1999-2000 WINTER AND SUMMER

STEELHEAD FORECASTS

AND

MANAGEMENT RECOMMENDATIONS

Section I - Tributaries to the Strait of Juan de Fuca
(Other Than the Elwha River)

Section II - Elwha River

Section III - Tributaries to Hood Canal

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1. Strait of Juan de Fuca Tributaries (Other than the Elwha River)

1.1 Management Periods

The management periods indicated in this report define the time interval during which regulatory actions are directed to meeting conservation and allocation needs of steelhead runs while taking into account catches (actual or expected) of steelhead made outside the management periods. Since many runs extend over lengthy periods of time and only a small portion of the population of each run is available at the extremes of its run timing, it is impractical to exercise directed management for nonselective fisheries on these portions of runs while continuing harvests of other species. However, effort should be spread throughout the management periods to achieve escapement and catch from all segments of the run. The following management periods have been identified for each area:

Winter Steelhead	Management Periods
Dungeness River	December 12 through April 14
Discovery Bay and Sequim Bay Tributaries	November 28 through March 31
Hoko River and Sekiu River	December 5 through March 31
Other Strait Tributaries	November 28 through April 14

Summer Steelhead	Management Periods
Dungeness River	May 25 through August 24
Lyre River, Morse Creek	June 8 through September 5

Management periods for winter and summer steelhead in streams along the Strait of Juan de Fuca were estimated on the basis of historical harvest patterns of the recreational fishery and have been adjusted to minimize overlaps with the management periods of other species. Catch accounting periods for all fisheries in the Strait of Juan de Fuca rivers and streams are November 1 - April 30 for winter run steelhead and May 1 - October 31 for summer run steelhead.

1.2 Run Size Forecasts

Run size estimates are approximate and used only for the purpose of estimating harvestable numbers for the 1999-00 fishery.

Winter Steelhead

Treaty net fisheries have generally been targeted at hatchery reared recruits which are expected to return primarily from December through February. To calculate estimated run size each year, the estimated harvests were adjusted for an assumed harvest rate of 90 percent for treaty net fisheries and 70 percent for recreational fisheries. The run size forecasts for the December through February portion of the run (Tables 1 and 2) are based on steelhead harvests and estimated run sizes from past years. Even though data for more years is available, only the past five years were used to estimate the run size forecast because these years best represent the current trend in survival.

Table 1 shows winter steelhead run size forecasts for Strait of Juan de Fuca rivers (excluding the Elwha River) during the December through February portion of the run. These forecasts do not represent the total anticipated steelhead return to each river system. For example, most of the wild winter steelhead return during March, April, and May. These wild steelhead are not included in the run size forecasts in Table 1. These forecasts will not be further modified in-season unless agreed to by all affected parties. Fish originating from hatchery smolts stocked, as well as natural runs, were forecast as the estimated mean run size in each river from 1994-95 through 1998-99 (Appendix Tables A.1 to A.12). The method of forecasting adult returns from number of hatchery smolts stocked was not used for this region because no significant relationship has been found between number of hatchery smolts stocked and subsequent landed harvest levels. In the Hoko River the forecast was estimated as the mean run size of the last five years, reconstructed by adding harvest and escapement estimates in each year (Appendix Table A.11).

Table 1
1999-00 Strait of Juan de Fuca Winter Steelhead Run Size Forecast

River	Stock	Run Size
Dungeness River	Natural and Hatchery	170
Morse Creek	Natural and Hatchery	191
Lyre River	Natural and Hatchery	928
East Twin River	Natural	16
West Twin River	Natural	12
Salt Creek	Natural	9
Deep Creek	Natural	7
Pysht River	Natural and Hatchery	287
Clallam River	Natural and Hatchery	86
Hoko River	Natural and Hatchery	1,247
Sekiu River	Natural and Hatchery	87
Total:		3,040

Summer Steelhead

Table 2 shows summer steelhead run size forecasts for Strait of Juan de Fuca rivers. These forecasts do not represent the total anticipated steelhead return to each river system. For the Lyre River, expected return to harvest was estimated from the number of smolts stocked and the mean age specific return rates for the last five available smolt years. Based on age composition information provided by WDFW for Kalama River summer steelhead, an assumed age composition of 3.8 percent age 2, 78.8 percent age 3, and 14.6 percent age 4+ was used and other age groups and repeat spawners were accounted for by dividing the estimated return by 0.972. For Lyre River summer steelhead, total run size was estimated by dividing the expected return to harvest by an estimated maximum harvest rate of 0.80 (Appendix Table A.15). This method was discontinued this season for Dungeness summer steelhead since no hatchery summer steelhead smolts have been stocked since 1995 (Appendix Table A.13a).

For summer steelhead in the Dungeness River and Morse Creek, run size forecast is the mean of the estimated run sizes from the 1994 through 1998 seasons. The run size for each season was estimated by dividing the total harvest for each year by an estimated maximum harvest rate of 0.70 (Appendix Tables A.13b and A.14).

Table 2
2000 Strait of Juan de Fuca Summer Steelhead Run Size Forecast

River	Stock	Run Size
Dungeness River	Natural	29
Morse Creek	Natural	6
Lyre River	Natural and Hatchery	88
Total:		123

1.3 Harvest and Escapement

No escapement goals have been agreed to between WDFW and the Tribes for any runs of winter or summer steelhead returning to natural spawning areas in tributaries to the Strait of Juan de Fuca. Wild steelhead spawner escapement has been monitored in several Strait of Juan de Fuca streams (Appendix Table A.16).

The treaty and non-treaty harvestable shares of steelhead have been computed by halving the total harvest forecast using allowable harvest rates (summer and winter) in each system. The harvest forecast is calculated by applying an 80 percent harvest rate to the run size forecast. The 80 percent harvest rate is appropriate whenever the harvest rate is to be shared equally, with the recreational fishery exerting a maximum harvest rate of 70 percent and the commercial fishery a maximum harvest rate of 90 percent [(Appendix Table A.1) and [Appendix Table C.1(Hood Canal)]. Tribes in the Point No Point Treaty Area and the Makah Treaty Area intend to harvest their share of summer steelhead during the winter steelhead management period. If the treaty share of summer steelhead is taken during the winter steelhead season, no treaty fisheries directed at summer steelhead should occur. In accordance with prior agreements with the WDFW, a maximum of 65 fish of the Pysht River Treaty Indian share may be taken during the winter fishery in Pysht Bay. The number of harvestable winter and summer steelhead for each system is shown in Table 3 and the expected harvest by Treaty Indian fisheries and non-treaty (recreational) fisheries is shown in Table 4. The number of harvestable winter steelhead in the Hoko River was estimated by applying the mean exploitation rate for the 1984-85 through 1998-99 return years (excluding 1990-91) to the 1999-00 forecasted run size (Appendix Table A.11).

1.4 Management Recommendations

For winter steelhead, there is uncertainty regarding the status of some wild stocks and the run timing of naturally reared steelhead in tributaries of the Strait of Juan de Fuca. Limited available information indicates that the catch after the end of February is comprised primarily of naturally reared steelhead. In order to provide additional protection for that portion of the run, commercial net and consumptive recreational fisheries should be prohibited after February 28. In streams where returns from hatchery smolts are expected, fisheries should be regulated to harvest, prior to March 1, the number of fish indicated in Table 3. This management strategy will provide for the harvest of hatchery steelhead while protecting from harvest wild steelhead entering the streams after March 1. In addition, wild steelhead release regulations have been in effect for recreational fisheries from June 1 through February 28 in the Dungeness River since the 1993-94 season, in Morse Creek since the 1994-95 season, and in Salt Creek, Lyre River, East Twin River, and West Twin River since the 1996-97 season. Deep Creek will again be closed to steelhead fishing for the 1999-00 season due to severe habitat degradation caused by a landslide into the stream.

For summer steelhead, the management period overlaps the spring/summer chinook management period in the Dungeness River. During that period, non-selective fisheries should remain closed. It is also recommended that no wild summer steelhead harvest be permitted in Morse Creek, because of the extremely low anticipated return. In order to minimize recreational fishery impacts to wild summer steelhead, wild steelhead release regulations have been in effect in all freshwater areas since 1992 and in all marine areas since 1993.

Table 3
1999-00 Harvestable Shares of Strait of Juan de Fuca Steelhead

River	Winter	Summer	Total	50% Share
Dungeness River	136	0	136	68
Morse Creek	152	0	152	77
Lyre River	742	71	813	407
East Twin River	13		13	7
West Twin River	9		9	5
Salt Creek	7		7	4
Deep Creek	0		0	0
Pysht River	229		229	115
Clallam River	69		69	35
Hoko River	529		529	265
Sekiu River	69		69	35
Totals:	1,956	71	2,026	1,018

Table 4
1999-00 Expected Timing of Strait of Juan de Fuca Steelhead Harvest by Management Unit

	Treaty Indian Harvest			Non-Treaty Harvest		
River	Winter	Summer	Totals	Winter	Summer	Totals
Dungeness River	68		68	68	0	68
Morse Creek	77	0	77	77	0	77
Lyre River	407	0	407	336	71	407
East Twin River	7		7	7		7
West Twin River	5		5	5		5
Salt Creek	4		4	4		4
Deep Creek	0		0	0		0
Pysht River	115		115	115		115
Clallam River	35		35	35		35
Hoko River	265		265	265		265
Sekiu River	35		35	35		35
Totals:	1,018	0	1,018	947	71	1,018

1.5 Spawner Surveys

Steelhead spawner escapement should be monitored in Strait of Juan de Fuca streams. Wild steelhead spawner surveys and escapement estimates have been made on Snow Creek, Dungeness River, Morse Creek, Salt Creek, Lyre River, East Twin River, West Twin River, Deep Creek, Pysht River and Hoko River (Appendix Table A.16). Surveys on these streams should be continued. However, past spawner surveys have been limited to periods after March 1 in most seasons. For the 1999-00 season, it is recommended that spawner surveys during begin during January or early February on Morse Creek and the Pysht River to better estimate steelhead spawn timing and spawner escapement. These streams often flood during the recommended spawner survey period and the amount of information collected will depend on suitable river conditions.

2. Elwha River

2.1 Management Periods

The management periods described in this report define the time interval during which regulatory actions will be directed to meet conservation and allocation needs of steelhead runs while taking into account catches (actual or expected) of steelhead made outside of these management periods. The management periods are intended to encompass the majority of the historical run timing of the target species. However, many runs extend over lengthy periods of time while only a small portion of the population of each run is available at the extremes of its run timing. Therefore, it is impractical to exercise directed management for nonselective fisheries on these portions of runs while continuing harvests of other species or stocks. To achieve escapement and limit impacts on any particular segment of the runs, effort should be spread throughout the management periods.

Fishery	Management Period
Winter Steelhead	December 12 through April 14
Summer Steelhead	June 8 through September 5

Management periods for winter and summer steelhead in the Elwha River were estimated on the basis of the historical harvest pattern of the sport fishery.

Catch accounting periods for all fisheries in the Elwha River are November 1 - April 30 for winter run steelhead and May 1 - October 31 for summer run steelhead.

