

SUMMARY OF 2009 HOOD CANAL FORECASTS and Forecasting Methods

Species (Ref.#)	Origin	Type	Number		Mass Marked	Number Type	Model Designation
Chinook (A-1)	Mixed	Secondary	2,503			TRS	Natural
	Hatchery	Primary	40,142			TRS	Hatchery
Pink (A-2)	Natural	Primary	51,602			Total Recruits	
	Hatchery	Secondary	3,409			Total Recruits	
Summer Chum (A-3)	Natural (supplemented)	Secondary	18,948	18,009		Total Recruits	
Coho (A-4)¹	Natural	Primary	64,807			Total DA2 ¹ Recruits	Natural
	Natural	Secondary	2,999			Total DA2 ¹ Recruits	Hatchery
	Hatchery	Secondary	66,391		59,553	Total DA2 ¹ Recruits	Hatchery
Fall Chum (A-5)	Total Run		374,929	683,613		WA Run	

¹ See overleaf for Coho FRAM model inputs.

NOTES: Summer Chum salmon, although secondary, are under rehabilitation.

Forecasts for individual Hood Canal Management Units are:

Mainstem Hood Canal MU 8,593 8,593

SE Hood Canal MU 2,611 2,188

Quilcene MU 7,744 7,228

Natural Chinook salmon, although classified as “secondary”, are under rehabilitation.

Forecasts for individual Hood Canal Management Units are:

Mid Hood Canal MU 114

Skokomish MU (Nat.) 2,118

(Hat.) 26,696

Hoodsport MU 13,446

Miscell. 271

Fall Chum forecasts are preliminary. They will be updated in July 2009, when 2005-08 return data become available, and the 2000 - 2007 return year data have been reconciled and corrected.

Coho FRAM Model Inputs:

Stock Name	DA2	nuFRAM Stock	nuFRAM Age 3	Marked nuFRAM	Marked %
Port Gamble Net Pens	9,170	ptgamh	8,473	8,473	100.00%
Port Gamble Bay Natural	1,250	ptgamw	1,155		
Area 12/12B Natural	27,126	ar12bw	25,065		
Quilcene Bay Net Pens	8,229	qlcnbh	7,604	7,604	100.00%
Quilcene Hatchery	25,822	qlcenh	23,860	21,517	90.18%
Area 12A Natural	1,748	ar12aw	1,616		
Hoodspport Hatchery	n/a	hoodsh	0		
Area 12C/12D Natural	29,881	ar12dw	27,610		
George Adams Hatchery	23,170	gadamh	21,409	17,434	81.43%
Skokomish River Natural	7,800	skokrw	7,207		

A. Pre-season Forecasting Methods

A-1. Summer/Fall Chinook Salmon

Table A-1-a. Hood Canal Summer/Fall Chinook Releases at WDFW Hatcheries and Run Sizes.

Return Year (RY)	0+ Lbs. Released in RY-3	Return/Lb	Terminal Run
1984	39,232	0.42295	16,593
1985	40,098	0.50574	20,279
1986	55,499	0.39329	21,827
1987	50,811	0.51412	26,123
1988	55,967	0.50753	28,405
1989	65,510	0.38222	25,039
1990	54,674	0.23280	12,728
1991	100,366	0.18881	18,950
1992	101,102	0.02929	2,961
1993	89,517	0.05293	4,738
1994	78,335	0.04785	3,748
1995	82,895	0.11068	9,175
1996	73,472	0.11065	8,130
1997	32,571	0.23963	7,805
1998	58,652	0.27658	16,222
1999	89,149	0.33894	30,216
2000	87,306	0.23917	20,881
2001	101,591	0.29912	30,388
2002	89,837	0.37659	33,832
2003	106,363	0.39140	41,630
2004	95,282	0.39327	37,472
2005	92,989	0.50734	47,177
2006	76,768	0.57777	44,354
2007	89,952	0.44326	39,872
2008*	95,366	0.39622	37,786
2009	88,632		
2010			
Average 2005-2008		0.48115	
2009 Forecast			42,645

(*) : 2008 return data are preliminary and subject to revision, following reconciliation of records.

The 2009 forecasted terminal run size of summer-run Hood Canal chinook salmon is the product of brood 2005 fingerling lbs released from WDFW facilities in 2006, multiplied by the average of post-season estimated terminal area return rates (total terminal run / hatchery fingerling lbs released 3 yrs previous) for the last four return years (2005-2008), (Table A-1-a). The data series used this year was intended to estimate a terminal return to net fisheries, freshwater sport and escapements. It does not include other run components or contributions. The historical data series was recently reconciled from the 1998 return year to the present, to include this information for 2009 forecasting purposes only (Tables A-1-a and A-1-b). The resulting terminal area run forecast is 42,645 chinook salmon. The forecast was apportioned to 40,142 chinook expected to return to hatcheries and 2,503 fish expected to return to natural spawning areas, based on the Hood Canal terminal runs' relative contribution of the individual Hood Canal management units in the most recent brood cycle, comprised of the 2005-2008 return years (Table A-1-d). These estimates will be used as inputs to generate ocean recruit forecasts during pre-season simulation modeling.

