2012 PRESEASON FORECAST PACKET
FOR HOOD CANAL
SALMON RUNS'

PRESEASON FORECAST PACKET PREPARED BY:

SKOKOMISH TRIBE
WDFW

SALMON FORECASTS AGREED TO BY:

LOWER ELWHA TRIBE

PNPTC (FOR JAMESTOWN & PORT GAMBLE)

SKOKOMISH TRIBE

WDFW

FINAL 10FEB2012

SUMMARY OF 2012 HOOD CANAL FORECASTS
and Forecasting Methods

Species (Ref.#)	Origin	Type	Number	Mass Marked	Number Type	Model Designation
Chinook (A-1)	Mixed	Secondary	2,854		TRS	Natural
	Hatchery	Primary	43,873		TRS	Hatchery
Summer Chum (A-2)	Natural (supplemented)	Secondary	8,970		Total Recruits	
Coho (A-3)[1]	Natural	Primary	97,886		Total DA2[1] Recruits	Natural
	Natural	Secondary	4,121		Total DA2[1] Recruits	Hatchery
	Hatchery	Secondary	79,399	71,209	Total DA2[1] Recruits	Hatchery
Fall Chum (A-4)	Natural		119,392		WA Run	Natural
	Hatchery		307,283			Hatchery

[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	5,682
SE Hood Canal MU	843
Quilcene MU	2,445

Natural Chinook salmon, although classified as "secondary", are under rehabilitation.
Forecasts for individual Hood Canal Management Units are:

Mid Hood Canal MU	192
Skokomish MU (Nat.)	2,620
(Hat.)	30,813
Hoodsport MU	13,060
Miscell.	42

Coho FRAM Model Inputs:

Stock Name	DA2	nuFRAM Stock	nuFRAM Age 3	Marked nuFRAM	Marked %
Port Gamble Net Pens	11,442	ptgamh	10,573	10,530	99.60%
Port Gamble Bay Natural	929	ptgamw	859		
Area 12/12B Natural	44,766	ar12bw	41,364		
Quilcene Bay Net Pens	7,121	qlcnbh	6,580	6,580	100.00%
Quilcene Hatchery	33,362	qlcenh	30,827	27,383	88.83%
Area 12A Natural	3,191	ar12aw	2,949		
Hoodsport Hatchery	n/a	hoodsh	0		
Area 12C/12D Natural	49,315	ar12dw	45,567		
George Adams Hatchery	27,474	gadamh	25,386	21,304	83.92%
Skokomish River Natural	3,805	skokrw	3,516		

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	0.29913	30,389
2002	89,837	0.38332	34,436
2003	106,363	0.36476	38,797
2004	95,282	0.38720	36,893
2005	92,989	0.63831	59,356
2006	76,769	0.61204	46,986
2007	89,952	0.43716	39,323
2008	95,368	0.42885	40,899
2009	88,634	0.49692	44,044
2010	90,491	0.48344	43,747
2011*	89,269	0.67036	59,842
2012*	89,877		
Average 2008-2011		0.51989	
2012 Forecast			46,726

(*) 2011 & 2012 return data are preliminary and subject to revision, following reconciliation of records.

The 2012 forecasted terminal run size of summer-run Hood Canal Chinook salmon is the product of brood 2008 fingerling lbs released from WDFW facilities in 2009, 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 (2008-2011), (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 2008 through 2011 return years, to include this information for 2012 forecasting purposes (Tables A-1-a and A-1-b). The resulting terminal area run forecast is 46,726 Chinook salmon. The forecast was apportioned to 43,873 chinook expected to return to hatcheries and 2,854 fish expected to return to natural spawning areas (Table A-1-d), 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 2008-2011 return years (Table A-1-c). 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	204	3,247	14,965	11,042	30,389
2002	0	95	38	114	2,273	14,439	17,477	34,436
2003	0	194	93	107	1,928	17,175	19,300	38,797
2004	0	129	1,094	95	3,677	18,824	13,074	36,893
2005	0	45	623	109	3,579	28,226	26,774	59,356
2006	0	30	292	34	2,537	25,930	18,163	46,986
2007	0	73	40	22	959	29,664	8,565	39,323
2008	0	275	10	26	2,416	29,172	9,000	40,899
2009	0	130	20	31	2,199	27,271	14,393	44,044
2010	0	84	32	15	2,800	30,191	10,625	43,747
2011*	0	290	22	5	3,069	36,811	19,646	59,842

Note: Values for years prior to 1998 DO NOT include freshwater recreational catch
Note: The 2008-2011 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	Hoodsport
2008	0.00000	0.00672	0.00024	0.00064	0.05907	0.71327	0.22005
2009	0.00000	0.00295	0.00045	0.00070	0.04993	0.61918	0.32679
2010	0.00000	0.00192	0.00073	0.00034	0.06400	0.69013	0.24287
2011	0.00000	0.0048	0.00037	0.00008	0.05129	0.61513	0.3282979
'08 - 2011 Mean	0.00000	0.00411	0.00045	0.00044	0.05607	0.65943	0.27950

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

Hood Canal Production Unit	Terminal Run Forecast	Proportion
12B	192	0.00411
12C	21	0.00045
12D	21	0.00044
Skokomish	2,620	0.05607
Natural Subtotal	2,854	0.06107
George Adams	30,813	0.65942
Hoodsport	13,060	0.27950
Hatchery Subtotal	43,873	0.93893
Total	46,726	1.00000

Note: The forecasted proportions are derived from the 2008-2011 mean distribution.