2.2 Run Size Forecast

2.2.1 Winter Steelhead

Table 5
1999-00 Elwha River Winter Steelhead Forecast

River	Stock	Run size
Elwha River	Natural and Hatchery	2,672

The total forecast return of 2,672 Elwha River winter steelhead was derived from a separate hatchery reared forecast return of 2,519 winter steelhead and a naturally reared forecast return of 153 winter steelhead (Table 6). These estimates were developed utilizing information from prior seasons' fisheries and numbers of hatchery smolts released.

The hatchery reared forecast return of 2,441 age 3 and age 4 fish (Table 6) was based on a return of 1,954 age 3 fish (160,188) smolt year 1998 releases and a mean age 3 return rate of 0.0122) and 487 age 4 fish (135,145 smolt year 1997 releases and a projected age 4 return rate of 0.0036). The resulting total was then divided by 0.9690 to account for other hatchery age classes (Table 7), providing a total hatchery origin forecast return of 2,519 fish (Table 6).

The hatchery reared forecast return was calculated as:

Hatchery Forecast Return =

[(Mean Age 3 return rate) * (Smolt release during 1996 smolt year) +
(Projected Age 4 return rate) * (Smolt release during 1995 smolt year)] / 0.9690.

It should be noted that in prior years age 4 returns were estimated via a quadratic relation between age 4 and age 3 return rates. Scale data from last years' fishery will be available when samples are analyzed.

The naturally reared forecast return of 153 fish (Table 6) was based on a five year average of the estimated natural returns for return years 1992-93 through 1996-97 (Table 8).

The naturally reared component and the hatchery reared component of each years' run were estimated as follows. First the historical total run size estimate (natural and hatchery fish) for each of the prior seasons was determined by dividing the combined harvest (sport, commercial, ceremonial, and subsistence) by 0.9 (assumed maximum harvest rate of fish escaping to spawn naturally) and adding hatchery rack returns.

Second, the historical naturally reared component for each years' total run (Table 8) was estimated using scale data collected from the commercial fishery during each season from 1982-83 through 1996-97 and an estimate of the 'completeness' of the natural run on the last sample date (Table 9), using the equation:

$$N = \frac{P_t * C}{H * T_t}$$

where:

P_t = cumulative proportion of the commercial catch estimated to be naturally reared;
C = commercial catch;
H = commercial harvest rate; and,
T_t = cumulative proportion of the commercial catch (proportion of the natural run complete on the last day of the commercial season).

Third, the historical hatchery component of the run was estimated by simply subtracting the natural component from the total run size. The results of this analysis are shown in Table 9. Table 10 shows the estimated run timing for naturally reared Elwha winter steelhead used to calculate T_t above.

During the 1995-96 season, the tribal hatchery blocked entry of fish into the hatchery following the week ending January 20, 1996. However, a large number of fish were still in the system. It is expected that the true harvest rate in 1995-96 was lower than the assumed 90% level. It is strongly recommended that State and Tribal managers consider options for estimating actual harvest rates in future years.

Table 6 1999-00 Elwha River Winter Steelhead Forecast by Age Group			
Cohort	Smolts Released	Projected Return Rate	Estimated Return
Age 3	160,188	0.0122	1,954
Age 4	135,145	0.0036	487
Subtotal			2,441
Proportion of Age 3 and Age 4 hatchery return (from Table 7):			0.9690
Total hatchery run forecast:			2,519
Average natural run size (from Table 8):			153
Total run size forecast:			2,672

Table 7 Age Composition of Elwha River Hatchery-reared Winter Steelhead				
Return Year	Age 3	Age 4	Others	Sample Size
1982-83	0.622	0.352	0.026	384
1983-84	0.783	0.175	0.041	314
1984-85	0.909	0.070	0.021	1,005
1985-86	0.799	0.172	0.029	732
1986-87	0.682	0.258	0.061	264
1987-88	0.806	0.177	0.017	526
1988-89	0.177	0.783	0.040	576
1989-90	0.866	0.128	0.009	335
1990-91	0.553	0.431	0.019	295
1991-92	0.324	0.568	0.108	53
1992-93	0.602	0.364	0.034	88
1993-94	0.957	0.043	0.000	115
1994-95	0.736	0.220	0.044	252
1995-96	0.757	0.222	0.020	342
1996-97	0.854	0.146	0.000	48
Mean	0.695	0.274	0.031	

Table 8
Computation of Return Rates Used to Predict Hatchery-Reared Winter Steelhead Returning to the Elwha River

Return Year	Total Run	Wild Run	Hatchery Run	Smolt Year	Smolt Release	Age 3 Return	Age 3 Return Rate	Age 4 Return	Age 4 Return Rate
				1979	30,000			521	0.0174
1981-82[a]	2,907	643	2,264	1980	51,000	1,758	0.0345	561	0.0110
1982-83	2,243	647	1,596	1981	66,400	993	0.0150	532	0.0080
1983-84	3,590	554	3,036	1982	63,600	2,379	0.0374	366	0.0058
1984-85	6,085	835	5,250	1983	86,300	4,775	0.0553	658	0.0076
1985-86	4,655	834	3,821	1984	95,600	3,054	0.0319	785	0.0082
1986-87	3,542	493	3,049	1985	89,950	2,079	0.0231	741	0.0082
1987-88	4,690	499	4,191	1986	118,800	3,378	0.0284	1963	0.0165
1988-89	2,923	416	2,507	1987	73,630	444	0.0060	311	0.0042
1989-90	2,707	286	2,421	1988	88,174	2,096	0.0238	575	0.0065
1990-91	1,483	148	1,335	1989	118,611	738	0.0062	249	0.0021
1991-92	998	560	438	1990	46,065	142	0.0031	278	0.0060
1992-93	836	70	766	1991	90,997	461	0.0051	70	0.0008
1993-94	1,834	225	1,609	1992	83,500	1,539	0.0184	697	0.0083
1994-95	3,434	270	3,164	1993	229,146	2,328	0.0102	444	0.0019
1995-96	2,046	47	1,999	1994	92,436	1,514	0.0164	173	0.0010
1996-97	1,337	153	1,184	1995	94,000	1,011	0.0108		
				1996	170,055				
Means:		153[d]				Avg:	0.0122	Avg:	0.0036

a) 1981-82 wild run size estimate is based on the average of the following five years.
b) Age 3 average return rate is based on the smolt years 1991 through 1995.
c) Age 4 average return rate is based on the smolt years 1990-95.
d) Average of 1992-93 through 1996-97 return years.

Table 9
Calculation of Naturally Reared Elwha River Winter Steelhead Return
N = (P*C)/(H*T)

Year	Total Run [1]	Treaty Commercial Harvest (C)	Commercial Rate (H)	Number Aged [2]	Wild Fish [3]	Proportn Wild (P)	Wild Run Completed (T)[4]	Wild Run Estimate (N)
1982-83	2,243	1,088	0.485	230	13	0.057	0.196	647
1983-84	3,590	1,582	0.441	168	10	0.060	0.386	554
1984-85	6,085	1,857	0.305	416	31	0.075	0.543	835
1985-86	4,655	2,767	0.594	695	86	0.124	0.691	834
1986-87	3,542	2,546	0.719	185	15	0.081	0.583	493
1987-88	4,690	1,760	0.375	470	26	0.055	0.520	499
1988-89	2,923	1,078	0.369	455	24	0.053	0.371	416
1989-90	2,707	1,605	0.593	357	22	0.062	0.583	286
1990-91	1,483	823	0.555	317	22	0.069	0.695	148
1991-92	998	423	0.424	53	16	0.302	0.538	560
1992-93	836	242	0.289	25	1	0.040	0.479	70
1993-94	1,847	809	0.438	125	10	0.080	0.656	225
1994-95	3,434	1,179	0.343	152	9	0.059	0.754	270
1995-96	2,046	995	0.486	188	3	0.016	0.695	47
1996-97	1,337	575	0.430	52	4	0.077	0.674	153

1. Total run = ((Sport + Commercial + C&S) / 0.9) + hatchery escapement.
2. Number of fish in commercial net fishery with readable scales.
3. Number of wild fish (aged 2.x.x or 2+.x.x) from (2).
4. Proportion of wild run completed as estimated from historical sport catch data (See Table 10).

Table 10
Estimated Run Timing of Elwha River Naturally Reared Winter Steelhead

	Month							
	Nov	Dec	Jan	Feb	Mar	Apr	May	Total
Avg Sport Catch	6	235	278	198	265	231	16	1,229
Proportion	0.005	0.191	0.226	0.161	0.216	0.188	0.013	
Cum. Prop.	0.005	0.196	0.422	0.583	0.799	0.987	1.000	

The run timing of the natural winter run of steelhead to the Elwha River was estimated from sport catches in years in which the return from stocked fish was minimal. Years included are 1961-62 through 1965-66.

2.2.2 Summer Steelhead

Table 11
2000 Elwha River Summer Steelhead Forecast

River	Stock	Run size
Elwha River	Hatchery/Natural	81

The 1998 summer steelhead run size was forecast as the estimated steelhead adult return adjusted by an assumed maximum harvest rate (Appendix Table B.1). The number of hatchery steelhead adults returning to harvest was estimated (1) using the mean return-to-harvest rate, by age group, for hatchery smolts released during smolt years 1987 through 1994; (2) an assumed adult age composition of 3.8% aged 2, 78.8% age 3, and 14.6% age 4 based on information for summer steelhead in the Kalama River supplied by WDFW; and (3) the number of adults in other age groups and repeat spawners were accounted for by dividing this estimate by 0.972. The return to harvest estimate of summer steelhead represents the average number of fish available for harvest, not the total run size. The total return was estimated by dividing the expected return to harvest by an assumed maximum recreational harvest rate of 0.70, resulting in the 2000 forecast of 81 fish (Table 11). Historically, approximately 85% of the harvest was taken in the recreational fishery.

2.3 Harvest and Escapement

Table 12
1999-2000 Treaty and Non-Treaty Harvest Shares Of Elwha River Steelhead Stocks

Harvestable			Treaty Share			Non-Treaty Share		
Winter	Summer	Total	Winter	Summer	Total	Winter	Summer	Total
2270	57	2,327	1,146	17	1,163	1,123	40	1,163

No escapement goals for natural spawning areas have been agreed to for winter or summer steelhead in the Elwha River. A total of 150 winter steelhead will be required for broodstock at the Elwha Hatchery. The number of harvestable winter steelhead in the Elwha River was computed by multiplying the estimated run size, after subtracting hatchery escapement requirements of 150, by an expected harvest rate of 90 percent, resulting in 2,270 fish. This harvest rate should provide sport fishermen with an opportunity to harvest the non-treaty share of winter steelhead if the commercial fishery is dispersed in time. The harvestable number of summer steelhead was estimated from the run size of fish multiplied by the assumed harvest rate of 0.70.

The treaty and non-treaty shares of steelhead were computed by halving the total number of harvestable fish (summer and winter) for the Elwha River. The Lower Elwha S'Klallam Tribe intends to harvest the majority of its share of all steelhead during the winter steelhead management period. The remainder (17 summer steelhead) will be reserved for anticipated incidental and summer recreational harvests in tribal fisheries. If the targeted treaty share of summer steelhead is taken during the winter steelhead season, no treaty net fisheries directed at summer steelhead should occur. The number of harvestable fish and preseason estimates of shares are given in Table 12.

