EVALUATION OF SPAWNING GROUND SURVEYS FOR INDEXING THE ABUNDANCE OF ADULT WINTER STEELHEAD IN OREGON COASTAL BASINS

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INTRODUCTION

Winter steelhead *Oncorhynchus mykiss* have historically occurred in varying abundance in all of Oregon's coastal streams and in the Columbia River upstream to Fifteen-mile Creek near The Dalles (Wagner 1967). In the past, the Oregon Department of Fish and Wildlife (ODFW) primarily used a combination of dam passage counts and angler punch card records for tracking trends in adult steelhead abundance (Kenaston 1989). Beginning in 1992, in an effort to conserve declining wild steelhead populations, ODFW began restricting the harvest of natural origin steelhead. Further restrictions were implemented in 1997, effectively eliminating the take of natural origin steelhead outside of the Rogue and Umpqua Basins where harvest is limited to one wild steelhead per week and five per year. The elimination or significant reduction in angler retention of natural origin steelhead has significantly reduced the utility of using punch-card data for indexing trends in Coastal Oregon natural steelhead populations. Having at least relative numbers that accurately depict the status of steelhead populations is imperative for our continued management of our steelhead resources. There is a need to develop new monitoring programs for tracking trends in steelhead populations. Starting in 1997, the Coastal Salmonid Inventory Project of ODFW was charged with the task of developing new monitoring methods for Oregon coastal stocks of winter steelhead.

Methodologies for monitoring chinook *O. tshawytscha* and coho *O. kisutch* salmon in Oregon coastal basins are based on observation of live adults and the recovery of carcasses on the spawning grounds (Jacobs and Cooney 1997). This approach is not entirely applicable to steelhead because 1) steelhead spend only a short time on spawning beds, 2) fish not actively spawning are elusive, and 3) hard to count and steelhead do not necessarily die after spawning. In addition to difficulties associated with their behavior in spawning streams, the extensive temporal and spatial spawning patterns exhibited by coastal winter steelhead stocks create challenging survey conditions. The spawning season is generally quite protracted, lasting up to 6 months. Furthermore, steelhead have basin-wide spawning distribution, spawning in higher gradient headwater streams, as well as larger tributaries and mainstem areas.

Creel surveys are another potential method for monitoring coastal steelhead abundance. Creel surveys have been conducted extensively in Oregon coastal watersheds. These surveys generally estimate catch rate through angler interviews and fishing effort through comprehensive pressure counts. These two parameters are then used to estimate harvest. Estimates of catch or catch rate derived from creel surveys provide assessments of coastal steelhead status to the degree that these parameters correlate with actual run size. However, given that environmental conditions can have a large influence on angler harvest, creel data may not provide a sufficiently sensitive measure of run size. In addition, because of the wide-ranging restrictions on the harvest of wild steelhead, estimates of the catch of wild fish would need to rely on indirect information supplied by anglers regarding their catch and release on non fin-marked fish.

Starting in 1998, pilot steelhead spawning surveys were implemented in selected coastal basins to test the feasibility and viability of conducting steelhead-spawning surveys. A combination of comprehensive and supplemental spawner surveys was initiated in 22 coastal watersheds. Comprehensive surveys were conducted in areas above adult counting stations. The primary purpose of the surveys was to determine the feasibility and validity of conducting steelhead spawner surveys and to collect baseline data on spawning winter steelhead, coastal cutthroat and pacific lamprey.

The percentage of hatchery origin steelhead spawning naturally in the wild poses a great deal of concern to fisheries managers. The Oregon Wild Fish Management Policy (OAR 635-07-525) sets guidelines as to the percentage of stray hatchery fish permitted to spawn naturally in individual basins and subbasins. It is important for fisheries managers to know the percentage of hatchery strays spawning naturally in the wild. Currently, all of the hatchery origin steelhead released in Oregon and destined to return as adults in 1998 are marked with an adipose fin-clip. We have started to evaluate the feasibility of using visual detection of marked and unmarked adults on the spawning beds to determine hatchery:wild ratios.

The purpose of this report is threefold. First, we review available data from creel and spawner surveys to assess their potential utilities as tools for monitoring Oregon coastal steelhead abundance. Second, we present the findings of our initial year of evaluating the potential of conducting spawning ground surveys. Finally, we describe our plans for the upcoming (1999) monitoring season.

REVIEW OF MONITORING METHODS

Creel Surveys

Steelhead catch or catch rate as measured by creel surveys could be used as an index of adult steelhead abundance. The principal advantage of this approach is that methodology is readily available and that data collected would potentially provide continuity with historic punch card records. Garrison and Rosentreter (1980) showed a good relationship between estimates of catch of hatchery origin steelhead and hatchery steelhead run-size in the Alsea River. The run-size of hatchery origin steelhead was estimated by adding hatchery return and sport catch. Sport catch was estimated using a statistical creel survey. Figure 1 shows the relationship between estimated run-size and catch in the Alsea River for return years 1975 though 1984. This relationship suggests that catch estimates derived from creel surveys provide a good annual measure of run size. However when the catch component is removed from the dependent variable (Figure 2), the relationship is not strong indicating that there is strong autocorrelation occurring.

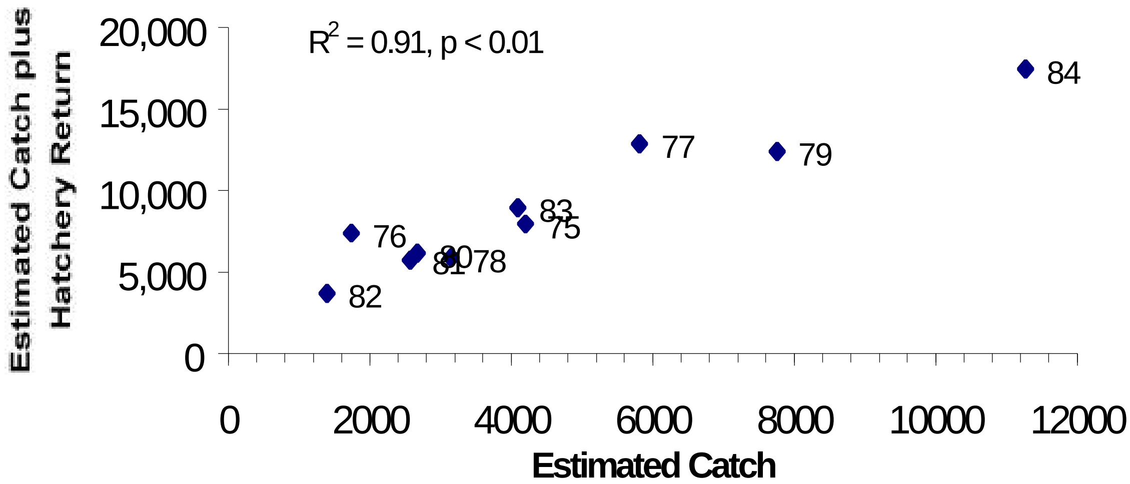


Figure 1. Relationship between estimates of recreational catch of hatchery origin Alsea River winter steelhead and run size, 1975-84.

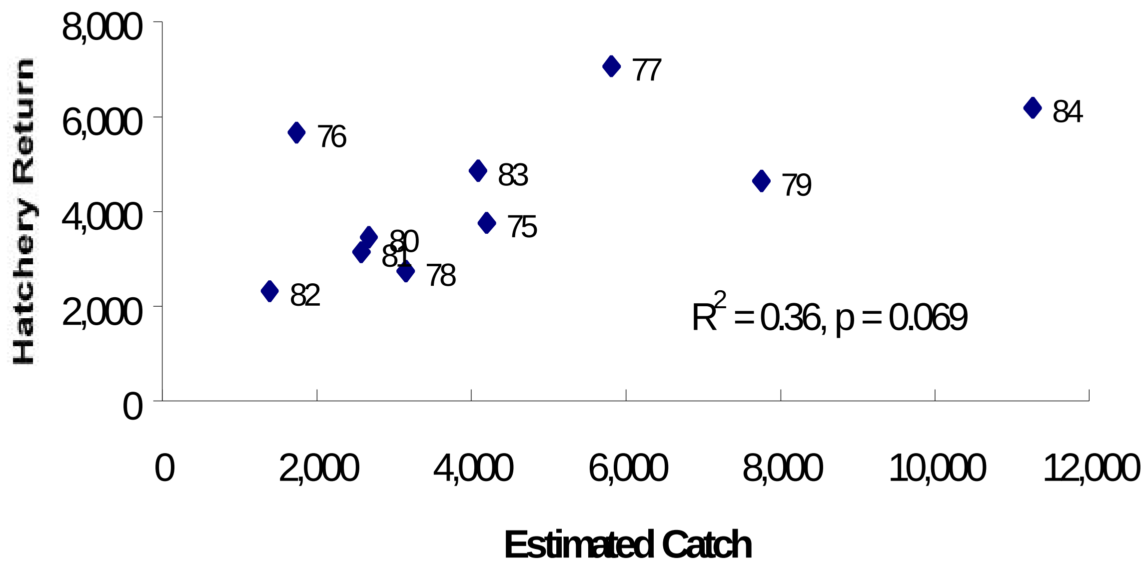


Figure 2. Relationship between estimates of recreational catch of hatchery origin Alsea River winter steelhead and hatchery return, 1975-85.

Coastal basins with known winter steelhead abundance are limited to the Rogue River above Gold Ray Dam and North Umpqua above Winchester Dam. However, estimates of angler harvest of winter steelhead in these basins are available only from returns of Salmon-Steelhead Tags (punch cards). Based on data from the Alsea River it appears that punch cards provide a reasonable index of angler harvest (Figure 3), so punch card data can be used to assess the relationship between catch and run size in these basins.

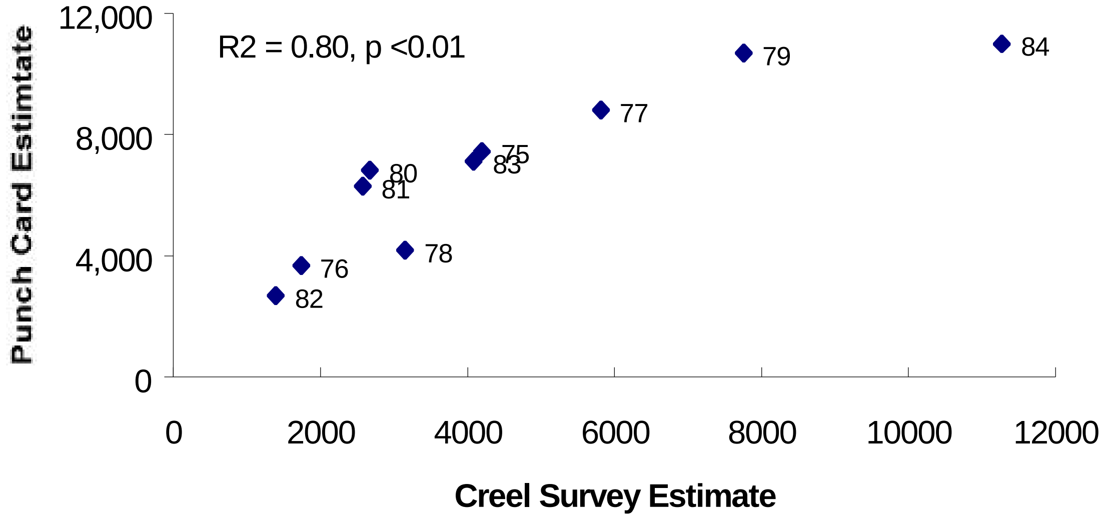


Figure 3. Relationship between estimates of angler harvest of winter steelhead derived from creel surveys and returns of angler punch cards in the Alsea River, 1975-84.

Figures 4 and 5 represent the relationships between angler catch as estimated by punch cards and winter steelhead dam counts at Winchester and Gold Ray Dams, respectively. Winchester data was significantly correlated, however the relationship was not strong (R^2 = 0.58, P= 0.0102). No significant relationship existed between dam counts and catch for the Gold Ray data (R^2 = 0.27, P= 0.099). McGie (1990) suggested that river flow during the angling season had a major influence on harvest of winter steelhead in the Rogue Basin. Including flow in the regression, increased the R^2 to 0.45.

Angler retention of wild origin steelhead has been eliminated except in the Rogue and Umpqua Basins. Creel census of natural steelhead would rely on anglers accurately reporting released catch. Lindsay et al. (1993) found that the number of wild steelhead released and voluntarily recorded on the angler punch card was consistent among the five basins surveyed. However, in the Siuslaw Basin where independent estimates of hatchery-wild ratios were made, data suggested that anglers over reported the number of wild steelhead released. An additional complicating factor in using creel data to monitor the run of natural stock of coastal winter steelhead is the correspondence of fishing seasons with run timing. Most coastal basins are closed to steelhead after 31 March. However, available passage data suggest that substantial portions of the run of wild winter steelhead migrate after this date (Lindsay et al. 1991). Thus, fishery data may not reliably encompass the run timing of wild steelhead stocks.

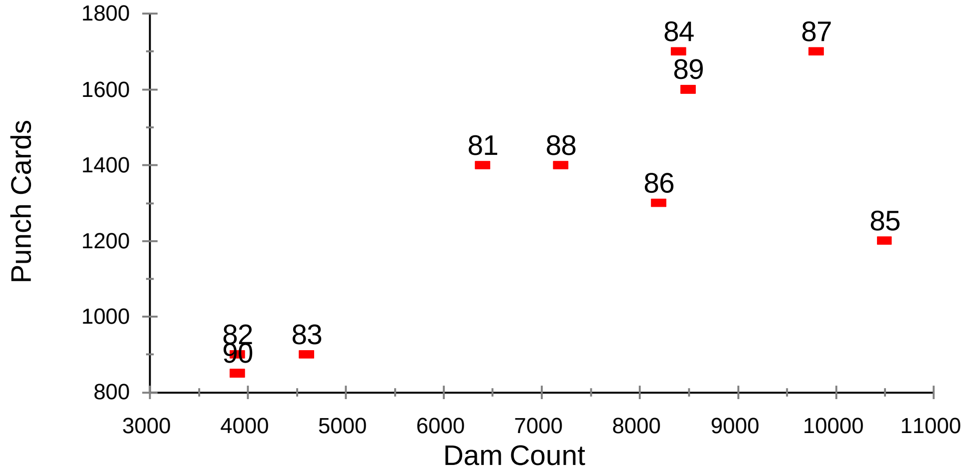


Figure 4. Relationship between counts of winter steelhead passing Winchester Dam on the North Umpqua River and angler harvest of winter steelhead upstream from the dam site, 1981-90. Angler harvest estimates were derived from returns of punch cards.