A-2. Summer Chum Salmon

A-2.1 Natural Runs

The 2012 pre-season forecast of the Hood Canal summer chum salmon returns was forecast as total recruitment to all fisheries and escapements for the Mainstem Hood Canal, Quilcene, and SE Hood Canal Management Units (MUs). Also factored into the 2012 forecast was the performance of recent summer chum forecasts when compared to actual returns.

Abundance for the Mainstem Hood Canal MU and the Southeast Hood Canal MU was forecast as the mean of the 2008 through 2011 returns and the mean was then adjusted by the ratio of actual abundance to forecast abundance during 2008-2009. The actual to forecast ratios were 0.842 for the Mainstem Hood Canal MU and 0.589 for the SE Hood Canal MUs.

Abundance for the Quilcene / Dabob MU was forecast as the mean of the 2009 through 2011 returns. Summer chum returns have declined in 2009 and 2011 compared to 2008 and the 2009-2011 mean return is a better measure of the anticipated return during 2012 than the 20087-2011 mean used for the other Hood Canal MUs.

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 2008. 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 projects in Lilliwaup Creek, the Hamma Hamma River, and the Tahuya River are each expected to contribute supplementation-origin recruits (SORs) during 2012. The projects in the Quilcene River, Big Beef Creek, and the Union River were terminated and no SORs are expected to return from those projects in 2012.

For the Mainstem Hood Canal MU, the returns of summer chum were forecast based on total (NORs + SORs) returns. For the Quilcene / Dabob MU, the returns of summer chum were forecast based NORs. The return to the SE Hood Canal MU was forecast as the mean of the NORs to Union River plus the mean of the total (NORs + SORs) recruits to Tahuya River.

Estimates of the number of natural-origin recruits and supplementation-origin recruits returning to each MU each year from 2000 through 2011 and forecasts for 2012 are shown in Table A-2-a.

The 2012 forecasted returns are 5,682 summer chum to the Mainstem Hood Canal MU, 2,445 summer chum to the Quilcene / Dabob Bays MU, and 843 summer chum to the SE Hood Canal MU. The total forecasted return is 8,970 summer chum to Hood Canal in 2012 (Table A-2-a).

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 15,740 (Recovery) for the Mainstem Hood Canal MU, and 340 (Critical) and 550 (Recovery) for the SE Hood Canal MU.

The 2012 forecasted abundance for the returns of summer chum exceed the Critical threshold for each Management Unit and exceeds the Recovery threshold for the SE Hood Canal MU.

Table A-2-a. Hood Canal Summer Chum Salmon Natural and Supplementation 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	4,911		2,385	0	615	383
2010	8,543		2,115		1,160	969
2011	3,684		2,836		624	
2012 Forecast a/b/	5,682		2,445		843	
2012 Total Hood Canal Forecast					8,970	

a/ 2008-11 mean return adjusted by ratio of actual abundance to forecast abundance during 2008 through 2009; see text.
b/ 2009-2011 mean return for Quilcene/DaBob.

The Co-managers have agreed to monitor the incidental harvest of summer chum in all scheduled fisheries and to monitor the in-season abundance of summer chum in the Quilcene / Dabob Bays MU. As in 2011 and for 2012, the Co-managers agree that no gillnet fisheries will occur until spawner escapement exceeds 1,500 summer chum in the Big and Little Quilcene rivers.

The Co-managers will conduct annual post-season abundance assessments comparing the forecasts to actual returns for each MU. All of the above actions are consistent with the requirements and provisions of the SCSCI.

A-3. Coho Salmon

A-3.1 Natural Runs

The forecasted recruitment of 2012 Hood Canal natural runs was based on a linear regression model that related the return of tagged natural 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 2002-2007 (Table A-3-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:

$$\textit{Hood Canal Recruitment} = 32391.610 + (391.095 * (\textit{BBC Tagged Jacks}))$$

Relevant statistics of the model used to derive the 2012 forecast are shown below.

Using Brood Years 1983-1998 , 2002-2007	
Multiple R	0.79704
R^2	0.63527
Adj. R^2	0.61704
Std Error of Estimate	36540.931
N	22
Intercept	32391.610
Slope	391.095
2011 Jacks (X)	178
2012 Forecast (Y)	102,007

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 102, 007 natural DA2 recruits was thus apportioned into 97,886 from primary and 4,121 from secondary units, on the basis of their parent brood spawner distribution (Table A-3-b).

