SUMMARY OF 2006 STRAIT OF JUAN DE FUCA
Forecasts and Forecasting Methods

Species (Ref.#)	Origin	Type	Number	Mass Marked	Number Type	FRAM Model Designation
S/F Chinook (A-1)	Mixed	Primary	4,204		TRS	Natural
Summer Chum (A-2)	Natural	Primary	8,238		Total Recruits	
Coho W. SJF (A-3)[1]	Natural	Primary	29,648		Total DA2[1] Recruits	Natural
	Natural	Primary	5,185		Total DA2[1] Recruits	Natural
Coho E. SJF (A-3)[1]	Natural	Secondary	8,080		Total DA2[1] Recruits	Hatchery
	Hatchery	Primary	19,211	16,750	Total DA2[1] Recruits	Hatchery
Fall Chum (A-4)	Natural	Primary	3,800		WA Run	

[1] See overleaf for Coho FRAM inputs.

NOTES: Summer Chum salmon, although primary, are under rehabilitation.
Forecasts for individual Strait of Juan de Fuca Management Units are:

Discovery Bay	6,377
Sequim Bay	868
Chimacum	993

Chinook salmon, classified as “wild and hatchery”, are under rehabilitation.
Forecasts for individual Strait of Juan de Fuca Management Units are:

Dungeness River	806
Elwha River	2,616
Hoko River	782

Coho FRAM Model Inputs

Stock Name	DA2	nuFRAM Stock	nuFRAM Age 3	Marked	Marked %
Dungeness River Natural	7,422	dungew	6,858		
Dungeness Hatchery	16,786	dungeh	15,510	15,239	98.3%
Elwha River Natural	658	elwhaw	608		
Elwha Hatchery	2,425	elwhah	2,241	1,511	67.5%
East Juan de Fuca Misc. Natural	5,185	ejdfmw	4,791		
West Juan de Fuca Misc. Natural	29,648	wjdfmw	27,395		
Port Angeles Net Pens	0	ptangh	0		
Area 9 Misc. Natural	0	area9w	0		

A. Pre-Season Forecasting Methods

A-1. Chinook Salmon

Given the fact that the forecasted returns of the Strait of Juan de Fuca chinook salmon are being entered into the FRAM simulation model as a single population, the forecasted return the terminal areas, in 2006, was forecasted as a single quantity, which was then apportioned to individual populations, given their recent years' performance. This approach is believed to lessen the errors caused by summing individual stock forecasts. The forecast was made using the mean terminal area return in the last four years (2002 - 2005) and was also apportioned using the relative distribution in the same period, which may better reflect recent survival rates and the increasing proportional contribution from the Dungeness stock. The resulting TRS forecast for 2006, is 4,204 region total (Table A-1-a), apportioned to Hoko (782), Elwha (2,616), and Dungeness (806) (Table A-1-b).

Table A-1-a. Strait of Juan de Fuca Chinook Salmon TRS

Year	Hoko	Elwha	Dungeness	Strait ETRS
1986	839	3,159	254	4,252
1987	606	6,220	133	6,959
1988	820	8,667	372	9,859
1989	862	5,704	95	6,661
1990	498	3,606	361	4,465
1991	1,032	3,761	199	4,992
1992	755	4,002	154	4,911
1993	908	1,669	54	2,631
1994	447	1,580	65	2,092
1995	925	1,814	163	2,902
1996	1,274	1,877	183	3,334
1997	919	2,534	52	3,505
1998	1,722	2,411	110	4,243
1999	1,688	1,642	75	3,405
2000	731	1,913	218	2,862
2001	946	2,246	453	3,645
2002	686	2,416	633	3,735
2003	1,100	2,305	640	4,045
2004	1,088	3,443	1,014	5,545
2005	283	2,130	1,079	3,492
2006 Forecast (2002-05 Avg.)				**4,204**

Table A-1-b. Proportional Distribution of Strait of Juan de Fuca Chinook TRS

Year	Hoko	Elwha	Dungeness
1986	0.197	0.743	0.060
1987	0.087	0.894	0.019
1988	0.083	0.879	0.038
1989	0.129	0.856	0.014
1990	0.112	0.808	0.081
1991	0.207	0.753	0.040
1992	0.154	0.815	0.031
1993	0.345	0.634	0.021
1994	0.214	0.755	0.031
1995	0.319	0.625	0.056
1996	0.382	0.563	0.055
1997	0.262	0.723	0.015
1998	0.406	0.568	0.026
1999	0.496	0.482	0.022
2000	0.255	0.668	0.076
2001	0.260	0.616	0.124
2002	0.184	0.647	0.169
2003	0.272	0.570	0.158
2004	0.196	0.621	0.183
2005	0.081	0.610	0.309
2002 - 05 Avg.	0.183	0.613	0.189
2006 Forecast Distribution	782	2,616	806