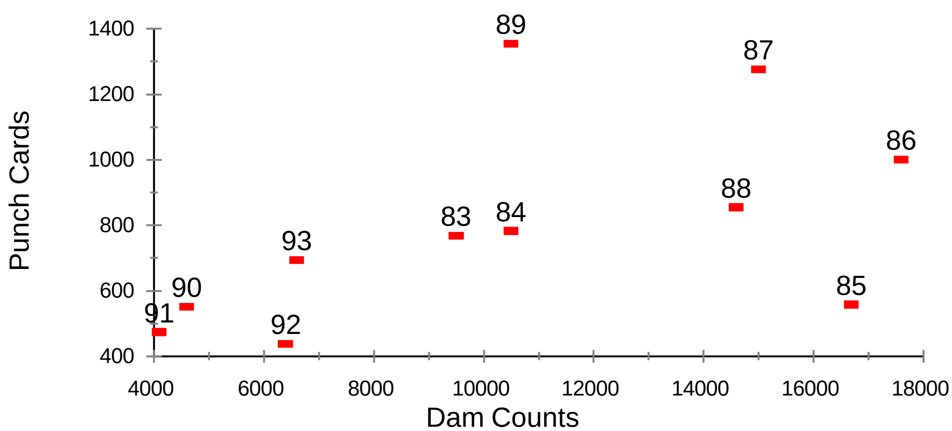


Figure 5. Relationship between counts of winter steelhead passing Gold Ray Dam on the Rogue River and angler harvest of winter steelhead upstream from the dam site, 1983-93. Angler harvest estimates were derived from returns of punch cards.

Spawning Ground Surveys

The secretive behavior of adult steelhead has probably evolved to maximize reproduction success and increase possibilities of repetitive spawning. As mentioned earlier these behaviors pose great difficulties in conducting conventional spawning ground surveys. Counting steelhead redds (fish nests) may be a way to overcome problems associated with live counts. Steelhead spawn later in the winter and during lower flow conditions than coho and chinook (Withler 1966). This makes redds less susceptible to scouring flows and also creates a longer window of opportunity for viewing. Freymond and Foley (1985) reported steelhead redds lasting between 14 and 30 days in coastal Washington streams during the winter of 1985.

Redd counts have been widely used to index the abundance of summer steelhead in the Columbia Basin (Orcutt et al 1966). The State of Washington uses steelhead redd counts for estimating actual population abundance and escapement of winter steelhead (Leland 1997). Washington's methodology is based on the relationship of steelhead passed above known barriers and subsequent redd counts. The relationship between females passed and redds are then expanded to areas where only redd counts are available. Figure 6 shows the relationship between female abundance and redd counts on Snow Creek, a tributary of Discovery Bay. Regression analysis revealed that adult abundance accounted for 91% of the variation in redd counts (Freeman and Foley 1985). Similar long-term data sets in Oregon that compare actual steelhead numbers and comprehensive redd counts are not readily available. Haxton (ODFW unpublished data) reported a good relationship between Willamette Falls passage of winter steelhead and redd counts in Mid-Willamette tributaries. Figure 7 represents the relationship between redd counts on the Molalla River and steelhead counts at Willamette Falls from 1980-1997. Regression analysis suggested that 74% of the variation in redd counts was explained by adult abundance. This is particularly noteworthy given that surveys are conducted only once during the spawning season and that the areas that are surveyed annually did not remain consistent during the time series.

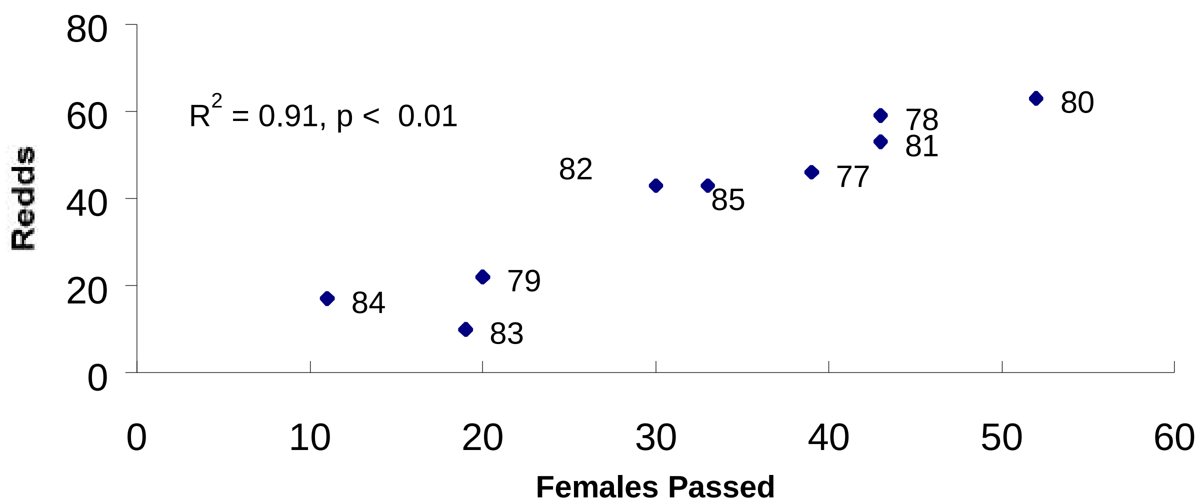


Figure 6. Relationship between female winter steelhead passing a weir and redd counts on Snow Creek, 1977-83.

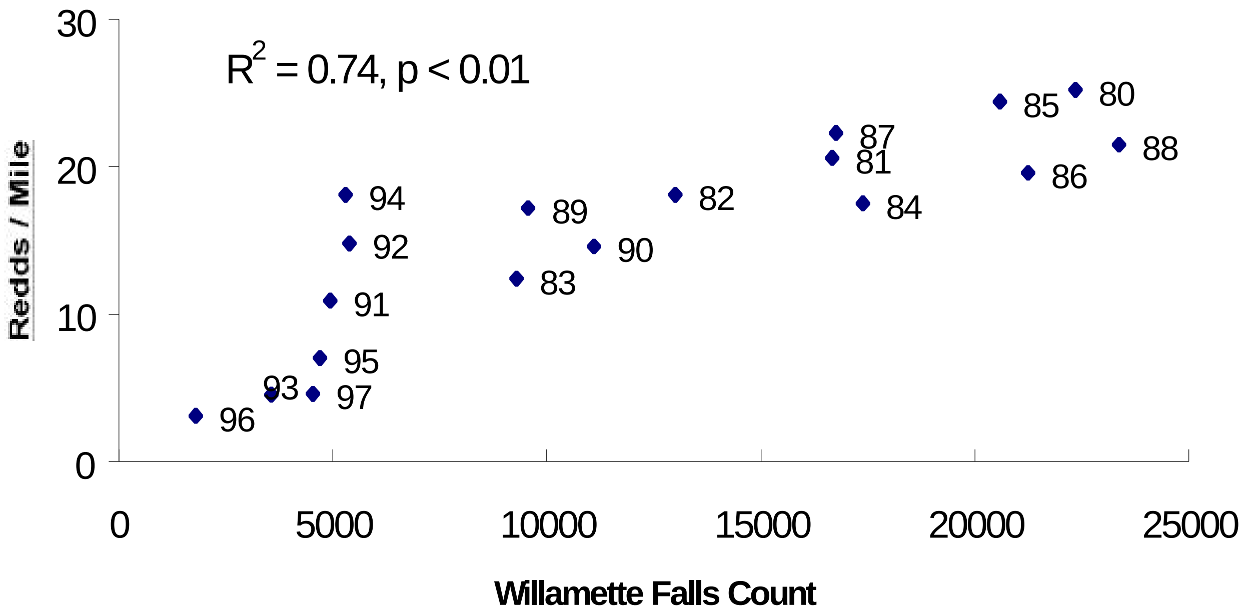


Figure 7. Relationship between counts of winter steelhead passing Willamette Falls and redd counts in Molla River tributaries, 1980-97.

These relationships indicate that redd counts have potential in providing a reliable index of winter steelhead abundance in Oregon coastal streams. However, because the validity of redd counts has not been determined in coastal streams, we feel that an evaluation must take place before this technique is widely applied. A major drawback of such an evaluation however, is that it would require several years to accomplish, and given that no other monitoring is presently taking place, devoting all efforts solely to evaluations would further delay any assessment of stock status. Given this paradox and the suggestion that redd counts have potential to provide at least some degree of stock status assessment, we elected to simultaneously initiate annual redd counts for winter steelhead while also evaluating this technique. Index areas will be chosen using an iterative process over a period of 2-3 years that is based on recommendations from field staff and trial and error. Ideally, we hope to end up with a collection of index stream reaches that are reliably used for spawning and are conducive to redd counting methodology. Evaluations will consist of relating inter-annual variability of redd counts to that observed in adult spawners in watersheds where adult population estimates can be obtained.

RESULTS OF 1998 STUDIES

Sampling was initiated in 1998 to work towards the goal of implementing a monitoring program for coastal winter steelhead stocks. Work priorities were identified to accomplish two major objectives. These objectives, along with associated work tasks are as follows:

Objective 1. Assess the feasibility of conducting spawner surveys for winter steelhead in Oregon coastal streams

Task 1.1 Identify stream reaches where spawning occurs and that have potential as survey sites.

Task 1.2. Determine if spawner surveys can be conducted over the range of stream order and flow conditions present in winter steelhead spawning habitat during the spawning season.

Task 1.3. Develop methods for counting redds constructed by winter steelhead.

Activity *1.3.1. Determine surveyors ability to distinguishing steelhead redds from redds constructed by other species (cutthroat and lamprey).*

Activity *1.3.2. Determine the minimum longevity of steelhead redds in spawning streams.*

Task 1.4. Determine the spawning season of winter steelhead in coastal streams.

Task 1.5. Determine if the ratio of wild to hatchery fish can be detected for spawning winter steelhead.

Task 1.6. Determine what information can be obtained for cutthroat and lamprey from winter steelhead spawning surveys.

Objective 2. Assess the reliability of spawner surveys to index inter-annual variability of the abundance of coastal stocks of winter steelhead.

Task 2.1. Select watersheds where rigorous annual estimates of adult steelhead can be obtained.

Task 2.2. Estimate spawner abundance using trap catches or mark-recapture.

Task 2.3. Conduct spawner surveys in selected stream reaches upstream from trap sites to index population abundance.

Task 2.4. Compare population estimates to indices of spawner abundance derived from spawning surveys to assess reliability.

Methods

Study Areas

Steelhead spawning surveys were conducted in 21 different watersheds or subbasins of Oregon coastal streams, ranging from the Necanicum River in the north to the South Fork of the Coquille River in the south (**Appendix A**). Survey sites in the north and central coast were chosen to coincide with adult steelhead inventory already being done at adult trap sites operated by the ODFW Life Cycle Monitoring Project. These sites were chosen even though most were in low gradient streams and not in classical steelhead habitat (Table 1). To address Objective 1, additional survey sites in more classical steelhead habitat were selected. This would insure our surveyors would see at least some steelhead.

Table 1. Characteristics of calibration sites initiated in 1998.

Watershed	Nature of Barrier	Complete count	Survey Miles	Spawning Miles
Nehalem, N Fk	Falls	no	24.4	38.8
Fishhawk Cr	Dam	yes	11.9	11.9
Siletz R, Mill Cr	Falls	no	10.2	10.2
Yaquina R, Mill Cr	Dam	yes	2.2	2.2
Cascade Cr	Falls	no	6.6	6.6
North Umpqua R	Dam	yes	34.7	450

Surveys on the North Coast were chosen above adult trapping sites on Fishhawk Creek, an upper Nehalem River tributary and above the falls on North Fork Nehalem River. Volunteers form the Fishhawk Lake Watershed Council operated the adult trap at the Fishhawk Lake fish ladder. Central Coast survey sites above adult counting stations included: Mill Creek (lower Siletz River tributary), Mill Creek (Yaquina River) and Cascade Creek (Alsea Basin).

Siuslaw Basin surveys were conducted primarily on Bureau of Land Management (BLM) lands in cooperation with the Eugene District of the BLM. Surveys were selected to evaluate salmon and steelhead spawning use on BLM lands in the Siuslaw Basin. As time allowed later in the season additional supplemental surveys were conducted throughout the basin.

Umpqua River surveys sites above Winchester Dam on the North Umpqua River were selected in areas where we thought highest densities of spawning occurs. Survey sites were divided between ODFW, USFS and BLM personnel. District personnel conducted surveys on the South Umpqua.

Timing of Surveys

Surveys were conducted from mid January to mid May. Sites were surveyed on a weekly basis early in the season. After the surveyors established a relative level of fish use, some of the less productive sites were either dropped or surveyed on a 2-week rotation.

Survey Setup

Survey sections were setup using the protocol developed by Jacobs and Cooney (1990). Streams were divided into reaches. Reach brakes were defined at anadromous salmonid bearing tributary junctions. Long reaches were generally subdivided into approximately 1-mile segments. Upper and lower ends of survey segments were marked with 10x10" orange department survey boundary markers. Global positioning units were used to identify survey start and end points. Survey segments were measured using a hip-chain. The amount of available spawning gravel deposits within each survey segment was quantified. Detailed descriptions were written for each survey and included in our coast-wide spawning survey database.

Survey Procedure

Surveys were conducted starting at the downstream end of the survey and walking upstream. Larger streams were floated using a 13-foot inflatable raft. Surveyors recorded field data in a pre-printed Spawning Fish Survey Field book. Prior to conducting the survey, basin, subbasin and survey name were recorded. Amber colored polarized sunglasses and baseball style hats were worn to aid in reducing glare on the water. Glasses also protected eyes from branches and other foreign objects.

Steelhead entrance into spawning tributaries generally coincides with freshet conditions. Priorities in scheduling were set so that tributary surveys could be conducted as soon as possible after high water events. During prolonged periods of low water or later in the spawning season emphasis was placed on mainstem areas.

Surveys were conducted only when the visibility into the water was sufficient to see clearly into the tail-outs of pools and into riffles. Visibility was classified into three categories: 1) can see clearly into pools and riffles, 2) can only see into the tail-outs of pools and into riffles, 3) cannot see into either pools or riffles. Surveys were conducted only in visibility of 1 or 2.