Table A-3-a. 2012 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	26,062	427	346	211,127
1984	23,994	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	*19,739*	173	122	*81,147*
1989	*23,646*	167	144	*66,306*
1990	*18,677*	273	202	*67,729*
1991	*13,071*	206	149	*140,612*
1992	*18,431*	188	157	*95,144*
1993	*16,574*	224	185	*73,734*
1994	*25,820*	410	298	*149,823*
1995	*40,828*	610	510	*180,517*
1996	*22,222*	60	45	*23,437*
1997	*20,967*	96	85	*55,909*
1998	*47,088*	189	179	*165,500*
1999	*21,803*	120	111	*107,024*
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	*57,206*
2004	38,579	161	86	*111,437*
2005	29,911	47	39	*39,674*
2006	27,416	111	95	96,089
2007	45,399	32	26	16,879
2008	24,396	197	177	
2009	57,271	212	178	

*Data Italicized Denotes Methodology Currently Under Review and agreed to for forecasting purposes only

Table A-3-b. Apportionment of the 2012 Hood Canal Natural Coho Forecast

Area	Escapement Capacity	Escapement BY 2009	Management Unit Type	Proportion of Brood Escapement	December Age-2 Recruits
12 / 12B	28.88%	12,330	Primary	43.89%	44,766
12C / 12D	31.66%	13,583	Primary	48.35%	49,315
Skokomish	29.01%	1,048	Primary	3.73%	3,805
9A	1.25%	256	Secondary	0.91%	929
12A	9.20%	879	Secondary	3.13%	3,191
Primary Subtotal	89.55%	26,961		95.96%	97,886
Secondary Subtotal	10.45%	1,135		4.04%	4,121
Grand Total	100.00%	28,096		100.00%	102,007

**Table A-3-c. Escapement of Coho Salmon to
Primary Natural Spawning Areas of Hood Canal**

Year	North (12-12B)	South (12C-12D)	Skokomish	Total
1986	17,865	19,679	3,432	40,976
1987	7,286	8,026	3,510	18,822
1988	4,523	4,983	1,948	11,454
1989	6,488	7,148	934	14,570
1990	2,518	2,774	1,281	6,573
1991	5,118	5,638	1,541	12,297
1992	8,026	8,842	2,179	19,047
1993	9,800	10,795	1,327	21,922
1994	20,847	22,965	12,128	55,940
1995	16,340	18,000	5,560	39,900
1996	18,428	20,300	4,008	42,736
1997	37,016	40,777	17,568	95,361
1998	40,323	44,420	14,957	99,700
1999	6,854	7,550	1,847	16,251
2000	8,724	9,610	8,288	26,622
2001	35,134	38,703	20,601	94,438
2002	26,170	28,829	13,647	68,646
2003	60,546	66,697	44,757	172,000
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
2008	5,082	5,598	836	11,516
2009	12,330	13,583	1,048	26,961
2010	1,906	2,099	192	4,197

Table A-3-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	*4,363*	*0.05098*
1986	337,700	32,908	0.09745	429,141	29,183	0.06800	574,171	*98,188*	*0.17101*	193,522	*16,075*	*0.08307*
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	*24,903*	*0.07372*
1992	301,019	15,688	0.05212	361,553	13,281	0.03673	400,700	34,709	0.08662	287,187	*8,379*	*0.02918*
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	*25,250*	*0.06977*	179,711	*8,165*	*0.04543*
2004	290,570	*20,739*	*0.07137*	540,000	*13,871*	*0.02569*	488,080	*41,686*	*0.08541*	215,731	*2,817*	*0.01306*
2005	245,608	*26,842*	*0.10929*	247,500	*5,081*	*0.02053*	273,099	*23,247*	*0.08512*	124,813	*8,331*	*0.06675*
2006	294,151	31,150	0.10590	415,000	16,421	0.03957	358,131	57,903	0.16168	193,808	*4,945*	*0.02551*
2007	296,474	14,621	0.04932	412,208	6,721	0.01630	357,967	17,982	0.05023	162,381	*1,763*	*0.01086*
2008	296,029			423,584			441,117			207,071		
2009	306,329			395,362			345,604			180,673		
Average (2002-07)			0.08969			0.02894			0.09653			0.03941
2012 Forecast:	27,474			11,442			33,362			7,121		

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 values agreed to for preseason forecasting only. Values in boldface were excluded from the analysis

A-3.2 Hatchery Runs

The 2012 forecast utilized survival rates the two brood cycles, or six brood years (Table A-3-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-3-d).

The 2012 forecast of 79,399 hatchery reared December Age-2 coho recruits (Table A-3-d) was predicted from the brood year 2009 smolt releases multiplied by the average estimated marine survival rate for each facility's smolts from the six latest available brood years. (Table A-3-d).

