2017 PRESEASON FORECAST PACKET FOR HOOD CANAL SALMON RUNS'

PRESEASON FORECAST PACKET PREPARED BY:

SKOKOMISH TRIBE

SALMON FORECASTS AGREED TO BY:

LOWER ELWHA TRIBE

PNPTC (FOR JAMESTOWN & PORT GAMBLE)

SKOKOMISH TRIBE

WDFW

FINAL 18FEB17

SUMMARY OF 2017 HOOD CANAL FORECASTS
and Forecasting Methods

Species (Ref.#)	Origin	Type	Number	Mass Marked	Number Type	Model Designation
Chinook (A-1)	Mixed	Secondary	2,459		TRS	Natural
	Hatchery	Primary	48,305		TRS	Hatchery
Summer Chum (A-2)	Natural (supplemented)	Secondary	34,188		Total Recruits	
Coho (A-3)[1]	Natural	Primary	154,102		Total DA2[1] Recruits	Natural
	Natural	Secondary	6,253		Total DA2[1] Recruits	Hatchery
	Hatchery	Secondary	93,585	83,916	Total DA2[1] Recruits	Hatchery
Fall Chum (A-4)	Natural		156,736		WA Run	Natural
	Hatchery		336,156			Hatchery
Pink (A-5)	Natural		226,406		WA Run	Natural
	Hatchery		3,034			Hatchery

[1] See overleaf for Coho FRAM model inputs (DA2 = December Age 2; OA3 = Ocean Age 3).

NOTES: Summer Chum salmon, although classified as "secondary", are under rehabilitation.
Forecasts for individual Hood Canal Management Units (MU) are:

Mainstem Hood Canal MU	16,410
SE Hood Canal MU	2,754
Quilcene MU	15,024

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

Mid Hood Canal MU	325
Skokomish MU	
(Natural)	1,956
(Hatchery)	25,773
Hoodsport MU	22,532
Miscell.	177

Coho FRAM Model Inputs:

Stock Name	DA2	nuFRAM Stock	nuFRAM OA3 = DA2/1.333	Marked nuFRAM	Marked %
Port Gamble Net Pens	16,089	ptgamh	12,067	12,018	99.60%
Port Gamble Bay Natural	1,783	ptgamw	1,337		
Area 12/12B Natural	57,932	ar12bw	43,449		
Quilcene Bay Net Pens	3,857	qlcnbh	2,893	2,835	98.00%
Quilcene Hatchery	44,490	qlcenh	33,368	29,497	88.40%
Area 12A Natural	4,471	ar12aw	3,353		
Hoodsport Hatchery	n/a	hoodsh	0		
Area 12C/12D Natural	63,809	ar12dw	47,857		
George Adams Hatchery	29,149	gadamh	21,862	18,587	85.02%
Skokomish River Natural	32,361	skokrw	24,271		

A. Pre-season Forecasting Methods

A-1. Summer/Fall Chinook Salmon

The 2017 forecasted terminal run size of summer-run Hood Canal Chinook salmon is the product of brood 2013 fingerling lbs released from WDFW facilities in 2014, 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 (2013-2016), (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 2010 through 2015 return years (2016 remains preliminary), to include this information for 2017 forecasting purposes (Tables A-1-a and A-1-b). The resulting terminal area run forecast is 50,763 Chinook salmon. The forecast was apportioned to 48,304 chinook expected to return to hatcheries and 2,459 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 2013-2016 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-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	0.78651	70,211
2012	89,877	1.08488	97,506
2013	90,075	0.85407	76,930
2014	86,661	0.31241	27,074
2015	85,352	0.42141	35,968
2016*	86,209	0.76746	66,162
Average 2013-2016		0.58884	
2017 Forecast			50,763

(*) 2016 return data are preliminary and subject to revision, following reconciliation of records.