2.4 Management Recommendations

During the November-January fishing period, commercial net fisheries should be scheduled to secure a minimum of 23 landings (historic minimum number of landings during the update period), during the evaluation or update period (November 1 - January 15). Information from these fisheries will be used to update the preseason run size estimate. Thereafter, tribal net fisheries should be periodic, with intervening closures of sufficient duration to provide each party with an adequate opportunity to harvest its share. Fisheries should also be scheduled at widely spread intervals, in order to avoid preemption of recreational opportunity as the run comes in.

The 1999-00 management period for winter steelhead does not overlap the management period for fall chum which ends December 11 Treaty net fisheries should not occur prior to the end of the chum management period, as the chum salmon escapement needs should receive priority. Additionally, following the end of the chum management period, area closures for steelhead fishing should be considered if escapement surveys show significant numbers of chum salmon remain in the river.

To protect an expected low return of wild steelhead, the WDFW and Lower Elwha Tribe have agreed that the Elwha River, from the mouth to the Aldwell Lake Dam, will close to all recreational angling for game fish on February 29, 2000. The Lower Elwha Tribe will cease net fishing by February 29, 2000. Wild steelhead release regulations are in effect for recreational fisheries during the 1999-00 season since most hatchery steelhead returning to the river have been marked with clipped adipose fins. This management strategy will provide for the harvest of hatchery steelhead while protecting wild steelhead from harvest.

The 2000 management period for summer steelhead overlaps the management period for spring chinook. In order to protect spring chinook, which are expected to return below escapement needs, non-selective fisheries should remain closed during the spring chinook management period. It also overlaps the management period for summer/fall chinook salmon. During that period, non-selective fisheries should be targeted to meet summer/fall chinook management objectives while taking appropriate measures to minimize any unnecessary harvest of summer steelhead.

2.5 In-season Update

Prior to January 15, or until sufficient fisheries occur, the preseason forecast will be used to manage the Elwha River steelhead fishery. Fisheries will be considered sufficient when there has been a minimum of 23 landings. Given sufficient fisheries, the cumulative steelhead net catch and landings from November 1 thru January 15 will be used to update the run size, assuming that the observed catch is within the historic data range (Table 13). The following equation using run size and catch data for winter fisheries of 1987-88 through 1996-97 was used to derive the steelhead in season update of abundance for the Elwha River:

$$N = 172.6675 + 3.4726 * (Catch)$$

where: N = Runsize,
Catch = Cumulative steelhead net catch from November 1 through January 15

For the above inseason update model (Table 13) the coefficient of multiple determination (R^2) was 0.888, the square root of the mean square error (σ) was 429.9 and the F test p value for the significance of the regression model was 4.49E-05. If the observed cumulative catch in 1999-00 is outside the historic data range, then the updated run size will be developed by agreement of the parties using all available information.

Table 13
Historical data used for the Elwha River Steelhead In Season Update Model

Return Year	Preseason Forecast	Commercial Catch (11/1 - 01/15)	Commercial Landings (11/1 - 01/15)	Run Size	Hindcasting Prediction
1987-88	5,610	1,144	204	4,690	4,169
1988-89	4,211	699	117	2,923	2,625
1989-90	3,892	897	170	2,707	3,264
1990-91	3,038	528	95	1,483	1,994
1991-92	2,754	223	42	998	914
1992-93	2,076	113	23	836	525
1993-94	1,760	481	56	1,834	1,931
1994-95	4,322	864	64	3,434	3,482
1995-96	2,891	693	40	2,046	2,579
1996-97	2,093	279	24	1,337	1,142

3.1 Management Periods

The management periods indicated in this report define the time interval during which regulatory actions are directed to meeting conservation and allocation needs of steelhead stocks while taking into account catches (actual or expected) of steelhead made outside of the management periods. Since many runs extend over lengthy periods of time and only a small portion of the population of each run is available at the extremes of its run timing, it is impractical to exercise directed management for nonselective fisheries on these portions of runs while continuing harvests of other species or stocks. Effort should be spread throughout the management periods to achieve escapement and catch from all segments of the run.

Winter Steelhead

Area	Management Period
Area 9A	December 5 through March 31
Hood Canal Rivers	December 5 through April 8

Management periods for winter steelhead were established by reviewing historical information on the timing of recreational catches. The end of the management period was adjusted to match the beginning of the spring chinook management period.

Summer Steelhead

Area	Management Period
Dosewallips River	June 1 through September 15
Duckabush River	June 1 through September 15
Skokomish River	June 1 through August 22

Summer-run steelhead management periods for the Dosewallips River, Duckabush River, and the Skokomish River were established on the basis of historical harvest patterns by recreational fisheries to include approximately the central 80 percent of the run distribution. Catch accounting periods for all fisheries in Hood Canal rivers and streams are November 1 - April 30 for winter run steelhead and May 1 - October 31 for summer run steelhead.

3.2 Run Size Forecasts

Run size estimates are approximate and used only for the purpose of estimating harvestable numbers for the 1999-2000 fishery.

Winter Steelhead

Treaty net fisheries have generally been targeted at hatchery reared recruits which are expected to return primarily from December through February. To calculate estimated run size each year, the estimated harvests were adjusted for an assumed harvest rate of 90 percent for treaty net fisheries and 70 percent for recreational fisheries. The run size forecasts for the December through February portion of the run (Tables 1 and 2) are based on steelhead harvests and estimated run sizes from past years. Even though data for more years is available, only the past five years were used to estimate the run size forecast because these years best represent the current trend in survival.

Table 14 shows winter steelhead run size forecasts for Hood Canal rivers during the December through February portion of the run. These forecasts do not represent the total anticipated steelhead return to each river system. For example, most of the wild winter steelhead return during March, April, and May; these wild steelhead are not included in the run size forecasts in Table 14. These forecasts will not be further modified in-season unless agreed to by all affected parties. Fish originating from hatchery smolts stocked, as well as natural runs, were forecast as the estimated mean run size in each river based on steelhead harvests from 1994-95 through 1998-99 (Appendix Tables C.1 through C.9). The method of forecasting adult returns from number of hatchery smolts stocked was not used for this region because no significant relationship has been found between number of hatchery smolts stocked and subsequent harvest levels.

Table 14
1999-2000 Hood Canal Winter Steelhead Run Size Forecast

River	Stock	Run Size
Big Quilcene River	Natural	6
Dosewallips River	Natural and Hatchery	10
Duckabush River	Natural and Hatchery	11
Hamma Hamma River	Natural	0
Dewatto River	Natural	0
Skokomish River	Natural and Hatchery	28
Tahuya River	Natural	8
Union River	Natural	3
Total:		66

Summer Steelhead

Table 15 shows summer steelhead run size forecasts for Hood Canal rivers. These forecasts do not represent the total anticipated steelhead return to each river system. Run size of summer steelhead during 2000 was predicted using the mean harvest in the years 1994 through 1998. Run size in the Dosewallips River, Duckabush River, and the Skokomish River, where there was no treaty net catch during that period, was estimated by dividing the recreational catch by an assumed maximum harvest rate of 0.70 (Appendix Tables C.10 to C.12).

Table 15
2000 Hood Canal Summer Steelhead Run Size Forecast

River	Stock	Run Size
Dosewallips River	Natural	3
Duckabush River	Natural	4
Skokomish River	Natural	13
Total:		20

3.3 Harvest and Escapement

No escapement goals have been agreed to between WDFW and the Tribes for any natural stocks of winter or summer steelhead in the Hood Canal area. Wild steelhead spawner escapement has been monitored in some Hood Canal streams (Appendix Table C.13). Harvestable numbers were estimated by applying a 80% harvest rate to each run size forecast. The treaty and non-treaty harvestable shares of steelhead were computed by halving the total harvestable number (summer and winter) for each system as shown in Tables 16 and 17.

In accordance with prior agreements with WDFW, the mixed stock harvest to be taken by treaty fishermen in Area 9A shall be limited to one-sixth of the total harvestable number for Hood Canal. The expected mixed stock harvest of Hood Canal stocks by non-treaty fishermen in recreational areas 9 and 12 was estimated using the average sport harvest in the years 1993 through 1996 and apportioning it to each Hood Canal river on the basis of runsize forecasts for the 1996-97 season. Similarly, the expected mixed stock harvest of Hood Canal stocks by Treaty Indian fisheries in area 9A was estimated using the average tribal harvest in the years 1993 through 1997 and apportioning it to each Hood Canal river on the basis of runsize forecasts for the 1999-2000 season. The number of harvestable fish for each system and the expected harvest by Treaty Indian fisheries and non-treaty (recreational) fisheries are shown in Tables 18 and 19.

Table 16

1999-2000 Harvestable Shares of Hood Canal Steelhead

River	Winter	Summer	Totals	50% Share
Big Quilcene River	5		5	2
Dosewallips River	8	2	10	5
Duckabush River	9	3	12	6
Hamma Hamma River	0		0	0
Dewatto River	0		0	0
Skokomish River	22	10	32	16
Tahuya River	6		6	3
Union River	2		2	1
Totals:	52	15	67	33

Table 17

1999-2000 Expected Timing of Hood Canal Steelhead Harvest by Management Unit

	Treaty Indian Harvest			Non-Treaty Harvest		
Harvest Area	Winter	Summer	Totals	Winter	Summer	Totals
Big Quilcene River	3		3	2		2
Dosewallips River	5		5	3	2	5
Duckabush River	6		6	3	3	6
Hamma Hamma River	0		0	0		0
Dewatto River	0		0	0		0
Skokomish River	16		16	6	10	16
Tahuya River	3		3	3		3
Union River	1		1	1		1
Totals:	34	0	34	18	15	33

Table 18

1999-2000 Treaty Indian Harvest Adjusted for Marine Area 9A

Harvest Area	Winter	Summer	Totals
Big Quilcene River	3		3
Dosewallips River	5	0	5
Duckabush River	6	0	6
Hamma Hamma River	0		0
Dewatto River	0		0
Skokomish River	16	0	16
Tahuya River	3		3
Union River	1		1
Marine Area 9A	0	0	0
Totals:	34	0	34

Table 19

1999-2000 Non-Treaty Harvest Adjusted for Marine Areas 9 and 12

Harvest Area	Winter	Summer	Totals
Big Quilcene River	2		2
Dosewallips River	3	2	5
Duckabush River	3	3	6
Hamma Hamma River	0		0
Dewatto River	0		0
Skokomish River	6	10	16
Tahuya River	3		3
Union River	1		1
Marine Area 12	0		0
Marine Area 9	0		0
Totals:	18	15	33

3.4 Management Recommendations

The first net fisheries for steelhead on the Dosewallips and Duckabush rivers may be scheduled no earlier than the week of December 13. In all cases, through December 26, priority shall be given to chum salmon management needs when managing non-selective fisheries.