Table A-1-b. Hood Canal Summer/Fall Chinook Terminal Runs

Year	12A	12/12B	12C	12D	Skokomish	G.A. Hatchery	Hoodsport Hatchery	Total
1984	0	758	0	440	5,302	5,537	4,183	16,220
1985	0	1,908	0	1,040	8,297	5,739	3,044	20,028
1986	0	21	0	169	8,690	10,628	2,221	21,729
1987	0	112	0	64	8,064	12,743	4,311	25,294
1988	0	150	0	79	7,078	13,086	6,888	27,281
1989	0	129	0	158	6,133	13,023	5,175	24,618
1990	0	47	0	49	2,484	8,454	1,577	12,611
1991	0	88	0	73	5,461	9,746	3,514	18,882
1992	0	96	0	20	1,373	490	965	2,944
1993	29	143	0	46	1,385	883	2,242	4,728
1994	4	384	1	30	809	609	1,889	3,726
1995	7	103	2	491	1,398	5,196	1,978	9,175
1996	8	24	1	1	995	3,100	4,001	8,130
1997	27	6	15	7	452	1,887	5,411	7,805
1998	0	288	0	177	1,187	5,630	8,940	16,222
1999	0	876	86	249	2,123	10,332	16,550	30,216
2000	0	439	262	194	1,203	5,238	13,545	20,881
2001	0	326	605	203	3,247	14,965	11,042	30,388
2002	0	95	38	114	2,312	13,801	17,472	33,832
2003	0	194	93	106	2,059	18,346	20,832	41,630
2004	0	129	1,091	95	3,706	18,973	13,478	37,472
2005	0	45	619	108	3,044	24,009	19,352	47,177
2006	0	30	295	34	2,294	23,446	18,255	44,354
2007	0	73	41	23	996	30,801	7,938	39,872
2008*	0	275	10	26	2,171	26,223	9,081	37,786

Note: Values for years prior to 1998 DO NOT include freshwater recreational catch

Note: The 2008 run reconstruction is preliminary and subject to revision.

Table A-1-c. Proportional Distribution of Hood Canal Summer/Fall Chinook Returns

Year	12A	12B	12C	12D	Skokomish	G.Adams	Hoodspport
2005	0.00000	0.00095	0.01312	0.00229	0.06452	0.50891	0.41020
2006	0.00000	0.00068	0.00665	0.00077	0.05172	0.52861	0.41158
2007	0.00000	0.00183	0.00103	0.00058	0.02498	0.77250	0.19909
2008	0.00000	0.00728	0.00026	0.00069	0.05746	0.69399	0.24033
'05 - 2008 Mean	0.00000	0.00268	0.00527	0.00108	0.04967	0.62600	0.31530

Table A-1-d. Apportionment of the Hood Canal Summer/Fall Chinook Forecast

Hood Canal Production Unit	Terminal Run Forecast	Proportion
12B	114	0.00268
12C	225	0.00527
12D	46	0.00108
Skokomish	2,118	0.04967
Natural Subtotal	2,503	0.05870
George Adams	26,696	0.62600
Hoodspport	13,446	0.31530
Hatchery Subtotal	40,142	0.94130
Total	42,645	1.00000

Note: The forecasted proportions are derived from the 2005-2008 mean distribution.

A-2. Pink Salmon.

A-2.1 Natural Runs

The 2009 return of naturally reared Hood Canal pink salmon was forecast as recruitment to all fisheries (Canadian and domestic) and escapement, using the product of the 2007 brood year estimated escapement of 29,001. (Table A-2-a).

Table A-2-a. Corrected Pink Salmon Natural Run Reconstruction for Hood Canal

Return Year	Hood Canal Natural Escapement	Hood Canal Natural Terminal Run	Hood Canal Total Natural Recruits	Hoodsport Hatchery Recruits	Hood Canal Total Recruits
1959	30,600	30,600	49,421	2,471	51,892
1961	36,900	36,900	47,951	3,833	51,784
1963	503,200	503,200	1,200,196	15,837	1,216,033
1965	160,500	160,500	226,069	606	226,675
1967	269,400	271,100	493,000	4,092	497,092
1969	42,100	42,100	59,714	3,206	62,920
1971	104,100	104,100	143,875	3,303	147,178
1973	47,100	47,200	76,748	2,455	79,203
1975	12,600	12,600	20,047	3,739	23,786
1977	44,300	44,300	76,762	10,067	86,829
1979	37,300	37,400	84,235	9,797	94,032
1981	6,550	7,150	13,639	3,395	17,034
1983	25,200	25,400	29,247	622	29,869
1985	64,100	66,200	90,812	2,167	92,979
1987	62,200	64,000	77,417	11,092	88,509
1989	60,970	80,100	130,646	4,583	145,961
1991	118,450	118,487	180,734	5,037	186,862
1993	35,647	35,647	40,366	13,025	53,391
1995	31,306	31,306	39,531	32,102	71,633
1997	8,363	8,363	14,684	37,738	52,422
1999	12,667	12,667	12,818	7,741	20,559
2001	98,338	98,338	102,608	74,854	177,462
2003	37,531	38,250	39,793	29,857	69,650
2005	17,481	17,856	18,436	14,723	33,159
2007	29,001	30,121	31,135	4,623	35,758

