	M	57	NM
Bertrand	01-0201	12/19/05	M	50	NM
Bertrand	01-0201	12/19/05	M	46	NM
Bertrand	01-0201	12/19/05	M	50	AC
Deer, lower	01-0165	12/5/05	M	43	NM
Deer, lower	01-0165	12/13/05	M	44	NM
Deer, lower	01-0165	12/13/05	F	56	NM
Deer, lower	01-0165	1/3/06	M	43	NM
Fishtrap, upper	01-0210	11/9/05	M	60	NM
Fishtrap, upper	01-0210	11/16/05	F	54	PAC
Fishtrap, upper	01-0210	11/16/05	F	69	PAC
Fishtrap, upper	01-0210	11/16/05	M	67	NM
Fishtrap, upper	01-0210	11/22/05	M	52	NM
Fishtrap, upper	01-0210	11/22/05	F	52	AC
Fishtrap, upper	01-0210	11/29/05	F	54	NM
Fishtrap, upper	01-0210	11/29/05	F	53	NM
Fishtrap, upper	01-0210	11/29/05	F	45	PAC
Fishtrap, upper	01-0210	11/29/05	M	55	NM
Fishtrap, upper	01-0210	11/29/05	M	60	NM
Fishtrap, upper	01-0210	11/29/05	M	70	NM
Fishtrap, upper	01-0210	11/29/05	M	37	AC
Fishtrap, upper	01-0210	12/6/05	F	69	AC
Fishtrap, upper	01-0210	12/12/05	M	45	NM
Fishtrap, upper	01-0210	12/20/05	M	45	NM
Fishtrap, upper	01-0210	12/20/05	M	59	NM
Fishtrap, upper	01-0210	12/20/05	M	51	NM
Fishtrap, upper	01-0210	12/20/05	F	54	NM
McCauley	01-0235	11/22/05	unk	unk	Unk
McCauley	01-0235	11/30/05	M	63	Unk
McCauley	01-0235	1/23/06	F	64	NM
Mitchell	01-0236	11/8/05	M	42	NM
Mitchell	01-0236	11/8/05	M	46	NM
Mitchell	01-0236	11/15/05	M	49	AC
Mitchell	01-0236	11/15/05	F	61	AC
Mitchell	01-0236	11/22/05	unk	59	AC
Mitchell	01-0236	11/22/05	unk	65	AC
Mitchell	01-0236	11/29/05	M	58	AC
Schell		11/28/05	F	52	AC
Schell		1/11/06	F	55	AC
Silver Springs	01-0184	1/5/06	F	52	PAC
Silver Springs	01-0184	1/6/06	F	49	AC

Coho Sample Index (n=60)					
Stream Name	**WRIA**	**Date**	**Sex**	**FKL (cm)**	**Adipose (NM, AC, PAC)**
Silver Springs	01-0184	1/6/06	F	54	NM
Silver Springs	01-0184	1/6/06	F	55	NM
Smith	01-0234	11/22/05	F	67	AC
Smith	01-0234	11/22/05	M	57	AC
Smith	01-0234	12/13/05	M	42	AC
Smith	01-0234	12/20/05	F	50	NM
Smith	01-0234	12/20/05	F	53	NM

Table 8. Sampled chum carcass information for 2005 NSEA spawner surveys.

Chum Sample Index (n=7)				
Stream Name	**WRIA**	**Date**	**Sex**	**FKL (cm)**
Bertrand	01-0201	12/19/05	M	62
Bertrand	01-0201	12/19/05	M	73
Fishtrap, upper	01-0210	11/22/05	M	81
Fishtrap, upper	01-0210	11/29/05	M	73
Fishtrap, upper	01-0210	11/29/05	M	77
Fishtrap, upper	01-0210	12/6/05	M	76
Fishtrap, upper	01-0210	12/20/05	M	79

Appendix B. Redd Count vs. Survey Effort

This is the data analysis that went into redds per survey effort. The first table shows how many surveys were done each year, on each stream. Tables 10, 11 and 12 show how many redds were seen in each stream, each year, for each species. Tables 13, 14 and 15 are the result of dividing the number of redds seen by the number of surveys completed for each year. This allows us to look at how many redds were documented based on how often we were out in the streams looking.