Tribes of the Point No Point Treaty Area intend to harvest the majority of their share of summer steelhead during the winter steelhead management period, therefore, no treaty fisheries directed at summer steelhead should occur. Treaty and non-treaty shares were divided into mixed stock and extreme terminal area (river) harvests. One sixth of the harvestable total has been allocated to marine Area 9A and if the mixed stock share is not expected to be taken by February 1, 2000, then the remaining numbers shall be reallocated to the extreme terminal areas on a gradual basis starting January 10.

For winter steelhead, there is uncertainty regarding the status of some wild stocks and run timing of naturally reared stocks returning to tributaries of Hood Canal. Due to this uncertainty, fisheries should be targeted at hatchery reared stocks, which are expected to return primarily during December and January. Due to the low harvestable shares presented it is recommended that no commercial net fisheries occur in the Skokomish River. In order to minimize recreational fishery impacts to wild winter steelhead, wild steelhead release regulations have been in effect in the Skokomish and Tahuya rivers since 1987 and in all other Hood Canal tributaries open during the winter steelhead season since the 1994-95 season. In addition, these regulations have been in effect since 1993 in all marine areas to protect wild winter steelhead.

For summer steelhead, the management period overlaps the spring chinook salmon management period (May 1 - Aug. 1) in the Skokomish River. In order to avoid the incidental capture of spring chinook, which are expected to return at levels below escapement needs, non-selective fisheries should remain closed through the end of the spring chinook management period in the Skokomish River. Wild steelhead release regulations have been in effect for recreational fisheries in all freshwater areas since 1992 and in all marine areas since 1993 to protect wild summer steelhead.

3.5 Test Fisheries

The run size forecasts presented in this report are based on simple expansion from recent historical harvest, and in the absence of significant fisheries, may result in a continuous reduction of run size forecasts. Therefore, an in-river test fishery was implemented in the Skokomish River during the 1996-97 through 1998-99 seasons to assess the entry timing pattern, stock contribution, and age distribution of the winter steelhead run. However, the test fishery has not been successful and will need re-evaluation. There will be no test fishery for steelhead in the Skokomish River during the 1999-2000 season.

3.6 Spawner Surveys

Steelhead spawner escapement should be monitored in Hood Canal streams. Wild steelhead spawner surveys and escapement estimates have been made on the Dewatto, Tahuya, Skokomish, Hamma Hamma, and Dosewallips rivers (Appendix Table C.13) and periodically on the Union and Duckabush rivers; these surveys should be continued. However, past spawner surveys have been limited to periods after March 1 in most seasons. For the 1999-2000 season, it is recommended that spawner surveys begin during January on the Tahuya and Skokomish rivers to better estimate steelhead spawn timing and spawner escapement. In addition, estimates of spawn timing and spawner escapement before March 1 on the Skokomish River system will complement population information collected in test fisheries and may enable better estimation of each run component. The Tahuya and Skokomish rivers often flood during the recommended spawner survey period and the amount of information collected will depend on suitable river conditions.

Appendix Tables A

Supporting Data for Estimation of Run Size and Harvestable Shares for Strait of Juan de Fuca Steelhead

Appendix Table A.1
Run Size Forecasts and Harvest Forecasts for Winter and Summer Run Steelhead in the Strait of Juan de Fuca during the 1999-00 Management Season

Stream	Run Size Forecast	Harvest Rate[1]	Harvest Forecast
Winter Run Steelhead			
Dungeness River	170	0.8	136
Morse Creek	191	0.8	152
Lyre River	928	0.8	742
E. Twin River	16	0.8	13
W. Twin River	12	0.8	9
Salt Creek	9	0.8	7
Deep Creek	7	0	0
Pysht River	287	0.8	229
Clallam River	86	0.8	69
Hoko River	1,247	0.4242	529
Sekiu River	87	0.8	69
Total	3,040		1,955
Summer Run Steelhead			
Dungeness River	29	0	0
Morse Creek	6	0	0
Lyre River	88	0.8	71
Total	123		71

[1]The 0.80 harvest rate is appropriate whenever the harvest rate is to be shared equally, with the recreational fishery exerting a maximum harvest rate of 0.70 and the commercial fishery a maximum harvest rate of 0.90.

Appendix Table A.2 Total Harvest and Estimated Run Size for Winter Run Steelhead in Dungeness River.

Winter Return Year	Sport Harvest	Tribal Harvest	Total Harvest	Estimated Run Size	Smolt Year	Smolts Stocked	Smolt-to-harvest Index[1]
1978-79					1977	40,100	
1979-80	411	181	592	788	1978	30,300	0.0180
1980-81	629	67	696	973	1979	24,800	0.0265
1981-82	518	158	676	916	1980	20,000	0.0318
1982-83	376	61	437	605	1981	20,100	0.0218
1983-84	448	142	590	798	1982	17,000	0.0331
1984-85	388	106	494	672	1983	18,600	0.0272
1985-86	226	48	274	376	1984	14,800	0.0173
1986-87	400	9	409	581	1985	15,900	0.0262
1987-88	409	44	453	633	1986	15,400	0.0292
1988-89	143	6	149	211	1987	15,545	0.0096
1989-90	169	0	169	241	1988	20,100	0.0089
1990-91	116	14	130	181	1989	20,123	0.0065
1991-92	115	4	119	169	1990	20,300	0.0059
1992-93	73	0	73	104	1991	15,000	0.0044
1993-94	148	8	156	220	1992	15,100	0.0103
1994-95	215	0	215	307	1993	15,300	0.0141
1995-96	146	0	146	209	1994	18,850	0.0082
1996-97	131	0	131	187	1995	9,900	0.0107
1997-98	22	0	22	31	1996	10,000	0.0022
1998-99	81	0	81	116	1997	10,000	0.0081
					1998	10,690	
Mean 1994-95 to 1998-99			119	170			

[1]Index is calculated assuming 0.735 Age 3 and 0.265 Age 4 contribution of hatchery reared fish.

Appendix Table A.3 Total Harvest and Estimated Run Size for Winter Run Steelhead in Morse Creek.

Winter Return Year	Sport Harvest	Tribal Harvest	Total Harvest	Estimated Run Size	Smolt Year	Smolts Stocked	Smolt-to-harvest Index[1]
1978-79					1977	10,000	
1979-80	194	0	194	277	1978	15,000	0.0142
1980-81	357	166	523	694	1979	12,900	0.0389
1981-82	290	116	406	543	1980	12,300	0.0326
1982-83	310	258	568	730	1981	18,000	0.0344
1983-84	546	216	762	1,020	1982	15,400	0.0474
1984-85	285	351	636	797	1983	16,400	0.0394
1985-86	235	281	516	648	1984	15,500	0.0328
1986-87	223	200	423	541	1985	15,900	0.0268
1987-88	188	283	471	583	1986	18,800	0.0261
1988-89	215	58	273	372	1987	15,200	0.0169
1989-90	189	45	234	320	1988	15,000	0.0155
1990-91	90	0	90	129	1989	15,514	0.0059
1991-92	135	0	135	193	1990	10,100	0.0117
1992-93	96	12	108	150	1991	14,700	0.0080
1993-94	195	0	195	281	1992	15,200	0.0131
1994-95	117	2	119	169	1993	15,400	0.0078
1995-96	258	11	269	381	1994	15,338	0.0175
1996-97	155	0	155	221	1995	15,029	0.0103
1997-98	73	0	73	104	1996	5,076	0.0094
1998-99	54	0	54	77	1997	5,000	0.0106
					1998	5,000	
Mean 1994-95 to 1998-99			134	191			

[1]Index is calculated assuming 0.735 Age 3 and 0.265 Age 4 contribution of hatchery reared fish.

Appendix Table A.4 Total Harvest and Estimated Run Size for Winter Run Steelhead in Salt Creek.

Winter Return Year	Sport Harvest	Tribal Harvest	Total Harvest	Estimated Run Size
1979-80	98	0	98	140
1980-81	27	0	27	39
1981-82	55	79	134	166
1982-83	15	0	15	21
1983-84	46	0	46	66
1984-85	28	18	46	60
1985-86	11	0	11	16
1986-87	32	11	43	58
1987-88	2	13	15	17
1988-89	2	9	11	13
1989-90	37	2	39	55
1990-91	11	0	11	16
1991-92	36	0	36	51
1992-93	16	0	16	23
1993-94	17	0	17	24
1994-95	6	0	6	9
1995-96	6	0	6	9
1996-97	6	0	6	9
1997-98	8	0	8	11
1998-99	6	0	6	9
Mean of 1994-95 to 1998-99			6	9

Appendix Table A.5 Total Harvest and Estimated Run Size for Winter Run Steelhead in Lyre River.

Winter Return Year	Sport Harvest	Tribal Harvest	Total Harvest	Estimated Run Size	Smolt Year	Smolts Stocked	Smolt-to-harvest Index[1]
1978-79					1977	30,000	
1979-80	578	150	728	992	1978	30,400	0.0240
1980-81	961	152	1,113	1,542	1979	30,000	0.0370
1981-82	685	173	858	1,171	1980	26,500	0.0313
1982-83	921	576	1,497	1,956	1981	30,100	0.0514
1983-84	1,100	443	1,543	2,064	1982	26,000	0.0570
1984-85	1,283	545	1,828	2,438	1983	22,100	0.0790
1985-86	635	350	985	1,296	1984	25,900	0.0396
1986-87	903	281	1,184	1,602	1985	15,600	0.0646
1987-88	788	566	1,354	1,755	1986	23,600	0.0630
1988-89	623	343	966	1,271	1987	20,700	0.0450
1989-90	564	444	1,008	1,299	1988	25,200	0.0420
1990-91	444	55	499	695	1989	30,152	0.0173
1991-92	462	66	528	733	1990	24,100	0.0205
1992-93	366	0	366	523	1991	25,000	0.0148
1993-94	362	0	362	521	1992	25,400	0.0144
1994-95	796	100	896	1,248	1993	25,100	0.0356
1995-96	930	0	930	1,329	1994	26,094	0.0360
1996-97	893	0	893	1,276	1995	25,169	0.0351
1997-98	87	0	87	124	1996	25,159	0.0035
1998-99	463	1	464	663	1997	25,012	0.0184
					1998	25,061	
Mean of 1994-95 to 1998-99			654	928			

[1]Index is calculated assuming 0.735 Age 3 and 0.265 Age 4 contribution of hatchery reared fish.

Appendix Table A.6 Total Harvest and Estimated Run Size for Winter Run Steelhead in East Twin River.

Winter Return Year	Sport Harvest	Tribal Harvest	Total Harvest	Estimated Run Size
1979-80	17	0	17	24
1980-81	17	0	17	24
1981-82	20	0	20	29
1982-83	31	0	31	44
1983-84	78	0	78	111
1984-85	0	0	0	0
1985-86	10	0	10	14
1986-87	27	0	27	39
1987-88	27	2	29	41
1988-89	9	14	23	28
1989-90	12	11	23	29
1990-91	8	2	10	14
1991-92	28	13	41	54
1992-93	4	0	4	6
1993-94	6	0	6	9
1994-95	6	0	6	9
1995-96	38	0	38	54
1996-97	3	0	3	4
1997-98	0	0	0	0
1998-99	9	0	9	13
Mean of 1994-95 to 1998-99			11	16

Appendix Table A.7 Total Harvest and Estimated Run Size for Winter Run Steelhead in West Twin River.