Table A-2-b. Hood Canal Natural Pink Salmon Returns per Spawner

Cycle 1 BY	Cycle 1 R/S	Cycle 2 BY	Cycle 2 R/S	Cycle 3 BY	Cycle 3 R/S
1959	1.567	1961	32.526	1963	0.449
1965	3.072	1967	0.222	1969	3.417
1971	0.737	1973	0.426	1975	6.092
1977	1.901	1979	0.366	1981	4.465
1983	3.604	1985	1.208	1987	2.100
1989	2.964	1991	0.341	1993	1.109
1995	0.469	1997	1.533	1999	8.100
2001	0.405	2003	0.491	2005	1.781
Average:	1.840		0.655		4.214
Std. Dev.	1.261		0.504		2.586
2009 Tribal Forecast					53,358
2009 WDFW Forecast					49,846
2009 Agreed to Tribal/WDFW Forecast					51,602

The Tribal forecast used the 2007 escapement, multiplied by the average estimated "Cycle 1" return rate of (1.840) for a forecast of 53,358 natural pink salmon total recruits (Table A-2-b).

The WDFW provided a separate forecast of 49,846 recruits, using the same escapement values, multiplied by a Cycle 1 return rate of 1.729 recruits / spawner. This difference (approx. 7%) was most likely the result of differences in historical run reconstruction methods. These differences should be addressed in the near future.

Given the relatively small difference between methodology, the agreed to forecast for 2009 is 51,602 natural pink salmon recruits, the mean of the Tribal and WDFW forecasts.

A-2.2 Hatchery runs.

The 2009 return of hatchery reared Hood Canal pink salmon was forecast as recruitment to all fisheries and escapement, using the product of the 2007 brood year fingerling pounds released from the Hoodsport Hatchery (1,267), multiplied by the long term average recruits per pound rate estimated for the Hoodsport Hatchery

The Tribal recruit forecast is 3,501 pink salmon, calculated as 1,267 lbs. of fry released, times the long term return rate (2.763). (Table A-2-c).

The WDFW recruit forecast is 3,318 pink salmon, calculated as 1,267 lbs. of fry released, times a long term return rate (2.633). Again, the relatively small difference (less than 200 recruits) was probably due to differences in historical run reconstruction, and the use of one less historical year by WDFW. These differences should be addressed in the near future.

For 2009, again given the relatively small difference between methodology the agreed to forecast is 3,409 hatchery pink salmon recruits, the mean of the Tribal and WDFW forecasts.

Table A-2-c. Hoodspout Hatchery Pink Salmon Return Rates.

Brood Year	Lbs. Released	Total Recruits	Recruits/Lb
1959	2,515	3,833	1.5241
1961	492	15,837	32.1890
1963	1,209	606	0.5012
1965	1,283	4,092	3.1894
1967	1,416	3,206	2.2641
1969	2,399	3,303	1.3768
1971	3,071	2,455	0.7994
1973	2,104	3,739	1.7771
1975	3,477	10,067	2.8953
1977	3,496	9,797	2.8023
1979	2,253	3,395	1.5069
1981	1,748	622	0.3558
1983	655	2,167	3.3084
1985	2,152	11,092	5.1543
1987	5,625	4,583	0.8148
1989	1,913	5,037	2.6330
1991	4,453	13,025	2.9250
1993	6,532	32,102	4.9146
1995	7,623	37,738	4.9505
1997	7,851	7,741	0.9860
1999	3,117	74,854	24.0148
2001	3,244	29,857	9.2038
2003	3,563	14,723	4.1322
2005	1,670	4,623	2.7683
2007	1,267		
BY 1959-05 Average			2.7629
TRIBAL 2009 Forecast		3,501	
WDFW 2009 Forecast		3,318	
2009 Agreed to Tribal/WDFW Forecast			3,409

Note: Values in boldface were excluded from the analysis.

A-3. Summer Chum Salmon

A-3.1 Natural Runs (Tribal)

The 2009 forecast of the Hood Canal summer-timed chum salmon returns was forecast as total recruitment to all fisheries and escapements returning to the Mainstem Hood Canal, Quilcene, and SE Hood Canal Management Units (MUs).