All redds observed were counted. A redd is the depression in the gravel excavated by a salmonid female for egg deposition. Redds were identified by a hollow in the gravel and the adjacent downstream plume of excavated gravel. Figure 8 (page 14) shows a typical steelhead redd. The gravel excavated from a recently dug redd will usually appear lighter colored and less uniformly oriented than the undisturbed gravel. Care was taken not to confuse redds with scouring associated with roughness elements (large woody debris, boulders, rock outcroppings). Redds of different species were separately tallied. Identification was based on fish species seen on, near or digging the redd. When no fish were seen nearby, redds were subjectively assigned to a species using the surveyors best judgement. All redds observed were marked with a single colored rock. Chartreuse seemed to be the most visible color. The colored rock was placed into the deepest part of the redd. In addition to rock placement, the location of the redd was also flagged using colored cruse tape. Using a permanent marker surveyors recorded date, species, and a brief description of the redds' location on the flagging. The flagging was then tied to a tree branch in a location clearly visible from the stream. When there was a possibility of livestock eating the flagging or if the flagging was visible from a residence both ends of the flagging were secured. When adults were seen actively spawning, placement of the rock was postponed. A note was placed on the flagging indicating that no rock was placed and that fish were observed actively spawning. A rock was placed into the redd during the next visit to the site. The redd marking and flagging prevented double counting of redds. Marked redds that were visible on subsequent surveys were not recounted. When the marked redd was no longer visible, the flagging was removed. Upon removing the flagging the surveyor wrote the removal date on it and placed it in a zip-lock bag. All flags removed during a survey were placed into a single bag. At the end of the survey, the completed spawning fish survey field form was included in the bag to avoid confusing flagging from different surveys. At the end of each survey day, data on the flags were transcribed to the redd longevity form. Data from the data field form was also transcribed to the Spawning Steelhead Form at the end of each day.

Live fish seen during the survey were counted and tallied by species. Surveyors attempted to visually determine whether or not steelhead were adipose fin-clipped. All hatchery origin steelhead released in Oregon are adipose fin-clipped. All live steelhead observed were classified as (1) positively adipose fin-clipped (2) positively non-clipped or (3) unknown if fin-clipped or not. The surveyors made no inferences. The activity of live fish observed was also noted as to whether adults were mostly holding in pools, migrating through survey area, actively spawning, or mostly spawned out.

At the end of each survey, weather, stream flow and visibility were recorded in the survey field notebook.

Objective 1 Results (Survey Feasibility)

Task 1.1, 1.2 (Spawning Surveys)

Table 2 summarizes steelhead spawner surveys for individual watersheds. Listed are the number of surveys conducted, total number of live steelhead adults observed, the number of marked and unmarked adults seen, and the total number of redds counted. Also included are lamprey and cutthroat live adult and redd counts.

Table 2. Live steelhead counts and the observation of redds on steelhead spawning ground surveys in 1998.

Location	Number of surveys	Steelhead					Cutthroat		Lamprey	
		Total live	Marked	Un-marked	Dead	Redds	Total Live	Redds	Live	Redds
Necanicum River	3	7	0	1	1	134	2	1	18	228
Ecola Cr	1	25	2	5	0	55	0	0	3	24
Arch Cape Cr	2	84	5	16	1	22	0	0	1	9
Nehalem R, Lower	3	1	0	0	0	25	0	0	0	0
Nehalem, N Fk	32	42	2	9	0	129	19	5	10	62
Fishhawk Cr	16	6	0	0	0	18	8	2	0	0
Salmonberry River	1	17	0	0	1	99	0	0	0	0
Kilchis River	4	8	0	3	0	23	0	0	0	0
Wilson River	3	9	0	5	0	83	0	0	3	38
Salmon River	4	9	0	0	0	10	0	0	1	9
Siletz R, Mainstem	2	12	0	0	1	29	5	0	0	0
Siletz R, Mill Cr	10	26	1	0	2	42	2	1	0	8
Yaquina R, Mill Cr	2	2	0	0	0	15	0	0	0	0
Yaquina R, Mainstem	1	20	0	5	0	57	4	0	11	68
Alsea R, Fall Creek	1	0	0	0	0	0	0	0	1	20
Alsea R,Cascade Cr	7	1	0	0	0	1	7	0	0	0
Tenmile CR	1	34	0	0	0	69	0	0	2	14
Siuslaw R, Mainstem	46	35	0	3	0	106	25	0	45	679
Siuslaw R, Lake Cr	8	16	0	2	1	37	4	1	1	242
Siuslaw R, Wolf Cr	5	12	0	6	0	22	1	1	2	14
Siuslaw R, S Fk	3	0	0	0	0	0	0	0	0	0
North Umpqua R	28	225	12	75	3	585	50	25	1	1
Smith River	2	0	0	0	0	22	19	0	0	0
South Umpqua R	6	0	0	0	0	12	19	0	0	0
Coquille R, S Fk	2	44	1	18	0	23	0	0	0	0
Total	191	623	23	148	9	1589	160	36	99	1416

Overall, we conducted 191 surveys and observed 623 live steelhead and 1589 redds. Summaries of steelhead survey results for individual surveys are listed in **Appendix A**. Surveys were successfully conducted throughout the 4-month spawning season at intervals within our protocol. Also, at least during the latter periods of the spawning season, surveys were successfully conducted in several large order streams such as the mainstem Siletz River, Five Rivers, Lake Creek and the mainstem Siuslaw River.

Task 1.3. (Distinction of Redds)

One of the most confounding problems associated with conducting steelhead spawning ground redd counts is being able to distinguish the difference between steelhead and lamprey redds. Although we did not take quantitative measurements of lamprey and steelhead redds, we did make qualitative observations. We feel that a properly informed surveyor should be able to Identify most redds accurately. A typical steelhead redd is pictured in Figure 8. It is much longer than it is wide and the tailings are evenly distributed downstream with the current. A classical lamprey redd is shown in Figure.9. Note the neat and round appearance with a nice conical bowl. The most telling characteristic of a lamprey redd is the placement of tailings upstream from the redd (Figure 10). Lamprey excavate their redds by sucking onto the gravel and then depositing it outside the redd. Figure 11 shows a lamprey redd with tailings from the redd placed perpendicular to the flow. The identification of multiple lamprey redds is more subjective. What we found in 1998, was that most of these redds were fairly narrow and much wider than they were long (Figure 12). Also, the presence of numerous, small, conical bowls are common in sites containing multiple lamprey redds (Figure 13). On Esmond Creek, Siuslaw River, live lamprey were observed on a previously marked and flagged steelhead redd. In this case, it appeared that the lamprey were spawned out and were using the steelhead redd to escape the current. Thus, steelhead and lamprey utilize the same spawning habitat, but redd characteristics can be used to distinguish redds between the two species.

Figure 8. Typical steelhead redd

Figure 9. Typical pacific lamprey redd

Figure 10. Lamprey redd, note placement of excavated rocks upstream and to the side of the redd .

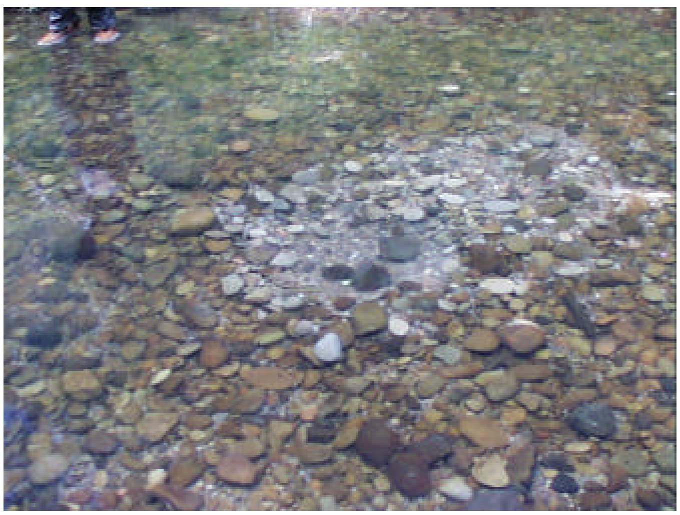
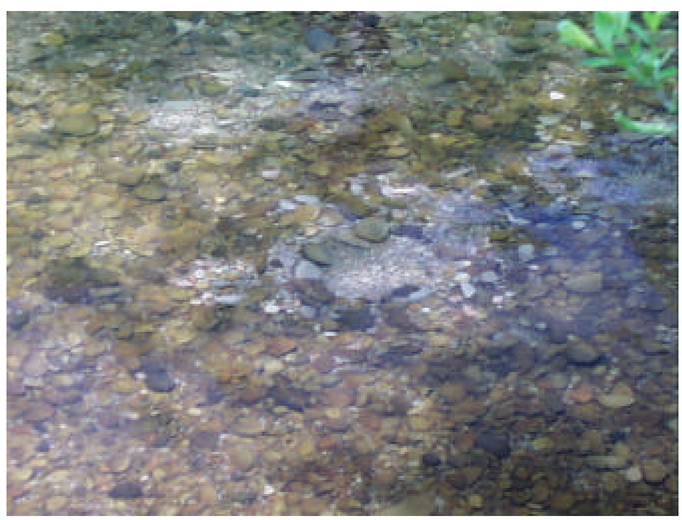


Figure 11. Lamprey redd showing placement of excavated debris perpendicular to flow.

Figure 12. multiple lamprey redds, about 5 feet wide but tailings of only 2 feet.

Figure 13. Small lamprey redd, 1 foot in diameter.



Task 1.3.2. (Redd longevity and survey recurrence interval)

Determining the optimum length of time between survey visits was a key objective for the 1998 surveys. Table 3 shows minimum, maximum and average time that marked redds remained visible for selected survey areas. Longevity averaged nearly 30 days, but was variable within and between survey areas. Redds still visible when surveys were terminated in May were not included in this summary. This omission would cause longevity to be negatively biased. Figure 14 shows the cumulative percentage of redds no longer visible though successive weeks of surveys. Virtually all redds were visible after one week. After two weeks the proportion of redds no longer visible ranged from 7% in the North coast to 32% in the mid-coast. In the Umpqua basin, 16% of the observed redds were no longer visible after two weeks.

The discrepancy in redd longevity between different geographic locations may be attributed to differences in spawning timing. The timing for redd observation was earlier on the mid-coast than it was on the north-coast or Umpqua (Figure 15). This may have significantly reduced redd longevity because higher flows were experienced early in the spawning season. Figure 16 shows the hydrograph for the Alsea during the 1998 sample year compared with long term average flow. Further analysis showed that flow patterns observed in the Alsea Basin during the steelhead spawning season generally represented those occurring in other coastal stream basins. As shown in Figure 16, early in the spawning season, flow conditions were greater than average. However, later in the season, flow dropped to below normal levels.

Table 3. Statistics of redds observed during the 1998 steelhead spawning surveys.

	Longevity of redds(days)				
	Sample Size	Average	Minimum	Maximum	Standard Deviation
Arch Cape Cr	22	26.0	7	58	12.7
Ecola Cr	47	18.8	7	50	9.87
Nehalem R, Lower	14	24.1	7	30	7.47
Fishhawk Cr	18	41.4	15	57	12.42
Nehalem, N Fk	133	24.8	6	76	13.87
Siletz R, Mill Cr	41	29.4	9	54	14.01
Yaquina R, Upper	53	27.4	6	97	16.57
Yaquina R, Mill Cr	16	20.6	4	35	8.78
Cascade Cr	1	34.0	34	34	--
Siuslaw R, Main	43	19.7	7	40	9.17
Siuslaw R, Lake Cr	10	16.9	7	50	11.84
Siuslaw R, Wolf Cr	21	23.8	7	44	10.26
North Umpqua	337	32.2	5	97	18.73

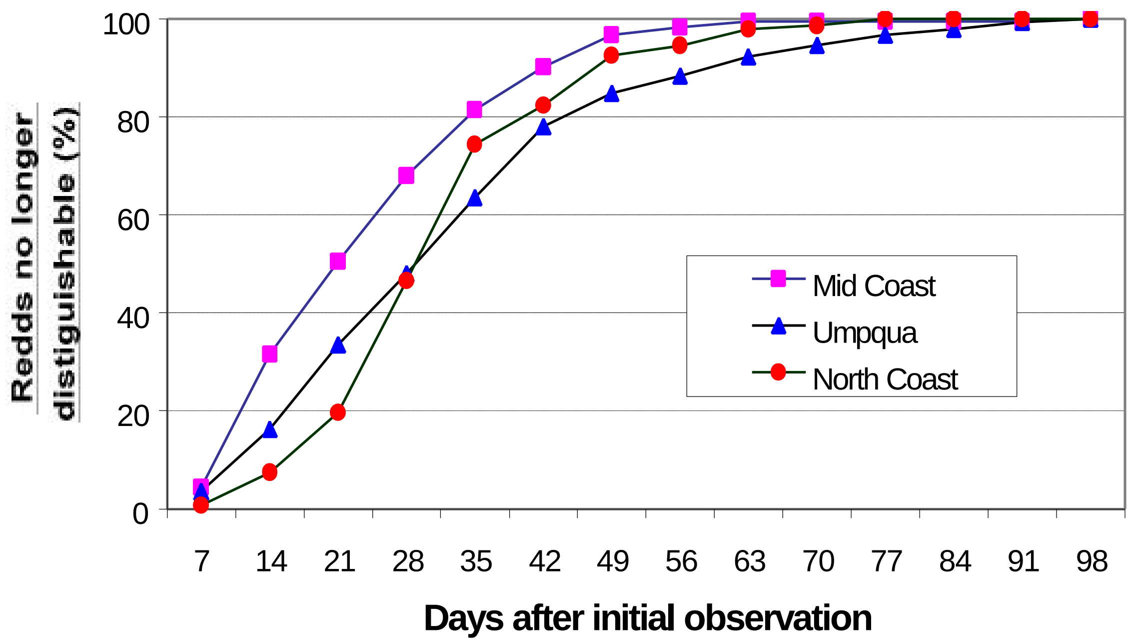


Figure 14. Percent of steelhead redds visible at one week intervals after initial observation.