Table 9. Number of surveys per reach per year.

Reach Name	Number of Surveys per year							All Years	Percent of total
	1999	2000	2001	2002	2003	2004	2005		
Deer, lower	2	1	5	8	8	12	10	46	7.1%
Deer, upper	3	7	5	5	8	12	5	45	6.9%
Silver Springs	5	5	6	5	9	14	14	58	8.9%
Ten Mile	no survey	2	4	5	9	8	8	36	5.5%
Starry	no survey	3	no survey	3	7	no survey	no survey	13	2.0%
Schell	no survey	no survey	no survey	no survey	no survey	no survey	10	10	1.5%
Bertrand	12	9	6	8	8	6	8	57	8.8%
Fishtrap, lower	4	7	7	7	5	7	no survey	37	5.7%
Fishtrap, upper	8	7	7	6	7	12	10	57	8.8%
Anderson	10	9	8	8	6	11	10	62	9.5%
Smith	9	9	7	3	5	11	12	56	8.6%
McCauley	8	7	7	3	5	13	14	57	8.8%
Mitchell	7	7	7	6	5	8	13	53	8.2%
Tinling	3	5	6	4	5	11	15	49	7.5%
Terrell	no survey	no survey	no survey	no survey	5	9	9	14	2.2%
Totals	**71**	**78**	**75**	**71**	**92**	**134**	**138**	**650**	100.0%

Table 10. Number of Chinook redds observed per reach per year.

Reach Name	Chinook Salmon Redds by Reach by Year							All Years	Percent of total
	1999	2000	2001	2002	2003	2004	2005		
Deer, lower	0	0	0	0	0	0	0	0	0.0%
Deer, upper	0	0	0	0	0	0	0	0	0.0%
Silver Springs	0	0	0	0	1	0	0	1	0.3%
Ten Mile	no survey	0	1	0	0	0	0	1	0.3%
Starry	no survey	0	no survey	0	0	no survey	no survey	0	0.0%
Schell	no survey	no survey	no survey	no survey	no survey	no survey	0	0	0.0%
Bertrand	46	25	11	0	7	5	0	94	24.7%
Fishtrap, lower	17	9	18	0	8	29	no survey	81	21.3%
Fishtrap, upper	41	24	17	0	2	16	53	153	40.3%
Anderson	6	0	0	0	6	1	0	13	3.4%
Smith	6	3	1	0	1	4	1	16	4.2%
McCauley	1	0	0	0	11	1	0	13	3.4%
Mitchell	3	0	0	0	4	1	0	8	2.1%
Tinling	0	0	0	0	0	0	0	0	0.0%
Terrell	no survey	no survey	no survey	no survey	0	0	0	0	0.0%
Totals	**120**	**61**	**48**	**0**	**40**	**57**	**54**	**380**	100.0%

Table 11. Number of coho redds observed per reach per year.

Reach Name	Coho Salmon Redds by Reach by Year							All Years	Percent of total
	1999	2000	2001	2002	2003	2004	2005		
Deer, lower	2	10	12	26	18	16	6	90	8.8%
Deer, upper	5	25	30	12	11	17	8	108	10.5%
Silver Springs	8	9	16	22	21	11	7	94	9.2%
Ten Mile	no survey	0	0	6	1	7	2	16	1.6%
Starry	no survey	0	no survey	0	0	no survey	no survey	0	0.0%
Schell	no survey	no survey	no survey	no survey	no survey	no survey	1	1	0.1%
Bertrand	1	21	11	6	20	0	15	74	7.2%
Fishtrap, lower	0	1	0	16	37	10	no survey	64	6.2%
Fishtrap, upper	0	5	5	5	9	13	12	49	4.8%
Anderson	3	13	34	53	18	5	9	135	13.2%
Smith	5	20	23	7	6	3	11	75	7.3%
McCauley	18	21	23	3	12	6	15	98	9.6%
Mitchell	23	26	35	10	27	20	21	162	15.8%
Tinling	10	0	0	18	14	5	12	59	5.8%
Terrell	no survey	no survey	no survey	no survey	0	1	1	1	0.1%
Totals	**75**	**151**	**189**	**184**	**194**	**114**	**120**	**1026**	100.0%

