

Washington Department of Fish and Wildlife
Puget Sound Treaty Indian Tribes

Puget Sound Chinook Comprehensive Harvest Management Plan

Annual Report Covering
The 2007-2008 Fishing Season

Acknowledgements

This data contained in this report are the result of the widespread work of Tribal and WDFW staff throughout the Puget Sound Region. Staff members directly contributing to preparation of this report include:

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Executive Summary

This annual report on the Puget Sound Chinook Comprehensive Harvest Management Plan summarizes results of salmon fisheries occurring between May 1, 2007 and April 30, 2008. This includes comparisons of pre-season projections with actual catch in all commercial and some recreational fisheries. 2006 Recreational catch estimates are presented for those areas where data were not available in time for the 2006-2007 report. Chinook spawning escapement estimates for 2007 are reported for all Puget Sound populations, with details on escapement surveys and estimation methods. Comparisons are also made between pre-season projections of escapement, and actual results.

Commercial Chinook catch in Puget Sound pre-terminal areas (i.e., the Strait of Juan de Fuca and Rosario / Georgia Straits) was less than projected in all areas. This was a result of weaker than expected catches in troll fisheries, and lack of opportunity for sockeye openings due to weak Fraser River sockeye returns. Catch was substantially lower than projected in the Hood Canal terminal area, primarily due to low catches in the Hoodspout hatchery zone (12H). Catch substantially exceeded preseason projections in the South Puget Sound terminal areas, particularly the Duwamish and Nisqually rivers, and the Deep South Sound Marine areas. Although catch exceeded expectations, conservation objectives appear to have been met in these areas.

Marine and freshwater landed recreational Chinook catch in the 2006-2007 season was estimated, from a combination of Catch Record Card and creel data, to be 48,800, slightly higher than the pre-season projection of 44,400. Creel survey-based estimates of catch in 2007-2008 mark-selective recreational fisheries in Areas 5-6, 7, 8.1-8.2, 9-10, Skagit River, Skykomish River, and Puyallup/Carbon rivers are included in this report. Total mortality estimates (catch + non-landed mortality) for the marine area selective fisheries were generally lower than pre-season expectations.

Escapements to the Skagit (summer/fall), Cedar, Nisqually, Puyallup, White (spring), and Green management units exceeded pre-season projections. Escapement to the Skagit (spring), Stillaguamish, Skokomish, Mid-Hood Canal, Dungeness, Elwha and Hoko units were below their projected levels.

Escapement was below the lower management threshold for the Nooksack, Stillaguamish, Hoko, Dungeness, Skokomish, and Mid-Hood Canal management units. Escapements were above the Upper Management Thresholds in the Green, Cedar, Puyallup, and Nisqually Rivers. Escapements for other Puget Sound units were between their Upper Management Low Abundance thresholds.

Coded-wire tag sampling of 2006 commercial fisheries achieved the sampling rate objectives in most, but not all marine and freshwater areas. All marine area recreational fisheries were sampled at rates higher than 10% for the year.

1 Introduction

The Co-managers' Puget Sound Chinook Harvest Management Plan mandates annual reporting of the performance of Chinook harvest management relative to the standards and guidelines of the plan (PSIT and WDFW 2004). This report fulfills that requirement by assessing the performance and effectiveness of fishery management actions adopted for the most recent management year. Included in this report are:

- Management objectives for the 2007-2008 management year (May 1, 2007 through April 30, 2008)
- Projected and actual commercial landed catch in Puget Sound, and descriptions of fisheries, for the 2007-2008 management year
- Projected and actual landed catch for 2007 Puget Sound recreational fisheries where creel surveys were conducted, and for all 2006 Puget Sound recreational fisheries
- Projected and actual spawning escapement for all Puget Sound Chinook populations in 2007, with details on estimation methods and factors affecting the quality of estimates
- Coded-wire tag sampling rates for commercial and recreational fisheries
- Pre-season ISBM annual exploitation rate indices

1.1 Management Objectives

Harvest planning objectives, including Rebuilding Exploitation Rates (RERs), Critical Exploitation Rate Ceilings (CERCs) and spawning escapement thresholds for 2007-2008 fisheries are presented below in Table 1. Derivation of the exploitation rate ceilings and management thresholds is detailed in the HMP.