A-4. Fall Chum Salmon

The 2012 forecast of the Hood Canal fall chum salmon run was estimated separately for natural production units, off-station augmented production in natural rearing areas, and individual hatchery production units.   The following descriptions of methods and source data are intended to provide documentation of the methods and approaches used.

A-4.1.1 Natural Run Forecasts (Tribal)

The 2012 return of Hood Canal natural fall-timed chum salmon of each returning age group (3, 4, and 5 year olds) was forecast using the available mean return-per-spawner-at-age rates for all available broods, from 1968 to the present, excluding estimates from the 1983 brood (ages 3 and 4) and the 1989 brood (age 5) return. The mean recruit-per-spawner return rates were 1.21539, 2.61020, and 0.30363, for 3, 4, and 5 year-olds respectively (Table A-4-a). These adjusted rates of return were multiplied with the 2009, 2008, and 2007 brood escapements (13,961, 38,512, and 78,218; respectively) to estimate the total 2012 forecast of 141,240 Hood Canal natural fall chum returning to Puget Sound, before the addition of anticipated returns from in-stream supplementation projects. The Hood Canal natural run forecast was further apportioned to individual production units (Tables A-4-d and A-4-e), on the basis of relative proportion attributable to each production unit's spawners (brood year escapements), for each returning age group.

The grand total return of 141,261 to each natural production unit was estimated by adding the estimated return from in-stream enhancement and supplementation efforts. The forecast of this latter component is described under "Hatchery runs" (Section A-4.2).

A-4.1.2 Natural Run Forecasts (WDFW)

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 and terminal forecasts allocated by escapement goal.

The WDFW natural fall chum salmon forecast was estimated for Puget Sound using the recruit/spawner method. Escapement of parent broods of 2007, 2008, and 2009 and age composition were used to estimate 2012 returns of Age 3, Age 4, and Age 5 natural fall chum. The 2012 forecast of natural fall chum to Puget Sound is 97,060 Age 3, 279,177 Age 4, and 252,854 Age 5 fish for a total run size of 629,091 (Table A-4b).

The apportionment of 629,091 Puget Sound natural fall chum to Hood Canal was determined by applying the Hood Canal parent escapement proportion to each age class. The Hood Canal forecast by age is 40,662 Age 3, 45,182 Age 4, and 11,679 Age 5 fish for a total Hood Canal forecast of 97,522 natural fall chum (Table A-4c).

The Hood Canal natural run forecast was further apportioned to individual production units (Tables A-4-d and A-4-e), on the basis of relative proportion attributable to each production unit's spawners (brood year escapements), for each returning age group.   The forecast for Hood Canal is 97,522 natural fall chum salmon (Table A-4-c). 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 (Table A-4-f).

A-4.1.3 Joint 2012 Hood Canal Natural Fall Chum Salmon Forecast

For preliminary preseason planning, we agreed to use a forecast of 119,392 natural fall chum, the average of the Tribal and WDFW results. The total forecast was then apportioned to individual production units on the basis of the age specific brood escapement distribution (Table A-4-g).

Table A-4-a. Hood Canal Natural Fall Chum Returns-at-Age per Spawner

Brood Year	Brood Escapement	3's	4's	5's	Total
1968	47,802	0.58849	1.63839	0.09531	2.32219
1969	30,070	0.55346	1.14771	0.09264	1.79381
1970	41,698	0.55975	1.58101	0.01314	2.15390
1971	41,139	0.58683	0.41252	0.33535	1.33470
1972	41,602	0.26600	1.27781	0.00000	1.54381
1973	27,870	1.77432	2.60438	0.07441	4.45311
1974	52,224	0.81057	4.42759	0.07083	5.30899
1975	16,266	7.39080	0.05030	0.00000	7.44110
1976	48,078	0.53107	0.20951	0.03284	0.77342
1977	26,074	2.63782	2.75187	0.13638	5.52607
1978	79,156	0.00000	0.60521	0.05628	0.66149
1979	14,323	1.90574	2.12510	0.00000	4.03084
1980	21,672	0.51985	2.14281	0.23020	2.89286
1981	14,311	3.49591	**12.57517**	0.62961	16.70069
1982	12,134	2.88354	7.08386	0.94399	10.91139
1983	7,121	**9.05912**	**24.36310**	1.13297	**34.55519**
1984	22,751	1.29322	5.88289	0.37653	7.55264
1985	50,910	0.47585	2.67119	0.33941	3.48645
1986	29,549	0.00000	3.15515	0.44356	3.59871
1987	24,481	0.00000	3.54568	1.04655	4.59223
1988	30,704	1.51411	8.58958	1.42974	11.53343
1989	24,873	0.11184	6.46342	**5.71902**	12.29428
1990	20,811	1.48264	8.26697	0.69326	10.44287
1991	44,745	0.59753	1.58643	0.12973	2.31369
1992	96,382	2.21238	4.21549	0.20013	6.62800
1993	67,770	1.07479	1.38931	0.10130	2.56540
1994	151,821	0.30984	0.88726	0.03062	1.22772
1995	119,344	0.58343	0.40133	0.01270	0.99746
1996	251,803	0.01977	0.20395	0.00000	0.22372
1997	53,492	0.52960	2.05414	0.40225	2.98599
1998	101,631	1.54720	2.17750	0.01927	3.74398
1999	33,924	2.88881	8.36176	1.46228	12.71284
2000	37,131	2.95919	**12.40288**	0.25103	15.61310
2001	103,713	1.92253	0.71772	0.08583	2.72608
2002	173,037	0.36398	1.62283	0.09993	2.08674
2003	148,512	0.21273	1.32788	0.21269	1.75329
2004	168,126	0.15014	0.91883	0.05347	1.12244
2005	47,598	1.76695	1.02192	0.00000	2.78887
2006	97,104	0.17061	0.44776		
2007	78,218	0.70884			
2008	38,512				
2009	13,961				
Mean: Brood Years 1968-09 (exclusive of outliers, in bold)					
All Odd Years	48,738	1.53778	2.84488	0.59890	5.02761
All Even Years	74,463	0.90912	2.91234	0.26527	4.75481
All Years *	60,772	1.21539	2.61020	0.30363	4.88752
		3's	4's	5's	
2012 Tribal Forecast*		16,968	100,524	23,749	141,241