Winter Return Year	Sport Harvest	Tribal Harvest	Total Harvest	Estimated Run Size
1979-80	10	0	10	14
1980-81	0	0	0	0
1981-82	17	0	17	24
1982-83	6	0	6	9
1983-84	62	0	62	89
1984-85	0	0	0	0
1985-86	16	0	16	23
1986-87	17	0	17	24
1987-88	27	0	27	39
1988-89	15	4	19	26
1989-90	14	9	23	30
1990-91	2	0	2	3
1991-92	8	0	8	11
1992-93	14	0	14	20
1993-94	8	0	8	11
1994-95	23	0	23	33
1995-96	9	0	9	13
1996-97	9	0	9	13
1997-98	0	0	0	0
1998-99	0	0	0	0
Mean of 1994-95 to 1998-99			8	12

Appendix Table A.8 Total Harvest and Estimated Run Size for Winter Run Steelhead in Deep Creek.

Winter Return Year	Sport Harvest	Tribal Harvest	Total Harvest	Estimated Run Size
1979-80	7	0	7	10
1980-81	39	0	39	56
1981-82	27	0	27	39
1982-83	98	0	98	140
1983-84	95	0	95	136
1984-85	93	0	93	133
1985-86	49	0	49	70
1986-87	70	0	70	100
1987-88	56	17	73	99
1988-89	54	11	65	89
1989-90	10	12	22	28
1990-91	17	10	27	35
1991-92	32	5	37	51
1992-93	24	0	24	34
1993-94	5	0	5	7
1994-95	22	0	22	31
1995-96	3	0	3	4
1996-97	0	0	0	0
1997-98	0	0	0	0
1998-99	0	0	0	0
Mean of 1994-95 to 1998-99			5	7

Appendix Table A.9 Total Harvest and Estimated Run Size for Winter Run Steelhead in Pysht River.

Winter Return Year	Sport Harvest	Tribal Harvest	Total Harvest	Estimated Run Size	Smolt Year	Smolts Stocked	Smolt-to-harvest Index[1]
1978-79					1977	15,100	
1979-80	123	179	302	375	1978	15,300	0.0198
1980-81	158	145	303	387	1979	11,800	0.0238
1981-82	108	108	216	274	1980	9,000	0.0222
1982-83	114	194	308	378	1981	15,100	0.0228
1983-84	259	171	430	560	1982	13,052	0.0316
1984-85	440	205	645	856	1983	14,100	0.0467
1985-86	131	177	308	384	1984	9,100	0.0295
1986-87	280	156	436	573	1985	10,600	0.0427
1987-88	351	173	524	694	1986	10,100	0.0512
1988-89	246	184	430	556	1987	10,300	0.0420
1989-90	97	113	210	264	1988	10,100	0.0207
1990-91	49	30	79	103	1989	10,450	0.0076
1991-92	212	204	416	530	1990	10,100	0.0408
1992-93	166	141	307	394	1991	13,500	0.0240
1993-94	120	181	301	400	1992	11,400	0.0254
1994-95	206	128	334	437	1993	21,500	0.0177
1995-96	147	103	250	324	1994	15,351	0.0147
1996-97	197	118	315	413	1995	15,215	0.0207
1997-98	23	11	34	45	1996	10,070	0.0030
1998-99	129	28	157	215	1997	10,010	0.0156
					1998	10,017	
Mean of 1994-95 to 1998-99			218	287			

[1]Index is calculated assuming 0.735 Age 3 and 0.265 Age 4 contribution of hatchery reared fish.

Appendix Table A.10 Total Harvest and Estimated Run Size for Winter Run Steelhead in Clallam River.

Winter Return Year	Sport Harvest	Tribal Harvest	Total Harvest	Estimated Run Size	Smolt Year	Smolts Stocked	Smolt-to-harvest Index[1]
1978-79					1977		
1979-80	106		106	151	1978	10,200	
1980-81	74		74	106	1979	5,500	0.0110
1981-82	58		58	83	1980	5,200	0.0110
1982-83	132		132	189	1981	10,100	0.0150
1983-84	74	59	133	171	1982	8,600	0.0148
1984-85	40	157	197	232	1983	10,000	0.0205
1985-86	29	74	103	124	1984	10,300	0.0101
1986-87	114	93	207	266	1985	10,400	0.0200
1987-88	73	309	382	448	1986	10,100	0.0375
1988-89	45	144	189	224	1987	5,208	0.0291
1989-90	47	15	62	84	1988	5,100	0.0121
1990-91	26	1	27	38	1989	5,068	0.0053
1991-92	28	67	95	114	1990	0	0.0707
1992-93	35	9	44	60	1991	5,900	0.0101
1993-94	48	21	69	92	1992	4,000	0.0153
1994-95	88	0	88	126	1993	6,400	0.0153
1995-96	61	0	61	87	1994	5,247	0.0199
1996-97	57	0	57	81	1995	5,375	0.0107
1997-98	5	0	5	7	1996	5,152	0.0009
1998-99	89	3	92	130	1997	5,000	0.0183
				-	1998	5,010	
Mean of 1994-95 to 1998-99			61	86			

[1]Index is calculated assuming 0.735 Age 3 and 0.265 Age 4 contribution of hatchery reared fish.

Appendix Table A.11 Total Harvest and Estimated Run Size for Winter Run Steelhead in Hoko River.

Winter Return Year	Sport Harvest	Tribal Harvest	Total Harvest	Escapement	Run Size	Exploitation Rate[1]
1978-79						
1979-80	292	279	571			
1980-81	161	462	623			
1981-82	142	246	388			
1982-83	279	269	548			
1983-84	210	223	433			
1984-85	226	292	518	802	1,320	0.3924
1985-86	253	103	356	726	1,082	0.3290
1986-87	510	486	996	792	1.788	0.5570
1987-88	275	386	661	913	1,574	0.4199
1988-89	240	258	498	699	1,197	0.4160
1989-90	174	157	331	770	1,101	0.3006
1990-91	91	41	132	861	993	0.1329
1991-92	197	122	319	394	713	0.4474
1992-93	286	168	454	425	879	0.5165
1993-94	169	177	348	453	799	0.4330
1994-95	284	263	547	792	1,339	0.4085
1995-96	220	340	560	667	1,227	0.4564
1996-97	373	138	511	397	908	0.5628
1997-98	79	208	287	756	1043	0.2752
1998-99	283	445	729	990	1719	0.4241
Forecast Run Size (Return years 1994-95 through 1998-99)						1247
Mean Exploitation Rate (Return years 1984-85 through 1998-99; exclude 1990/91)						0.4242
Total Harvestable (Run Size * Exploitation Rate)						529

Smolt Year	Smolts Stocked	Smolt-to-harvest Index[2]
1977	15,000	
1978	10,200	0.0498
1979	12,800	0.0514
1980	5,500	0.0522
1981	10,000	0.0622
1982	8,600	0.0483
1983	15,000	0.0389
1984	10,500	0.0304
1985	15,600	0.0699
1986	15,100	0.0434
1987	12,000	0.0388
1988	15,100	0.0232
1989	15,500	0.0086
1990	15,600	0.0205
1991	16,000	0.0286
1992	15,900	0.0219
1993	23,500	0.0255
1994	21,000	0.0259
1995	20,855	0.0245
1996	20,182	0.0141
1997	20,156	0.0362
1998	21,065	

[1]Spawning escapement estimates are deemed conservative because surveys have generally been limited to periods after March 1. Run Size = (Total Harvest + Escapement). Exploitation Rate= (Total Harvest / Run Size).

[2]Index is calculated assuming 0.735 Age 3 and 0.265 Age 4 contribut[illegible] of hatchery reared fish.

Appendix Table A.12 Total Harvest and Estimated Run Size for Winter Run Steelhead in Sekiu River.

Winter Return Year	Sport Harvest	Tribal Harvest	Total Harvest	Estimated Run Size	Smolt Year	Smolts Stocked	Smolt-to-harvest Index[1]
1979-80	24	111	135	158	1978		
1980-81	27	130	157	183	1979		
1981-82	27	25	52	66	1980		
1982-83	48	78	126	155	1981		
1983-84	25	53	78	95	1982		
1984-85	29	53	82	100	1983		
1985-86	42	149	191	226	1984		
1986-87	65	16	81	111	1985		
1987-88	36	74	110	134	1986		
1988-89	32	56	88	108	1987		
1989-90	10	33	43	51	1988		
1990-91	4	39	43	49	1989	5,700	
1991-92	20	20	40	51	1990	5,000	0.0098
1992-93	25	17	42	55	1991	4,800	0.0087
1993-94	28	48	76	93	1992	5,000	0.0154
1994-95	71	30	101	135	1993	12,100	0.0099
1995-96	34	24	58	75	1994	8,528	0.0061
1996-97	40	17	57	76	1995	10,104	0.0059
1997-98	6	7	13	16	1996	9,605	0.0013
1998-99	89	3	92	130	1997	9,602	0.0096
					1998	10,447	
Mean of 1994-95 to 1998-99			64	87			

[1] Index is calculated assuming 0.225 Age-3 and 0.265 Age-4 contribution of hatchery reared fish.

Appendix Table A.13a Total Harvest and Estimated Run Size for Summer Run Steelhead in Dungeness River.

Summer Return Year	Sport Harvest	Tribal Harvest	Total Harvest	Age 1.1	Age 1.2	Age 1.3	Smolt Year	Smolts Stocked	Age 1.1 Return Rate[1]	Age 1.2 Return Rate	Age 1.3 Return Rate	Total Return Rate
							1977	19,530		0.0029	0.0019	0.0048
1979	71	0	71	3	56	10	1978	18,300	0.0001	0.0112	0.0024	0.0138
1980	254	6	260	10	205	38	1979	20,025	0.0005	0.0120	0.0010	0.0135
1981	274	32	306	12	241	45	1980	10,010	0.0012	0.0109	0.0014	0.0135
1982	136	2	138	5	109	20	1981	9,701	0.0005	0.0080	0.0024	0.0110
1983	99	0	99	4	78	14	1982	9,990	0.0004	0.0128	0.0008	0.0139
1984	162	0	162	6	128	24	1983	4,150	0.0015	0.0101	0.0018	0.0134
1985	53	0	53	2	42	8	1984	5,000	0.0004	0.0082	0.0018	0.0104
1986	52	0	52	2	41	8	1985	10,379	0.0002	0.0047	0.0011	0.0060
1987	62	0	62	2	49	9	1986	5,150	0.0005	0.0119	0.0029	0.0153
1988	71	7	78	3	61	11	1987	10,178	0.0003	0.0078	0.0004	0.0085
1989	101	0	101	4	80	15	1988	10,100	0.0004	0.0021	0.0005	0.0030
1990	27	0	27	1	21	4	1989	10,123	0.0001	0.0030	0.0005	0.0035
1991	38	0	38	1	30	6	1990	6,120	0.0002	0.0042	0.0005	0.0050
1992	33	0	33	1	26	5	1991	0	-----	-----	-----	-----
1993	21	0	21	1	17	3	1992	10,009	0.0001	0.0033	0.0002	0.0036
1994	42	0	42	2	33	6	1993	16,100	0.0001	0.0142	0.0003	0.0146
1995	16	0	16	1	13	2	1994	10,500	0.0001	0.0000		
1996	36	0	36	1	28	5	1995	0	N/A			
1997	3	0	3	0	3	0	1996	0	N/A			
1998	3	0	3	0	3	0	1997	0	N/A			
							1998	0	N/A			
Mean of Smolt Year 1989-94 (Age 1.1); 1989-94 (Age 1.2); 1988-93 (Age 1.3) [w/o 1991]									0.00012	0.00495	0.00042	0.00597
Smolts Planted									0	0	0	
Return to Harvest (x)									0	0	0	0
Total Return to Harvest (including "other" ages) (x / 0.972)												0
Run Size [x / 0.972] / 0.80												0

Appendix Table A.13b Total Harvest and Estimated Run Size for Summer Run Steelhead in Dungeness River.