Table 12. Number of chum redds observed per reach per year.

Reach Name	Chum Salmon Redds by Reach by Year							All Years	Percent of total
	1999	2000	2001	2002	2003	2004	2005		
Deer, lower	0	0	14	0	1	0	0	15	11.3%
Deer, upper	0	0	8	0	0	1	0	9	6.8%
Silver Springs	0	4	6	15	1	0	0	26	19.5%
Ten Mile	no survey	0	2	20	0	0	0	22	16.5%
Starry	no survey	0	no survey	0	0	no survey	no survey	0	0.0%
Schell	no survey	no survey	no survey	no survey	no survey	no survey	0	0	0.0%
Bertrand	0	1	10	7	8	0	1	27	20.3%
Fishtrap, lower	0	0	0	6	11	0	no survey	17	12.8%
Fishtrap, upper	0	0	1	12	2	0	0	15	11.3%
Anderson	0	0	0	2	0	0	0	2	1.5%
Smith	0	0	0	0	0	0	0	0	0.0%
McCauley	0	0	0	0	0	0	0	0	0.0%
Mitchell	0	0	0	0	0	0	0	0	0.0%
Tinling	0	0	0	0	0	0	0	0	0.0%
Terrell	no survey	no survey	no survey	no survey	0	0	0	0	0.0%
Totals	**0**	**5**	**41**	**62**	**23**	**1**	**1**	**133**	100.0%

Table 13. Number of Chinook redds observed per year per reach divided by the number of surveys done on the individual reaches per year.

Reach Name	Ratio of Chinook Salmon Redds per Survey Effort							Ratio Mean
	1999	2000	2001	2002	2003	2004	2005	
Deer, lower	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Deer, upper	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Silver Springs	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.02
Ten Mile	no survey	0.00	0.25	0.00	0.00	0.00	0.00	0.04
Starry	no survey	0.00	no survey	0.00	0.00	no survey	no survey	0.00
Schell	no survey	no survey	no survey	no survey	no survey	no survey	0.00	0.00
Bertrand	3.83	2.78	1.83	0.00	0.88	0.83	0.00	1.45
Fishtrap, lower	4.25	1.29	2.57	0.00	1.60	4.14	no survey	2.31
Fishtrap, upper	5.13	3.43	2.43	0.00	0.29	1.33	5.30	1.80
Anderson	0.60	0.00	0.00	0.00	1.00	0.09	0.00	0.24
Smith	0.67	0.33	0.14	0.00	0.20	0.36	0.08	0.24
McCauley	0.13	0.00	0.00	0.00	2.20	0.08	0.00	0.34
Mitchell	0.43	0.00	0.00	0.00	0.80	0.13	0.00	0.19
Tinling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Terrell	no survey	no survey	no survey	no survey	0.00	0.00	1.00	0.00
Yearly average	**1.37**	**0.60**	**0.60**	**0.00**	**0.51**	**0.54**	**0.49**	**0.44**

Table 14. Number of coho redds observed per year per reach divided by the number of surveys done on the individual reaches per year.