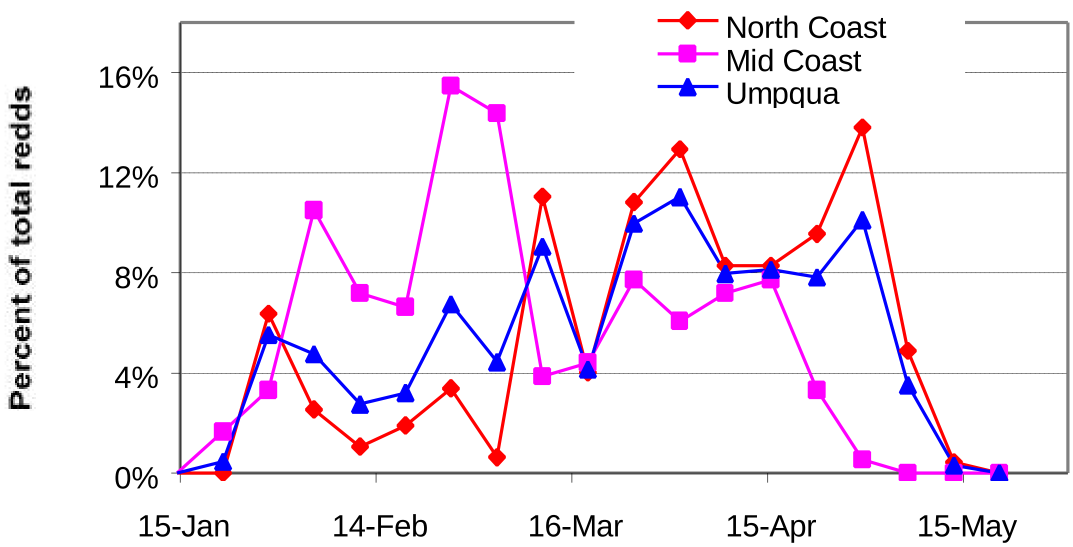


Figure 15. Temporal distribution of first date of observation for steelhead redds observed during 1998 spawning surveys.

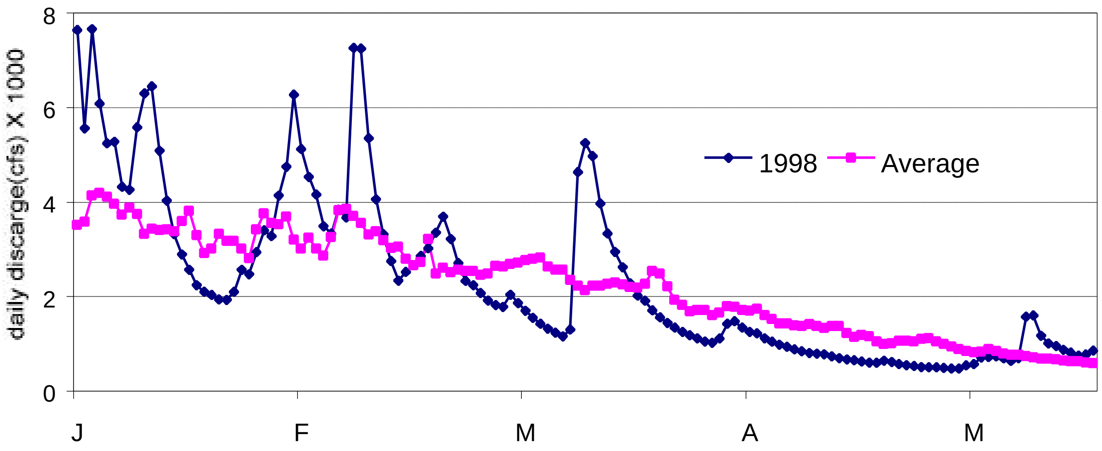


Figure 16. Daily discharge for the Alsea River during the steelhead spawning season in 1998 versus the1939-1996 average.

When establishing survey recurrence interval, temporal variation in flow patterns and the variation in spawning timing between locations must be taken into account. Results of this year's work indicate that weekly survey intervals would provide a reliable count of essentially all observable redds throughout the spawning season. In the absence of significant freshets, it also appears that at least for the second half of the spawning season surveys could be spaced two weeks apart and still provide fairly reliable counts of most of the observable redds.

Task 1.4. (Spawning timing)

Steelhead spawning activity was observed from the end of January to the beginning of May. Temporal distribution of steelhead spawning on the North Coast, Mid-Coast and Umpqua is graphically depicted in Figure 15. Mid coast spawning was slightly earlier, with peak in spawning activity observed during the last week in February. Spawning timing in the North Coast and the Umpqua Basins was similar. These results further show that steelhead spawning is very protracted. Peak spawning activity observed on the North Coast was during the fourth week in April.

Task 1.5 (Observation of fin-marks)

Table 2 on page 12 lists the total number of live positively identified marked, unmarked and total steelhead observed on spawning grounds. Of the 627 total live adult steelhead observed on the 1998 spawning surveys, 150 were identified as being unmarked and 23 were identified as being marked. Surveyors were able to positively identify hatchery or wild origin of nearly 30% of the live adults observed. The use of binoculars may significantly increase this percentage.

Task 1.6 (Cutthroat and Lamprey)

Observations for cutthroat *(O. clarki)* should be considered incidental and opportunistic. This methodology is probably not a sensitive indicator of spawning abundance for cutthroat. Alternatively, spawning Pacific Lamprey (*Lampetra tridentata*) were readily observed on surveys, and we believe spawning surveys may provide reliable data on their status. As with steelhead, 191 surveys were conducted. We observed 160 live cutthroat and 36 redds. We observed 99 live lamprey and 1416 redds. Summaries of cutthroat and lamprey observations on individual surveys are listed in **Appendix B**.

The numbers of cutthroat and cutthroat redds observed on the 1998 surveys was surprisingly low and may be due to several reasons. Surveys were not conducted in cutthroat spawning habitat. Surveys were not conducted when cutthroat spawn. Spawning ground surveys are not a sensitive indicator of cutthroat presence or spawning abundance. The latter is probably the most logical answer. Similar conclusions have been drawn on the reliability of spawning surveys for Rogue River half-pound summer steelhead. These steelhead are about the same size as coastal sea-run cutthroat. Satterthwaite (1999) concluded that the lack of a relationship between half-pounder redd counts and estimates of adult abundance was due to the small size of the redds and surveyor error in detecting them.

In contrast to cutthroat, lamprey were more abundant on our surveys than anticipated. It appears that spawning ground surveys would be a reasonable method for indexing lamprey abundance. Lamprey were widely distributed in the streams surveyed (Table 2). Figure 17 graphically displays the spawning time of pacific lamprey on the North and Mid Coast. The Mid Coast is again a combination of Central Coast and Siuslaw Basin surveys. Spawning clearly peaked in the Mid and North Coast during the second week in April. This is well after most yearly high water events occur. Only one lamprey redd was observed in the North Umpqua in 1998. Only four lamprey were passed over Winchester dam in 1997-98 (Rod Thompson personal communication). No live lamprey or redds were observed above the trap sites on Fishhawk Creek and Yaquina Mill Creek. This may suggest that Mill and Fishhawk dams are possible passage barriers for lamprey.

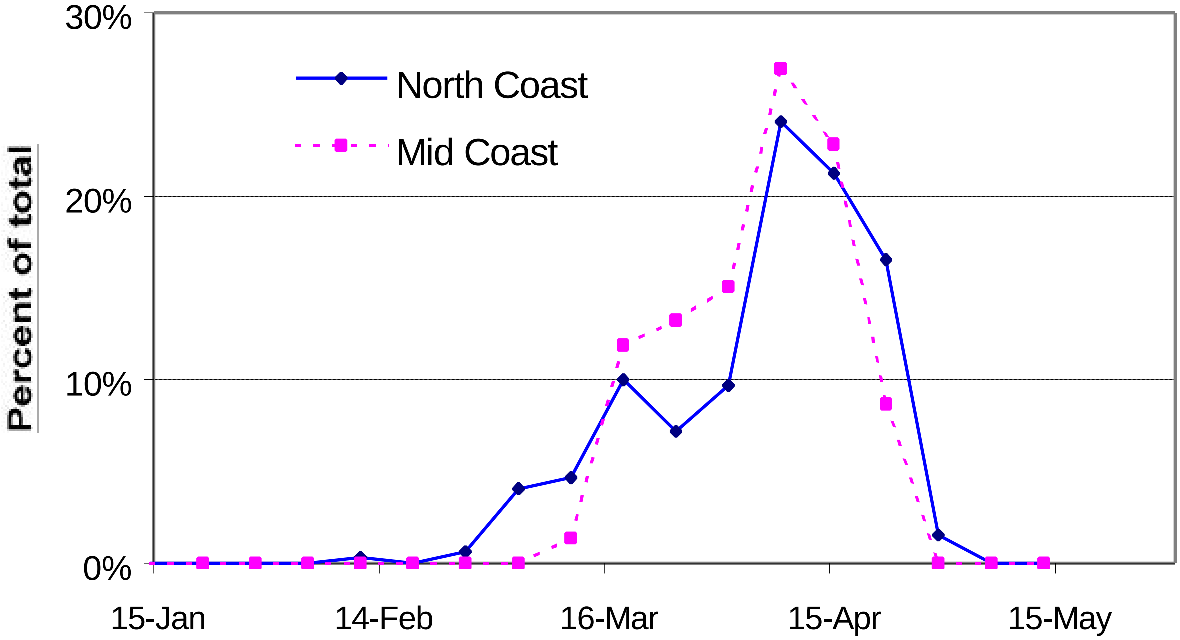


Figure 17. Temporal frequency of first date of observation for lamprey redds identified during spawning surveys conducted in 1998.

Objective 2 Results (Survey Reliability)

Table 3 compares the number of steelhead passed at adult trap sites and our subsequent spawning survey redd counts. Redds per female passed ranged from a low in Cascade Creek of 0.25 to a high in the North Fork Nehalem River of 4.45. All available spawning habitat was surveyed in Cascade Creek on a weekly basis. Low and moderate flows in Cascade Creek provided excellent survey viewing conditions. It is likely that adult steelhead passed above the trap site dropped back down below the trap and spawned elsewhere. The opposite problem occurred on the North Fork Nehalem. Nearly four times the number of redds were counted than would be expected from the number of females passed. The results strongly suggest that the North Fork Nehalem Falls is not a passage barrier. During the fall of 1998 numerous chinook salmon were observed bypassing the North Fork trap and swimming directly up the falls (Brian Riggers personal communication). In the other sites where comprehensive surveys were conducted (Fishhawk Creek, Mill Creek-Siletz River, and Mill Creek-Yaquina River) the ratio of redds to females passed was within a believable range and averaged about 1 redd per female. This is only slightly lower than the 1.2 redds per female reported by Freeman and Foley (1985).

The percent of the live adults passed and subsequently visually counted on the surveys varied widely between surveys. We saw only 4 percent of the live adults passed on Mill Creek Yaquina compared with 30 percent on Mill Creek Siletz. On Fishhawk Creek we accounted for 17 percent of the live fish passed. The variation of these data would suggest that adult live counts would not be a reliable indicator of the abundance of adult steelhead.

The North Umpqua River was not comprehensively surveyed. We surveyed about 8% of the available spawning habitat and counted 585 steelhead redds. Assuming a 50-50 sex ratio during passage at Winchester Dam, an estimated total of 4,600 steelhead females total were passed with a one redd per female ratio a total of 4,600 redds were in the North Umpqua Basin. Given that, we accounted for approximately 13% of the total redds. This also yielded an index of 16.8 steelhead redds per mile surveyed.

Table 3. Statistics from winter steelhead surveys above adult counting stations.

Subbasin	Adults passed at Traps	Females Passed at Traps	Live Adults Observed	Redds Observed	Redds/ Mile Surveyed	Redds/ Female	Live/ redd
Nehalem, N Fk	54	29	42	129	5.3	4.4	3.07
Fishhawk Cr	35	17	6	18	1.5	1.1	3.00
Siletz R, Mill Cr	86	42	26	42	4.1	1.0	1.62
Yaquina R, Mill Cr	47	20	2	15	6.8	0.8	7.50
Cascade Cr	11	4	1	1	0.2	0.2	1.00
North Umpqua [a]	9,200 [b]	4,600 [c]	225	585	16.8	0.1	2.60

[a] *Basin not comprehensively surveyed above trap site.*
[b] *combination of summer and winter steelhead. Adjustments were made for angler harvest*
[c] *assumes 50:50 sex ratio*

CONCLUSIONS

- We were able to conduct surveys throughout the steelhead spawning season.
- Steelhead redds could be distinguished from lamprey redds.
- Surveys should be conducted on a weekly basis during the first half of the season or during high flow periods.
- Surveys can be conducted at longer intervals during periods of low stream flow.
- Redd counts showed a fairly consistent relationship with spawner abundance in areas where reliable estimates of steelhead spawner abundance were obtained.
- Survey methodology is strait forward and can easily be utilized by watershed councils.

PLANS FOR 1999

For our 1999 sampling, we plan to build from our 1998 experiences and continue to develop methodology for long-term adult winter steelhead indexing. The emphasis of our 1999 surveys will be similar to that of 1998. Assessing the reliability of using spawner surveys to index coastal winter steelhead stocks inter-annual abundance variability will remain a key objective for our 1999 sampling. To achieve this goal we will continue to sample in areas of known adult steelhead abundance. Table 5 lists the areas where we intend to conduct calibration surveys during the 1999 season. We plan to survey all available spawning habitat on Nehalem-Fishhawk Creek, Yaquina-Mill Creek, Alsea-Drift Creek above Bohannon Falls and Siletz-Schooner Creek. These sites will provide a comparison between absolute numbers of steelhead and our spawning survey counts. Additional effort will be undertaken to obtain a mark-recapture population estimate of adult steelhead in the North Fork Nehalem. If successful, we will also be able to use the North Fork as a key calibration site. We are dropping Cascade Creek and reducing sampling effort on Siletz Mill and in the North Umpqua in order to survey additional areas. We will also conduct a limited number of surveys above fish traps and adult counting stations that are not complete barriers. This will allow us to compare relative fish passage numbers with our survey counts.

Table 4. List of 1999 steelhead survey calibration sites.

Calibration Sites	Complete Barrier	Years Surveyed	Comprehensive
Nehalem, N Fk	No	98,99	No
Fishhawk Cr	Yes	98,99	Yes
Siletz R, Mill Cr	No	98,99	No
Yaquina R, Mill Cr	Yes	98,99	Yes
Whittaker Creek	No	99	No
Greenleaf Creek	No	99	No
Schooner Creek	Unknown	99	Yes
Drift Creek	Unknown	99	Yes
North Umpqua	Yes	98,99	No

In 1999, we also plan to fine-tune our survey methodology. We will continue to mark and flag redds in order to optimize survey recurrence interval. At two locations, Alsea-Drift Creek and Siletz-Schooner Creek, we will also have the opportunity to compare actual hatchery wild ratios and ratios observed and recorded during spawner surveys.

Additional sites will be surveyed apart from the calibration sites in order to begin developing standardized indexing areas. It is important to start evaluating potential standardized sites a soon as possible because it may take several years to establish an adequate number of survey sites for coast wide evaluation**. Appendix C** lists the1999 steelhead spawner survey sites for North Coast, Mid-Coast-Siuslaw, Umpqua and Coos-Coquille-Floras Basins. We plan to have two surveyors in each of the respective locations.