Pre-season fishery planning for 2007-2008 fisheries projected that natural spawning escapement would fall below the critical abundance thresholds for the Nooksack early Chinook and Mid-Hood Canal Chinook management units (MU). As a result, the 2003 Southern United States (SUS) fishing regime was modeled with 2007 forecasts of abundance, to determine 2003 fishery-based SUS exploitation rates for these MUs. The resulting 2003 fishery-based rates were 6.1% for Nooksack early Chinook, and 11.8% for Mid-Hood Canal Chinook. Southern U.S. fisheries were planned pre-season to not exceed these rates.

Table 1. 2007 Puget Sound Chinook Harvest Management Objectives.

Management Unit	RER	CERC	Upper Management Threshold	Low Abundance Threshold
Nooksack		6.1% SUS	4,000	
North Fork		(based on 2003 SUS	2,000	1,000
South Fork		fishing regime)	2,000	1,000
Skagit summer / fall	50%	15% SUS even-years;	14,500	4,800
Upper Skagit summer		17% SUS odd-years		2,200
Sauk summer				400
Lower Skagit fall				900
Skagit spring	38%	18% SUS	2,000	576
Upper Sauk				130
Cascade				170
Suiattle				170
Stillaguamish	25%	15% SUS	900	650
North Fork summer			600	500
South Fork & MS fall			300	
Snohomish	21%	15% SUS	4,600	2,000
Skykomish			3,600	1,745
Snoqualmie			1,000	521
Lake Washington	15% PTSUS	12% PTSUS		
Cedar River			1,200	200
Green	15% PTSUS	12% PTSUS	5,800	1,800
White River spring	20%	15% PTSUS	1,000	200
Puyallup fall	50%	12% PTSUS		500
South Prairie Creek			500	
Nisqually			1,100	
Skokomish	15% PTSUS	12% PTSUS	3,650 aggregate; 1,650 natural	1,300 aggregate; 800 natural
Mid-Hood Canal	15% PTSUS	11.8% PTSUS (based on 2003 SUS fishing regime)	750	400
Dungeness	10% SUS	6% SUS	925	500
Elwha	10% SUS	6% SUS	2,900	1,000
Western SJDF	10% SUS	6% SUS	850	500

2 Commercial Harvest

This chapter provides post-season estimates of Chinook catch for Puget Sound commercial fisheries, and also includes catch from tribal ceremonial and subsistence (C&S) fisheries, and test or research fisheries. Catch is projected pre-season through modeling of the fishery regime, which is developed and agreed upon in the Pacific Fisheries Management Council (PFMC) and North of Cape Falcon (NOF) forums, using the Fishery Regulation Assessment Model (FRAM). The regime agreed to for the 2007-2008 fishing season is described in detail in the Co-managers List of Agreed-to Fisheries, which describes all salmon fisheries for all areas of Puget Sound and the Washington coast. The final pre-season projections of catch under this regime were made in FRAM run number 3907.

Actual catch is accounted for by summarizing fish tickets, which are the sales receipts used for recording commercial, C&S, and research fishery landings. Fish ticket data are stored in a database maintained jointly by WDFW and the Puget Sound Tribes. In some fisheries, particularly non-treaty purse seine fisheries, estimates of non-landed mortality are also available, for comparison to pre-season expectations. WDFW conducts on-the-water observations of by-catch in commercial fisheries, concentrating on areas and gears where Chinook retention is not allowed. Summary results of that monitoring are included here.

Commercial troll and recreational catches in Washington coastal fisheries north of Cape Falcon were substantially less than their quotas (Table 2). Comparisons of projected and actual Puget Sound catch are provided here for two pre-terminal areas (Strait of Juan de Fuca and Georgia/Rosario Straits), and six regional terminal fisheries (Nooksack/Samish, Skagit, Stillaguamish/Snohomish, South Puget Sound, Hood Canal, and Strait of Juan de Fuca). General information is presented for the 2007-2008 fisheries, including in-season management actions that deviated from the pre-season plan, and explanations for differences in projected and actual catch.

Table 2. Summary of projected (FRAM 3907) and actual Chinook catch in Washington ocean and Puget Sound commercial fisheries in 2007.		
Fishery	Projected	Actual
Washington ocean non-treaty troll	16,250	14,268
Washington ocean recreational	16,250	8,944
Washington ocean treaty troll	35,000	22,976
Puget Sound pre-terminal net & troll total		
Strait of Juan de Fuca troll	8,950	5,629
Strait of Juan de Fuca net	824	107
San Juan Islands net	6,766	2,621
Area 9 net / hook & line	714	8
Nooksack-Samish terminal net	12,177	18,339
Skagit terminal net	1,436	1,848
Stillaguamish-Snohomish net	7,645	6,201
South Puget Sound terminal net	43,896	78,165
Hood Canal terminal net	26,342	16,410
Strait Tributaries terminal net	10	4
Puget Sound marine recreational	38,747	
Puget Sound freshwater recreational	10,273	