Reach Name	Ratio of Coho Salmon Redds per Survey Effort							Ratio Mean
	1999	2000	2001	2002	2003	2004	2005	
Deer, lower	1.00	10.00	2.40	3.25	2.25	1.33	0.60	2.89
Deer, upper	1.67	3.57	6.00	2.40	1.38	1.42	1.60	2.35
Silver Springs	1.60	1.80	2.67	4.40	2.33	0.79	0.50	1.94
Ten Mile	no survey	0.00	0.00	1.20	0.11	0.88	0.25	0.36
Starry	no survey	0.00	no survey	0.00	0.00	no survey	no survey	0.00
Schell	no survey	no survey	no survey	no survey	no survey	no survey	0.10	0.00
Bertrand	0.08	2.33	1.83	0.75	2.50	0.00	1.88	1.07
Fishtrap, lower	0.00	0.14	0.00	2.29	7.40	1.43	no survey	1.88
Fishtrap, upper	0.00	0.71	0.71	0.83	1.29	1.08	1.20	0.66
Anderson	0.30	1.44	4.25	6.63	3.00	0.45	0.90	2.30
Smith	0.56	2.22	3.29	2.33	1.20	0.27	0.92	1.41
McCauley	2.25	3.00	3.29	1.00	2.40	0.46	1.07	1.77
Mitchell	3.29	3.71	5.00	1.67	5.40	2.50	1.62	3.08
Tinling	3.33	0.00	0.00	4.50	2.80	0.45	0.80	1.58
Terrell	no survey	no survey	no survey	no survey	0.00	0.11	0.11	0.04
Yearly average	**1.28**	**2.23**	**2.45**	**2.40**	**2.29**	**0.85**	**0.88**	**1.42**

Table 15. Number of chum redds observed per year per reach divided by the number of surveys done on the individual reaches per year.

Reach Name	**Ratio of Chum Salmon Redds per Survey Effort**							Ratio Mean
	1999	2000	2001	2002	2003	2004	2005	
Deer, lower	0.00	0.00	2.80	0.00	0.13	0.00	0.00	0.42
Deer, upper	0.00	0.00	1.60	0.00	0.00	0.08	0.00	0.24
Silver Springs	0.00	0.80	1.00	3.00	0.11	0.00	0.00	0.70
Ten Mile	no survey	0.00	0.50	4.00	0.00	0.00	0.00	0.75
Starry	no survey	0.00	no survey	0.00	0.00	no survey	no survey	0.00
Schell	no survey	no survey	no survey	no survey	no survey	no survey	0.00	0.00
Bertrand	0.00	0.11	1.67	0.88	1.00	0.00	0.13	0.61
Fishtrap, lower	0.00	0.00	0.00	0.86	2.20	0.00	no survey	0.51
Fishtrap, upper	0.00	0.00	0.14	2.00	0.29	0.00	0.00	0.35
Anderson	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.04
Smith	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McCauley	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mitchell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tinling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Terrell	no survey	no survey	no survey	no survey	0.00	0.00	0.00	0.00
Yearly average	**0.00**	**0.07**	**0.64**	**0.84**	**0.27**	**0.01**	**0.01**	0.24

Appendix C. Preliminary surveys on additional streams

In addition to the 12 streams surveyed every seven to 10 days, four additional streams were surveyed with less regularity. These 'supplemental surveys' were done on streams where restoration projects were conducted and/or fish passage barriers removed. Data was collected on these streams to see if fish were present, what types of salmonids used these streams and if and where they spawned. Depending on the findings of these preliminary surveys, more extensive spawner surveys may be done in the future. Table 15 describes the locations of these 'reaches,' and why they were surveyed. Directions to Kendall Creek are included in this table, even though we were unable to conduct surveys on this stream this season. Table 16 describes what fish, if any, were observed. Figure 10 is a map depicting the locations of these reaches within the Nooksack River basin.

Table 16. List of preliminary spawner survey reaches, with directions to sites and brief justifications for the surveys.