Hood Canal units were forecast as the mean of the 2005 - 2008 returns. (Table A-3-a). Insufficient age-specific information is currently available for summer chum salmon, to attempt forecasts that are based on age specific, or cohort returns.. The forecasted recruitment, to all fisheries (domestic and Canadian) and escapement, for summer chum, is 8,593 for the Mainstem, 7,744 for the Quilcene, and 2,611 for the SE Hood Canal management units, for a total of 18,948. The forecasts include summer chum salmon which are expected to return to a number of streams from supplementation and reintroduction projects.

A-3.2 Natural Runs (WDFW)

The 2009 forecast of the Hood Canal summer-timed chum salmon returns was forecast as total recruitment to all fisheries and escapements returning to the Mainstem Hood Canal, Quilcene, and SE Hood Canal Management Units (MUs). For the Quilcene / Dabob MU, the returns of summer chum were forecast in terms of natural origin recruits because after the termination of the Big Quilcene supplementation project, no supplementation-origin adults are expected to return to this MU in 2009.

Supplementation and reintroduction projects were implemented in the Big Quilcene River from 1992 through 2003 (Quilcene / Dabob MU); in the Union River from 2000 through 2003 and in the Tahuya River from 2003 through the present (SE Hood Canal MU). In the Mainstem Hood Canal MU, supplementation and reintroduction projects were implemented in Lilliwaup Creek from 1992 through the present, in Big Beef Creek from 1996 through 2004 and in the Hamma Hamma River from 1997 through the present. Summer chum fry from each project were marked and natural-origin recruits (NORs) can be distinguished from supplementation-origin recruits (SORs) upon return as adults. Fry released from each project have contributed substantially to the summer chum adult recruitment and escapements.

The supplementation project in Lilliwaup Creek, the Hamma Hamma River, and the Tahuya River are ongoing and adults from the project (SORs) are expected to return during 2009. The projects in the Quilcene/Dabob MU and the Union River were terminated and no SORs are expected to return from those projects in 2009. Estimates of the number of natural-origin recruits (NORs) and supplementation-origin recruits (SORs) returning to each MU each year from 2000 through 2008 and forecasts for 2009 are shown in Table A-3-b.

The return to the Quilcene/Dabob MU was forecast as the mean of NOR recruits from the 2005 through 2008 return years; the forecast is 7,228 summer chum. The return to the Mainstem Hood Canal MU was forecast as the mean of the total (NOR + SOR) recruits from the 2005 through 2008 return years; the forecast is 8,593 summer chum. The return to the SE Hood Canal MU was forecast as the mean of the NOR recruits to Union River from 2005 through 2008 plus the mean of the total (NOR + SOR) recruits to Tahuya River from 2006 through 2008; the forecast is 2,188 summer chum. The total forecast of 2009 Hood Canal summer chum salmon recruits is 18,009 (Table A-3-b).

Table A-3-a. Hood Canal Summer Chum Salmon Recruits.

Year	Mainstem Hood Canal	Quilcene / Dabob	SE Hood Canal	Hood Canal Total
1974	11,810	944	1,067	13,821
1975	19,370	3,235	3,757	26,362
1976	35,613	11,206	21,869	68,688
1977	11,159	1,918	2,587	15,664
1978	18,791	5,555	716	25,062
1979	7,844	734	817	9,395
1980	8,867	1,932	2,133	12,932
1981	4,331	761	477	5,569
1982	5,522	1,494	956	7,972
1983	543	2,351	597	3,491
1984	1,279	1,486	502	3,267
1985	1,765	1,025	1,417	4,207
1986	1,284	1,483	5,001	7,768
1987	150	2,722	1,030	3,902
1988	2,191	2,540	915	5,646
1989	614	1,599	2,184	4,397
1990	259	623	577	1,459
1991	700	1,174	321	2,195
1992	1,953	1,237	183	3,373
1993	402	183	283	868
1994	1,170	896	891	2,957
1995	4,394	4,830	760	9,984
1996	10,734	9,801	511	21,046
1997	681	8,199	493	9,373
1998	758	3,201	255	4,214
1999	778	3,554	174	4,506
2000	2,035	6,704	757	9,496
2001	4,248	7,595	1,516	13,359
2002	6,220	6,050	890	13,160
2003	11,142	12,863	12,019	36,024
2004	25,890	63,167	5,997	95,054
2005	7,127	7,023	2,002	16,152
2006	11,425	14,291	3,630	29,346
2007	5,964	3,962	2,838	12,764
2008	9,857	5,701	1,972	17,530
2009 Tribal Forecast	8,593	7,744	2,611	18,948

* 2008 Data is preliminary and subject to revision. ** Outliers (in bold) were not used

Table A-3-b. Hood Canal Summer Chum Salmon Natural and Supplemetation Origin Recruits.