2.1 Strait of Juan de Fuca and Georgia / Rosario Straits

Fraser sockeye fisheries in Rosario Strait and Georgia Strait (catch areas 6/7/7A) were expected to start between August 1 and 6, with short openings through August 16. Additional openings targeting pink salmon were expected to occur in September. The sockeye-directed fishery never opened due to a much lower than expected abundance of returning sockeye. Actual starting dates for the pink salmon fishery were August 23 for Treaty fishers in areas 4B/5/6C, August 26 for Treaty fishers in areas 6/7/7A, August 23 for Non-Treaty reefnets, and August 28 for non-treaty gillnets and purse seines. Openings occurred through September 10. Expected effort in the Treaty fishery was 11 purse seines and 200 gillnets; actual effort was much different due to the fishery targeting pinks rather than sockeye, with 14 purse seine and 2 gillnet vessels participating.

Bycatch projections were prepared for the treaty and non-treaty fisheries, and plans were put in place for limiting bycatch should projections be exceeded in-season (see the 2008 Co-managers' List of Agreed-to Fisheries for details). Predicted bycatch for the treaty fishery was 4,670 Chinook, while actual bycatch was 2,425 (Table 2-2), including those taken for ceremonial and subsistence purposes. The majority of the Chinook were caught between August 26 and September 3.

Non-treaty purse seines are required to release all Chinook sampling, so non-treaty purse seine bycatch projections consisted of expected numbers of Chinook encounters, multiplied by an assumed mortality rate of 33%. Pre-season projections were for 1,698

mortalities from the purse seine fishery, plus an additional 233 Chinook captured by gillnet. The post-season estimates for mortalities in the fisheries were 157 for purse seine, and zero for gillnet. Effort for both gears was much lower than expected, due to the lack of sockeye opportunity. Gillnet effort was almost zero, with only 3 landings reported for the entire season.

2.2 Nooksack/Samish Terminal Area

In the Comprehensive Management Plan for Puget Sound Chinook: Harvest Management Component (PSIT and WDFW 2004), the Nooksack Indian Tribe and the Lummi Nation committed to limiting NOR mortalities for ceremonial and subsistence fisheries to 30, in the Nooksack River during the period of native early chinook migration between February and August. This commitment was based on an average of 10% of the interceptions being NORs from either stock, and the remainder as HORs from the supplementation program at Kendall. In the years since the Management Plan was developed, catch information suggested that due the 50% reduction in the Kendall Creek Hatchery supplementation program, that the NORs might make up 20% of the harvest during this period. In the 2007-8 Co-Managers' List of Agreed Fishing Plans, the tribes agreed to manage their ceremonial and subsistence fishery to 100 Chinook with an estimated mortality of 20 NORs.

The Lummi fishery was conducted in the lower river between the Slater Road Bridge and the mouth of the river. It had two components, a fishery to collect fish for the first salmon ceremony on March 16, April 18, May 10 and May 24, and a subsistence fishery July 3rd. Both fisheries are intensively monitored. Table 3 contains the total harvest, the number of hatchery fish identified by coded wire tags, the number of hatchery fish identified by adipose fin clips and the number of hatchery fish identified by distinct otolith marks. Tissues for those fish not identifiable as hatchery origin by CWTs, fin clips or otolith marks as hatchery origin were processed by the WDFW Genetics Lab for assignment by microsatellite DNA analysis and assigned to stock group. For the tribal fisheries the total catch was below target at 91, and the total harvest of NORs was 9, or 9.9% of the total catch. The two NOR South Fork Population identified in the July 3rd fishery represented the only fishery with South Fork Population Harvest. Because of the critical status of the South Fork Population, the Tribes are canceling the highly valued early July fishery and moving their subsistence harvest into the May period to avoid unnecessary impacts on the critical South Fork Population. Additional work will be implemented in the future to identify the timing of the entry and migration South Fork Chinook.