Landingstrip Creek	WRIA 01-0263	N/A	Take Highway 9 past the town of Acme. Turn left onto Rosenthal Road. Survey Landingstrip Creek and its tributary. Survey makes a big U starting at the first culver under the driveway, to the second culvert under the driveway. Start by walking the tributary moving downstream, to avoid too much backtracking. This is one of NSEA's largest restoration sites.
Kendall Creek	WRIA 01-0406	N/A	Take Mt. Baker highway to the town of Kendall. Turn left on Kendall Creek Road. The gravel road winds up and then down a hill. Park at the bridge (about 0.5 miles in). Several tributaries come together just upstream of the bridge. Look around to see if any of them have salmon. NSEA recently replaced a fish passage barrier with this bridge.
Anderson Creek Tributary	WRIA 01-0232	N/A	Take a right onto Squalicum Lake Road, going away from town on the Mt. Baker Highway. Turn left onto Henderson Road. Follow the road until you see a sign for a family tree farm on your right. Turn onto the gravel logging road/driveway and follow it to the new bridge over the stream. Follow the stream to the confluence with Anderson Creek and then survey upstream about .25 mile past the bridge.
Toss Creek	WRIA 01-0247	RM 0.4-0.5	Take Highway 9 south off the Mt. Baker Highway. Park at pink house on the right side of the road. Turn off is just before the large U curve before Van Zandt. Survey about 0.1 miles ending at Route 9. Significant restoration has occurred upstream and downstream of this site.
Larrabee Springs	WRIA 01-0141	RM 2.4-2.8	Take Smith Road west of the Guide Meridian. Park on the left side of the road just before Manthey Road. (It's easier to turn around before parking). Larrabee Springs goes along the road here. Walk downstream on far bank until the stream goes under Smith Road. Survey from here to the spring. This entire site is a restoration project and in the past has had remote site incubators with chum eggs.

Table 17. Results of spawner surveys in supplemental streams. Surveys were started too late in the season to see Chinook. No chum were observed.

2005 NSEA Preliminary Spawner Survey Summary				
Stream	**Number of surveys**	**Coho**		
		Live	***Dead***	***Redds***
Toss Creek	3	7	0	5
Landingstrip Creek	3	10	9	3
Anderson Creek tributary	3	0	0	0
Larrabee Springs	3	0	2	6