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	21	4	2,377	46,320	21,199	70,211
2012	0	431	21	32	3,193	55,161	38,667	97,506
2013	*3*	*674*	*49*	*96*	*2,805*	*39,358*	*33,945*	*76,930*
2014	*0*	*141*	*1*	*63*	*1,564*	*13,912*	*11,392*	*27,074*
2015	*0*	*259*	*221*	*29*	*1,014*	*17,384*	*17,061*	*35,968*
*2016**	*0*	*292*	*98*	*84*	*2,100*	*34,538*	*29,052*	*66,162*

*Note: Values for years prior to 1998 DO NOT include freshwater recreational catch and the 2016 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
2013	0.00004	0.00876	0.00064	0.00124	0.03646	0.51161	0.44125
2014	0.00000	0.00522	0.00004	0.00234	0.05777	0.51385	0.42077
2015	0.00000	0.00720	0.00614	0.00080	0.02819	0.48333	0.47435
2016	0.00000	0.00441	0.00148	0.00127	0.03173	0.52202	0.43910
2013-16 Mean	0.00001	0.00640	0.00208	0.00141	0.03854	0.50770	0.44387

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

Hood Canal Production Unit	Terminal Run Forecast	Proportion
12A	0.50	0.00001
12B	325	0.00640
12C	106	0.00208
12D	72	0.00141
Skokomish	1,956	0.03854
Natural Subtotal	2,459	0.04844
George Adams	25,773	0.50770
Hoodsport	22,532	0.44387
Hatchery Subtotal	48,305	0.95157
Total	50,763	1.0

Note: The forecasted proportions are derived from the 2013-2016 mean distribution.

A-2. Summer Chum Salmon

A-2.1 Natural Summer Chum Runs

The 2017 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/Dabob, and Southeast Hood Canal Management Units (MUs).

Abundance for each MU was forecast as the mean of the 2013 through 2016 returns.

Estimates of the number of natural-origin recruits and supplementation-origin recruits returning to each MU each year from 2007 through 2016 and associated forecasts for 2017 are shown in Table A-2-a.

The 2017 forecasted returns are 16,410 summer chum to the Mainstem Hood Canal MU, 15,024 summer chum to the Quilcene/Dabob Bays MU, and 2,754 summer chum to the SE Hood Canal MU. The total forecasted return is 34,188 summer chum to Hood Canal in 2017 (Table A-2-a).

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 and the Tahuya River are each expected to contribute supplementation-origin recruits (SORs) during 2017. 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 2017.

The Summer Chum Salmon Conservation Initiative (SCSCI) defines interim Critical and Recovery abundance thresholds for each MU. The interim 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 2017 forecasted returns of summer chum exceed the interim Critical threshold for each Hood Canal Management Unit and exceed the interim Recovery threshold for the Quilcene/Dabob MU and 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
2007	5,939		3,802	75	2,070	768
2008	9,835		5,866	0	1,174	798
2009	4,953		2,498	0	615	383
2010	8,625		2,101	9	1,170	979
2011	3,700		2,736		627	
2012	14,315		12,501		3,762	
2013	11,336		8,723		2,906	
2014	16,285		12,197		1,007	
2015	11,894		20,437		2,068	
2016	26,126		18,739		5,034	
2017 Forecast a/	**16,410**		**15,024**		**2,754**	
2017 Total Hood Canal Forecast					**34,188**	

a/ 2013-16 mean return

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 2010 - 2016, the Co-managers agree that no gillnet fisheries will occur in 2017 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 Coho Salmon Natural Runs

The forecasted recruitment of 2017 Hood Canal natural coho salmon runs was based on a linear regression model that related the return of tagged natural jack coho at Big Beef Creek (BBC) to Hood Canal December Age 2 (DA2) recruits in the subsequent run year. This model used recruit data from brood years 1983-1998 and 2002-2012 (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:

$$\textit{Hood Canal Recruitment} = 34859.37 + (393.535 * (\textit{BBC Tagged Jacks}))$$

Relevant statistics of the model used to derive the 2017 forecast are shown below.