Year	Mainstem Hood Canal		Quilcene / Dabob		SE Hood Canal	
	NOR	SOR	NOR	SOR	NOR	SOR
2000	2,035		6,704		757	0
2001	2,696	1,552	3,632	3,964	1,517	0
2002	2,832	3,388	4,330	1,720	890	0
2003	8,748	2,394	10,850	2,013	7,974	4,045
2004	20,905	4,984	59,333	3,833	3,611	2,386
2005	4,767	2,360	6,231	792	709	1,293
2006	8,928	2,497	13,093	1,198	1,747	1,883
2007	5,964		3,887	75	2,070	768
2008	9,857		5,701	0	1,174	798
2009 NOR+SOR Forecast	8,593				2,188	
2009 NOR Forecast			7,228			
2009 WDFW Total Hood Canal Forecast					18,009	

A-2.3 Natural Runs (Joint Approach)

The Summer Chum Salmon Conservation Initiative (SCSCI) defines Critical and Recovery abundance thresholds for each MU. The abundance thresholds are 1,260 (Critical) and 4,570 (Recovery) for the Quilcene/Dabob MU, 2,980 (Critical) and 15,560 (Recovery) for the Mainstem Hood Canal MU, and 340 (Critical) and 550 (Recovery) for the SE Hood Canal MU. The 2009 forecasted abundance for the returns of summer chum, under the Co-Managers' different forecasting approaches provide a range from 7,228 to 7,744 recruits for the Quilcene/Dabob MU, an estimate of 8,593 recruits for the Mainstem Hood Canal MU, and a range of estimates of 2,188 and 2,611 recruits for the SE Hood Canal MU. All estimates exceed the Critical threshold for their respective MUs and exceed the Recovery threshold for the Quilcene/Dabob and SE Hood Canal MUs. The Co-Managers will conduct annual post-season abundance assessments comparing the ranges in the forecasts to actual returns for each MU, as required by the SCSCI.

A-4. Coho Salmon

A-4.1 Natural Runs

The forecasted recruitment of 2009 Hood Canal natural runs was based on a linear regression model that related the return of tagged jack coho at BBC to Hood Canal December Age 2 recruits in the subsequent run year. This model used recruit data from brood years 1983-1998 and 2002-2004 (Table A-4-a). Recruit data from brood years 1999-2001 were excluded because of their unusually high recruit per tagged jack ratio, which is not expected to occur this year. The final form of the regression is shown below:

$$\text{Hood Canal Recruitment} = 32332.182 + (381.433 * (\text{BBC Tagged Jacks}))$$

Relevant statistics of the model used to derive the 2009 forecast are shown below.

Using Brood Years 1983-1998 , 2002-2004	
Multiple R	0.76785
R ²	0.58960
Adj. R ²	0.56546
Std Error of Estimate	38593.59
N	19
Intercept	32332.182
Slope	381.433
2008 Jacks (X)	93
2009 Forecast (Y)	67,805

The forecasted recruits were subsequently apportioned to primary and secondary units on the basis of the distribution of their parent brood escapement. The total forecast of 67,805 natural DA2 recruits was thus apportioned into 64,807 from primary and 2,999 from secondary units, on the basis of their parent brood spawner distribution (Table A-4-b).

Table A-4-a. 2009 Hood Canal Natural Coho Forecast Data

Brood Year	Big Beef Creek Total Smolts	Big Beef Total Natural Jacks	Big Beef Tagged Natural Jacks	Hood Canal Total Dec Age-2 Recruits
1975	35,025			
1976	17,619		36	
1977	45,634		452	
1978	20,715		265	
1979	41,054		398	
1980	25,225			
1981	25,333		210	
1982	36,636		554	
1983	25,720	427	346	211,127
1984	24,479	445	350	232,860
1985	11,510	201	121	40,236
1986	26,534	314	208	117,460
1987	17,594	336	234	118,316
1988	19,565	173	122	70,422
1989	23,646	167	144	61,949
1990	18,677	273	202	64,929
1991	13,071	206	149	138,845
1992	18,431	188	157	94,029
1993	16,574	224	185	71,422
1994	25,820	410	298	145,541
1995	40,828	610	510	176,029
1996	22,222	60	45	23,436
1997	20,967	96	85	54,905
1998	47,089	189	179	164,989
1999	21,803	120	111	106,147
2000	24,352	80	70	268,753
2001	36,060	339	254	298,347
2002	25,060	294	235	76,798
2003	32,949	61	33	57,167
2004	38,579	161	86	100,961
2005	29,911	47	39	
2006	26,889	109	93	

Table A-4-b. Apportionment of the 2009 Hood Canal Natural Coho Forecast

Area	Escapement Capacity	Escapement BY 2006	Management Unit Type	Proportion of Brood Escapement	December Age-2 Recruits
12 / 12B	28.88%	5,554	Primary	40.01%	27,126
12C / 12D	31.66%	6,118	Primary	44.07%	29,881
Skokomish	29.01%	1,597	Primary	11.50%	7,800
9A	1.25%	256	Secondary	1.84%	1,250
12A	9.20%	358	Secondary	2.58%	1,748
Primary Subtotal	89.55%	13,269		95.58%	64,807
Secondary Subtotal	10.45%	614		4.42%	2,999
Grand Total	100.00%	13,883		100.00%	67,805