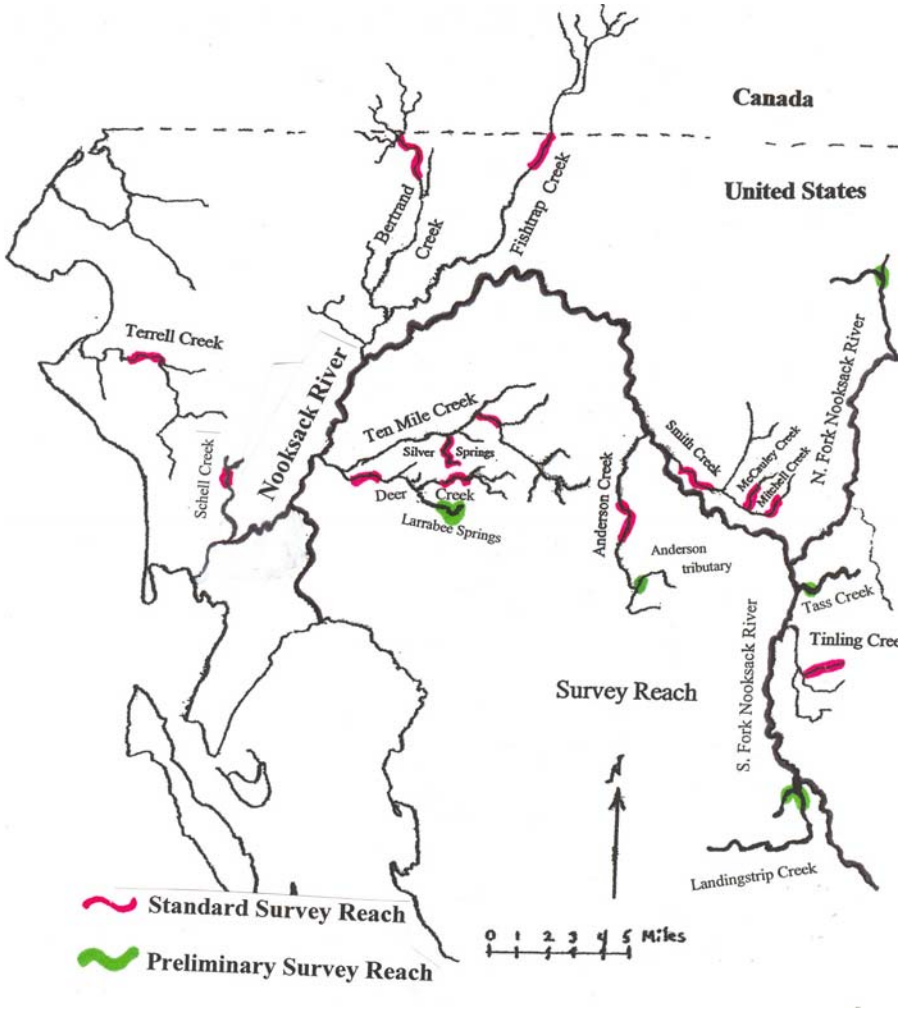


Figure 10. Map of standard survey reaches and preliminary survey reaches within the Nooksack basin.

Appendix D. WA Trout Study and the importance of monitoring spawner success

This year, NSEA worked collaboratively with Washington Trout and the City of Bellingham to collect data for a WA Trout directed study of pre-spawn mortality of coho in western Washington. In recent years, pre-spawn mortality rates in coho have been elevated in many urban areas. The causes of this trend are, as yet, unknown. The purpose of the Washington Trout study is to map the distribution and frequency of unexplained pre-spawn mortality in key areas of western Washington. The data will be correlated with land-use maps in an effort to determine trends and relationships between geography, anthropogenic influence and unexplained pre-spawn mortality. For more information about the project contact Jamie Glasgow at Washington Trout.

Washington Trout
15629 Main Street NE
P.O. Box 402 (mail only)
Duvall, WA. 98019
425-788-1167
Fax 425-788-9634

Because we at NSEA are ultimately interested in salmonid fecundity, we believe that it is important to look at spawner success and not just salmonid returns. A stream with 100 returning coho that all die before spawning is very different from a stream with 100 successful spawners. Salmon in the Nooksack River watershed have many environmental and anthropogenic factors affecting their ability to spawn successfully. While it is not in NSEA's current capacity to study the causes of pre-spawn mortality, it takes little extra effort to document incidences of pre-spawn mortality by including spawning success in the spawner survey protocol. For this reason, we recommend that NSEA continue to monitor spawner success on returning salmonids.

When evaluating spawner success, it is important to search for causes of pre-spawn mortality. High temperatures lead to reduced dissolved oxygen levels and increased susceptibility to fungal and bacterial infection. Active predators can also take substantial tolls on individual stream populations. Taking a temperature and searching carcasses for serious wounds is helpful for ruling out and/or identifying causes of death. All carcasses are cut open along their ventral side in order to see if eggs are present or testes are full. If eggs are left, they can be counted or their volume can be measured. If volume is taken, the beaker of eggs should be filled with water to the same height as the eggs. The diameter of several eggs should also be taken so that an estimate of the number of eggs left can be made. For male carcasses it is difficult to assess very accurately the percentage of spawning success that occurred. The best we can do is look at the fullness of testes and try to estimate if they are completely spawned, partially spawned or not spawned at all. A sample data sheet with all of the necessary measurements is included below (figure 11). These survey methods have been adopted from WA Trout survey protocol.