Using Brood Years 1983-1998, 2002-2012		Scaled by Jackknife MPE -17.5
Multiple R	0.78904	NA
R^2	0.62259	NA
Adj. R^2	0.60749	NA
Std Error of Estimate	34859.37	NA
N	27	NA
Intercept	33414.528	NA
Slope	393.535	NA
2016 Jacks	409	NA
2017 Forecast	194,370	160,356

For 2017 as was done in 2016, the co-managers have agreed to apply a bias correction to the current accepted methodology described above) for forecasting natural coho in Hood Canal. The co-managers felt that this was a conservative approach in order to address concerns of possible poor ocean survival, accounting for and encompasses the same range of error in the regression parameters that would adjust for the known tendency of the BBC jack model to overestimate the recruitment of Hood Canal natural DA2's.

This bias correction factor was calculated by applying the Mean Percent Error (MPE) to the 2017 primary DA2 forecast, as calculated through the Jackknife analysis. The percent error in the MPE, in this case, is an indication of the overestimation of the regression. The subsequent application of the MPE value -17.5 reduces the forecast on the primary DA2 from 194,370 to 160,356. The forecasted recruits were subsequently apportioned to primary and secondary units on the basis of the distribution of their parent brood escapement.

The total adjusted forecast of 160,356 natural DA2 recruits was thus apportioned into 154,102 primary and 6,253 from secondary units, on the basis of their parent brood spawner distribution (Table A-3-b).

Table A-3-a. 2017 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	18,994
2008	24,396	197	177	102,243
2009	51,932	212	178	154,318
2010	18,732	90	70	53,757
2011	24,028	124	84	82,550
2012	56,389	172	127	56,389
2013	8,115	91	69	
2014	23,384	537	409	

*Data italicized denotes methodology currently under review and agreed to for forecasting purposes only.

Table A-3-b. Apportionment of the 2017 Hood Canal Natural Coho Forecast

Area	Escapement Capacity	Escapement BY 2014	Management Unit Type	Proportion of Brood Escapement	December Age-2 Recruits	Scaled by Jack-knife MPE -17.5
12 / 12B	28.88%	8,319	Primary	36.13%	70,220	57,932
12C / 12D	31.66%	9,163	Primary	39.79%	77,345	63,809
Skokomish	29.01%	4,647	Primary	20.18%	39,225	32,361
9A	1.25%	256	Secondary	1.11%	2,161	1,783
12A	9.20%	642	Secondary	2.79%	5,419	4,471
Primary Subtotal	89.55%	22,129		96.10%	186,790	154,102
Secondary Subtotal	10.45%	898		3.90%	7,580	6,253
Grand Total	100.00%	23,027		100.00%	194,370	160,356

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
2011	9,106	10,030	5,252	24,388
2012	22,400	24,673	4,709	51,782
2013	6,779	7,467	1,798	16,044
2014	8,319	9,163	4,647	22,129
2015	12,252	13,495	590	26,337

A-3.2 Coho Salmon Hatchery Runs

The 2017 forecast utilized survival rates for two complete 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 2017 forecast of 93,585 hatchery reared December Age-2 coho recruits (Table A-3-d) was predicted from the brood year 2014 smolt releases multiplied by the average estimated marine survival rate for smolts from the six most recent available brood years for all facilities (Table A-3-d). In the winter of 2012-2013 a storm damaged the Quilcene Bay Net Pens, as a result BY12 fish destined for the net pens were held and released on station at the Quilcene National Fish Hatchery.