Summer Return Year	Sport Harvest	Tribal Harvest	Total Harvest	Estimated Run Size
1979	71	0	71	101
1980	254	6	260	371
1981	274	32	306	437
1982	136	2	138	197
1983	99	0	99	141
1984	162	0	162	231
1985	53	0	53	76
1986	52	0	52	74
1987	62	0	62	89
1988	71	7	78	111
1989	101	0	101	144
1990	27	0	27	39
1991	38	0	38	54
1992	33	0	33	47
1993	21	0	21	30
1994	42	0	42	60
1995	16	0	16	23
1996	36	0	36	51
1997	3	0	3	4
1998	3	0	3	4
Mean of 1994 to 1998			20	28

Appendix Table A.14 Total Harvest and Estimated Run Size for Summer Run Steelhead in Morse Creek.

Summer Return Year	Sport Harvest	Tribal Harvest	Total Harvest	Estimated Run Size
1979	17	0	17	24
1980	44	0	44	63
1981	10	0	10	14
1982	12	0	12	15
1983	6	0	6	9
1984	7	0	7	10
1985	17	0	17	24
1986	4	0	4	6
1987	2	0	2	3
1988	0	0	0	0
1989	4	0	4	6
1990	2	0	2	3
1991	4	0	4	6
1992	0	0	0	0
1993	3	0	3	4
1994	3	0	3	4
1995	0	0	0	0
1996	6	0	6	9
1997	10	0	10	14
1998	3	0	3	4
Mean of 1994 to 1998			4	6

Appendix Table A.15 Total Harvest and Estimated Run Size for Summer Run Steelhead in Lyre River.

Summer Return year	Sport Harvest	Tribal Harvest	Total Harvest	Age 1.1	Age 1.2	Age 1.3
1982	162	0	162	6	128	24
1983	155	0	155	6	122	23
1984	252	0	252	10	199	37
1985	88	0	88	3	69	13
1986	97	0	97	4	76	14
1987	77	0	77	3	61	11
1988	79	0	79	3	62	12
1989	130	0	130	5	102	19
1990	66	0	66	3	52	10
1991	23	0	23	1	18	3
1992	32	0	32	1	25	5
1993	26	0	27	1	21	4
1994	167	0	167	6	132	24
1995	219	0	219	8	173	32
1996	361	0	361	14	284	53
1997	74	0	74	3	58	11
1998	16	0	16	1	13	2

Smolt Year	Smolts Stocked	Age 1.1 Return Rate[1]	Age 1.2 Return rate	Age 1.3 Return rate	Total Return Rate
1980	10,010		0.0128	0.0023	0.0150
1981	11,322	0.0005	0.0108	0.0032	0.0146
1982	7,800	0.0008	0.0255	0.0016	0.0279
1983	4,000	0.0024	0.0173	0.0035	0.0233
1984	8,060	0.0004	0.0095	0.0014	0.0113
1985	7,525	0.0005	0.0081	0.0015	0.0101
1986	5,000	0.0006	0.0125	0.0038	0.0168
1987	9,100	0.0003	0.0113	0.0011	0.0127
1988	10,008	0.0005	0.0052	0.0003	0.0060
1989	10,260	0.0002	0.0018	0.0005	0.0025
1990	8,235	0.0001	0.0031	0.0005	0.0037
1991	0				
1992	9,900	0.0001	0.0133	0.0032	0.0166
1993	16,200	0.0004	0.0107	0.0033	0.0143
1994	20,579	0.0004	0.0138	0.0005	0.0147
1995	21,422	0.0006	0.0027	0.0001	
1996	15,241	0.0002	0.0008		
1997	5,100	0.0001			
1998	10,001				

Mean of Smolt Year 1990-95 (Age 1.1); 1989-94 (Age 1.2); 1988-93 (Age 1.3) [excluding 1991]	0.0003	0.0083	0.0015	0.0104
Smolts Planted	10,001	5,100	15,241	
Return to Harvest (x)	3	42	23	68
Total Return to Harvest (including "other" ages) (x / 0.972)				71
Run Size [x / 0.972] / 0.80				88

[1]Past returns were broken down using the average return year age composition of Kalama River Summer Steelhead (1.1= 3.8%; 1.2= 78.8%; 1.3= 14.6%). Other age groups and repeat spawners are accounted for by dividing by 0.972 .

Appendix Table A.16

Estimated Wild Steelhead Spawner Escapement for Strait of Juan de Fuca Streams (Spawner escapement estimates are deemed conservative because surveys (redd counts) have generally been limited to periods after March 1).

Return Year	Snow Creek[1]	Dungeness River	Morse Creek	Salt Creek	Lyre River	East Twin River	West Twin River	Deep Creek	Pysht River	Hoko River
1976-77	106									
1977-78	140									
1978-79	78									
1979-80	120									
1980-81	128									
1981-82	109									
1982-83	52									
1983-84	131		139						326	
1984-85	154		145						238	802
1985-86	61		105						398	726
1986-87	72		118						360	792
1987-88	71	438	138						445	913
1988-89	29	429	60						254	699
1989-90	12	408	78						265	770
1990-91	34	423	91						242	861
1991-92	51	292	100						200	394
1992-93	30	338							233	425
1993-94	41	337							203	453
1994-95	45		128	123	79	79	120	117	220	792
1995-96	139	261	89	181	81	55	112	203	284	667
1996-97	79		183	125		65	63	122	335	397[2]
1997-98	64		102	206		186	168	170	384	756[3]
1998-99			81[4]	237		52	105	152	452	990[3]

[1] For Snow Creek, based on steelhead adults trapped and redd counts each return year; except 1995-96 based on redd counts.

[2] Minimum estimates in 1997 due to high water/poor visibility during substantial portion of the survey season.

[3] Does not include tributary escapement estimates from Makah surveys.

[4] Only one survey conducted during season due to high flows. No surveys for Dungeness and Lyre rivers because of high flows.

Appendix Tables B

Supporting Data for Estimation of Run Size and Harvestable Shares for Elwha River Steelhead

Appendix Table B.1
Estimated Return of Hatchery Reared Summer Steelhead to the Elwha River.

Return Year	Sport Harvest	Tribal Harvest	Total Harvest	Age 1.1	Age 1.2	Age 1.3	Smolt Year	Smolts Stocked	Age 1.1 Return Rate[1]	Age 1.2 Return Rate	Age 1.3 Return Rate
							1976	19,926			0.0036
							1977	20,776		0.0186	0.0056
1979	468	23	491	19	387	72	1978	27,100	0.0007	0.0230	0.0047
1980	790	0	790	30	623	115	1979	20,007	0.0015	0.0347	0.0057
1981	858	22	880	33	693	128	1980	20,020	0.0017	0.0305	0.0050
1982	534	242	776	29	611	113	1981	26,115	0.0011	0.0208	0.0024
1983	651	38	689	26	543	101	1982	17,820	0.0015	0.0193	0.0028
1984	435	1	436	17	344	64	1983	15,175	0.0011	0.0178	0.0013
1985	258	85	343	13	270	50	1984	20,285	0.0006	0.0051	0.0010
1986	108	24	132	5	104	19	1985	20,700	0.0002	0.0051	0.0018
1987	127	7	134	5	106	20	1986	18,900	0.0003	0.0109	0.0029
1988	157	104	261	10	206	38	1987	19,800	0.0005	0.0147	0.0024
1989	281	89	370	14	292	54	1988	25,400	0.0006	0.0101	0.0005
1990	206	118	324	12	255	47	1989	19,826	0.0006	0.0035	0.0005
1991	68	19	87	3	69	13	1990	15,000	0.0002	0.0033	0.0002
1992	25	38	63	2	50	9	1991	0			
1993	20	1	21	1	17	3	1992	23,598	0.0000	0.0034	0.0007
1994	92	11	103	4	81	15	1993	25,070	0.0002	0.0036	0.0006
1995	107	8	115	4	91	17	1994	0			
1996	101	20	121	5	95	18	1995	25,118	0.0002	0.0037	0.0007
1997	30	2	32	4	95	5	1996	20,190	0.0002	0.0004	0.0002
							1997	10,025			
							1998	10,012			
Mean of smolt Year 1989-1995 (Age 1.1); 1988-1993 (Age 1.2 and 1.3); [excluding 1991and 1994]									0.0002	0.0048	0.0005
Smolts Stocked									10,100	10,012	10,025
Return to Harvest (X)											55
Total Return to Harvest (including "other ages") (X / 0.972)											57
Run Size [X / 0.972] / 0.70											81

[1]Past returns were broken down using the average return year age composition of Kalama River Summer Steelhead (1.1= 3.8%; 1.2= 78.8%; 1.3= 14.6%). Other age groups and repeat spawners are accounted for by dividing by 0.972 .

Appendix Tables C

Supporting Data for Estimation of Run Size and Harvestable Shares for Hood Canal Steelhead

Appendix Table C.1
Run Size Forecasts and Harvest Forecasts for Winter and Summer Run Steelhead
in Hood Canal Streams during the 1999-2000 Management Season

Stream	Run Size Forecast	Harvest Rate	Harvest Forecast
Winter Run Steelhead			
Quilcene River	6	0.8	5
Dosewallips River	10	0.8	8
Duckabush River	11	0.8	9
Hamma Hamma River	0	0.8	0
Dewatto River	0	0.8	0
Skokomish River	28	0.8	22
Tahuya River	8	0.8	6
Union River	3	0.8	2
Total	66		52
Summer Run Steelhead			
Dosewallips River	3	0.8	2
Duckabush River	4	0.8	3
Skokomish River	13	0.8	10
Total	20		15

Appendix Table C.2 Total Harvest and Estimated Run Size for Winter Run Steelhead in Quilcene River.

