

**SUMMARY OF 2004 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)	75C (Hoko) Mixed	Primary	866		Terminal Run	Natural
	76A (Dungeness) Natural/Suppl.	Primary	486		Terminal Run	Natural
	76B (Elwha) Mixed	Primary	2,220		Terminal Run	Hatchery
Summer Chum (A-2)	Natural	Primary	4,739		Total Recruits	
Coho W. SJF (A-3)¹	Natural	Primary	39,464		DA2 ¹	Natural
	Natural	Primary	8,165		DA2 ¹	Natural
Coho E. SJF (A-3)¹	Natural	Secondary	7,842		DA2 ¹	Hatchery
	Hatchery	Primary	30,445	22,545	DA2 ¹	Hatchery
Fall Chum (A-4)	Natural	Primary	2,224		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	3,939
Sequim Bay	202
Chimacum	598

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

Dungeness River	486
Elwha River	2,220
Hoko River	866

Coho FRAM Model Inputs

Stock Name	DA2	nuFRAM Stock	nuFRAM Age 3	Marked
Dungeness River Natural	6,708	dungew	6,198	
Dungeness Hatchery	20,105	dungeh	18,577	18,577
Elwha River Natural	1,134	elwhaw	1,048	
Elwha Hatchery	10,341	elwhah	9,555	2,255
East Juan de Fuca Misc. Natural	8,165	ejdfmw	7,545	
West Juan de Fuca Misc. Natural	39,464	wjdfmw	36,465	
Port Angeles Net Pens	0	ptangh	0	
Area 9 Misc. Natural	0	area9w	0	

A-1. Chinook Salmon

A-1.1 Dungeness River Natural

The forecast of the Dungeness River natural-origin chinook salmon terminal area run for 2004, was estimated using the mean of the post season estimates of the 2000-03 terminal (Area 6D) runs. The run sizes for the return years 2000-03 best represent current survival conditions. The races were aggregated because of the lack of adequate information to separately quantify the returns of any spring and summer chinook salmon. The 2004 terminal area forecast return is 486 natural chinook salmon (Table A-1-a).

In the Dungeness River, releases of supplementation chinook from brood years 1997-99 are expected to contribute a currently unquantified number of terminal area returns. However, returns from past supplementation releases are included indirectly, by using recent years' returns. This forecast was used to estimate recruitment inputs for pre-season simulation modeling.

Table A-1-a. 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	42	495
2002*	633	0	0	633
2003*	640	0	0	640
2004 Forecast (Average Return 2000-03)				486

(*) The 2003 estimate is preliminary and subject to revision. Also, by agreement, the preliminary estimate of recreational harvest, from 2001 was not used in the estimation of the forecast because it is likely in error.

A-1.2 Elwha River

The 2004 forecast return of Elwha River chinook salmon, to the terminal area, was estimated as the 2000-03 average terminal area run. The resulting 2004 terminal area forecast is 2,220 (Table A-1-b).

Table A-1-b. 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
2000-03	2,220				
2004 Forecast	2,220				

Harvest does not include Recreational Catch

(*) The 2003 estimate is preliminary and subject to revision

Table A-1-c. 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

In order to estimate the potential escapements in 2004, the forecasted return to the Elwha River was further apportioned, using the 2000-2003 mean proportions (Table A-1-c), as follows: Of the 2,220 , **12.8%** (284) are expected to voluntarily return to the Elwha Rearing Channel, and **87.2%** (1,936) to the river. The voluntary hatchery return was reduced by **22.0%** (62), to account for average on-station pre-spawning mortality, leaving 221 hatchery spawners. The in-river escapement was not reduced for in-river pre-spawning mortality, based on recent years' survival. However, the 1,936 in-river escapement was reduced by **57.5%** (1,113) to account for broodstock removals (gaff & seine), leaving an anticipated in-river spawning escapement of 823 chinook salmon and an anticipated hatchery broodstock total of 1,335.

A-1.3 Hoko River

The forecast of Hoko River chinook salmon for 2004 was estimated as the 2000-03 average return to the terminal area. The 2004 forecast estimate is 866 chinook salmon (Table A-1-d).