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**
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	23,275	0.07851	412,208	4,929	0.01196	357,967	32,815	0.09167	162,381	*3,384*	*0.02084*
2008	292,529	27,729	0.09479	423,584	23,035	0.05438	441,117	68,719	0.15578	200,499	*3,586*	*0.01789*
2009	306,329	29,754	0.09713	223,210	28,708	0.12861	345,604	68,639	0.19861	179,587	*6,025*	*0.03355*
2010	239,228	43,553	0.182056	397,581	15,470	0.03891	393,654	38,934	0.09890	204,578	*3,204*	*0.01566*
2011	289,734	15,845	0.05469	397,442	5,667	0.01426	426,115	10,279	0.02412	199,195	*2,012*	*0.01010*
2012	301,569	12,672	0.04202	414,013	1,728	0.00417	627,039	20,284	0.03235	0		
2013	314,174			394,424			441,449			200,165		
2014	318,458			382,615			443,838			196,706		
Average (2007-12)			0.09153			0.04205			0.10024			0.01961
2017 Forecast:	29,149			16,089			44,490			3,857		

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

A-4. Fall Chum Salmon

The 2017 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 2017 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 the brood years 2003-10. The mean recruit-per-spawner return rates were 1.24912, 1.28089, and 1.06484, for 3, 4, and 5 year-olds respectively (Table A-4-a). These adjusted rates of return were multiplied with the 2014, 2013, and 2012 brood escapements (51,216, 61,114, and 40,460; respectively) to estimate the total 2017 forecast of 178,980 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 179,209 to each natural production unit was estimated by adding the estimated 230 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 2012, 2013, and 2014 and age composition were used to estimate 2017 returns of Age 3, Age 4, and Age 5 natural fall chum. The 2017 forecast of natural fall chum to Puget Sound is 34,419 Age 3; 497,690 Age 4; and 160,790 Age 5 fish for a total run size of 692,898 (Table A-4b).

The apportionment of 692,898 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 21,867 Age 3; 107,201 Age 4; and 7,966 Age 5 fish for a total Hood Canal forecast of 134,034 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 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 2017 Hood Canal Natural Fall Chum Salmon Forecast

For preliminary preseason planning, we agreed to use a forecast of 156,736 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 Escape	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	0.05885	0.67722
2007	78,218	0.70884	2.44524	0.67400	3.82808
2008	38,512	0.00000	1.52348	0.25191	1.77540
2009	13,961	6.98370	**19.92078**	2.21078	**29.11526**
2010	17,221	0.00000	**12.48167**	3.78543	16.26710
2011	48,446	0.40693	3.48951		3.89643
2012	40,460	0.49530			0.49530
2013	61,172	0.00000			
2014	51,216	0.00000			
Mean: Brood Years 1968-14 (exclusive of outliers, in bold)					
All Odd Years	47,754	1.66402	2.34565	0.67263	4.96447
All Even Years	69,693	0.81207	2.84289	0.41529	4.24042
Years 2003-10*	76,156	1.24912	1.28085	0.90589	1.99088
		3's	**4's**	**5's**	
2017 Tribal Forecast*		63,975	78,352	36,652	178,980

Table A-4-b. 2017 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
2012	5	280,427	2.31	2.31	647,043	0.0530000	34,419
2013	4	283,997	3.08	3.08	874,263	0.5690000	497,690
2014	3	376,600	2.31	2.31	868,950	0.1850000	160,790
						Total	692,898

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

Table A-4-c. 2017 WDFW Hood Canal Natural Fall Chum Salmon Forecasts

	Puget Sound Forecast	HC Parent Escapement Proportion	HC Forecast by Age
Age 3 (2014 Brood) Forecast	160,790	0.1360000	21,867
Age 4 (2013 Brood) Forecast	497,690	0.2150000	107,201
Age 5 (2012 Brood) Forecast	34,419	0.1440000	4,966
Total WDFW Forecast	692,898		134,034

Table A-4-d. 2017 Hood Canal Natural Fall Chum Salmon Parent Brood Escapement Distribution