Table A-4-b. 2012 WDFW Puget Sound Natural Fall Chum Salmon Forecast

Parent Brood	Age	Parent Escapement	Mean R/S[1]	Adjusted R/S	Estimated R/S (all ages)	Mean Age Composition[1]	Natural Forecast
2007	5	483,307	3.02	3.02	1,459,290	0.0670000	97,060
2008	4	239,485	2.43	1.53	366,009	0.7630000	279,177
2009	3	224,841	3.02	3.02	678,881	0.3720000	252,854
						Total	629,091

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

Table A-4-c. 2012 WDFW Hood Canal Natural Fall Chum Salmon Forecasts

	Puget Sound Forecast	HC Parent Escapement Proportion	HC Forecast by Age
Age 3 (2009 Brood) Forecast	252,854	0.1608655	40,675
Age 4 (2008 Brood) Forecast	279,177	0.1620428	45,239
Age 5 (2007 Brood) Forecast	97,060	0.1203269	11,679
Total WDFW Forecast	629,091		97,522

Table A-4-d. 2012 Hood Canal Natural Fall Chum Salmon Parent Brood Escapement Distribution

Area	2007	2008	2009
9A	0.00%	0.00%	0.00%
12	2.39%	1.89%	7.49%
12A	1.09%	0.12%	0.19%
12B	43.40%	18.42%	22.03%
12C	19.15%	10.09%	11.33%
82G	9.82%	43.79%	21.62%
12D	24.15%	25.69%	37.33%

Table A-4-e. Apportionment of the 2012 Tribal Hood Canal Natural Fall Chum Salmon Forecast

Area	3's	4's	5's	Total
9A	0	0	0	0
12	1,271	1,903	568	3,742
12A	32	120	258	410
12B	3,739	18,519	10,306	32,564
12C	1,923	10,141	4,549	16,612
82G	3,669	44,018	2,333	50,021
12D	6,335	25,820	5,735	37,890
Total	16,968	100,524	23,749	141,241

Table A-4-f. Apportionment of the 2012 WDFW Hood Canal Natural Fall Chum Salmon Forecast

Area	3's	4's	5's	Total
9A	0	0	0	0
12	3,046	855	279	4,181
12A	8,959	8,324	5,068	22,351
12B	77	54	127	258
12C	4,607	4,558	2,237	11,402
82G	8,793	19,785	1,147	29,725
12D	15,180	11,605	2,820	29,606
Total	40,662	45,182	11,679	97,522

Table A-4-g. Apportionment of the 2012 Joint Hood Canal Natural Fall Chum Salmon Forecast

Area	Tribal Forecast	WDFW Forecast	Joint Forecast
9A	0	0	0
12	3,742	4,181	3,961
12A	410	22,351	11,380
12B	32,564	258	16,411
12C	16,612	11,402	14,007
82G (Skokomish)	50,021	29,725	39,873
12D	37,890	29,606	33,748
12D Off-Station	21		
Total	141,262	97,522	119,392

A-4.2 Hatchery Runs (Tribal)

The 2012 hatchery-origin returns (including in-stream augmentation) of fall-timed chum salmon were generally forecasted using average returns-at-age-per-pound of fingerlings released, to Puget Sound net fisheries and escapements, using historical run sizes from the fall chum database, historical releases from each facility, and applying them to releases from brood years 2007, 2008, and 2009. In estimating the returns, the following information was used for each facility. The problems with recent years' terminal area run reconstruction, may have introduced significant positive bias to the estimates of Skokomish River hatchery runs, introducing a negative bias to Hoodsport hatchery runs. Off-station production, resulting from instream augmentation programs was estimated separately and was then added to the forecasted return to natural spawning areas.