ACKNOWLEDGMENTS

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We would like also like to acknowledge Neil Armatrout, and the Eugene District of the Bureau of Land Management for funding all of the Siuslaw Basin surveys**.**

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Appendix A. Summary of winter steelhead spawning surveys, 1998.

Basin, Subbasin or Survey reach	Reach	Seg-ment	Sur-veys	Times Surveyed	Live counts Total	Marked	Un-marked	Un-known	Dead	Redds
NECANICUM RIVER			**3**	**15**	**7**	**0**	**1**	**6**	**1**	**134**
MAIN STEM			**3**	**15**	**7**	**0**	**1**	**6**	**1**	**134**
NECANICUM R	26223.00	1		8	6	0	1	5	1	111
LITTLE JOE CR	26241.00	0.1		2	0	0	0	0	0	0
NECANICUM R	26243.00	2		5	1	0	0	1	0	23
ECOLA CREEK			**1**	**10**	**25**	**2**	**5**	**18**	**0**	**55**
NORTH FORK			**1**	**10**	**25**	**2**	**5**	**18**	**0**	**55**
ECOLA CR, N FK	26183.00	2		10	25	2	5	18	0	55
ARCH CAPE CREEK			**2**	**21**	**84**	**5**	**16**	**63**	**1**	**22**
MAIN STEM			**2**	**21**	**84**	**5**	**16**	**63**	**1**	**22**
ARCH CAPE CR	26163.00	1		11	50	2	13	35	0	18
ARCH CAPE CR	26163.00	2		10	34	3	3	28	1	4
NEHALEM RIVER			**52**	**372**	**70**	**2**	**11**	**57**	**1**	**294**
MAIN STEM			**19**	**109**	**7**	**0**	**0**	**7**	**0**	**43**
COOK CR	25907.00	1		1	1	0	0	1	0	19
COOK CR	25909.00	1		1	0	0	0	0	0	1
COOK CR	25911.00	1		1	0	0	0	0	0	5
FISHHAWK CR, TRIB A	26045.30	1		4	0	0	0	0	0	0
FISHHAWK CR, TRIB B	26045.50	1		4	0	0	0	0	0	0
BOXLER CR	26045.70	1		3	0	0	0	0	0	0
FISHHAWK CR	26045.90	1		8	0	0	0	0	0	5
FISHHAWK CR	26045.90	2		8	0	0	0	0	0	3
MCCOON CR	26046.00	1		8	0	0	0	0	0	0
MCCOON CR	26046.00	2		4	0	0	0	0	0	0
MCCOON CR	26046.00	3		4	0	0	0	0	0	0
FISHHAWK CR	26047.00	1		10	4	0	0	4	0	8
FISHHAWK CR, N FK	26048.00	1		9	1	0	0	1	0	0
WRONG WAY CR	26049.00	1		6	0	0	0	0	0	0
FISHHAWK CR, N FK	26050.00	1		6	0	0	0	0	0	0
FISHHAWK CR, N FK	26050.00	2		6	0	0	0	0	0	0
FISHHAWK CR	26051.00	1		10	1	0	0	1	0	2
FISHHAWK CR, TRIB C	26051.30	1		7	0	0	0	0	0	0
FISHHAWK CR	26051.70	1		9	0	0	0	0	0	0
NORTH FORK			**32**	**254**	**46**	**2**	**11**	**33**	**0**	**152**
SOAPSTONE CR	25864.00	2		1	1	0	0	1	0	0
BUCHANAN CR	25865.00	1		1	0	0	0	0	0	1

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Basin, Subbasin or Survey reach	Reach	Seg-ment	Sur-veys	Times Surveyed	Live counts Total	Marked	Un-marked	Un-known	Dead	Redds
SOAPSTONE CR	25866.00	2		1	0	0	0	0	0	8
NEHALEM R, N FK	25871.00	1		8	3	0	2	1	0	14
GODS VALLEY CR	25872.00	1		10	0	0	0	0	0	1
GODS VALLEY CR	25872.00	2		10	2	1	0	1	0	0
GODS VALLEY CR	25872.00	3		10	0	0	0	0	0	0
GODS VALLEY CR	25872.00	6		6	0	0	0	0	0	0
NEHALEM R, N FK	25873.00	1		9	2	0	0	2	0	24
LOST CR	25874.00	1		8	0	0	0	0	0	0
LOST CR	25874.00	2		6	0	0	0	0	0	0
NEHALEM R, N FK	25875.00	1		8	4	0	4	0	0	25
NEHALEM R, N FK	25875.00	2		8	10	0	5	5	0	11
SWEET HOME CR	25876.00	1		10	5	1	0	4	0	4
SWEET HOME CR	25876.00	2		10	3	0	0	3	0	2
SWEET HOME CR	25876.00	3		9	0	0	0	0	0	2
SWEETHOME CR, TRIB D	25876.50	1		5	0	0	0	0	0	0
SWEETHOME CR	25876.60	1		6	0	0	0	0	0	0
SWEETHOME CR	25876.60	2		1	0	0	0	0	0	0
NEHALEM R, N FK	25877.00	1		8	5	0	0	5	0	9
FALL CR	25878.00	1		8	0	0	0	0	0	3
NEHALEM R, N FK	25879.00	1		11	2	0	0	2	0	28
NEHALEM R, N FK	25879.00	2		11	3	0	0	3	0	9
NEHALEM R, N FK, TRIB R	25879.30	1		7	0	0	0	0	0	0
NEHALEM R, N FK	25879.40	1		12	1	0	0	1	0	0
NEHALEM R, LITTLE N FK	25880.00	1		14	1	0	0	1	0	2
NEHALEM R, LITTLE N FK	25880.00	2		14	0	0	0	0	0	3
NEHALEM R, LITTLE N FK	25880.00	3		13	4	0	0	4	0	6
NEHALEM R, LITTLE N FK	25880.00	4		7	0	0	0	0	0	0
NEHALEM R, LITTLE N FK	25880.00	5		7	0	0	0	0	0	0
NEHALEM R, LITTLE N FK	25880.00	6		7	0	0	0	0	0	0
NEHALEM R, N FK	25881.00	1		8	0	0	0	0	0	0
SALMONBERRY RIVER			**1**	**9**	**17**	**0**	**0**	**17**	**1**	**99**
SALMONBERRY R	25943.00	1.3		9	17	0	0	17	1	99
KILCHIS RIVER			**4**	**4**	**8**	**0**	**3**	**5**	**0**	**23**
MAIN STEM			**3**	**3**	**8**	**0**	**3**	**5**	**0**	**21**
KILCHIS R, S FK	25761.00	1		1	0	0	0	0	0	0
KILCHIS R, S FK	25761.00	2		1	6	0	3	3	0	5

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Basin, Subbasin or Survey reach	Reach	Seg-ment	Sur-veys	Times Surveyed	Live counts				Dead	Redds
					Total	Marked	Un-marked	Un-known		
KILCHIS R, N FK	25763.00	3		1	2	0	0	2	0	16
LITTLE SOUTH FORK			**1**	**1**	**0**	**0**	**0**	**0**	**0**	**2**
KILCHIS R, LITTLE S FK	25743.00	1		1	0	0	0	0	0	2
WILSON RIVER			**3**	**3**	**9**	**0**	**5**	**4**	**0**	**83**
MAIN STEM			**1**	**1**	**7**	**0**	**5**	**2**	**0**	**51**
CEDAR CR	25679.00	1		1	7	0	5	2	0	51
LITTLE NORTH FORK			**2**	**2**	**2**	**0**	**0**	**2**	**0**	**32**
WILSON R, N FK, LITTLE	25641.00	1		1	2	0	0	2	0	17
WILSON R, N FK, LITTLE	25641.00	2		1	0	0	0	0	0	15
SALMON RIVER			**4**	**4**	**9**	**0**	**0**	**9**	**0**	**10**
MAIN STEM AND BAY			**4**	**4**	**9**	**0**	**0**	**9**	**0**	**10**
SALMON R	25289.00	1		1	0	0	0	0	0	2
BEAR CR	25296.00	3		1	0	0	0	0	0	0
DEER CR	25310.00	1		1	6	0	0	6	0	7
SALMON R	25315.00	1		1	3	0	0	3	0	1
SILETZ RIVER			**10**	**134**	**26**	**1**	**0**	**25**	**2**	**42**
MAIN STEM			**10**	**134**	**26**	**1**	**0**	**25**	**2**	**42**
CERINE CR	25148.00	1		14	0	0	0	0	0	1
CERINE CR	25148.00	2		14	0	0	0	0	0	0
CERINE CR	25148.00	3		14	0	0	0	0	0	0
CERINE CR	25148.00	4		13	0	0	0	0	0	0
MILL CR	25149.00	1		15	17	1	0	16	1	24
GUNN CR	25149.30	1		12	1	0	0	1	0	1
MILL CR	25149.70	1		15	4	0	0	4	0	7
MILL CR, S FK	25150.00	1		12	0	0	0	0	1	1
MILL CR, S FK	25150.00	2		12	0	0	0	0	0	5
MILL CR, N FK	25151.00	1		13	4	0	0	4	0	3
YAQUINA RIVER			**3**	**40**	**22**	**0**	**5**	**17**	**0**	**72**
MAIN STEM AND BAY			**3**	**40**	**22**	**0**	**5**	**17**	**0**	**72**
MILL CR, E FK	24953.80	1		12	2	0	0	2	0	14
MILL CR	24953.90	1		12	0	0	0	0	0	1
YAQUINA R	25046.00	2		16	20	0	5	15	0	57
ALSEA RIVER			**8**	**56**	**1**	**0**	**0**	**1**	**0**	**1**
MAIN STEM AND BAY			**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**
FALL CR	24795.00	1		1	0	0	0	0	0	0
FIVE RIVERS			**7**	**55**	**1**	**0**	**0**	**1**	**0**	**1**

Appendix A. Summary of winter steelhead spawning surveys, 1998.

					Live counts					
Basin, Subbasin or Survey reach	**Reach**	**Seg-ment**	**Sur-veys**	**Times Surveyed**	**Total**	**Marked**	**Un-marked**	**Un-known**	**Dead**	**Redds**
CASCADE CR	24750.00	2		7	1	0	0	1	0	0
CASCADE CR, N FK	24751.00	1		8	0	0	0	0	0	1
CASCADE CR, N FK	24751.00	2		8	0	0	0	0	0	0
CASCADE CR	24752.00	1		8	0	0	0	0	0	0
CASCADE CR	24752.00	2		8	0	0	0	0	0	0
CASCADE CR, TRIB A	24752.30	1		8	0	0	0	0	0	0
CASCADE CR	24752.70	1		8	0	0	0	0	0	0
TENMILE CREEK			**1**	**10**	**34**	**0**	**0**	**34**	**0**	**69**
MAIN STEM			**1**	**10**	**34**	**0**	**0**	**34**	**0**	**69**
TENMILE CR	24528.00	5		10	34	0	0	34	0	69
SIUSLAW RIVER			**62**	**521**	**63**	**0**	**11**	**52**	**1**	**165**
MAIN STEM			**46**	**413**	**35**	**0**	**3**	**32**	**0**	**106**
PAT CR	24245.00	1		4	0	0	0	0	0	0
SAN ANTONE CR	24249.00	1		16	1	0	0	1	0	6
MEADOW CR	24253.00	1		3	0	0	0	0	0	0
SHULTZ CR	24272.00	1		12	0	0	0	0	0	0
SHULTZ CR	24272.00	2		12	0	0	0	0	0	0
WILDCAT CR	24297.00	2		16	0	0	0	0	0	2
WILDCAT CR	24299.00	1		15	0	0	0	0	0	0
BOUNDS CR	24302.00	1		8	1	0	0	1	0	0
BOUNDS CR	24302.00	2		14	13	0	0	13	0	4
ESMOND CR	24349.00	1		2	2	0	0	2	0	15
ESMOND CR	24349.00	2		2	2	0	0	2	0	15
LEOPOLD CR	24350.00	1		11	8	0	2	6	0	16
LEOPOLD CR	24352.00	1		16	5	0	1	4	0	4
LEOPOLD CR, TRIB B	24352.30	1		3	1	0	0	1	0	1
LEOPOLD CR	24352.70	1		4	0	0	0	0	0	2
ESMOND CR	24353.00	1		1	0	0	0	0	0	3
ESMOND CR	24359.00	1		1	0	0	0	0	0	0
SIUSLAW R	24363.30	1.2		1	0	0	0	0	0	0
NORTH CR	24363.60	1		15	0	0	0	0	0	0
SIUSLAW R	24364.00	1.5		1	0	0	0	0	0	13
CLAY CR	24373.00	1		14	0	0	0	0	0	0
SIUSLAW R	24374.00	1.2		1	0	0	0	0	0	3
EDRIS CR	24375.00	1		13	0	0	0	0	0	0
JOHNSON CR	24381.00	1		14	0	0	0	0	0	0

Appendix A. Summary of winter steelhead spawning surveys, 1998.

Basin, Subbasin or Survey reach	Reach	Seg-ment	Sur-veys	Times Surveyed	Live counts Total	Marked	Un-marked	Un-known	Dead	Redds
SIUSLAW R	24384.00	1.4		1	0	0	0	0	0	12
CAMP CR	24399.00	1		2	0	0	0	0	0	0
CONGER CR	24401.00	1		13	0	0	0	0	0	0
DOGWOOD CR	24405.00	1		4	0	0	0	0	0	3
DOGWOOD CR	24405.00	2		15	0	0	0	0	0	0
DOE HOLLOW CR	24411.00	1		14	2	0	0	2	0	3
SIUSLAW R	24412.00	1.3		1	0	0	0	0	0	3
BOTTLE CR	24415.00	2		12	0	0	0	0	0	0
BOTTLE CR	24415.00	3		12	0	0	0	0	0	0
BUCK CR, TRIB B	24420.00	1		14	0	0	0	0	0	0
BUCK CR, TRIB B	24420.00	2		14	0	0	0	0	0	0
BUCK CR	24421.00	1		15	0	0	0	0	0	0
SIUSLAW R	24422.00	1.2		1	0	0	0	0	0	0
DOE CR	24423.00	1		1	0	0	0	0	0	0
RUSSELL CR	24425.00	1		14	0	0	0	0	0	0
RUSSELL CR	24427.00	1		14	0	0	0	0	0	0
SHAW CR	24431.00	1		3	0	0	0	0	0	0
SHAW CR	24431.00	2		13	0	0	0	0	0	0
LITTLE SIUSLAW CR	24434.00	2		13	0	0	0	0	0	0
SMITH CR	24435.00	1		13	0	0	0	0	0	1
SMITH CR	24435.00	2		13	0	0	0	0	0	0
DOUGLAS CR	24443.00	5		12	0	0	0	0	0	0
LAKE CREEK			**8**	**26**	**16**	**0**	**2**	**14**	**1**	**37**
ALPHA CR	24169.50	1		11	0	0	0	0	0	0
ROCK CR	24170.00	1		5	0	0	0	0	0	0
LAKE CR	24198.00	1.5		1	0	0	0	0	0	20
GREENLEAF CR	24203.00	1		1	0	0	0	0	0	1
GREENLEAF CR	24203.00	2		2	2	0	0	2	0	2
GREENLEAF CR	24203.00	3		3	1	0	0	1	0	9
GREENLEAF CR	24203.00	4		2	5	0	2	3	0	1
LAKE CR	24233.00	3		1	8	0	0	8	1	4
WOLF CREEK			**5**	**49**	**12**	**0**	**6**	**6**	**0**	**22**
SALERATUS CR	24306.00	1		15	6	0	5	1	0	15
WOLF CR	24309.00	1		2	0	0	0	0	0	2
GRENSHAW CR	24326.00	1		1	0	0	0	0	0	0
SWAMP CR	24334.00	1		15	6	0	1	5	0	3

Appendix A. Summary of winter steelhead spawning surveys, 1998.