A-1.1 Dungeness River Natural

Table A-1-c. Dungeness River Chinook Salmon Forecast Data

Return Year	Escapement	Area 6D Harvest	Recreational Catch	Terminal Run
1986	238	9	7	254
1987	100	4	29	133
1988	335	5	32	372
1989	88	1	6	95
1990	310	0	51	361
1991	163	19	17	199
1992	153	1	0	154
1993	43	1	10	54
1994	65	0	0	65
1995	163	0	0	163
1996	183	0	0	183
1997	50	0	2	52
1998	110	0	0	110
1999	75	0	0	75
2000	218	0	0	218
2001	453	0	0	453
2002	633	0	0	633
2003	640	0	0	640
2004	1,014	0	0	1,014
2005	1,077	2	0	1,079

A-1.2 Elwha River

Table A-1-d. Elwha River Chinook Salmon Forecast Data.

Return Year	Extreme Terminal Run	Natural Spawning Escapement	Hatchery Broodstock	Prespawning Mortality	Terminal Harvest
1986	3,159	855	1,414	858	32
1987	6,220	1,642	1,989	2,262	327
1988	8,667	5,228	2,167	478	794
1989	5,704	3,035	1,892	560	217
1990	3,606	1,644	1,312	224	426
1991	3,761	1,642	1,719	108	292
1992	4,002	479	743	2,637	143
1993	1,669	633	929	7	100
1994	1,580	163	1,053	330	34
1995	1,814	524	626	662	2
1996	1,877	364	1,244	267	2
1997	2,534	1,578	939	10	7
1998	2,411	720	1,638	51	2
1999	1,642	903	699	23	17
2000	1,913	715	1,136	62	0
2001	2,246	655	1,553	38	0
2002	2,416	863	1,513	40	0
2003*	2,305	1,045	1,182	78	0
2004	3,443	2,075	1,329	39	0
2005	2,130	723	1,396	7	4

Harvest does not include Recreational Catch

(*) The 2003-04 estimates are preliminary and subject to revision

Table A-1-e. Elwha River Chinook Natural and WDFW Rearing Channel Prespawning Mortalities

Return Year	Hatchery Voluntary Escapement	Natural Spawners	In-River Gross Escapement	Gaff-Seine Removals	In-Hatchery Prespawning Mortality	In-River Prespawning Mortality
1986	1,285	855	1,842	505	376	482
1987	1,283	1,642	4,610	1,138	432	1,830
1988	2,089	5,228	5,784	506	428	50
1989	1,135	3,035	4,352	905	148	412
1990	586	1,644	2,594	886	160	64
1991	970	1,642	2,499	857	108	n/a
1992	97	479	3,762	672	26	2,611
1993	165	633	1,404	771	7	0
1994	365	163	1,181	749	61	269
1995	145	524	1,667	518	37	625
1996	214	364	1,661	1,177	147	120
1997	318	1,578	2,209	624	3	7
1998	138	720	2,271	1,551	51	0
1999	113	903	1,512	609	23	0
2000	177	715	1,736	1,021	62	0
2001	195	655	2,051	1,396	38	0
2002	473	863	1,943	1,080	40	0
2003	314	1,045	1,991	946	78	n/a
2004	515	2,075	2,928	853	39	0
2005	211	723	1,915	1,192	7	0

In order to estimate the potential escapements in 2006, the forecasted return to the Elwha River was further apportioned, using the 2002-2005 mean proportions (Table A-1-e), as follows: Of the forecasted 2,576, **0.3%** (8) are expected to be harvested; **17.17%** (442) are expected to voluntarily return to the Elwha Rearing Channel, and **82.53%** (2,126) to the river. The voluntary hatchery return is expected to be reduced by **11.05**% (49), to account for average on-station pre-spawning mortality, leaving 394 hatchery spawners. The in-river escapement was not reduced for in-river pre-spawning mortality, based on recent years' survival. However, the 2,126 in-river escapement was reduced by **48.59%** (1,033) to account for broodstock removals (gaff & seine), leaving an anticipated in-river spawning escapement of 1,093 chinook salmon and an anticipated hatchery broodstock total of 1,427.

A-1.3 Hoko River

Table A-1-f. Hoko River Chinook Salmon Forecast Data.