The effects of changes to the Hood Canal hatchery chum programs will continue to be seen in 2012, including the return of Area 12A production unit to natural production, since the last release from the Quilcene National Fish Hatchery occurred with the 2002 brood. Also, the 2004 brood was the first year of reduced production at the Hoodsport and George Adams / McKernan facilities, which first affected age-5 returns in 2009 and subsequent years.

A-4.2.1 Forecasts of Instream Augmentation (Tribal)

Egg box and fry-augmented runs to streams of areas 12, 12B, 12C, 12D, 82G: The Tribal forecast applied one half of the mean return rates of age 3, age 4, and age 5 fish per pound planted at Hoodsport Hatchery (1965-71 broods) (Tables A-4-h and A-4-i). The resulting forecast for 2012 is 21 fish. This forecast was apportioned to each area, according to the volume released from each brood year and the resulting estimates were added to the corresponding natural run components.

Table A-4-h. Tribal Hood Canal Fall Chum 2012, Off-Station Lbs. Planted

Area	BY 2008		BY 2007		BY 2006	
	Lbs	%	Lbs	%	Lbs	%
9A	0	0.0%	0	0.0%	0	0.0%
12	0	0.0%	0	0.0%	0	0.0%
12B	0	0.0%	0	0.0%	0	0.0%
12A	0	0.0%	0	0.0%	0	0.0%
12C	0	0.0%	0	0.0%	0	0.0%
Skokomish	0	0.0%	0	0.0%	0	0.0%
12D	10	0.0%	0	0.0%	344	100.0%
Total	10	0.0%	0	0.0%	344	100.0%

Table A-4-i. Apportionment of the 2012 Tribal Hood Canal Fall Chum Off-Station Forecast

Area	3's	4's	5's	Total
9A	0	0	0	0
12	0	0	0	0
12B	0	0	0	0
12A	0	0	0	0
12C	0	0	0	0
82G	0	0	0	0
12D	5	0	16	21
Total	5	0	16	21

A-4.2.2 Hatchery On-Station Forecasts (Tribal)

Hoodsport Hatchery: Mean return rate of age 3, 4, and 5 fish per pound planted at Finch Creek (1997-2005 broods) (Table A-4-j). The resulting forecast for 2012 is 83,139. Run reconstruction problems may have biased this run low.

George Adams/McKernan Hatcheries: Mean return rate of age 3, age 4, and age 5 fish per pound released (1997-2005 broods), excluding BY 1999 (ages 4 and 5) and BY 2000 (age 4) (Table A-4-k). The resulting forecast for 2012 is 193,967.

Little Boston Hatchery: Mean return rate of age 3, age 4 and age 5 fish per pound planted at Hoodsport Hatchery (1997-2005 broods) (Table A-4-j). The resulting forecast for 2012 is based on the fingerling releases of 1,087 lbs (BY 2009), 1,865 lbs (BY 2008), and 1,018 lbs (BY 2007), which were used to estimate the return of 3, 4, and 5-year olds respectively, for a total return of 4,331 (Table A-4-n).

Enetai Hatchery: Mean return rates of age 3, age 4 and age 5 fish per pound planted (1997-2005 broods). (Table A-4-l). The resulting forecast for 2012 is based on the fingerling releases of 4,700 lbs (BY2009), 3,951 lbs. (BY 2008), and 6,469 lbs. (BY 2007), which were used to estimate the return of 3, 4, and 5-year olds respectively, for a total return of 26,774.

The Tribal forecasts of hatchery returns are summarized in Table A-4-n and indicate a total forecast of on-station hatchery-origin fall chum of 308,211.

A-4.2.3 Hatchery Forecasts (WDFW)

The 2012 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 2009 brood year chum by the long-term, even-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 by age are shown for Hood Canal hatcheries in Table A-4-m. The 2012

WDFW Hood Canal hatchery fall chum forecast is 306,280 on-station and 75 off-station for a total forecast of 306,355.

A-4.2.4 Joint 2012 Hood Canal Hatchery Fall Chum Salmon Forecast

For preliminary preseason planning, we agreed to use a forecast of 307,283 hatchery fall chum, the average of the Tribal and WDFW forecasting methods' results, apportioned to individual hatchery facilities (Table A-4-o).