Winter Return Year	Sport Harvest River	Sport Harvest MA 12	Sport Harvest MA 9	Sport Harvest TOTAL	Tribal Harvest River	Tribal Harvest MA 9A	Tribal Harvest MA 12	Tribal Harvest TOTAL	GRAND TOTAL HARVEST	Estimated Run Size	Smolt Year	Smolts Stocked	Smolt-to-harvest Index[1]
1978-79											1977	15,100	
1979-80	95	0	10	105	0	19	0	19	124	171	1978	15,300	0.0081
1980-81	118	0	3	121	0	31	0	31	152	207	1979	9,600	0.0137
1981-82	48	0	2	50	0	13	0	13	63	86	1980	9,585	0.0066
1982-83	19	0	1	20	0	20	4	24	44	55	1981	15,043	0.0032
1983-84	51	1	2	54	0	7	0	7	61	85	1982	13,060	0.0045
1984-85	47	1	3	51	16	12	0	28	79	104	1983	11,900	0.0065
1985-86	22	0	1	23	7	4	1	12	35	46	1984	10,300	0.0033
1986-87	26	0	1	27	8	7	0	15	42	55	1985	10,200	0.0041
1987-88	13	0	0	13	0	5	0	5	18	24	1986	10,200	0.0018
1988-89	10	0	0	10	0	5	0	5	15	20	1987	5,300	0.0023
1989-90	22	1	0	23	0	1	0	1	24	34	1988	5,100	0.0047
1990-91	4	0	2	6	0	0	0	0	6	9	1989	10,160	0.0007
1991-92	0	0	0	0	0	0	0	0	0	0	1990	10,100	0.0000
1992-93	2	0	0	2	0	0	0	0	2	3	1991	0	0.0007
1993-94	0	0	0	0	0	0	0	0	0	0	1992	0	N/A
1994-95	6	0	0	6	0	2	0	2	8	11	1993	0	N/A
1995-96	0	0	0	0	0	0	0	0	0	0	1994	0	N/A
1996-97	0	0	0	0	0	0	0	0	0	0	1995	0	N/A
1997-98	3	0	0	3	0	0	0	0	3	4	1996	0	N/A
1998-99	10	0	0	10	0	0	0	0	10	14	1997	0	N/A
											1998	0	N/A
Mean 1994-95 to 1998-99									4	6			

[1]Index is calculated assuming 0.735 Age 3 and 0.265 Age 4 contribution of hatchery reared fish.

Appendix Table C.3 Total Harvest and Estimated Run Size for Winter Run Steelhead in Dosewallips River.

Winter Return Year	Sport Harvest River	Sport Harvest MA 12	Sport Harvest MA 9	Sport Harvest TOTAL	Tribal Harvest River	Tribal Harvest MA 9A	Tribal Harvest MA 12	Tribal Harvest TOTAL	GRAND TOTAL HARVEST	Estimated Run Size	Smolt Year	Smolts Stocked	Smolt-to-harvest Index[1]
1978-79											1977	20,000	
1979-80	476	1	50	527	0	94	0	94	621	857	1978	30,000	0.0227
1980-81	369	1	10	380	2	99	0	101	481	655	1979	25,200	0.0182
1981-82	218	0	14	232	136	99	1	236	468	594	1980	23,200	0.0197
1982-83	173	2	22	197	134	70	0	204	401	508	1981	23,700	0.0170
1983-84	262	4	14	280	143	58	0	201	481	623	1982	18,200	0.0245
1984-85	283	7	16	306	119	75	0	194	500	653	1983	20,000	0.0256
1985-86	167	1	6	174	91	33	6	130	304	393	1984	25,100	0.0128
1986-87	154	2	6	162	0	30	1	31	193	266	1985	20,800	0.0088
1987-88	113	0	5	118	9	43	1	53	171	227	1986	19,600	0.0086
1988-89	34	0	1	35	0	17	1	18	53	70	1987	15,000	0.0033
1989-90	49	0	3	52	0	3	0	3	55	78	1988	25,400	0.0024
1990-91	32	0	1	33	0	0	0	0	33	47	1989	25,000	0.0013
1991-92	6	0	0	6	0	0	0	0	6	9	1990	15,100	0.0000
1992-93	7	0	1	8	0	2	0	2	10	14	1991	5,600	0.0012
1993-94	23	0	0	23	0	1	0	1	24	34	1992	15,000	0.0019
1994-95	6	0	0	6	0	7	0	7	13	16	1993	20,100	0.0007
1995-96	10	0	0	10	0	0	0	0	10	14	1994	14,742	0.0060
1996-97	3	0	0	3	0	0	0	0	3	4	1995	5,000	0.0004
1997-98	11	0	0	11	0	0	0	0	11	16	1996	12,648	0.0014
1998-99	0	0	0	0	0	0	0	0	0	0	1997	0	
											1998	12,540	
											1999	12,339	
Mean 1994-95 to 1998-99									7	10			

[1] Index is calculated assuming 0.735 Age 3 and 0.265 Age 4 contribution of hatchery reared fish.

Appendix Table C.4 Total Harvest and Estimated Run Size for Winter Run Steelhead in Duckabush River.

Winter Return Year	Sport Harvest River	Sport Harvest MA 12	Sport Harvest MA 9	Sport Harvest TOTAL	Tribal Harvest River	Tribal Harvest MA 9A	Tribal Harvest MA 12	Tribal Harvest TOTAL	GRAND TOTAL HARVEST	Estimated Run Size	Smolt Year	Smolts Stocked	Smolt-to-harvest Index[1]
1978-79											1977	20,000	
1979-80	575	1	50	626	0	94	0	94	720	999	1978	26,400	0.0291
1980-81	288	1	8	297	16	81	1	98	395	533	1979	15,100	0.0218
1981-82	253	0	13	266	75	92	0	167	433	566	1980	15,000	0.0288
1982-83	148	1	15	164	59	47	0	106	270	352	1981	17,800	0.0158
1983-84	230	4	12	246	117	49	0	166	412	536	1982	18,100	0.0229
1984-85	231	5	11	247	47	52	0	99	346	463	1983	20,000	0.0177
1985-86	201	1	6	208	52	33	6	91	299	398	1984	20,000	0.0150
1986-87	145	2	6	153	12	31	1	44	197	267	1985	20,100	0.0098
1987-88	111	0	4	115	0	39	0	39	154	208	1986	22,300	0.0071
1988-89	75	1	3	79	0	38	1	39	118	156	1987	5,000	0.0123
1989-90	61	1	3	65	0	4	0	4	69	97	1988	20,000	0.0043
1990-91	20	0	1	21	0	0	0	0	21	30	1989	20,000	0.0011
1991-92	48	1	2	51	0	3	0	3	54	76	1990	15,000	0.0033
1992-93	17	1	2	20	0	6	0	6	26	35	1991	0	0.0065
1993-94	13	0	0	13	0	2	0	2	15	21	1992	15,100	0.0014
1994-95	14	0	0	14	0	10	0	10	24	31	1993	17,000	0.0015
1995-96	16	0	0	16	0	0	0	0	16	23	1994	15,142	0.0010
1996-97	9	0	0	9	0	0	0	0	9	13	1995	5,000	0.0012
1997-98	9	0	0	9	0	0	0	0	9	13	1996	10,080	0.0015
1998-99	3	0	0	3	0	0	0	0	3	4	1997	0	
											1998	10,032	
											1999	10,638	
Mean 1994-95 to 1998-99									10	11			

[1] Ratio of Column 0.735 Age 3 and 0.265 Age 4 contribution of hatchery reared fish.

Appendix Table C.5 Total Harvest and Estimated Run Size for Winter Run Steelhead in Hamma Hamma River.

Winter Return Year	Sport Harvest River	Sport Harvest MA 12	Sport Harvest MA 9	Sport Harvest TOTAL	Tribal Harvest River	Tribal Harvest MA 9A	Tribal Harvest MA 12	Tribal Harvest TOTAL	GRAND TOTAL HARVEST	Estimated Run Size
1979-80	78	0	8	86	0	15	0	15	101	140
1980-81	43	0	1	44	0	11	0	11	55	75
1981-82	90	0	4	94	20	31	0	51	145	191
1982-83	38	0	3	41	0	9	0	9	50	69
1983-84	150	2	5	157	0	21	0	21	178	248
1984-85	150	3	6	159	0	28	0	28	187	258
1985-86	38	0	1	39	0	5	1	6	45	62
1986-87	47	1	2	50	0	9	0	9	59	81
1987-88	24	0	1	25	0	8	0	8	33	45
1988-89	10	0	0	10	0	5	0	5	15	20
1989-90	6	0	0	6	0	0	0	0	6	9
1990-91	6	0	0	6	0	0	0	0	6	9
1991-92	4	0	0	4	0	0	0	0	4	6
1992-93	2	0	0	2	0	0	0	0	2	3
1993-94	0	0	0	0	0	0	0	0	0	0
1994-95	0	0	0	0	0	0	0	0	0	0
1995-96	0	0	0	0	0	0	0	0	0	0
1996-97	0	0	0	0	0	0	0	0	0	0
1997-98	0	0	0	0	0	0	0	0	0	0
1998-99	0	0	0	0	0	0	0	0	0	0
Mean 1994-95 to 1998-99									0	0

Appendix Table C.6 Total Harvest and Estimated Run Size for Winter Run Steelhead in Dewatto River.

Winter Return Year	Sport Harvest River	Sport Harvest MA 12	Sport Harvest MA 9	Sport Harvest TOTAL	Tribal Harvest River	Tribal Harvest MA 9A	Tribal Harvest MA 12	Tribal Harvest TOTAL	GRAND TOTAL HARVEST	Estimated Run Size	Smolt Year	Smolts Stocked	Smolt-to-harvest Index[1]
1978-79											1977	10,400	
1979-80	74	8	0	82	0	15	0	15	97	134	1978	10,000	0.0096
1980-81	23	1	0	24	0	6	0	6	30	41	1979	10,000	0.0030
1981-82	44	2	0	46	8	15	0	23	69	91	1980	10,000	0.0069
1982-83	38	3	0	41	0	9	0	9	50	69	1981	12,400	0.0043
1983-84	36	1	0	37	0	5	0	5	42	58	1982	9,996	0.0039
1984-85	73	3	1	77	0	14	0	14	91	126	1983	12,000	0.0079
1985-86	102	4	0	106	91	25	5	121	227	286	1984	12,000	0.0189
1986-87	19	4	1	24	82	20	1	103	127	149	1985	11,000	0.0113
1987-88	13	3	0	16	61	26	0	87	103	120	1986	9,900	0.0101
1988-89	4	0	0	4	0	2	0	2	6	8	1987	3,000	0.0012
1989-90	2	0	0	2	0	0	0	0	2	3	1988	10,100	0.0002
1990-91	4	0	0	4	0	0	0	0	4	6	1989	14,800	0.0003
1991-92	0	0	0	0	0	0	0	0	0	0	1990	10,000	0.0000
1992-93	0	0	0	0	0	0	0	0	0	0	1991	0	0.0000
1993-94	3	0	0	3	0	0	0	0	3	4	1992	0	
1994-95	0	0	0	0	0	0	0	0	0	0	1993	0	
1995-96	0	0	0	0	0	0	0	0	0	0	1994	0	
1996-97	0	0	0	0	0	0	0	0	0	0	1995	0	
1997-98	0	0	0	0	0	0	0	0	0	0	1996	0	
1998-99	0	0	0	0	0	0	0	0	0	0	1997	0	
											1998	0	
Mean 1994-95 to 1998-99									0	0			

[1] 0.735 for 2 and 0.265 for 1 year(s) of hatchery reared fish.