**Table A-4-c. Escapement of Coho Salmon to
Primary Natural Spawning Areas of Hood Canal**

Year	North (12-12B)	South (12C-12D)	Skokomish	Total
1986	17,485	18,943	3,432	39,860
1987	6,922	7,498	3,510	17,930
1988	4,623	5,009	1,948	11,580
1989	6,924	7,502	934	15,360
1990	2,664	2,885	1,281	6,830
1991	5,433	5,886	1,541	12,860
1992	8,199	8,882	2,179	19,260
1993	10,052	10,890	1,327	22,269
1994	21,289	23,063	12,128	56,480
1995	17,049	18,470	5,560	41,079
1996	16,254	17,609	4,008	37,871
1997	37,338	40,450	17,568	95,356
1998	40,323	44,420	14,957	99,700
1999	6,854	7,550	1,847	16,251
2000	8,687	9,569	8,288	26,544
2001	35,134	38,703	20,601	94,438
2002	26,172	28,831	13,647	68,650
2003	59,552	65,601	44,757	169,910
2004	39,439	43,445	62,995	145,879
2005	14,854	16,363	6,286	37,503
2006	5,554	6,118	1,597	13,269
2007	19,017	20,949	6,381	46,347

Table A-4-d. Hood Canal Hatchery and Net Pen Smolt to Dec-2 Recruit Survival

Brood Year	George Adams Hatchery			Port Gamble Net Pens			Quilcene NFH			Quilcene Bay Net Pens		
	Smolts	Recruits	R/Sm	Smolts	Recruits	R/Sm	Smolts	Recruits	R/Sm	Smolts	Recruits	R/Sm
1976	30,171						397,562					
1977	1,816,704						490,611					
1978	1,042,520						377,098					
1979	1,406,424			682,900			502,189					
1980	322,580			454,000			498,166					
1981	351,474			400,000			352,298					
1982	364,000			394,000			271,035					
1983	310,100	106,593	0.34374	586,400	89,105	0.15195	223,128					
1984	312,800	52,163	0.16676	394,400	73,890	0.18735	542,480			247,221	40,095	0.16218
1985	355,400	20,960	0.05898	351,900	9,450	0.02685	617,231			85,575	<i>4,363</i>	<i>0.05098</i>
1986	337,700	32,908	0.09745	429,141	29,183	0.06800	574,171	<i>98,188</i>	<i>0.17101</i>	193,522	<i>16,075</i>	<i>0.08307</i>
1987	298,000	28,068	0.09419	407,600	157,116	0.38547	753,390	75,121	0.09971	146,000	30,269	0.20732
1988	310,700	14,698	0.04731	383,629	74,033	0.19298	491,303	64,066	0.13040	311,327	21,484	0.06901
1989	300,300	7,106	0.02366	298,944	53,439	0.17876	352,556	9,874	0.02801	266,193	7,834	0.02943
1990	307,300	7,894	0.02569	403,600	32,220	0.07983	501,254	27,662	0.05519	353,263	18,203	0.05153
1991	304,197	20,054	0.06592	383,419	63,120	0.16462	397,701	49,061	0.12336	337,800	<i>24,903</i>	<i>0.07372</i>
1992	301,019	15,688	0.05212	361,553	13,281	0.03673	400,700	34,709	0.08662	287,187	<i>8,379</i>	<i>0.02918</i>
1993	303,054	31,320	0.10335	414,844	4,672	0.01126	425,334	29,577	0.06954	216,737	1,864	0.00860
1994	396,084	17,542	0.04429	378,686	8,741	0.02308	625,700	40,118	0.06412	0		
1995	434,140	6,963	0.01604	342,828	8,450	0.02465	425,971	17,650	0.04143	220,000	5,756	0.02616
1996	527,317	11,878	0.02253	441,656	17,564	0.03977	452,203	9,322	0.02061	225,269	3,421	0.01234
1997	534,554	22,621	0.04232	420,482	3,830	0.00911	437,222	22,091	0.05053	189,951	10,872	0.05724
1998	502,266	38,971	0.07759	391,765	7,196	0.01837	368,399	23,966	0.06505	208,000	9,780	0.04702
1999	493,992	46,008	0.09314	432,847	4,931	0.01139	428,995	33,187	0.07736	0		
2000	587,937	36,351	0.06183	432,161	6,521	0.01509	411,674	27,053	0.06571	210,627	12,982	0.06164
2001	336,886	44,572	0.13231	409,221	4,803	0.01174	388,212	42,242	0.10881	90,000	2,272	0.02524
2002	501,031	55,380	0.11053	423,746	16,270	0.03840	404,582	51,373	0.12698	200,835	15,035	0.07486
2003	309,179	28,359	0.09172	437,306	14,502	0.03316	361,891	25,676	0.07095	179,711	7,546	0.04199
2004	290,570	22,361	0.07696	540,000	11,792	0.02184	488,080	30,711	0.06292	215,731	7,690	0.03565
2005	245,608			247,500			273,099			124,813		
2006	294,151			415,000			358,131			193,808		
Average (1996-04)			0.07877	0.02210			0.07210			0.04246		
2009 Forecast:		23,170		9,170			25,822			8,229		

Note: DEC Age-2 Recruits have been recalculated for BY95 - BY2001 and are therefore NOT comparable to those from earlier years. Earlier broods are in the process of being recalculated as well.