Table A-4-j.   Fall Chum Returns-per-Pound,
by Age at Return from Hoodsport Hatchery Releases

Brood Year	Release Lbs.	3's	4's	5's	Total
1965	888	0.80208	2.35750	0.01558	3.17516
1966	1,771	0.92010	2.66721	0.02299	3.61030
1967	2,301	0.93776	1.15006	0.11132	2.19914
1968	4,373	0.54928	1.56195	0.19686	2.30809
1969	2,424	0.59879	2.69040	0.26275	3.55194
1970	3,036	1.45276	4.96486	0.00000	6.41762
1971	3,794	1.45488	1.48756	0.02969	2.97213
1972	4,126	0.55870	7.49948	**0.82970**	8.88788
1973	9,202	0.70599	3.60727	0.16357	4.47683
1974	27,368	0.89570	5.68814	0.03343	6.61727
1975	22,776	2.54895	2.78624	0.05244	5.38763
1976	24,490	0.76752	1.80998	0.04155	2.61905
1977	21,883	3.98451	2.02120	0.02757	6.03328
1978	33,256	1.00278	2.34466	0.24428	3.59172
1979	24,238	2.98678	2.89652	0.21504	6.09834
1980	44,336	0.48636	2.23768	0.04039	2.76443
1981	23,589	3.18480	4.51989	0.36118	8.06587
1982	32,058	1.69592	4.43338	0.15862	6.28792
1983	34,748	1.23151	4.91046	0.44689	6.58886
1984	60,763	1.76204	2.85909	0.09411	4.71524

Table A-4-j (cont'd).   Fall Chum Returns-per-Pound, by Age at Return from Hoodsport Hatchery Releases

1985	39,279	2.92389	5.00571	0.20595	8.13555
1986	33,036	0.53259	2.21872	0.20579	2.95710
1987	40,323	0.42814	3.70929	0.14736	4.28479
1988	36,877	3.13411	7.17034	0.29712	10.60157
1989	35,149	0.71847	1.79583	0.50845	3.02275
1990	38,422	4.27142	7.01940	0.37401	11.66483
1991	39,379	3.01183	1.98098	0.07460	5.06741
1992	33,678	2.33155	3.93700	0.12497	6.39352
1993	33,920	1.77835	4.03487	0.17676	5.98998
1994	37,075	0.73558	1.96470	0.03943	2.73971
1995	37,583	1.29662	0.93342	0.01997	2.25001
1996	25,374	0.35104	1.66305	0.05572	2.06981
1997	30,276	0.34889	2.52394	0.09089	2.96372
1998	37,534	2.62754	3.21934	0.03818	5.88506
1999	33,196	3.81337	2.85193	0.30443	6.96973
2000	34,067	0.18327	1.12001	0.06995	1.37323
2001	35,033	1.16696	0.88571	0.04609	2.09876
2002	35,574	0.48600	0.98579	0.00808	1.47987
2003	33,231	0.83763	0.63987	0.04794	1.52544
2004	31,410	0.33036	0.56328	0.01959	0.91323
2005	29,031	0.77693	1.52074	0.16253	2.46020
2006	29,958	0.08529	1.31603		
2007	25,523	1.40372			
2008	28,653				
2009	30,092				
All Odd Years	25,559	1.67913	2.58616	0.16542	4.54287
All Even Years	28,965	1.22248	2.84715	0.12691	4.69487
All Years	27,224	1.44420	2.84263	0.13485	4.61887
All Years 65-71	2,655	0.95938	2.41136	0.09131	3.46205
All Years 72-05	32,126	1.58518	3.03994	0.14839	4.79355
All Years 97-05*	33,261	1.17455	1.59007	0.08752	2.85214
2012 Tribal Forecast*	35,345	45,560	2,234	83,139

Table A-4-k. Fall Chum Returns-per-Pound, by Age at Return from George Adams / McKernan Hatchery Releases

Brood Year	Release Lbs.	3's	4's	5's	Total
1978	18,717	0.11901	0.85327	0.15188	1.12416
1979	40,273	0.36752	0.61002	0.06715	1.04469
1980	24,418	0.30902	2.10810	0.05751	2.47463
1981	12,028	3.24075	4.43634	0.36758	8.04467
1982	26,780	1.03328	3.20556	0.20036	4.43920
1983	25,917	1.25574	8.01500	0.44456	9.71530
1984	28,601	1.49188	1.18815	0.05936	2.73939
1985	24,500	0.78202	1.85405	0.20669	2.84276
1986	36,329	0.12036	1.56008	0.24038	1.92082
1987	30,566	0.10195	1.44458	0.20499	1.75152
1988	31,083	1.45527	4.69637	0.54805	6.69969
1989	32,315	0.52929	2.25103	0.20309	2.98341
1990	17,032	0.47710	5.81499	0.43246	6.72455
1991	30,024	1.45064	1.33176	0.05341	2.83581
1992	25,235	1.59492	2.86789	0.09179	4.55460
1993	27,016	1.21873	2.78823	0.32053	4.32749
1994	27,723	0.54142	3.79484	0.03621	4.37247
1995	22,624	3.11094	1.06483	0.00880	4.18457
1996	23,138	0.27842	0.47256	0.11599	0.86697
1997	27,884	0.06412	5.23332	0.21356	5.51100
1998	33,440	5.59772	3.99864	0.27753	9.87389
1999	27,365	4.78742	**22.40721**	**2.17993**	**29.37456**
2000	8,486	4.76506	**15.87349**	0.72806	21.36661
2001	31,946	3.95554	2.51829	0.00000	6.47383
2002	30,996	1.44617	4.05078	0.09009	5.58704
2003	32,631	5.01811	6.81432	0.32729	12.15972
2004	23,127	5.35825	3.32306	0.06471	8.74602
2005	22,768	5.35290	**12.04153**	0.75741	18.15184
2006	24,833	0.95216	3.67314		
2007	21,035	5.61999			
2008	22,371				
2009	22,482				
Average Return Brood Years (1978-05) excluding outliers in bold.					
Odd Years	26,961	2.23112	3.87718	0.24424	5.15623
Even Years	25,144	1.75628	2.91802	0.18202	4.62488
All Years	26,053	1.86928	3.05184	0.23220	5.51403
Years 97-05*	26,516	4.03837	4.32307	0.30733	10.98374
2012 Tribal Forecast*		90,791	96,711	6,465	193,967