Area	2012	2013	2014
9A	0.00%	0.00%	0.00%
12	4.26%	2.47%	2.41%
12A	1.51%	2.34%	8.06%
12B	43.26%	20.29%	40.25%
12C	11.10%	17.51%	19.68%
82G	23.87%	35.83%	22.53%
12D	16.00%	21.55%	7.07%

Table A-4-e. Apportionment of the 2017 Tribal Hood Canal Natural Fall Chum Salmon Forecast

Area	3's	4's	5's	Total
9A	0	0	0	0
12	1,540	1,938	1,560	5,038
12A	5,156	1,837	554	7,546
12B	25,750	15,898	15,856	57,504
12C	12,592	13,721	4,068	30,381
82G	14,413	28,072	8,750	51,235
12D	4,524	16,886	5,864	27,275
Total	63,975	78,352	36,653	178,980

Table A-4-f. Apportionment of the 2017 WDFW Hood Canal Natural Fall Chum Salmon Forecast

Area	3's	4's	5's	Total
9A	0	0	0	0
12	526	2,652	211	3,390
12A	8,801	21,752	2,148	32,701
12B	1,762	2,513	75	4,351
12C	4,304	18,773	551	23,628
82G	4,926	38,407	1,186	44,519
12D	1,546	23,104	795	25,445
Total	21,867	107,201	4,966	134,034

Table A-4-g. Apportionment of the 2017 Joint Hood Canal Natural Fall Chum Salmon Forecast

Area	Tribal Forecast	WDFW Forecast	Joint Forecast
9A	0	0	0
12	5,038	3,390	4,214
12A	7,546	32,701	20,124
12B	57,504	4,351	30,927
12C	30,381	23,628	27,004
82G (Skokomish)	51,235	44,519	47,877
12D	27,275	25,445	26,360
12D Off-Station	230		230
Total	179,210	134,034	156,736

A-4.2 Hatchery Runs (Tribal)

The 2017 hatchery-origin returns 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 2012, 2013, and 2014. 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 2016, including Area 9A Little Boston Hatchery production increases coupled with 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 (2003-2010 broods) (Tables A-4-h and A-4-i). The resulting forecast for 2017 is 230 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 2017, Off-Station Lbs. Planted

Area	BY 2014	BY 2013	BY 2012
	Lbs	Lbs	Lbs
9A		0	0
12	5	12	1
12B		0	0
12A		0	0
12C		0	0
Skokomish	0	1	0
12D	35	176	0
Total	40	188	1

Table A-4-i. Apportionment of the 2017 Tribal Hood Canal Fall Chum Off-Station Forecast

Area	3's	4's	5's	Total
9A	0.00	0.00	0.00	0
12	5.09	12.00	1.00	18
12B	0.00	0.00	0.00	0
12A	0.00	0.00	0.00	0
12C	0.00	0.00	0.00	0
82G	0.00	1.00	0.04	1
12D	35.00	176.00	0.00	211
Total	40	189	1	230

A-4.2.2 Fall Chum Hatchery On-Station Forecasts (Tribal)

Hoodsport Hatchery: Mean return rate of age 3, 4, and 5 fish per pound planted at Finch Creek (2003-2010 broods) (Table A-4-j). The resulting forecast for 2017 is 64,810. Run reconstruction problems have biased this run low.

George Adams/McKernan Hatcheries: Mean return rate of age 3, age 4, and age 5 fish per pound released (2003-2010 broods) (Table A-4-k). The resulting forecast for 2017 is 257,867.

Little Boston Hatchery: Mean return rate of age 3, age 4 and age 5 fish per pound planted at Hoodsport Hatchery (2003-2010 broods) (Table A-4-j). The resulting forecast for 2017 is based on the fingerling releases of 3,069 lbs (BY14), 2,703 lbs. (BY13), and 1,713 lbs. (BY2012), which were used to estimate the return of 3, 4, and 5-year olds respectively, for a total return of 5,904 (Table A-4-n).