Note: Values in italics indicate untaged production units. Values in boldface were excluded from the analysis

A-4.2 Hatchery Runs

For 2009, given the lower than average marine survival experienced by BY 2002 and BY 2003 natural and, in the case of BY 2003, hatchery smolts, we have decided to use a longer term mean of the estimated survival rates for each hatchery facility. The 2009 forecast utilized survival rates the latest available three brood cycles, or 9 broods (Table A-4-d). Historic marine survival rates were estimated from CWT-based cohort reconstruction of December Age-2 recruits, as were those of natural coho. Because there are several enhancement facilities in Hood Canal, and tag data were not available for all facilities for all years, marine survival rates were estimated from reconstructed cohorts, using the assumption that untagged releases contributed to preterminal fisheries in a way that maintained the same ratio to tagged releases, as estimated by RRTERM to have entered the Hood Canal terminal area (Table A-4-d).

The 2009 forecast of 66,391 hatchery reared December Age-2 coho recruits (Table A-4-d) was predicted from the brood year 2006 smolt releases multiplied by the average estimated marine survival rate for each facility's smolts from the nine latest available brood years. (Table A-4-d).

A-5. Fall Chum Salmon

A-5.1 Tribal Forecast of Total Return

The 2009 forecast of the Hood Canal fall chum salmon run was estimated as a total return, which may be apportioned to a hatchery and a natural component. The total return was estimated as the mean of the last ten years' (2 generational cycles) estimated total returns. The return may be further apportioned to likely natural and hatchery components, using the estimated mean composition in the same ten years (Table A-5-a). Because of delays in catch reconciliation records from 2000 through 2007 terminal area fisheries, it cannot be combined with the available age specific data from the 2005-07 return years, these forecasts are extremely preliminary and should be treated as such. For instance, substantial catches in Area 12H (Hoodsport hatchery zone) were reconstructed as being in Area 12C. This resulted in a possibly significant positive bias to the historical estimates for natural and Skokomish R. hatchery returns, with a corresponding negative bias to Hoodsport hatchery returns. This may have also affected the recruits at age estimates, for numerous Hood Canal units. In effect, the preliminary forecast, shown below, suffers from the lack of up to date data, from as far back as ten years. It is our intent to correct this information in time to generate an updated forecast that shall replace the preliminary one, in the time frame specified in the Order Re: Puget Sound Salmon Management Plan, for the 2009 season. This forecast should not be used during the 2009 season.

A-5.2 WDFW Forecasts

A-5.2.1 Natural Run Forecasts (WDFW)

The 2009 return of natural fall-timed chum salmon to Hood Canal was preliminarily derived as a portion of the forecasted return of all Puget Sound natural fall-timed chum. Natural fall chum forecasts were calculated using the Puget Sound-wide recruit/spawner (R/S) method, with the regional (Hood Canal) forecast, and terminal forecasts within Hood Canal, allocated according to parent escapement.

The Puget Sound forecast was initially estimated using parent brood escapements, long-term odd/even-year specific average R/S values, and long-term odd/even-year specific mean proportions returning at age for 3, 4, and 5-year old returns. For example, the three-year old forecast was derived by multiplying the 2006 natural escapement by the mean even-year brood R/S value to get a total return of 2006 brood offspring. That number was then multiplied by the mean proportion of the return at age 3 for even-year broods, yielding the 2009 age 3 return forecast. This was repeated for the 4 and 5-year old components, and all three were summed to obtain a total Puget Sound forecast.

The Puget Sound natural fall chum parent escapements were large in 2004 and 2006. The 2004 parent escapement (872,280 fall chum) was the third largest escapement for all years, and the 2006 parent escapement (792,613 fall chum) was strong. Without some adjustment to the traditional R/S method, the 2009 forecasts would likely be over-estimates. For example, the actual return of natural-origin chum in Hood Canal (and South Sound) in 2006, 2007, and 2008 were about three-fourths of the predicted runsize using the traditional R/S method. In addition, there are potential negative impacts of fall floods in 2006 on expected returns for that brood. To address this, we used 75% of the long-term R/S averages for the 2009 forecasts. This keeps the prediction inside the bounds of the existing data and compensates for the uncertainty resulting from record escapements and apparent decreases in survival. This method forecast returns of 724,533 natural fall chum to Puget Sound (Table A-5-b).