Return Year	Hoko River Escapement	Commercial Catch	Recreational Catch
1986	801	38	0
1987	581	25	0
1988	776	37	7
1989	842	17	3
1990	493	5	0
1991	1,006	16	10
1992	740	9	6
1993	894	14	0
1994	428	11	8
1995	905	20	0
1996	1,265	5	4
1997	891	20	8
1998	1,722		0
1999	1,688		0
2000	731		0
2001	946		0
2002	686		0
2003	1,100		0
2004	1,088		
2005	283		

A-2. Summer Chum Salmon

Table A-2-a. Summer Chum Salmon Recruits to Fisheries and Escapement

Year	Discovery	Sequim	Chimacum	Eastern Strait Total
1974	1,494	492		1,986
1975	1,374	373		1,747
1976	1,264	409		1,673
1977	1,364	446		1,810
1978	2,413	828		3,241
1979	699	201		900
1980	4,127	1,447		5,574
1981	879	261		1,140
1982	2,771	771		3,542
1983	946	272		1,218
1984	1,311	397		1,708
1985	304	108		412
1986	890	327		1,217
1987	1,673	508		2,181
1988	2,952	1,177		4,129
1989	441	355		796
1990	432	98		530
1991	253	172		425
1992	592	802		1,394
1993	520	124		644
1994	196	18		214
1995	647	234		881
1996	1,075	31		1,106
1997	923	62		985
1998	1,206	101		1,307
1999	532	7	38	577
2000	879	55	52	986
2001	2,811	262	909	3,982
2002	6,072	42	867	6,981
2003	6,003	450	563	7,016
2004	6,431	1,666	1,142	9,239
2005*	7,001	1,315	1,401	9,717
2006 Forecast:	6,377	868	993	8,238

*The 2005 estimate is preliminary and subject to revision

The 2006 return of summer-timed chum to the Discovery, Chimacum and Sequim Management Units was forecasted as a 4 year mean (2002-2005) of the total recruitment, of each unit, to all fisheries and escapement (Table A-2-a). The forecasts are 6,377 fish to the Discovery MU, 868 fish to Sequim MU and 993 to the Chimacum MU. Recruits to the Dungeness / Graywolf system are few and unquantifiable at this time.

A-3. Coho Salmon

A-3.1 Natural Runs

The method used to develop the 2006 forecasted return of naturally reared coho salmon, for primary units, relied on an estimate of emigrating smolts (2005 emigration), multiplied by an estimate of marine survival.

A-3.1.1 Naturally reared smolts

For primary units in the Western Strait of Juan de Fuca (SJF) the number of smolts from five production units, comprising 19.03% of the total, was measured and expanded to 260,809 smolts for the sub-region (Table A-3-a). For primary units in the Eastern SJF the number of smolts from two production units, comprising 16.31% of the total, excluding Snow Creek, was measured and expanded to 35,365 wild smolts for the sub-region (Table A-3-a). To those, we added 10,245 smolts from the Snow Creek supplemented natural emigration, bringing the sub-region total to 45,610 smolts (Table A-3-c). The total number of estimated smolts, produced from all primary units, is estimated at 306,419.

The number of emigrating smolts from secondary units (Elwha River and Dungeness River) was estimated by extrapolation, using the ratio of the natural escapement of the secondary units to that of the primary units in the parent brood year (2003) (Table A-3-b). This resulted in an estimate of 71,076 smolts, from secondary natural units.

A-3.1.2 Marine Survival

The forecasted survival value of 11.37%, to DA2 recruitment, was obtained by estimating an average recruits/smolt relationship, using escapement in parent years 1999-2001 and smolt emigration in years 2001-2003 with associated DA2 recruitment in return years 2002-2004. Applying this marine survival value to the estimates of 2005 emigrating smolts, resulted in an estimate of 34,833 primary December-Age 2 (DA2) coho recruits (5,185 Eastern and 29,648 Western) (Table A-3-c) and an estimate of 8,080 DA2 coho recruits from secondary units (658 Elwha and 7,422 Dungeness) (Table A-3-d).