Enetai Hatchery: Mean return rates of age 3, age 4 and age 5 fish per pound planted (2003-2010 broods). (Table A-4-l). The resulting forecast for 2017 is based on the fingerling releases of 9,705 lbs (BY14), 7,976 lbs. (BY13), and 9,637 lbs. (BY2012), which were used to estimate the return of 3, 4, and 5-year olds respectively, for a total return of 51,058.

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 379,638.

A-4.2.3 Fall Chum Hatchery Forecasts (WDFW)

The 2017 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 2014 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 2017 WDFW Hood Canal hatchery fall chum forecast is 292,163 on-station and 512 off-station for a total forecast of 292,675.

A-4.2.4 Joint 2017 Hood Canal Hatchery Fall Chum Salmon Forecast

For preliminary preseason planning, we agreed to use a forecast of 336,156 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

Continued ...

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	0.02103	1.42236
2007	25,523	1.40372	2.16346	0.21276	3.77993
2008	28,653	0.02999	0.29356	0.01520	0.33875
2009	30,092	1.30740	1.65037	0.21783	3.17560
2010	27,262	0.15984	3.06169	0.35500	3.57653
2011	30,171	0.63369	2.09860		
2012	31,246				
2013	30,347				
2014	29,497				
All Odd Years	25,935	1.62008	2.50924	0.16963	4.35970
All Even Years	29,010	1.10216	3.06954	0.11165	4.34812
All Years	27,472	1.36663	2.78343	0.14129	4.35404
All Years 65-73	3,546	0.88670	3.10959	0.10035	4.17768
All Years 74-10	32,985	1.50318	2.72260	0.15014	4.39813
All Years 03-10*	29,395	0.61639	1.40113	0.13148	2.14900
2017 Tribal Forecast*		18,182	42,519	4,108	64,810

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	0.08015	4.70544
2007	21,035	5.61999	**14.76001**	0.80514	**21.18514**
2008	22,371	0.86000	2.69175	0.09309	3.64483
2009	22,482	**13.30859**	**35.85918**	0.97884	**50.14661**
2010	22,855	**10.16291**	9.15311	1.05806	20.37408
2011	33,674	1.36967	5.22500		
2012	24,781				
2013	25,878				
2014	29,061				
Average Return Brood Years (1978-10) excluding outliers in bold.					
Odd Years	27,274	2.38908	3.19681	0.44618	6.15589
Even Years	25,211	1.65000	3.34077	0.22485	4.63063
All Years	26,214	2.01954	3.27907	0.29015	5.93650
Years 03-10*	24,013	3.86023	5.13108	0.52058	10.88305
2017 Tribal Forecast*		112,182	132,784	12,901	257,867

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	0.02931	0.83596
2007	6,469	0.88754	3.41262	0.05968	4.35984
2008	3,951	0.05116	0.70356	0.10902	0.86374
2009	4,700	7.54088	5.64889	0.39302	13.58280
2010	5,531	2.19477	5.51053	0.40200	8.10731
2011	6,301	0.50739	1.39891		
2012	9,637				
2013	7,976				
2014	9,705				
Average (Brood Years 1976-10).					
Odd Years	4,539	2.83789	2.62063	0.14313	5.69608
Even Years	5,131	1.60454	2.56519	0.18284	3.87562
All Years	4,842	2.22121	2.50106	0.16363	4.71583
Years 03-10*	5,503	2.79627	2.77247	0.18751	5.75625
2017 Tribal Forecast*		27,138	22,113	1,807	51,058

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

Table A-4-m. Summary of 2017 WDFW Hood Canal Hatchery Fall Chum Forecasts

Facility	Age 3	Age 4	Age 5	Total
Little Boston Hatchery	2,944	6,517	156	9,617
Hoodsport Hatchery	25,620	80,618	3,313	109,551
G. Adams / McKernan Hatchery	57,905	71,850	5,067	134,822
Enetai Hatchery	16,308	19,905	1,960	38,173
12D Streams - Augmentation	91	420	1	512
Total	102,868	179,310	10,497	292,675