Table A-1-d. 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
Average 2000-03	866		

*The 2003 estimate is preliminary and subject to revision.

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*	5,994	449	562	7,005
2004 Forecast (00-03 Avg.):	3,939	202	598	4,739

*The 2003 estimate is preliminary and subject to revision

The 2004 return of summer-timed chum to the Discovery, Chimacum and Sequim Management Units was forecasted as a 4 year mean (2000-2003) of the total recruitment, of each unit, to all fisheries and escapement. (Table A-2-a). The forecasts are 3,939 fish to the Discovery MU, 202 fish to Sequim MU and 598 to the Chimacum MU. Recruits to the Dungeness / Graywolf system are unquantifiable at this time.

A-3. Coho Salmon

A-3.1 Natural Runs

The method used to develop the 2004 forecasted return of naturally reared coho salmon, for primary units, relied on an estimate of emigrating smolts (2003 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 six production units, comprising 21.64% of the total, was measured and expanded to 238,368 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 16,919 wild smolts for the sub-region. To those, we added 32,400 smolts from the Snow Creek supplemented natural emigration, bringing the sub-region total to 49,319 smolts (Table A-3-c). The total number of estimated smolts, produced from all primary units, is estimated at 287,687.

This is the first year that the Snow Creek supplemented smolts have been included in the forecast, so the estimate of recruit contribution from this supplementation activity may be somewhat optimistic. There are indications that smolts originating from this supplementation program may be experiencing a significantly lower rate of marine survival than that experienced by coho whose entire life history took place in the natural environment.

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 (2001) (Table A-3-b). This resulted in an estimate of 42,497 smolts.

A-3.1.2 Marine Survival

The forecasted survival value of 16.56% was obtained by estimating an average recruits/smolt relationship, using escapement in parent years 1997-1999 and smolt emigration in years 1999-2001 with associated recruitment in return years 2000-2002. Applying this marine survival value to the estimates of emigrating smolts, resulted in an estimate of primary DA2 coho recruits (3,267 Eastern and 39,464 Western) (Table A-3-c) and estimate of 7,036 DA2 coho recruits from secondary units (1,017 Elwha and 6,018 Dungeness) (Table A-3-d).

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

2003 Smolt Trapping	Enumerated Smolts	Enumerated Proportion of Total Potential	Estimated Total Smolts
Snow Crk. (Suppl. Nat.)	32,400		32,400
Jimmycomelately Crk	1,274		
Siebert Crk	1,485		
East Total w/o Snow	2,759	0.16307	16,919
Salt Crk	15,385		
E. Twin R.	9,772		
W. Twin R.	7,819		
Deep Crk	11,818		
Little Hoko R.	2,050		
Johnson Crk	4,746		
West Total	51,590	0.21643	238,368
E+W+Snow Total	54,349		287,687

Note: The smolt value shown for Little Hoko is likely an under estimate, due to uncorrected trapping inefficiencies. Therefore, the resulting forecasts are considered conservative.

Table A-3-b. Estimation of Marine Survival

	RY 2000	RY 2001	RY 2002
Primary, Parent Escapement (RY-3)	5,788	16,517	9,328
Secondary, Parent Escapement (RY-3)	3,630	1,271	1,337
Primary Proportion	0.61457	0.92855	0.87464
Primary Smolts (RY-1)	202,431	383,322	285,427
Primary Recruits (RY)	41,715	45,522	49,051
Marine Survival	0.20607	0.11876	0.17185
Primary Escapement (RY)	18,980	36,963	23,133
Secondary Escapement (RY)	5,113	6,086	1,614
Mean Smolt to Recruit Survival			0.16556

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	2,759	0.16307	49,319	8,165
West Strait	51,590	0.21643	238,368	39,464
SJF Summary	54,349		287,687	47,629

Table A-3-d. Secondary Management Units Summary

Secondary Management Units	2001 Natural Escapement	2001 Brood Escapement Proportion	Estimated DA2's
Elwha	880	0.145	1,134
Dungeness	5,206	0.855	6,708
Total Secondary	6,086	1.000	7,842

A-3.2 Hatchery Runs

The 2004 returns of Strait of Juan de Fuca hatchery coho were predicted using the estimated 2000-02 (3 years - 1 brood cycle) average smolt survival to December-Age 2 (DA2) recruits, applied to the 2003 smolt releases (Table A-3-e). More specifically, the following sources of information were selected:

Dungeness Hatchery: 2000-2002 average recruits per smolt (0.03975) (Table A-3-e). Given a release of 505,750 smolts, the 2004 forecast is 20,105 DA2 recruits.