Table A-3-a. SJF Coho Smolt Production in Small Streams

2005 Smolt Trapping	Enumerated Smolts	Enumerated Proportion of Total Potential	Estimated Total Smolts
Snow Crk. (Suppl. Nat.)	10,245		10,245
Jimmycomelately Crk	2,220		
Siebert Crk	3,547		
East Total w/o Snow	5,767	0.16307	35,365
Salt Crk	10,567		
E. Twin R.	15,340		
W. Twin R.	11,943		
Deep Crk	10,062		
Johnson Crk	1,731		
West Total	49,643	0.19034	260,809
E+W+Snow Total	55,410		306,419

Table A-3-b. Estimation of Marine Survival

	RY 2002	RY 2003	RY 2004
Primary, Parent Escapement (RY-3)	7,145	17,547	29,048
Secondary, Parent Escapement (RY-3)	1,339	5,107	6,226
Primary Proportion	0.84217	0.77457	0.82350
Primary Smolts (RY-1)	285,427	264,724	287,687
Primary Recruits (RY)	27,710	28,745	38,943
Marine Survival	0.09708	0.10858	0.13537
Primary Escapement (RY)	20,117	17,042	19,755
Secondary Escapement (RY)	2,218	3,953	1,232
Mean Smolt to Recruit Survival			0.11368

Table A-3-c. Primary Natural Management Units Summary

Primary Management Units	Measured Wild Smolts	Proportion of Total Potential Measured	Estimated Total Smolts w Snow	DA2's Using Mean Marine Survival
East Strait	5,767	0.16307	45,610	5,185
West Strait	49,643	0.19034	260,809	29,648
SJF Summary	55,410		306,419	34,833

Table A-3-d. Secondary Management Units Summary

Secondary Management Units	2003 Natural Escapement	2003 Brood Escapement Proportion	Estimated DA2's
Elwha	322	0.081	658
Dungeness	3,631	0.919	7,422
Total Secondary	3,953	1.000	8,080

A-3.2 Hatchery Runs

The 2006 returns of Strait of Juan de Fuca hatchery coho were predicted using the estimated 2002-04 (3 years - 1 brood cycle) average smolt survival to DA2 recruits, applied to the 2005 smolt releases (Table A-3-e). More specifically, the following sources of information were selected:

Dungeness Hatchery: 2002-2004 average recruits per smolt (0.03276) (Table A-3-e). Given a release of 512,450,300 smolts, the 2006 forecast is 16,786 DA2 recruits.

Elwha Hatchery: 2002-2004 average recruits per smolt (0.01383) (Table A-3-e). Given a release of 176,380 smolts, the 2006 forecast is 2,425 DA2 recruits.

The total hatchery-origin pre-season forecast value of 19,211 DA2 recruits (17,751 Age 3 ocean) will be used for simulation modeling and pre-season planning.

Table A-3-e. Strait of Juan de Fuca Hatchery Coho Contribution to Puget Sound Net Fisheries and Escapements

Run Year	Dungeness Hatchery			Elwha Hatchery		
	Smolts Released	DA 2 Recruits	R/Sm	Smolts Released	DA 2 Recruits	R/Sm
1979	796,100			1,387,900		
1980	399,200			837,900		
1981	679,700			1,168,700		
1982	929,400			2,845,100		
1983	106,590			2,756,200		
1984				567,800		
1985	188,000			751,000		
1986	298,000			645,400		
1987	320,000			836,000		
1988	748,600	*20,948*	*0.02798*	728,500	5,260	0.00722
1989	301,700	25,401	0.08419	240,700	15,017	0.06239
1990	359,050	*20,811*	*0.05796*	413,500	12,320	0.02979
1991	342,700	*12,102*	*0.03531*	768,600	3,522	0.00458
1992	296,400	14,058	0.04743	688,600	9,848	0.01430
1993	433,700	*9,789*	*0.02257*	755,600	4,913	0.00650
1994	340,000	8,923	0.02624	580,000	2,504	0.00432
1995	680,000	26,830	0.03946	707,700	10,250	0.01448
1996	808,700	29,804	0.03685	801,000	13,705	0.01711
1997	871,600	16,596	0.01904	722,200	11,988	0.01660
1998	774,600	12,301	0.01588	643,037	6569	0.01022
1999	877,300	6,073	0.00692	867,379	9,438	0.01088
2000	788,600	42,393	0.05376	645,856	4,962	0.00768
2001	865,700	52,851	0.06105	684,856	15,237	0.02225
2002	550,700	17,588	0.03194	494,610	12,419	0.02511
2003	565,300	26,894	0.04757	662,231	3,461	0.00523
2004	505,750	9,486	0.01876	724,594	8,074	0.01114
2005	509,300			661,700		
2006	512,450			175,380		
Average(2002-04):			0.03276	**Average (2002-04):**		0.01383
2006 Forecast DA2's			16,786			2,425

Table A-3-f. Coho Salmon Spawning Escapements to Primary Natural Spawning Areas of the Strait of Juan de Fuca