Note: Because of incomplete reconstruction, 2006-2009 return rates were not available

Table A-4-l. Fall Chum Returns-per-Pound, by Age at Return for Enetai Hatchery Releases

Brood Year	Release Lbs.	3's	4's	5's	Total
1976	3,696	0.18155	0.75214	0.00000	0.93369
1977	5,785	1.53198	3.31116		
1978	6,514	1.40297		0.01172	
1979	2,666		0.62223	0.09213	
1980	3,053	0.43328	1.81825	0.10249	2.35402
1981	4,985	2.12202	2.89871	0.10103	5.12176
1982	6,130	2.23198	2.83908	0.05719	5.12825
1983	2,727	3.66295	4.00346	0.12399	7.79040
1984	5,855	2.34790	1.46902	0.02738	3.84430
1985	5,485	2.22696	2.49188	0.03179	4.75063
1986	5,495	1.13061	1.07304	0.09600	2.29965
1987	4,455	1.07889	1.44217		
1988	4,493	1.46308		0.08704	
1989	4,191		1.67962	0.06531	
1990	3,294	3.14615	6.08997		
1991	2,936	6.39302		0.06815	
1992	2,095		3.07692	0.10468	
1993	4,297	1.77956	2.41267	0.08406	4.27629
1994	6,809	1.37618	3.03970	0.00296	4.41884
1995	3,456	4.32699	0.34679	0.00621	4.67999
1996	2,302	0.41883	0.65893	0.07013	1.14789
1997	4,068	0.20813	1.79254	0.13066	2.13133
1998	3,270	1.82332	3.93045		5.75377
1999	1,542	3.21144		0.36481	3.57625
2000	195		1.77961	1.69690	3.47651
2001	4,326	4.12338	2.11684	0.19163	6.43185
2002	7,081	1.58006	6.80996	0.05611	8.44613
2003	3,264	3.10357	2.25885	0.41600	5.77842
2004	6,613	5.50110	1.07494	0.07300	6.64904
2005	6,603	2.70151	3.15335	0.01853	5.87339
2006	6,895	0.38965	0.41699		
2007	6,469	0.88754			
2008	3,951				
2009	4,700				
Average (Brood Years 1976-09).					
Odd Years	4,233	2.66842	2.19464	0.13033	5.04103
Even Years	4,573	1.67333	2.48779	0.18351	4.04110
All Years	4,403	2.17088	2.34664	0.15692	4.51726
Years 97-05*	4,107	2.78156	2.86457	0.36845	5.34630
2012 Tribal Forecast*		13,073	11,318	2,384	26,775

Note: Because of incomplete reconstruction, and lack of rack sampling, return rates after 2005 were not available

Table A-4-m. Summary of 2012 WDFW Hood Canal Hatchery Fall Chum Forecasts

Facility	Age 3	Age 4	Age 5	Total
Little Boston Hatchery	1,031	5,714	107	6,852
Hoodsport Hatchery	55,416	92,535	4,579	152,530
G. Adams / McKernan Hatchery	55,240	62,627	6,055	123,922
Enetai Hatchery	12,074	9,976	926	22,976
12D Streams - Augmentation	51	0	24	75
Total	123,812	170,852	11,691	306,355

Table A-4-n. Summary of 2012 Tribal Hood Canal Hatchery Fall Chum Forecasts

Facility	Age 3	Age 4	Age 5	Total
Little Boston Hatchery	1,277	2,965	89	4,331
Hoodsport Hatchery	35,345	45,560	2,234	83,139
G. Adams / McKernan Hatchery	90,791	96,711	6,465	193,967
Enetai Hatchery	13,073	11,318	2,384	26,775
Total	140,485	156,555	11,171	308,211

Table A-4-o. Apportionment of the 2012 Joint Hood Canal Hatchery Fall Chum Salmon Forecasts

Facility	Tribal Forecast	WDFW Forecast	Joint Forecast
Little Boston Hatchery	4,331	6,852	5,592
Hoodsport Hatchery	83,139	152,530	117,834
G. Adams / McKernan Hatchery	193,967	123,922	158,944
Enetai Hatchery	26,775	22,976	24,875
12D Streams - Augmentation		75	
Total	308,211	306,355	307,283