Table A-4-n. Summary of 2017 Tribal Hood Canal Hatchery Fall Chum Forecasts

Facility	Age 3	Age 4	Age 5	Total
Little Boston Hatchery	1,892	3,787	225	5,904
Hoodsport Hatchery	18,182	42,519	4,108	64,809
G. Adams / McKernan Hatchery	112,182	132,784	12,901	257,867
Enetai Hatchery	27,138	22,113	1,807	51,058
Total	159,393	201,203	19,041	379,638

Table A-4-o. Apportionment of the 2017 Joint Hood Canal Hatchery Fall Chum Salmon Forecasts

Facility	Tribal Forecast	WDFW Forecast	Joint Forecast
Little Boston Hatchery	5,904	9,617	7,761
Hoodsport Hatchery	64,809	109,551	87,180
G. Adams / McKernan Hatchery	257,867	134,822	196,345
Enetai Hatchery	51,058	38,173	44,616
12D Streams - Augmentation		512	
Total	379,638	292,675	336,156

A-5. Pink Salmon.

A-5.1 Pink Salmon Natural Runs

Tribal Forecast:

The 2017 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 2015 brood year estimated escapement (549,512) (Table A-5-a) multiplied by the long-term recruit per spawner average estimated "Cycle 2" return rate of (0.66090775) for a forecast of 363,177 natural pink salmon total recruits (Table A-5-b).

Table A-5-a. Pink Salmon Natural Run Reconstruction for Hood Canal

Return Year (RY)	Brood Year (BY)	Hood Canal Parent (BY) Natural Escapement	Hood Canal Natural 4B Run (RY)	Hood Canal Total Natural Recruits (RY) (4B+CDN)	Hoodsport Hatchery Recruits (RY)	Hood Canal Total Recruits (RY)
1961	1959	30,600	37,863	44,388	3,560	47,948
1963	1961	36,900	629,272	901,536	11,893	913,429
1965	1963	503,200	167,326	217,872	586	218,458
1967	1965	160,500	294,136	465,405	3,869	469,274
1969	1967	269,400	42,957	58,604	3,146	61,750
1971	1969	42,100	106,788	138,686	3,188	141,874
1973	1971	104,100	48,991	70,592	2,291	72,883
1975	1973	47,100	13,194	18,402	3,457	21,859
1977	1975	12,600	45,643	79,795	10,530	90,325
1979	1977	44,300	42,243	74,371	8,710	83,081
1981	1979	37,300	7,652	12,013	3,044	15,057
1983	1981	6,550	25,803	29,222	626	29,848
1985	1983	25,200	66,602	91,738	2,196	93,934
1987	1985	64,100	68,988	77,341	11,117	88,458
1989	1987	62,200	87,472	114,943	4,047	118,990
1991	1989	60,970	131,677	166,259	4,683	170,942
1993	1991	118,450	37,225	38,695	12,599	51,294
1995	1993	35,647	32,280	36,148	29,373	65,521
1997	1995	31,306	9,202	9,477	23,969	33,446
1999	1997	8,363	12,673	12,673	7,635	20,308
2001	1999	12,667	98,962	99,061	71,539	170,600
2003	2001	98,338	38,242	38,242	25,217	63,459
2005	2003	37,531	17,585	17,603	14,107	31,710
2007	2005	17,481	29,505	29,564	4,406	33,970
2009	2007	29,001	11,501	11,501	22,455	33,956
2011	2009	11,093	15,256	15,256	17,791	33,047
2013	2011	15,122	202,798	203,204	4,903	208,107
2015	2013	195,601	589,896	591,671	5,948	597,619