Elwha Hatchery: 2000-2002 average recruits per smolt (0.01427) (Table A-3-e). Given a release of 724,594 smolts, the 2004 forecast is 10,341 DA2 recruits.

The total hatchery-origin pre-season forecast value of 30,445 DA2 recruits (28,122 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	8,287	0.01070	643,037	6,272	0.00975
1999	877,300	5,182	0.00591	867,379	9,379	0.01081
2000	788,600	36,419	0.04618	645,856	4,838	0.00749
2001	865,700	38,648	0.04464	684,856	11,066	0.01616
2002	550,700	15,657	0.02843	494,610	9,479	0.01916
2003	565,300			662,231		
2004	505,750			724,594		
Average(2000-02):			0.03975	Average (2000-02):		0.01427
2004 Forecast DA2's			20,105	10,341		

**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	1,389	15,128	16,517
1999	1,360	7,968	9,328
2000	2,110	16,870	18,980
2001	2,626	34,337	36,963
2002	2,548	20,585	23,133

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 2004 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 runs observed in the years 1998 through 2002 (Table A-4-a). The resulting forecast of **2,010**, 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 2004 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 2001 wild escapement by the mean odd-brood R/S value to get a total return of 2001 brood offspring. That number was then multiplied by the mean return at age 3 for odd-year broods, yielding the 2004 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 1,099,425 (Table A-4-b).

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 **2,438** (Table A-4-d). The forecasts for individual production units are shown in Table A-4-e.

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-e)

Preliminary preseason forecasts will be updated by the PNPTC and WDFW, in the summer of 2004, prior to the fishing season, using the 2003 return year data, to update recruit per spawner and sibling return information.

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	1991	1,941
1981	6,518	1992	5,654
1982	6,744	1993	5,775
1983	1,765	1994	2,564
1984	8,280	1995	610
1985	8,330	1996	2,162
1986	1,922	1997	3,927
1987	7,269	1998	1,535
1988	13,962	1999	1,313
1989	4,331	2000	269
1990	1,220	2001	1,737
		2002	5,198
Average (All Yrs.):			3,860
PNPTC Average 1998-02:			2,010
Std. Dev. (98-02):			1,672

Table A-4-b. 2004 Puget Sound Natural Fall Chum R/S Based WDFW Forecast

Parent Brood	Age	Parent Escapement	Mean R/S¹	Estimated R/S (all ages)	Mean Age Composition¹	Natural Forecast
1999	5	337,398	3.1110	1,049,657	0.070	73,364
2000	4	193,762	2.5710	498,153	0.775	385,900
2001	3	563,670	3.1110	1,753,597	0.365	640,161
					Total	1,099,425

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

[REDACTED]		[REDACTED]	
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]

Table A-4-d. 2004 WDFW Puget Sound Natural Chum R/S, Sibling and Average of Forecasts

	R/S	Sibling	Average	SJF Parent Escapement Proportion	SJF Forecast by Age
Age 3 (2001 Brood) Forecast	640,161	n/a	640,161	0.0027	1,725
Age 4 (2000 Brood) Forecast	385,900	[REDACTED]	385,900	0.0011	436
Age 5 (1999 Brood) Forecast	73,364	[REDACTED]	73,364	0.0038	277
Total Forecast	1,099,425	[REDACTED]	1,099,425		2,438

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

Area	Proportion	PNPTC Forecast	WDFW Forecast	Joint Forecast
Pysht R	0.458	921	1,117	1,019
Dungeness R	0.139	279	339	309
Deep Creek	0.139	279	339	309
Miscellaneous	0.264	531	643	587
Total		2,010	2,438	2,224