Appendix Table C.7 Total Harvest and Estimated Run Size for Winter Run Steelhead in Skokomish River.

Winter Return Year	Sport Harvest River	Sport Harvest MA 12	Sport Harvest MA 9	Sport Harvest TOTAL	Tribal Harvest River	Tribal Harvest MA 9A	Tribal Harvest MA 12	Tribal Harvest TOTAL	GRAND TOTAL HARVEST	Estimated Run Size	Smolt Year	Smolts Stocked	Smolt-to-harvest Index[1]
1978-79											1977	35,800	
1979-80	302	1	43	346	113	82	0	195	541	711	1978	18,700	0.0233
1980-81	161	1	11	173	268	114	0	382	555	672	1979	10,500	0.0438
1981-82	145	0	19	164	347	137	0	484	648	772	1980	17,000	0.0424
1982-83	202	2	30	234	211	94	0	305	539	673	1981	27,200	0.0220
1983-84	202	4	13	219	165	52	0	217	436	554	1982	14,800	0.0241
1984-85	327	11	26	364	306	118	2	426	790	993	1983	27,082	0.0332
1985-86	332	2	16	350	400	95	18	513	863	1,070	1984	29,600	0.0290
1986-87	164	5	17	186	274	85	3	362	548	668	1985	23,100	0.0221
1987-88	87	1	12	100	231	112	1	344	444	525	1986	20,900	0.0207
1988-89	59	2	5	66	51	55	1	107	173	213	1987	20,000	0.0085
1989-90	68	1	7	76	57	8	0	65	141	181	1988	44,800	0.0037
1990-91	16	2	4	22	23	1	2	26	48	60	1989	39,975	0.0012
1991-92	21	0	1	22	3	1	0	4	26	36	1990	39,000	0.0007
1992-93	2	0	1	3	13	3	0	16	19	22	1991	19,900	0.0008
1993-94	14	0	1	15	20	3	0	23	38	77	1992	28,500	0.0023
1994-95	9	0	1	10	0	14	1	15	25	31	1993	20,000	0.0011
1995-96	19	0	0	19	0	0	0	0	19	27	1994	39,130	0.0006
1996-97	27	0	0	27	0	0	0	0	31	44	1995	39,296	0.0007
1997-98	10	0	1	11	0	0	0	0	11	16	1996	53,684	
1998-99	15	0	0	15	0	0	0	0	15	21	1997	14,688	
											1998	53,495	
											1999	46,737	
Mean 1994-95 to 1998-99									20	28			

[1] Index is calculated assuming 0.735 Age 3 and 0.265 Age 4 contribution of hatchery reared fish.

Appendix Table C.8 Total Harvest and Estimated Run Size for Winter Run Steelhead in Tahuya River.

Winter Return Year	Sport Harvest River	Sport Harvest MA 12	Sport Harvest MA 9	Sport Harvest TOTAL	Tribal Harvest River	Tribal Harvest MA 9A	Tribal Harvest MA 12	Tribal Harvest TOTAL	GRAND TOTAL HARVEST	Estimated Run Size	Smolt Year	Smolts Stocked	Smolt-to-harvest Index[2]
1978-79											1977	10,000	
1979-80	109	11	0	120	0	22	0	22	142	196	1978	9,900	0.0143
1980-81	74	2	0	76	0	20	0	20	96	131	1979	10,100	0.0096
1981-82	37	1	0	38	0	10	1	11	49	67	1980	10,500	0.0047
1982-83	46	3	0	49	0	10	0	10	59	81	1981	10,700	0.0055
1983-84	71	3	1	75	11	12	0	23	98	133	1982	8,400	0.0109
1984-85	115	5	2	122	0	22	0	22	144	199	1983	15,100	0.0108
1985-86	86	2	0	88	0	11	2	13	101	140	1984	10,300	0.0087
1986-87	23	1	0	24	3	5	0	8	32	43	1985	10,000	0.0032
1987-88	24	1	0	25	0	8	0	8	33	45	1986	10,000	0.0033
1988-89	8	0	0	8	0	4	0	4	12	16	1987	10,000	0.0012
1989-90	8	1	0	9	0	1	0	1	10	14	1988	10,000	0.0010
1990-91	14	0	0	14	0	0	0	0	14	20	1989	15,000	0.0010
1991-92	2	2	0	4	0	0	0	0	4	6	1990	0	*0.0010
1992-93	7	0	2	9	0	2	0	2	11	15	1991	0	
1993-94	3	0	0	3	0	0	0	0	3	4	1992	0	
1994-95	3	0	0	3	0	2	0	2	5	7	1993	9,800	**0.0007
1995-96	10	0	0	10	0	0	0	0	10	14	1994	14,976	0.0007
1996-97	0	0	0	0	0	0	0	0	0	0	1995	0	0.0000
1997-98	0	0	0	0	0	0	0	0	0	1	1996	0	
1998-99	13	0	0	13	0	0	0	0	13	19	1997	0	
											1998	0	
Mean 1994-95 to 1998-99									6	8			

[2]Index is calculated assuming 0.735 Age 3 and 0.265 Age 4 contribution of hatchery reared fish.

*Actual Index ** Age 3 only

Appendix Table C.9 Total Harvest and Estimated Run Size for Winter Run Steelhead in Union River.

Winter Return Year	Sport Harvest River	Sport Harvest MA 12	Sport Harvest MA 9	Sport Harvest TOTAL	Tribal Harvest River	Tribal Harvest MA 9A	Tribal Harvest MA 12	Tribal Harvest TOTAL	GRAND TOTAL HARVEST	Estimated Run Size	Smolt Year	Smolts Stocked	Smolt-to-harvest Index[1]
1978-79											1977	10,100	
1979-80	81	8	0	89	0	16	0	16	105	145	1978	10,000	0.0105
1980-81	67	2	0	69	0	18	0	18	87	119	1979	10,100	0.0086
1981-82	41	2	0	43	0	11	0	11	54	74	1980	10,300	0.0053
1982-83	40	3	0	43	0	9	0	9	52	71	1981	9,900	0.0052
1983-84	43	2	0	45	0	6	0	6	51	71	1982	10,010	0.0051
1984-85	83	3	1	87	0	16	0	16	103	142	1983	10,000	0.0103
1985-86	143	3	0	146	0	18	4	22	168	233	1984	10,000	0.0168
1986-87	20	1	0	21	0	4	0	4	25	34	1985	9,400	0.0026
1987-88	12	0	0	12	0	4	0	4	16	22	1986	10,000	0.0016
1988-89	38	1	2	41	0	19	0	19	60	80	1987	10,000	0.0060
1989-90	12	1	0	13	0	1	0	1	14	20	1988	15,000	0.0010
1990-91	14	0	0	14	0	0	0	0	14	20	1989	14,850	0.0009
1991-92	4	0	0	4	0	0	0	0	4	6	1990	10,035	0.0004
1992-93	13	0	2	15	0	4	0	4	19	26	1991	5,000	0.0030
1993-94	0	0	0	0	0	1	0	1	1	1	1992	10,000	0.0001
1994-95	3	0	0	3	0	3	0	3	6	8	1993	11,500	0.0005
1995-96	3	0	0	3	0	0	0	0	3	4	1994	15,028	0.0002
1996-97	0	0	0	0	0	0	0	0	0	0	1995	0	0.0000
1997-98	0	0	0	0	0	0	0	0	0	0	1996	0	0.0000
1998-99	0	0	0	0	0	0	0	0	0	0	1997	0	
											1998	0	
Mean 1994-95 to 1998-99									2	3			

Appendix Table C.10 Total Harvest and Estimated Run Size for Summer Run Steelhead in Dosewallips River.

Summer Return Year	NonTreaty Harvest	Treaty Harvest	Total Harvest	Estimated Run Size
1979	3	0	3	4
1980	33	0	33	47
1981	23	0	23	33
1982	30	0	30	43
1983	11	0	11	16
1984	21	0	21	30
1985	4	0	4	6
1986	15	0	15	21
1987	2	0	2	3
1988	8	0	8	11
1989	8	0	8	11
1990	9	0	9	13
1991	2	0	2	3
1992	2	0	2	3
1993	3	0	3	4
1994	6	0	6	9
1995	0	0	0	0
1996	6	0	6	9
1997	0	0	0	0
1998	0	0	0	0
Mean 1994 to 1998			2	3

Appendix Table C.11 Total Harvest and Estimated Run Size for Summer Run Steelhead in Duckabush River.

Summer Return Year	Nontreaty Harvest	Treaty Harvest	Total Harvest	Estimated Run Size
1979	40	0	40	57
1980	49	0	49	70
1981	29	0	29	41
1982	6	0	6	9
1983	6	0	6	9
1984	10	0	10	14
1985	4	0	4	6
1986	16	0	16	23
1987	34	0	34	49
1988	6	0	6	9
1989	2	0	2	3
1990	14	0	14	20
1991	4	0	4	6
1992	9	0	9	13
1993	9	0	9	13
1994	3	0	3	4
1995	7	0	7	10
1996	0	0	0	0
1997	0	0	0	0
1998	3	0	3	4
Mean 1994 to1998			3	4

Appendix Table C.12 Total Harvest and Estimated Run Size for Summer Run Steelhead in Skokomish River.

Summer Return Year	Nontreaty Harvest	Treaty Harvest	Total Harvest	Estimated Run Size
1979	6	5	11	14
1980	17	2	19	27
1981	20	0	20	29
1982	56	0	56	80
1983	30	0	30	43
1984	74	0	74	106
1985	42	30	72	60
1986	42	34	76	64
1987	26	15	41	37
1988	8	0	8	11
1989	36	19	55	73
1990	2	0	2	3
1991	2	0	2	3
1992	4	0	4	6
1993	0	0	0	0
1994	0	0	0	0
1995	7	0	7	10
1996	35	0	35	50
1997	3	0	3	4
1998	0	0	0	0
Mean 1994 to 1998			9	13

Appendix Table C.15

Estimated Wild Steelhead Spawner Escapement for Hood Canal Streams. (Spawning escapement estimates are deemed conservative because surveys have generally been limited to periods after March 1)

Return Year	Union	Dewatto	Tahuya	Skokomish	Hamma Hamma	Dosewallips	Duckabush	L. Quilcene
1980-81		12	94					
1981-82		34	86	822				
1982-83		22	44	659				
1983-84		86	172	777				
1984-85		102	185	968				
1985-86		32	142	866				
1986-87			119	546				
1987-88		23	102	742				
1988-89		22	142	1444				
1989-90			164	370				
1990-91			122	729				
1991-92			73					
1992-93		40	75					
1993-94		18	77	473				
1994-95		22	78	398	13 a/	79		
1995-96		39	92		8 a/	55		
1996-97		11	144		35 a/	60	19 c/	
1997-98	45	28	126	373	18 a/	49 b/	6 b/	
1998-99	65	15	340	311	21 a/	99 c/	29 c/	29

a/ Estimated escapement in index area (river mile 0.3 to 2.2)
b/ Minimum estimate due to poor visibility during survey season
c/ Minimum estimates