Basin, Subbasin or Survey reach	Reach	Seg-ment	Sur-veys	Times Surveyed	Live counts Total	Marked	Un-marked	Un-known	Dead	Redds
WOLF CR	24345.00	1		16	0	0	0	0	0	2
SOUTH FORK			**3**	**33**	**0**	**0**	**0**	**0**	**0**	**0**
SANDY CR	24454.00	1		12	0	0	0	0	0	0
SANDY CR	24454.00	2		12	0	0	0	0	0	0
KELLY CR	24456.00	3		9	0	0	0	0	0	0
UMPQUA RIVER			**36**	**463**	**225**	**12**	**75**	**138**	**3**	**619**
SMITH RIVER			**2**	**18**	**0**	**0**	**0**	**0**	**0**	**22**
CLEGHORN CR	22561.00	1.1		9	0	0	0	0	0	15
SMITH R, LITTLE S FK	22584.00	2		9	0	0	0	0	0	7
NORTH UMPQUA			**28**	**394**	**225**	**12**	**75**	**138**	**3**	**585**
CAVITT CR	23657.00	1		14	0	0	0	0	0	5
LITTLE R	23696.00	1		14	21	0	12	9	0	23
FRENCH CR	23722.00	1		15	11	0	8	3	0	18
MCCOMAS CR	23729.00	1		16	6	1	2	3	0	7
KELLY CR	23731.00	1		16	36	11	6	19	1	36
HARRINGTON CR	23739.00	1		12	5	0	1	4	1	48
HARRINGTON CR	23739.00	2		12	1	0	0	1	0	10
ROCK CR, E FK	23741.00	1		16	6	0	0	6	0	43
ROCK CR, E FK, N FK	23742.00	1		15	6	0	0	6	0	33
WILLIAMS CR	23764.00	1		16	5	0	2	3	0	14
WILLIAMS CR	23764.00	2		16	0	0	0	0	0	1
PASS CR	23780.00	1		15	13	0	9	4	0	23
PASS CR	23782.00	2		7	0	0	0	0	0	0
CANTON CR	23783.00	1		15	6	0	0	6	0	34
STEAMBOAT CR	23816.00	1		16	33	0	5	28	0	22
CEDAR CR	23819.00	1		15	10	0	6	4	0	45
CEDAR CR, N FK	23820.00	1		15	1	0	0	1	0	31
CEDAR CR, N FK	23820.00	2		15	0	0	0	0	0	10
CEDAR CR, N FK	23820.00	3		15	0	0	0	0	0	0
CEDAR CR, S FK	23821.00	1		14	4	0	2	2	0	16
LITTLE ROCK CR	23827.00	1		16	15	0	7	8	1	44
LITTLE ROCK CR	23829.00	1		14	17	0	3	14	0	25
HORSE HEAVEN CR	23833.00	1		14	11	0	6	5	0	24
HORSE HEAVEN CR	23833.00	2		15	5	0	2	3	0	7
HORSE HEAVEN CR	23833.00	3		15	0	0	0	0	0	4
LIMPY CR	23844.00	1		16	4	0	2	2	0	12

Appendix A. Summary of winter steelhead spawning surveys, 1998.

Basin, Subbasin or Survey reach	Reach	Seg-ment	Sur-veys	Times Surveyed	Live counts: Total	Marked	Un-marked	Un-known	Dead	Redds
CALF CR	23854.00	1		14	9	0	2	7	0	50
FISH CR	23882.00	1		1	0	0	0	0	0	0
SOUTH UMPQUA			**6**	**51**	**0**	**0**	**0**	**0**	**0**	**12**
ASH CR	23138.00	1		9	0	0	0	0	0	5
CATCHING CR	23146.00	1		8	0	0	0	0	0	2
BULL RUN CR	23313.00	1		8	0	0	0	0	0	0
O'SHEA CR	23405.00	1		8	0	0	0	0	0	2
STOUTS CR, W FK	23475.00	1		9	0	0	0	0	0	2
STOUTS CR, W FK	23475.00	2		9	0	0	0	0	0	1
COQUILLE RIVER			**2**	**12**	**44**	**1**	**18**	**25**	**0**	**23**
SOUTH FORK			**2**	**12**	**44**	**1**	**18**	**25**	**0**	**23**
JOHNSON CR	21889.00	1		1	3	0	3	0	0	1
ROCK CR	21903.00	1		11	41	1	15	25	0	22

Appendix B. Observation of cutthroat and lamprey spawning activity, 1998**.**

					CUTTHROAT		LAMPREY	
BASIN NAME	Reach	Seg-ment	No. Srvs	Times Surveyed	Live	Redds	Live	Redds
NECANICUM RIVER			**3**	**15**	**2**	**1**	**18**	**228**
MAIN STEM			**3**	**15**	**2**	**1**	**18**	**228**
NECANICUM R	26223.00	1		8	2	0	18	170
LITTLE JOE CR	26241.00	0.1		2	0	0	0	0
NECANICUM R	26243.00	2		5	0	1	0	58
ECOLA CREEK			**1**	**10**	**0**	**0**	**3**	**24**
NORTH FORK			**1**	**10**	**0**	**0**	**3**	**24**
ECOLA CR, N FK	26183.00	2		10	0	0	3	24
ARCH CAPE CREEK			**2**	**21**	**0**	**0**	**1**	**9**
MAIN STEM			**2**	**21**	**0**	**0**	**1**	**9**
ARCH CAPE CR	26163.00	1		11	0	0	0	6
ARCH CAPE CR	26163.00	2		10	0	0	1	3
NEHALEM RIVER			**52**	**372**	**27**	**7**	**10**	**62**
MAIN STEM			**19**	**109**	**8**	**2**	**0**	**0**
COOK CR	25907.00	1		1	0	0	0	0
COOK CR	25909.00	1		1	0	0	0	0
COOK CR	25911.00	1		1	0	0	0	0
FISHHAWK CR, TRIB A	26045.30	1		4	0	0	0	0
FISHHAWK CR, TRIB B	26045.50	1		4	0	0	0	0
BOXLER CR	26045.70	1		3	1	0	0	0
FISHHAWK CR	26045.90	1		8	0	0	0	0
FISHHAWK CR	26045.90	2		8	0	0	0	0
MCCOON CR	26046.00	1		8	0	0	0	0
MCCOON CR	26046.00	2		4	0	0	0	0
MCCOON CR	26046.00	3		4	0	0	0	0
FISHHAWK CR	26047.00	1		10	0	0	0	0
FISHHAWK CR, N FK	26048.00	1		9	0	0	0	0
WRONG WAY CR	26049.00	1		6	2	2	0	0
FISHHAWK CR, N FK	26050.00	1		6	1	0	0	0
FISHHAWK CR	26051.00	1		10	0	0	0	0
FISHHAWK CR, N FK	26050.00	2		6	4	0	0	0
FISHHAWK CR, TRIB C	26051.30	1		7	0	0	0	0
FISHHAWK CR	26051.70	1		9	0	0	0	0
SALMONBERRY RIVER			**1**	**9**	**0**	**0**	**0**	**0**
SALMONBERRY R	25943.00	1.3		9	0	0	0	0

Appendix B. Observation of cutthroat and lamprey spawning activity, 1998**.**

					CUTTHROAT		LAMPREY	
BASIN NAME	Reach	Seg-ment	No. Srvs	Times Surveyed	Live	Redds	Live	Redds
NORTH FORK NEHALEM			**32**	**254**	**19**	**5**	**10**	**62**
SOAPSTONE CR	25864.00	2		1	0	0	0	0
BUCHANAN CR	25865.00	1		1	0	0	0	0
SOAPSTONE CR	25866.00	2		1	0	0	0	3
NEHALEM R, N FK	25871.00	1		8	0	0	0	0
GODS VALLEY CR	25872.00	1		10	0	0	0	1
GODS VALLEY CR	25872.00	2		10	0	0	0	0
GODS VALLEY CR	25872.00	3		10	4	0	0	2
GODS VALLEY CR	25872.00	6		6	0	0	0	0
NEHALEM R, N FK	25873.00	1		9	0	0	0	1
LOST CR	25874.00	1		8	0	0	0	0
LOST CR	25874.00	2		6	0	0	0	0
NEHALEM R, N FK	25875.00	1		8	0	0	0	0
NEHALEM R, N FK	25875.00	2		8	0	0	0	0
SWEET HOME CR	25876.00	1		10	0	0	0	0
SWEET HOME CR	25876.00	2		10	0	0	0	1
SWEET HOME CR	25876.00	3		9	0	0	0	0
SWEETHOME CR, TRIB D	25876.50	1		5	2	1	0	0
SWEETHOME CR	25876.60	1		6	2	3	0	0
SWEETHOME CR	25876.60	2		1	1	1	0	0
NEHALEM R, N FK	25877.00	1		8	0	0	0	16
FALL CR	25878.00	1		8	0	0	0	0
NEHALEM R, N FK	25879.00	1		11	0	0	1	10
NEHALEM R, N FK	25879.00	2		11	0	0	3	4
NEHALEM R, N FK, TRIB R	25879.30	1		7	0	0	0	0
NEHALEM R, N FK	25879.40	1		12	3	0	1	14
NEHALEM R, LITTLE N FK	25880.00	1		14	6	0	3	6
NEHALEM R, LITTLE N FK	25880.00	2		14	0	0	0	2
NEHALEM R, LITTLE N FK	25880.00	3		13	0	0	2	2
NEHALEM R, LITTLE N FK	25880.00	4		7	0	0	0	0
NEHALEM R, LITTLE N FK	25880.00	5		7	0	0	0	0
NEHALEM R, LITTLE N FK	25880.00	6		7	1	0	0	0
NEHALEM R, N FK	25881.00	1		8	0	0	0	0

Appendix B. Observation of cutthroat and lamprey spawning activity, 1998**.**

					CUTTHROAT		LAMPREY	
BASIN NAME	Reach	Seg-ment	No. Srvs	Times Surveyed	Live	Redds	Live	Redds
KILCHIS RIVER			**4**	**4**	**0**	**0**	**0**	**0**
MAIN STEM			**3**	**3**	**0**	**0**	**0**	**0**
KILCHIS R, S FK	25761.00	1		1	0	0	0	0
KILCHIS R, S FK	25761.00	2		1	0	0	0	0
KILCHIS R, N FK	25763.00	3		1	0	0	0	0
LITTLE SOUTH FORK			**1**	**1**	**0**	**0**	**0**	**0**
KILCHIS R, LITTLE S FK	25743.00	1		1	0	0	0	0
WILSON RIVER			**3**	**3**	**0**	**0**	**3**	**38**
MAIN STEM			**1**	**1**	**0**	**0**	**3**	**35**
CEDAR CR	25679.00	1		1	0	0	3	35
LITTLE NORTH FORK			**2**	**2**	**0**	**0**	**0**	**3**
WILSON R, N FK, LITTLE	25641.00	1		1	0	0	0	0
WILSON R, N FK, LITTLE	25641.00	2		1	0	0	0	3
SALMON RIVER			**4**	**4**	**0**	**0**	**1**	**9**
MAIN STEM AND BAY			**4**	**4**	**0**	**0**	**1**	**9**
SALMON R	25289.00	1		1	0	0	0	0
BEAR CR	25296.00	3		1	0	0	0	5
DEER CR	25310.00	1		1	0	0	1	3
SALMON R	25315.00	1		1	0	0	0	1
SILETZ RIVER			**10**	**134**	**2**	**1**	**0**	**8**
MAIN STEM			**10**	**134**	**2**	**1**	**0**	**8**
CERINE CR	25148.00	1		14	0	0	0	0
CERINE CR	25148.00	2		14	0	0	0	0
CERINE CR	25148.00	3		14	0	1	0	0
CERINE CR	25148.00	4		13	0	0	0	0
MILL CR	25149.00	1		15	1	0	0	6
GUNN CR	25149.30	1		12	0	0	0	0
MILL CR	25149.70	1		15	0	0	0	2
MILL CR, S FK	25150.00	1		12	0	0	0	0
MILL CR, S FK	25150.00	2		12	1	0	0	0
MILL CR, N FK	25151.00	1		13	0	0	0	0
YAQUINA RIVER			**3**	**40**	**4**	**0**	**11**	**68**
MAIN STEM AND BAY			**3**	**40**	**4**	**0**	**11**	**68**
MILL CR, E FK	24953.80	1		12	0	0	0	0
MILL CR	24953.90	1		12	0	0	0	0
YAQUINA R	25046.00	2		16	4	0	11	68