Year	E. Strait	W. Strait	Total
1986			9,883
1987			4,860
1988			4,332
1989			7,222
1990			4,030
1991			3,752
1992			6,126
1993			3,329
1994			2,503
1995			6,386
1996			5,035
1997			5,788
1998	1,313	14,237	15,550
1999	1,314	5,831	7,145
2000	2,180	15,367	17,547
2001	2,539	26,509	29,048
2002	3,002	17,115	20,117
2003	3,249	13,793	17,042
2004	7,752	12,003	19,755

Note: Escapement estimation methods changed in 1998. Therefore prior estimates are not directly comparable

A-4. Fall Chum Salmon

A-4.1 Natural Fall Chum Salmon Forecast (PNPTC)

The 2006 return of fall-timed chum salmon to the Strait of Juan de Fuca tributaries was forecasted by PNPTC, in the aggregate, as the average of the natural and off-station runs observed in the years 2000 through 2004 (Table A-4-a). The resulting forecast of **2,323**, was apportioned on the basis of historical escapement survey data which resulted in the following proportions: Pysht River (46%), Dungeness River (14%), Deep Creek (14%), and miscellaneous, including Elwha R. and Lyre R. (26%) (Table A-4-e).

A-4.2 Natural Fall Chum Salmon Forecast (WDFW)

The 2006 return of wild fall-timed chum salmon to Strait of Juan de Fuca streams was forecast as a portion of the total return of all Puget Sound natural fall-timed chum. The Puget Sound return was initially forecast 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 2003 wild escapement by the mean odd-year brood R/S value to get a total return of 2003 brood offspring. That number was then multiplied by the mean return at age 3 for even-year broods, yielding the 2006 age 3 return forecast. This was repeated for 4 and 5-year old components, and all three were summed to obtain a total Puget Sound forecast of 3,065,669 (Table A-4-b). However, given the lack of age information for 2004 and 2005, and the lower return in 2005, from relatively high escapements, the forecast was reduced by 50% to 1,532,834.

The return of each age group to Puget Sound was apportioned to individual regions (including the Strait of Juan de Fuca), using proportions of the parent escapement of each brood into each unit. The resulting forecast for Strait of Juan de Fuca natural fall chum salmon is 5,277 (Table A-4-c). The forecasts for individual production units are shown in Table A-4-d.

Final forecasts, given the small difference in the results obtained by the two methods, were made using the mean of the results obtained by the PNPTC and WDFW, for each production unit. (Table A-4-d)

Table A-4-a. Strait of Juan de Fuca Historical Fall Chum Salmon "4B" Runs

Return Year	Fall Chum Run Size	Return Year	Fall Chum Run Size
1980	5,862	1993	5,775
1981	6,518	1994	2,564
1982	6,744	1995	610
1983	1,765	1996	2,162
1984	8,280	1997	3,927
1985	8,330	1998	1,535
1986	1,922	1999	1,313
1987	7,269	2000	269
1988	**13,962**	2001	1,737
1989	4,331	2002	5,198
1990	1,220	2003	1,177
1991	1,941	2004	3,233
1992	5,654	2005	
Average (All Yrs.):			3,722
PNPTC Average 2000-04:			**2,323**
Std. Dev. (00-04):			1,730

Table A-4-b. 2006 Puget Sound Natural Fall Chum R/S Based WDFW Forecast

Parent Brood	Age	Parent Escapement	Mean R/S[1]	Estimated R/S (all ages)	Mean Age Composition[1]	Natural Forecast
2001	5	572,576	3.11245	1,782,114	0.07026	125,211
2002	4	1,082,187	2.58517	2,797,637	0.76724	2,146,459
2003	3	698,551	3.11245	2,174,205	0.36519	793,998
					Total	3,065,669
					Adjusted to 50% Prior to Use	1,532,834

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

Table A-4-c. 2006 WDFW Puget Sound Natural Chum R/S, Sibling and Average of Forecasts

	R/S	SJF Parent Escapement Proportion	SJF Forecast by Age
Age 3 (2003 Brood) Forecast	396,999	0.00144	572
Age 4 (2002 Brood) Forecast	1,073,230	0.00423	4,540
Age 5 (2001 Brood) Forecast	62,606	0.00264	165
Total Forecast (4B)	1,532,834		**5,277**

Table A-4-d. Apportionment of the Strait of Juan de Fuca Fall Chum Salmon Forecast

Area	Proportion	PNPTC Forecast	WDFW Forecast	Joint Forecast
Pysht R	0.458	1,065	2,418	1,742
Dungeness R	0.139	323	733	528
Deep Creek	0.139	323	733	528
Miscellaneous	0.264	613	1,392	1,003
Total		2,323	5,277	3,800