The forecasted return of each age group to Puget Sound was apportioned to Hood Canal using the proportions of the parent escapement of each brood. The forecast for Hood Canal is **110,871** natural fall chum salmon (Table A-5-c).

Table A-5-a. Hood Canal Fall Chum Salmon Historical Runs

Year	Natural	Hatchery	Total	Natural Prop'n
1976	116,406	72,095	188,501	0.618
1977	114,915	97,711	212,626	0.540
1978	353,519	247,858	601,377	0.588
1979	30,050	95,489	125,539	0.239
1980	78,851	164,955	243,806	0.323
1981	73,331	114,846	188,177	0.390
1982	78,758	203,017	281,775	0.280
1983	46,159	160,047	206,206	0.224
1984	96,469	327,741	424,210	0.227
1985	219,941	293,730	513,671	0.428
1986	159,476	384,078	543,554	0.293
1987	214,366	585,481	799,847	0.268
1988	166,135	431,232	597,367	0.278
1989	144,557	304,376	448,933	0.322
1990	110,511	192,011	302,522	0.365
1991	146,398	387,915	534,313	0.274
1992	292,137	479,485	771,622	0.379
1993	235,519	363,330	598,849	0.393
1994	341,033	620,804	961,837	0.355
1995	298,646	290,952	589,598	0.507
1996	484,938	337,247	822,185	0.590
1997	160,482	297,552	458,034	0.350
1998	211,198	364,090	575,288	0.367
1999	53,761	93,498	147,259	0.365
2000	81,977	71,369	153,346	0.535
2001	263,250	530,112	793,362	0.332
2002	342,717	556,037	898,754	0.381
2003	419,354	853,303	1,272,657	0.330
2004	711,570	483,163	1,194,733	0.596
2005	146,290	199,411	345,701	0.423
2006	331,186	445,188	776,374	0.427
2007	246,660	431,999	678,659	0.363
Tribal Forecast			10-Yr Mean	Average
2009			683,613	0.412

Table A-5-b. 2009 WDFW Puget Sound Natural Fall Chum Salmon Forecast

Parent Brood	Age	Parent Escapement	Mean R/S ¹	Adjusted R/S (.75)	Estimated R/S (all ages)	Mean Age Composition ¹	Natural Forecast
2004	5	872,280	2.51	1.89	1,645,016	0.0475228	78,176
2005	4	286,719	3.13	2.35	673,402	0.5608921	377,706
2006	3	792,613	2.51	1.89	1,494,779	0.1797268	268,652
						Total	724,533

Note: Uses odd or even brood year average, depending on brood year

Table A-5-c. 2009 WDFW Hood Canal Natural Fall Chum Salmon Forecasts

	Puget Sound Forecast	HC Parent Escapement Proportion	HC Forecast by Age
Age 3 (2006 Brood) Forecast	268,652	0.1225891	32,934
Age 4 (2005 Brood) Forecast	377,706	0.1660092	62,703
Age 5 (2004 Brood) Forecast	78,176	0.1948812	15,235
Total WDFW Forecast	724,533		110,871

A-5.2.2 Hatchery Run Forecasts (WDFW)

The 2009 return of hatchery-origin fall chum was forecast by multiplying pounds released from each facility by long-term, even/odd brood year specific average return rates for that facility. For example, 3-year old returns were forecast by multiplying pounds released of 2006 brood year chum by the long-term, odd-year brood age 3 return rate for that hatchery. Age 4 and age 5 returns were forecast by the same method. For off-station releases (volunteer/cooperative projects), return rates were based on rates for a corresponding hatchery, reduced by a factor of 2 or 4 to compensate for smaller size at release. A summary of the WDFW forecasts are shown for Hood Canal hatcheries in Table A-5-d. The WDFW total Hood Canal hatchery on-station forecast is 264,058.

A-5.3 Joint Approach for the Preliminary Preseason Fall Chum Forecasts

While the estimates prepared by Tribal and WDFW are substantially different, it should be noted that differences between methods have been further confounded by the potential data bias, noted above, which would significantly affect the source data from the past ten years (See: Section 5.1 above). Therefore, for preliminary planning purposes, we have agreed to use the range of the WDFW and Tribal total (natural + hatchery) forecasts to describe the expected range of total (natural + hatchery) fall chum returns in 2009. The preliminary forecast of 374,924 to 683,613 fall chum will be used to estimate incidental chinook and coho mortalities in FRAM for treaty and non-treaty fisheries. The co-managers agree to correct this information in time to generate an updated forecast that shall replace the preliminary one, in the time frame specified in the Order Re: Puget Sound Salmon Management Plan, for the 2009 season.

Table A-5-d. Summary of 2009 WDFW Hood Canal Hatchery Fall Chum Forecasts

Facility	Total
Little Boston Hatchery	2,484
Hoodsport Hatchery	125,279
G. Adams / McKernan Hatchery	107,799
Enetai Hatchery	28,491
12D Streams - Augmentation	5
Total	264,058