Appendix B. Observation of cutthroat and lamprey spawning activity, 1998**.**

BASIN NAME	Reach	Seg-ment	No. Srvs	Times Surveyed	CUTTHROAT Live	CUTTHROAT Redds	LAMPREY Live	LAMPREY Redds
ALSEA RIVER			**8**	**56**	**7**	**0**	**1**	**20**
MAIN STEM AND BAY			**1**	**1**	**0**	**0**	**1**	**20**
FALL CR	24795.00	1		1	0	0	1	20
FIVE RIVERS			**7**	**55**	**7**	**0**	**0**	**0**
CASCADE CR	24750.00	2		7	0	0	0	0
CASCADE CR, N FK	24751.00	1		8	1	0	0	0
CASCADE CR, N FK	24751.00	2		8	6	0	0	0
CASCADE CR	24752.00	1		8	0	0	0	0
CASCADE CR	24752.00	2		8	0	0	0	0
CASCADE CR, TRIB A	24752.30	1		8	0	0	0	0
CASCADE CR	24752.70	1		8	0	0	0	0
TENMILE CREEK			**1**	**10**	**0**	**0**	**2**	**14**
MAIN STEM			**1**	**10**	**0**	**0**	**2**	**14**
TENMILE CR	24528.00	5		10	0	0	2	14
SIUSLAW RIVER			**62**	**521**	**30**	**2**	**48**	**935**
MAIN STEM			**46**	**413**	**23**	**0**	**39**	**679**
PAT CR	24245.00	1		4	0	0	0	0
SAN ANTONE CR	24249.00	1		16	0	0	0	0
MEADOW CR	24253.00	1		3	0	0	0	0
SHULTZ CR	24272.00	1		12	1	0	0	0
SHULTZ CR	24272.00	2		12	0	0	0	0
WILDCAT CR	24297.00	2		16	1	0	3	23
WILDCAT CR	24299.00	1		15	1	0	0	0
BOUNDS CR	24302.00	1		8	0	0	0	2
BOUNDS CR	24302.00	2		14	0	0	0	0
ESMOND CR	24349.00	1		2	1	0	5	81
ESMOND CR	24349.00	2		2	1	0	7	88
LEOPOLD CR	24350.00	1		11	0	0	1	16
LEOPOLD CR	24352.00	1		16	1	0	0	0
LEOPOLD CR, TRIB B	24352.30	1		3	0	0	0	0
LEOPOLD CR	24352.70	1		4	0	0	0	0
ESMOND CR	24353.00	1		1	0	0	2	30
ESMOND CR	24359.00	1		1	2	0	0	15
SIUSLAW R	24363.30	1.2		1	0	0	4	49
NORTH CR	24363.60	1		15	0	0	0	0
SIUSLAW R	24364.00	1.5		1	0	0	2	85

Appendix B. Observation of cutthroat and lamprey spawning activity, 1998**..**

					CUTTHROAT		LAMPREY	
BASIN NAME	**Reach**	**Seg-ment**	**No. Srvs**	**Times Surveyed**	**Live**	**Redds**	**Live**	**Redds**
CLAY CR	24373.00	1		14	1	0	0	0
SIUSLAW R	24374.00	1.2		1	0	0	0	20
EDRIS CR	24375.00	1		13	0	0	0	0
JOHNSON CR	24381.00	1		14	0	0	0	3
SIUSLAW R	24384.00	1.4		1	0	0	9	157
CAMP CR	24399.00	1		2	0	0	0	9
CONGER CR	24401.00	1		13	1	0	0	2
DOGWOOD CR	24405.00	1		4	0	0	1	15
DOGWOOD CR	24405.00	2		15	0	0	0	13
DOE HOLLOW CR	24411.00	1		14	0	0	0	0
SIUSLAW R	24412.00	1.3		1	1	0	0	10
BOTTLE CR	24415.00	2		12	0	0	0	0
BOTTLE CR	24415.00	3		12	0	0	0	0
BUCK CR, TRIB B	24420.00	1		14	0	0	1	7
BUCK CR, TRIB B	24420.00	2		14	0	0	0	0
BUCK CR	24421.00	1		15	2	0	4	21
SIUSLAW R	24422.00	1.2		1	0	0	0	14
DOE CR	24423.00	1		1	0	0	0	0
RUSSELL CR	24425.00	1		14	2	0	0	11
RUSSELL CR	24427.00	1		14	0	0	0	8
SHAW CR	24431.00	1		3	3	0	0	0
SHAW CR	24431.00	2		13	4	0	0	0
LITTLE SIUSLAW CR	24434.00	2		13	0	0	0	0
SMITH CR	24435.00	1		13	0	0	0	0
SMITH CR	24435.00	2		13	1	0	0	0
DOUGLAS CR	24443.00	5		12	0	0	0	0
LAKE CREEK			**8**	**26**	**6**	**1**	**7**	**242**
ALPHA CR	24169.50	1		11	2	0	0	0
ROCK CR	24170.00	1		5	1	0	0	0
LAKE CR	24198.00	1.5		1	2	0	6	231
GREENLEAF CR	24203.00	1		1	0	0	0	0
GREENLEAF CR	24203.00	2		2	1	0	0	0
GREENLEAF CR	24203.00	3		3	0	0	0	7
GREENLEAF CR	24203.00	4		2	0	1	1	4
LAKE CR	24233.00	3		1	0	0	0	0
WOLF CREEK			**5**	**49**	**1**	**1**	**2**	**14**
SALERATUS CR	24306.00	1		15	0	1	0	2

Appendix B. Observation of cutthroat and lamprey spawning activity, 1998**..**

					CUTTHROAT		LAMPREY	
BASIN NAME	**Reach**	**Seg- ment**	**No. Srvs**	**Times Surveyed**	**Live**	**Redds**	**Live**	**Redds**
WOLF CR	24309.00	1		2	0	0	0	4
GRENSHAW CR	24326.00	1		1	0	0	0	0
SWAMP CR	24334.00	1		15	1	0	0	0
WOLF CR	24345.00	1		16	0	0	2	8
SOUTH FORK			**3**	**33**	**0**	**0**	**0**	**0**
SANDY CR	24454.00	1		12	0	0	0	0
SANDY CR	24454.00	2		12	0	0	0	0
KELLY CR	24456.00	3		9	0	0	0	0
UMPQUA RIVER			**36**	**463**	**69**	**25**	**1**	**1**
SMITH RIVER			**2**	**18**	**0**	**0**	**0**	**0**
CLEGHORN CR	22561.00	1.1		9	0	0	0	0
SMITH R, LITTLE S FK	22584.00	2		9	0	0	0	0
NORTH UMPQUA			**28**	**394**	**50**	**25**	**1**	**1**
CAVITT CR	23657.00	1		14	0	0	1	1
LITTLE R	23696.00	1		14	0	0	0	0
FRENCH CR	23722.00	1		15	0	0	0	0
MCCOMAS CR	23729.00	1		16	0	0	0	0
KELLY CR	23731.00	1		16	0	0	0	0
HARRINGTON CR	23739.00	1		12	0	0	0	0
HARRINGTON CR	23739.00	2		12	0	0	0	0
ROCK CR, E FK	23741.00	1		16	0	0	0	0
ROCK CR, E FK, N FK	23742.00	1		15	7	2	0	0
WILLIAMS CR	23764.00	1		16	9	5	0	0
WILLIAMS CR	23764.00	2		16	1	2	0	0
PASS CR	23780.00	1		15	8	1	0	0
PASS CR	23782.00	2		7	1	0	0	0
CANTON CR	23783.00	1		15	0	0	0	0
STEAMBOAT CR	23816.00	1		16	0	0	0	0
CEDAR CR	23819.00	1		15	2	3	0	0
CEDAR CR, N FK	23820.00	1		15	8	4	0	0
CEDAR CR, N FK	23820.00	2		15	2	0	0	0
CEDAR CR, N FK	23820.00	3		15	3	1	0	0
CEDAR CR, S FK	23821.00	1		14	7	2	0	0
LITTLE ROCK CR	23827.00	1		16	1	1	0	0
LITTLE ROCK CR	23829.00	1		14	0	1	0	0
HORSE HEAVEN CR	23833.00	1		14	0	0	0	0
HORSE HEAVEN CR	23833.00	2		15	0	0	0	0

Appendix B. Observation of cutthroat and lamprey spawning activity, 1998.

BASIN NAME	Reach	Seg-ment	No. Srvs	Times Surveyed	CUTTHROAT Live	CUTTHROAT Redds	LAMPREY Live	LAMPREY Redds
HORSE HEAVEN CR	23833.00	3		15	0	0	0	0
LIMPY CR	23844.00	1		16	1	2	0	0
CALF CR	23854.00	1		14	0	1	0	0
FISH CR	23882.00	1		1	0	0	0	0
SOUTH UMPQUA			**6**	**51**	**19**	**0**	**0**	**0**
ASH CR	23138.00	1		9	7	0	0	0
CATCHING CR	23146.00	1		8	4	0	0	0
BULL RUN CR	23313.00	1		8	2	0	0	0
O'SHEA CR	23405.00	1		8	0	0	0	0
STOUTS CR, W FK	23475.00	1		9	4	0	0	0
STOUTS CR, W FK	23475.00	2		9	2	0	0	0
COQUILLE RIVER			**2**	**12**	**0**	**0**	**0**	**0**
SOUTH FORK			**2**	**12**	**0**	**0**	**0**	**0**
JOHNSON CR	21889.00	1		1	0	0	0	0
ROCK CR	21903.00	1		11	0	0	0	0

Appendix C. Spawner surveys planned for winter steelhead in the North Coast 1999.

BASIN	*SUBBASIN*	*REACH*	*REACH ID*	*Segment*	*CALIBRATION*
NECANICUM RIVER	MAIN STEM	NECANICUM R	26243.00	2	No
NECANICUM RIVER	MAIN STEM	LITTLE JOE CR	26241.00	0.1	No
NECANICUM RIVER	MAIN STEM	NECANICUM R	26223.00	1	No
ECOLA CREEK	NORTH FORK	ECOLA CR, N FK	26183.00	2	No
ARCH CAPE CREEK	MAIN STEM	ARCH CAPE CR	26163.00	1	No
ARCH CAPE CREEK	MAIN STEM	ARCH CAPE CR	26163.00	2	No
NEHALEM RIVER	MAIN STEM	FISHHAWK CR	26051.70	1	Yes
NEHALEM RIVER	MAIN STEM	FISHHAWK CR,	26051.30	1	Yes
NEHALEM RIVER	MAIN STEM	FISHHAWK CR	26051.00	1	Yes
NEHALEM RIVER	MAIN STEM	FISHHAWK CR, N	26050.00	1	Yes
NEHALEM RIVER	MAIN STEM	FISHHAWK CR, N	26050.00	2	Yes
NEHALEM RIVER	MAIN STEM	WRONG WAY CR	26049.00	1	Yes
NEHALEM RIVER	MAIN STEM	FISHHAWK CR, N	26048.00	1	Yes
NEHALEM RIVER	MAIN STEM	FISHHAWK CR	26047.00	1	Yes
NEHALEM RIVER	MAIN STEM	MCCOON CR	26046.00	1	Yes
NEHALEM RIVER	MAIN STEM	MCCOON CR	26046.00	2	Yes
NEHALEM RIVER	MAIN STEM	MCCOON CR	26046.00	3	Yes
NEHALEM RIVER	MAIN STEM	FISHHAWK CR	26045.90	1	Yes
NEHALEM RIVER	MAIN STEM	FISHHAWK CR	26045.90	2	Yes
NEHALEM RIVER	SALMONBERRY	SALMONBERRY R	25943.00	1.3	No
NEHALEM RIVER	MAIN STEM	COOK CR	25911.00	1	No
NEHALEM RIVER	MAIN STEM	COOK CR	25909.00	1	No
NEHALEM RIVER	MAIN STEM	COOK CR	25907.00	1	No
NEHALEM RIVER	NORTH FORK	NEHALEM R, LITTLE	25880.00	1	Yes
NEHALEM RIVER	NORTH FORK	NEHALEM R, LITTLE	25880.00	2	Yes
NEHALEM RIVER	NORTH FORK	NEHALEM R, LITTLE	25880.00	3	Yes
NEHALEM RIVER	NORTH FORK	NEHALEM R, N FK	25879.00	1	Yes
NEHALEM RIVER	NORTH FORK	NEHALEM R, N FK	25879.00	2	Yes
NEHALEM RIVER	NORTH FORK	FALL CR	25878.00	1	Yes
NEHALEM RIVER	NORTH FORK	NEHALEM R, N FK	25877.00	1	Yes
NEHALEM RIVER	NORTH FORK	SWEET HOME CR	25876.00	1	Yes
NEHALEM RIVER	NORTH FORK	SWEET HOME CR	25876.00	2	Yes
NEHALEM RIVER	NORTH FORK	SWEET HOME CR	25876.00	3	Yes

Appendix C. Spawner surveys planned for winter steelhead in the North Coast 1999.

BASIN	*SUBBASIN*	*REACH*	*REACH ID*	*Segment*	*CALIBRATION*
NEHALEM RIVER	NORTH FORK	NEHALEM R, N FK	25875.00	1	Yes
NEHALEM RIVER	NORTH FORK	NEHALEM R, N FK	25875.00	2	Yes
NEHALEM RIVER	NORTH FORK	LOST CR	25874.00	1	Yes
NEHALEM RIVER	NORTH FORK	LOST CR	25874.00	2	Yes
NEHALEM RIVER	NORTH FORK	NEHALEM R, N FK	25873.00	1	Yes
NEHALEM RIVER	NORTH FORK	GODS VALLEY CR	25872.00	1	Yes
NEHALEM RIVER	NORTH FORK	GODS VALLEY CR	25872.00	2	Yes
NEHALEM RIVER	NORTH FORK	SALLY CR	25871.30	1	Yes
NEHALEM RIVER	NORTH FORK	NEHALEM R, N FK	25871.00	1	Yes
KILCHIS RIVER	MAIN STEM	KILCHIS R, N FK	25763.00	3	No
KILCHIS RIVER	MAIN STEM	KILCHIS R, S FK	25761.00	1	No
KILCHIS RIVER	MAIN STEM	KILCHIS R, S FK	25761.00	2	No
KILCHIS RIVER	LITTLE SOUTH FORK	KILCHIS R, LITTLE S	25743.00	1	No
WILSON RIVER	MAIN STEM	CEDAR CR	25679.00	1	No
WILSON RIVER	LITTLE NORTH FORK	WILSON R, N FK,	25641.00	1	No
WILSON RIVER	LITTLE NORTH FORK	WILSON R, N FK,	25641.00	2	No
NESTUCCA RIVER	MAIN STEM AND BAY	CLEAR CR	25407.00	2	No

Appendix C. Spawner surveys planned for winter steelhead surveys in the Mid Coast 1999.