PRE-SPAWN MORTALITY DATA SHEET

Stream

Date

Crew

Weather:

Visibility:

Water temp:

										MALE		FEMALE				
Obs #	**Location**	**Species**	**Length**	**Sex**	**Adipose**	**Time since death**	**Body cavity intact**	**Cause of wound, if wounded**	**Fin(s) worn**	**Male Sign of Death**	**Male spawning Condition**	**Female Sign of death**	**Eggs Retained (# or volume)**		**Egg size (only if volume taken)**	**Picture taken?**
	Approximate River Mile	**Ck/ Co/ Ch**	**Cm**	**M,F, Unk**	**AC/NM/PAC**	**<6, 6-48, 48+**	**Y/N**	**dog, heron, bear…**	**Y/ N/ Unk**	**Wound, Stranded, Spawned, Unknown**	**Spawned, Partial, Unspawned, Unknown**	**Wound, Stranded, Spawned, Unknown**	**#, All, Unk**	**Volume, mL**	**diam. Of 5 eggs (mm)**	**Identify**
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																

Notes

Figure 11. Sample pre-spawn mortality data sheet.

Appendix E. Directions to stream reach locations

Table 18. Directions to stream reach locations

2005 Spawner Survey Reach Locations and Directions		
Anderson	RM 2.7-4.0	This stretch is from E Smith Road through to Kelly Road. Park one car west of the Sand/Kelly Road intersection, near the bridge. Park the downstream car in the private pull-out just west of the bridge on E Smith Road. Walk upstream from the E Smith Road bridge to the bridge on Kelly Road.
Bertrand	RM 8.4-9.7	Drive the Guide Meridian north to H Street. Turn left and drive west to the bridge over the creek. Park on the pull-out just before the bridge. Begin survey under bridge and walk upstream. You will pass under an old bridge about half-way through the survey. There are pink and green flags marking the exit point, which is about .25 miles past the large log jam and clay slide area, which will be on your left as you walk upstream. Walk up the right bank, over the barbed wire fence, through the field to the gravel driveway, and out to H Street. If you miss the exit flags, you can walk to the border and turn around.
Deer, lower	RM .5-1.1	Take Northwest Avenue north to Axton Road. Turn left on Axton, then take the next left on Judy Way. Drive down Judy Way, past the private driveway sign, and cross the bridge over the creek. Park in the pull-out on the right side of the driveway immediately past the bridge. Follow an old grass road/trail through the woods, with the creek on your right. Walk about .25 miles until you see the remnants of a tree house in a big cedar tree. If you reach Deer Court Lane, you've gone too far. Enter the creek at the cedar tree and survey upstream to Northwest Avenue.
Deer, upper	3.2-3.7	Drive north on the Guide Meridian. Turn left on Smith Road, and drive west until Manthey Road, which is directly across from a golf course. Turn right on Manthey and park at the barn on your right that is near the end of the road. Walk NE through the fields for .25 miles to a stand of alders at a bend in the field near the end of the barbed wire fence. Walk along the edge of the trees for a few hundred feet until you see an entrance to the stream (and pink flagging tape). Survey from here upstream to where the creek crosses under the power lines.
Fishtrap, lower	RM 3.0-4.1, 4.5-5.8	This index reach was not surveyed this year due to high levels of turbidity. To see directions to this site, check the 2004 report appendix D.
Fishtrap, upper	RM 8.5-10.0	Drive north on Northwood Rd. (east of Lynden) .8 miles past Pangborn Rd. Take a left at the gravel road immediately south of the house at 9621 Northwood Rd. Drive down the gravel road to where it crosses Fishtrap Creek. Park on the side and survey upstream to where the creek flows under an impenetrable thicket of blackberries. Then get out of the stream and walk up the east side, poking your head in where there are holes through the blackberries. Walk back down to your car, and drive up to the bridge on Northwood Rd. over the creek. Do a spot check here.
McCauley	RM 1.0-1.5	Going east on Mt. Baker Highway, turn left on McCauley Road (between Nugent's Corner and Deming). Park on the right side of the road, just past the bridge. Walk through the field back to the highway, and survey up stream, past the bridge .25 miles. There is pink flagging at the end of the survey reach, but you can also make sure you are there by checking that you are at the end of the fence line for a cow pasture.