Table A-5-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	1.455	1961	**24.498**	1963	**0.433**
1965	2.909	1967	0.218	1969	3.302
1971	0.679	1973	0.396	1975	6.384
1977	1.690	1979	0.324	1981	4.531
1983	3.670	1985	1.212	1987	1.851
1989	2.735	1991	0.327	1993	1.023
1995	0.303	1997	1.527	1999	7.823
2001	0.389	2003	0.470	2005	1.695
2007	0.397	2009	*0.639*	2011	3.131
2013	1.763	2015	0.835	2017	
Average:	1.599		0.661		3.717
Std. Dev.	1.192		0.449		2.390
2017 Tribal Forecast					363,177
2017 WDFW Forecast					89,636
2017 Joint Forecast					226,406

*WDFW Forecast**:***
WDFW provided a separate forecast for naturally reared Hood Canal pink salmon, using alternative regression method based on fry outmigration a departure from the R/S used in previous years. A fry based method was explored to try and account for a decline in freshwater production, of which the former WDFW R/S forecasts do not take into consideration.

The total forecast predicted from the regression equation produced a total forecast for Hood Canal of 89,636, which was then broken down to the respective watersheds by their 2015 escapement proportions.

Joint 2017 Hood Canal Natural Pink Salmon Forecast:
Given the difference between methodology, the agreed to forecast for 2017 is 226,406 natural pink salmon recruits, the mean of the Tribal and WDFW forecasts.

A-5.2 Pink Salmon Hatchery Runs.

Tribal Forecast:
The 2017 return of hatchery reared Hood Canal pink salmon was forecast as recruitment to all fisheries and escapement, using the product of the 2015 brood year fingerling pounds released from the Hoodsport Hatchery (1,309), multiplied by the long term average recruits per pound rate estimated for the Hoodsport Hatchery (2.6256). The resulting recruit forecast is 3,436 pink salmon recruits (Table A-5-c).

*WDFW Forecast**:***
For hatchery returns, the WDFW provided a separate forecast of 2,631 hatchery recruits using the same SaSI stock escapement values, multiplied by a Cycle 2 average return rate, excluding the 1999 outlier. The difference in State and Tribal forecasts is based on the different averaging methods.

Joint 2017 Hood Canal Hatchery Pink Salmon Forecast:
For 2017, given the relatively small difference between methodology the agreed to forecast is 3,034 hatchery pink salmon recruits, the mean of the Tribal and WDFW forecasts (Table A-5-c).

Table A-5-c. Hoodsport Hatchery Pink Salmon Return Rates.

Brood Year	Lbs. Released	Total Recruits	Recruits/Lb
1959	2,515	3,560	1.4155
1961	492	11,893	**24.1728**
1963	1,209	586	0.4847
1965	1,283	3,869	3.0156
1967	1,416	3,146	2.2218
1969	2,399	3,188	1.3289
1971	3,071	2,291	0.7460
1973	2,104	3,457	1.6431
1975	3,477	10,530	3.0285
1977	3,496	8,710	2.4914
1979	2,253	3,044	1.3511
1981	1,748	626	0.3581
1983	655	2,196	3.3527
1985	2,152	11,117	5.1659
1987	5,625	4,047	0.7195
1989	1,913	4,683	2.4480
1991	4,453	12,599	2.8293
1993	6,532	29,373	4.4968
1995	7,623	23,969	3.1443
1997	7,851	7,635	0.9725
1999	3,117	71,539	**22.9512**
2001	3,244	25,217	7.7734
2003	3,563	14,107	3.9593
2005	1,670	4,406	2.6383
2007	1,267	22,455	**17.7230**
2009	1,600	17,791	**11.1194**
2011	1,584	4,903	3.0953
2013	1,372	5,948	4.3353
2015	1,309		
BY 1959-013 Average			2.6256
TRIBAL 2017 Forecast		3,436	
WDFW 2017 Forecast		2,631	
2017 Joint Forecast			3,034

Note: Values in boldface were excluded from both forecast methods.