BASIN	*SUBBASIN*	*REACH*	*REACH ID*	*Segment*	*CALIBRATION*
SALMON RIVER	MAIN STEM AND BAY	TROUT CR	25299.70	1	No
SILETZ RIVER	SCHOONER CREEK	SCHOONER CR, S	25257.00	1	Yes
SILETZ RIVER	SCHOONER CREEK	SCHOONER CR, S	25257.00	2	Yes
SILETZ RIVER	SCHOONER CREEK	SCHOONER CR, S	25257.00	3	Yes
SILETZ RIVER	DRIFT CREEK	DRIFT CR	25237.00	1	No
SILETZ RIVER	DRIFT CREEK	NORTH CR	25236.00	1	No
SILETZ RIVER	DRIFT CREEK	DRIFT CR	25235.00	7	No
SILETZ RIVER	MAIN STEM	MILL CR	25149.70	1	Yes
SILETZ RIVER	MAIN STEM	MILL CR	25149.00	1	Yes
SILETZ RIVER	MAIN STEM	EUCHRE CR	25105.00	1	No
SILETZ RIVER	MAIN STEM	CEDAR CR	25102.50	1	No
YAQUINA RIVER	MAIN STEM AND BAY	YAQUINA R	25046.00	2	No
YAQUINA RIVER	MAIN STEM AND BAY	MILL CR	24953.90	1	Yes
YAQUINA RIVER	MAIN STEM AND BAY	MILL CR, E FK	24953.80	1	Yes
BEAVER CREEK	NORTH FORK	BEAVER CR, N FK	24924.00	4	No
ALSEA RIVER	MAIN STEM AND BAY	MILL CR, N FK	24829.30	1	No
ALSEA RIVER	MAIN STEM AND BAY	MILL CR	24829.00	2	No
ALSEA RIVER	MAIN STEM AND BAY	FALL CR	24795.00	1	No
ALSEA RIVER	FIVE RIVERS	FIVE RIVERS	24783.00	2	No
ALSEA RIVER	MAIN STEM AND BAY	SCOTT CR, E FK	24692.00	1	No
ALSEA RIVER	MAIN STEM AND BAY	SCOTT CR, E FK	24692.00	2	No
ALSEA RIVER	MAIN STEM AND BAY	SCOTT CR	24691.00	1	No
ALSEA RIVER	MAIN STEM AND BAY	ALSEA R	24658.00	1	No
ALSEA RIVER	DRIFT CREEK	DRIFT CR	24657.70	1	Yes
ALSEA RIVER	DRIFT CREEK	DRIFT CR	24657.70	2	Yes
ALSEA RIVER	DRIFT CREEK	UNNAMED TRIB	24657.30	1	No
ALSEA RIVER	DRIFT CREEK	UNNAMED TRIB	24657.30	2	No
ALSEA RIVER	DRIFT CREEK	UNNAMED TRIB	24657.30	3	No
ALSEA RIVER	DRIFT CREEK	DRIFT CR	24657.00	2	Yes
ALSEA RIVER	DRIFT CREEK	DRIFT CR	24657.00	3	No
YACHATS RIVER	MAIN STEM	YACHATS R	24596.00	1	No
YACHATS RIVER	NORTH FORK	YACHATS R, N FK	24577.00	1	No

Appendix C. Spawner surveys planned for winter steelhead surveys in the Siuslaw 1999.

BASIN	*SUBBASIN*	*REACH*	*REACH ID*	*Segment*	*CALIBRATION*
SIUSLAW RIVER	MAIN STEM	CONGER CR	24401.00	1	No
SIUSLAW RIVER	MAIN STEM	LEOPOLD CR	24352.00	1	No
SIUSLAW RIVER	MAIN STEM	LEOPOLD CR	24350.00	1	No
SIUSLAW RIVER	MAIN STEM	ESMOND CR	24349.70	1	No
SIUSLAW RIVER	MAIN STEM	ESMOND CR	24349.00	1	No
SIUSLAW RIVER	MAIN STEM	ESMOND CR	24349.00	2	No
SIUSLAW RIVER	MAIN STEM	WHITTAKER CR,	24303.30	1	No
SIUSLAW RIVER	MAIN STEM	WHITTAKER CR	24303.00	2	No
SIUSLAW RIVER	MAIN STEM	BOUNDS CR	24302.00	1	No
SIUSLAW RIVER	MAIN STEM	BOUNDS CR	24302.00	2	No
SIUSLAW RIVER	MAIN STEM	WHITTAKER CR	24301.00	2	No
SIUSLAW RIVER	MAIN STEM	CHICKAHOMINY CR	24282.00	1	No
SIUSLAW RIVER	MAIN STEM	WAITE CR	24261.00	1	No
SIUSLAW RIVER	MAIN STEM	TURNER CR	24259.00	1	No
SIUSLAW RIVER	MAIN STEM	BARBER CR	24243.00	1	No
SIUSLAW RIVER	LAKE CREEK	FISH CR	24209.00	1	No
SIUSLAW RIVER	LAKE CREEK	FISH CR	24207.00	1	No
SIUSLAW RIVER	LAKE CREEK	FISH CR	24207.00	2	No
SIUSLAW RIVER	LAKE CREEK	GREENLEAF CR	24203.00	1	Yes
SIUSLAW RIVER	LAKE CREEK	GREENLEAF CR	24203.00	2	Yes
SIUSLAW RIVER	LAKE CREEK	GREENLEAF CR	24203.00	3	Yes
SIUSLAW RIVER	LAKE CREEK	GREENLEAF CR	24203.00	4	Yes
SIUSLAW RIVER	LAKE CREEK	NELSON CR	24197.00	2	No
SIUSLAW RIVER	LAKE CREEK	NELSON CR	24197.00	3	No
SIUSLAW RIVER	LAKE CREEK	NELSON CR	24197.00	5	No
SIUSLAW RIVER	LAKE CREEK	NELSON CR	24195.00	1	No
SIUSLAW RIVER	LAKE CREEK	NELSON CR	24195.00	2	No
SIUSLAW RIVER	LAKE CREEK	ELK CR	24180.00	1	No
SIUSLAW RIVER	LAKE CREEK	DEADWOOD CR	24163.00	1	No
SIUSLAW RIVER	LAKE CREEK	MISERY CR	24159.00	1	No
SIUSLAW RIVER	LAKE CREEK	MISERY CR	24159.00	2	No
SIUSLAW RIVER	LAKE CREEK	MISERY CR	24159.00	3	No
SIUSLAW RIVER	LAKE CREEK	INDIAN CR	24141.00	1	No
SIUSLAW RIVER	LAKE CREEK	MARIA CR	24139.00	1	No
SIUSLAW RIVER	LAKE CREEK	INDIAN CR, W FK	24136.00	1	Yes

Appendix C. Spawner surveys planned for winter steelhead surveys in the Siuslaw 1999.

BASIN	*SUBBASIN*	*REACH*	*REACH ID*	*Segment*	*CALIBRATION*
SIUSLAW RIVER	LAKE CREEK	INDIAN CR, W FK	24136.00	2	Yes
SIUSLAW RIVER	NORTH FORK	SAM CR	24037.50	1	No
SIUSLAW RIVER	NORTH FORK	ELMA CR	24037.00	1	No
SIUSLAW RIVER	NORTH FORK	WILHELM CR	24031.00	1	No
SIUSLAW RIVER	NORTH FORK	MCLEOD CR	24024.50	1	No

Appendix C. Spawner surveys planned for winter steelhead in the Umpqua Basin 1999.

BASIN	*SUBBASIN*	*REACH*	*REACH ID*	*Segment*	*CALIBRATION*
UMPQUA RIVER	NORTH UMPQUA	FISH CR	23882.00	1	Yes
UMPQUA RIVER	NORTH UMPQUA	CALF CR	23854.00	1	Yes
UMPQUA RIVER	NORTH UMPQUA	LIMPY CR	23844.00	1	Yes
UMPQUA RIVER	NORTH UMPQUA	HORSE HEAVEN CR	23833.00	1	Yes
UMPQUA RIVER	NORTH UMPQUA	HORSE HEAVEN CR	23833.00	2	Yes
UMPQUA RIVER	NORTH UMPQUA	HORSE HEAVEN CR	23833.00	3	Yes
UMPQUA RIVER	NORTH UMPQUA	LITTLE ROCK CR	23829.00	1	Yes
UMPQUA RIVER	NORTH UMPQUA	LITTLE ROCK CR	23827.00	1	Yes
UMPQUA RIVER	NORTH UMPQUA	CEDAR CR, S FK	23821.00	1	Yes
UMPQUA RIVER	NORTH UMPQUA	CEDAR CR, N FK	23820.00	1	Yes
UMPQUA RIVER	NORTH UMPQUA	CEDAR CR, N FK	23820.00	2	Yes
UMPQUA RIVER	NORTH UMPQUA	CEDAR CR, N FK	23820.00	3	Yes
UMPQUA RIVER	NORTH UMPQUA	CEDAR CR	23819.00	1	Yes
UMPQUA RIVER	NORTH UMPQUA	STEAMBOAT CR	23816.00	1	Yes
UMPQUA RIVER	NORTH UMPQUA	CANTON CR	23783.00	1	Yes
UMPQUA RIVER	NORTH UMPQUA	PASS CR	23782.00	2	Yes
UMPQUA RIVER	NORTH UMPQUA	PASS CR	23780.00	1	Yes
UMPQUA RIVER	NORTH UMPQUA	WILLIAMS CR	23764.00	1	Yes
UMPQUA RIVER	NORTH UMPQUA	WILLIAMS CR	23764.00	2	Yes
UMPQUA RIVER	NORTH UMPQUA	ROCK CR, E FK, N	23742.00	1	Yes
UMPQUA RIVER	NORTH UMPQUA	ROCK CR, E FK	23741.00	1	Yes
UMPQUA RIVER	NORTH UMPQUA	HARRINGTON CR	23739.00	1	Yes
UMPQUA RIVER	NORTH UMPQUA	HARRINGTON CR	23739.00	2	Yes
UMPQUA RIVER	NORTH UMPQUA	KELLY CR	23731.00	1	Yes
UMPQUA RIVER	NORTH UMPQUA	MCCOMAS CR	23729.00	1	Yes
UMPQUA RIVER	NORTH UMPQUA	FRENCH CR	23722.00	1	Yes
UMPQUA RIVER	NORTH UMPQUA	LITTLE R	23696.00	1	Yes
UMPQUA RIVER	NORTH UMPQUA	CAVITT CR	23657.00	1	Yes
UMPQUA RIVER	SOUTH UMPQUA	STOUTS CR, W FK	23475.00	1	No
UMPQUA RIVER	SOUTH UMPQUA	STOUTS CR, W FK	23475.00	2	No
UMPQUA RIVER	SOUTH UMPQUA	STOUTS CR, E FK	23474.00	1	No
UMPQUA RIVER	SOUTH UMPQUA	DAYS CR	23437.00	1	No
UMPQUA RIVER	SOUTH UMPQUA	O'SHEA CR	23405.00	1	No

Appendix C. Spawner surveys planned for winter steelhead in the Umpqua Basin 1999.

BASIN	*SUBBASIN*	*REACH*	*REACH ID*	*Segment*	*CALIBRATION*
UMPQUA RIVER	SOUTH UMPQUA	BULL RUN CR	23313.00	1	No
UMPQUA RIVER	SOUTH UMPQUA	CATTLE CR	23178.00	1	No
UMPQUA RIVER	SOUTH UMPQUA	IRON MTN CR	23172.00	1	No
UMPQUA RIVER	SOUTH UMPQUA	IRON MTN CR	23172.00	2	No
UMPQUA RIVER	SOUTH UMPQUA	COUNCIL CR	23148.00	1	No
UMPQUA RIVER	SOUTH UMPQUA	CATCHING CR	23146.00	1	No
UMPQUA RIVER	SOUTH UMPQUA	ASH CR	23138.00	1	No
UMPQUA RIVER	ELK CREEK	BRUSH CR	22715.00	3	No
UMPQUA RIVER	ELK CREEK	BIG TOM FOLLEY	22713.00	2	No
UMPQUA RIVER	MAIN STEM AND BAY	WEATHERLY CR	22686.90	1	No
UMPQUA RIVER	SMITH RIVER	SMITH R, LITTLE S	22584.00	2	No
UMPQUA RIVER	SMITH RIVER	CLEGHORN CR	22561.00	1.1	No

Appendix C. Spawner surveys planned for winter steelhead for Coos-Coquille 1999.

BASIN	*SUBBASIN*	*REACH*	*REACH ID*	*Segment*	*CALIBRATION*
COOS RIVER	MAIN STEM	PALOUSE CR	22324.00	2	No
COOS RIVER	MILLICOMA RIVER	ELK CR	22297.00	2	No
COOS RIVER	MILLICOMA RIVER	LITTLE MATSON CR	22269.00	1	No
COOS RIVER	MILLICOMA RIVER	MILLICOMA R, E FK	22265.00	2	No
COOS RIVER	MILLICOMA RIVER	GLENN CR	22246.00	1	No
COOS RIVER	SOUTH FORK	TIOGA CR	22197.30	1	No
COOS RIVER	SOUTH FORK	TIOGA CR	22196.00	1	No
COOS RIVER	SOUTH FORK	MINK CR	22182.00	2	No
COOS RIVER	SOUTH FORK	COAL CR	22178.00	1	No
COOS RIVER	SOUTH FORK	DANIELS CR	22158.00	2	No
COQUILLE RIVER	NORTH FORK	COQUILLE R, N FK	22045.00	2	No
COQUILLE RIVER	NORTH FORK	GILES CR	22044.00	1	No
COQUILLE RIVER	NORTH FORK	COQUILLE R, N FK	22041.00	1	No
COQUILLE RIVER	NORTH FORK	MOON CR	22038.00	1	No
COQUILLE RIVER	NORTH FORK	MOON CR	22038.00	2	No
COQUILLE RIVER	NORTH FORK	MIDDLE CR	22014.00	1	No
COQUILLE RIVER	NORTH FORK	MIDDLE CR	22014.00	3	No
COQUILLE RIVER	NORTH FORK	MIDDLE CR	22012.00	2	No
COQUILLE RIVER	NORTH FORK	MIDDLE CR	22008.00	1	No
COQUILLE RIVER	EAST FORK	STEEL CR	21957.00	1	No
COQUILLE RIVER	EAST FORK	STEEL CR	21957.00	2	No
COQUILLE RIVER	SOUTH FORK	SALMON CR	21853.70	1	No
COQUILLE RIVER	SOUTH FORK	SALMON CR	21853.70	2	No
COQUILLE RIVER	MIDDLE FORK	SLATER CR	21782.00	1	No
COQUILLE RIVER	SOUTH FORK	GETTYS CR	21712.00	1	No
COQUILLE RIVER	MAIN STEM	BEAR CR	21620.00	1	No
NEW RIVER	MAIN STEM	MORTON CR	21566.70	2	No
NEW RIVER	MAIN STEM	MORTON CR	21566.50	2	No
NEW RIVER	MAIN STEM	MORTON CR	21566.50	3	No