Mitchell	RM .3-1.0	Going east on Mt. Baker Highway, turn left on Scarlett Road (a private driveway with a sign advertising One Heron Pond Pottery Studio). Follow the driveway past the first house and workshop and turn around in the driveway of the second house. Cross back over the bridge, and park on the corner just past the creek. Start the survey here, and walk upstream to the 3rd wooden bridge. You will know it's the correct bridge if you get out and look to the left and see a "Private Forest" sign on the closest tree. Walk towards the highway, then along the highway back to your car.
Schell		Take I-5 north to the Ferndale/Main Street exit. Go west on Main St. through town. Take a soft left onto Douglas Drive at the deli/market. Turn another soft left onto Imhoff Road. Park on the west side of the road at the fence marking the restoration project. Walk across the stream and then down through the fields, to where a large "hill" of blackberries can be seen, and where the old channel meets the new channel of Schell Creek. Walk upstream from here to the culvert under Douglas Drive.
Silver Springs	RM 0.0-1.1	Drive the Guide Meridian north, and turn right on Hemmi Road. Park at the dairy farm on the north side of the road where the creek crosses Hemmi Road. Walk through the farm downstream to the confluence with Tenmile. Start your survey here and walk back to your car. Once you cross the street, survey the stream until it goes under the barn. Walk around the barn and join the stream where it exits the barn. Walk up the creek until it runs along a fence and is bordered by heavy reed canary grass. Reach the upper section of the survey by driving back south on the Guide Meridian to Laurel Road. Turn east and park in the driveway of the house closest to where the creek crosses the stream. Walk back west along Laurel to the gravel driveway on your right. Walk down the driveway to where the creek crosses the driveway. Turn left and follow the creek to the end of the pool. Begin your survey there and walk back to your car. Be sure and also check the creek at the upstream side of Laurel Road.
Smith	RM 2.5-3.5	Drive east on Mt. Baker highway through Nugent's Corner. Park one car in the True Log Homes parking lot (on the north side of the highway) next to Smith Creek. Park the second car in the driveway of the house with a Shumway Berries sign. Walk upstream from the berries driveway, to the True Log driveway.
Tenmile	RM 9.0-9.2	This stretch is from the bridge on Hannegan Road upstream to the bridge on Tenmile Road. Park along Hannegan near the bridge, walk upstream to Tenmile Road, and walk back through the fields to your car.
Terrell	RM 4.7-5.3	Drive east on Grandview Road to Blaine Road. Turn right onto Blaine Road and take the first left to the gated parking area. Find a small hunters path that follows the edge of the trees that surround the creek. Walk along the trees until you see the pink flagging, about ¼ mile. Find your way down the hill to the stream and walk upstream to the culvert under Blaine Road. If the water level allows, walk through the culvert and continue upstream. If the water level is too high, find your way up the bank back to your parking spot, cross the street and scramble back down the bank on the other side. Continue 1/2 mile upstream to the flattening out of the stream, where there is a natural path up the left side bank. There are green and pink flags marking the end. Take the hunters path back to Blaine Road.
Tinling	RM 2.0-2.25	Drive out the Mt. Baker Highway to Highway 9 south. Turn left on to Strand Road, and continue right to Clipper Road. Park just over the bridge. Follow the creek downstream down a rough trail about .25 mile, until it reaches a swampy area marked with pink and green flagging. Survey upstream to the cement box culvert under Clipper Road. Cross through the culvert and continue upstream about ¼ mile until the stream takes a sharp left turn and there are deep pools.