Tribe	Date	Total Harvest	Coded Wire Tags	Adipose Clipped	N.F. HOR Otolith	N.F. NOR DNA	S.F. NOR DNA
Lummi	16-Mar	0	0	0	0	0	0
Lummi	18-Apr	14	3	5	5	1	0
Lummi	10-May	24	5	10	7	2	0
Lummi	24-May	12	1	4	5	2	0
Nooksack	23-24 May	28	3	12	8	0	0
Lummi	03-Jul	7	3	1	0	1	2
Nooksack	02-Jul	6	0	2	3	1	0
Total		91	15	34	28	7	2
Percent			16.50%	37.40%	30.80%	7.70%	2.20%

The Nooksack Tribe conducted very limited Ceremonial and Subsistence fisheries May 23-24 and July 2 in 2007. Both openings were by permit only, and in the lower North Fork as a voluntary conservation measure to minimize the likelihood of catching any South Fork population Chinook. The open area of the lower North Fork varied as described below.

May 23-24, the fishery occurred from the confluence of Racehorse Creek down to the train trestle, just downriver from SR 9 bridge (RM 36.6-45.2). A total of 28 Chinook were caught, and 24 of these were sampled. Of these 24 sampled fish, 23 were identified as Kendall origin by otolith mark, and 12 of these had adipose fin clips and 3 had coded wire tags (without fin clips). WDFW conducted microsatellite DNA analysis on the single natural origin fish with assignments to the two spring populations and Nooksack/Samish fall Chinook, and the result was North Fork spring Chinook.

On July 2, there was a 12-hour daylight opening from Mosquito Lake Rd Bridge down to the train trestle, just downriver from SR 9 bridge (RM 36.6-40.8). A total of 6 Chinook were caught and sampled. Five of these were identified as Kendall origin by otolith mark, and 2 had adipose clips. There were no coded wire tags. One was a natural origin Chinook, and the DNA assignment was also North Fork spring Chinook.

In summary, the Nooksack Tribe Ceremonial and Subsistence total catch was 34, and 30 of these were sampled. Twenty-eight of these had otolith marks identifying them as Kendall Hatchery origin North Fork spring Chinook, and two were natural origin North Fork spring Chinook. The 4 unsampled Chinook are assumed to have the same likelihood as the 30 sampled Chinook, so these are all estimated to be Kendall origin. Half of the 28 Kendall origin Chinook had adipose fin clips, and 3 had coded wire tags.

Since the time of last year's report, WDFW also conducted microsatellite DNA analysis on the 2006 natural origin Chinook in the Nooksack Tribe ceremonial and subsistence fishery. There were no South Fork population Chinook, although one lower North Fork May natural-origin fish was actually a fall Chinook (99.5% likelihood).

A total of 16,934 Chinook were caught in marine areas 7B, 7C, and 7D in 2007, compared to a pre-season expectation of 11,795. The return to Samish hatchery was considerably larger than the pre-season forecast of 18,800, contributing to the larger than expected harvest. Catches are detailed by timestep, area, and treaty/non-treaty fisheries in Table 4.

Area	Timestep	Projected	Actual	Difference
7B, 7C, 7D Treaty net	Jul-Sep	5,642	9,922	4,280
	Oct-Dec	170	232	62
7B, 7C Non-treaty net	Jul-Sep	5,856	6,612	756
	Oct-Dec	127	168	41
Nooksack Treaty net	Early Chinook, May-Jul	119	91	-28
	Fall Chinook, Aug-Dec	5,812	1,314	-4,498

2.3 Skagit Bay/Skagit River Terminal Areas

Almost all Skagit terminal area impacts on Chinook were expected to occur during Ceremonial and Subsistence fisheries targeted at summer/fall timed Chinook (750 fish divided among the three Skagit Tribes), commercial fisheries targeted at coho salmon, during Skagit River test fisheries, and during a mark-selective sport fishery on spring

Chinook (see Section 3 for discussion of sport fisheries). Chinook non-retention was required in the Non-treaty purse seine fisheries at all times and for river sport fisheries before June 1 and after July 8. Chinook retention was permitted in Non-treaty gill net fisheries, Treaty fisheries, test fisheries, and during the spring Chinook selective river sport fishery June 1 through July 8 (for marked fish only). The preseason forecast was calculated based on FRAM recruit scalars with environmental variables adjusting the abundance—this methodology was initially used in 2006. The spring Chinook preseason forecast was 3,645 fish (1,617 wild extreme terminal run size, ETRS; 2,008 hatchery ETRS). The summer/fall preseason forecast was 10,421 ETRS; this included both the summer and fall run wild indicator broodstock.

Test fisheries including Blakes Drift Chinook, coho, and chum, Spudhouse drift coho, River Area 2 set net, and the Sockeye test (conducted during weeks 25–31 at the Spudhouse Drift, Highway 9 Bridge, Fernando Camp, and the Baker River mouth), were conducted mostly as scheduled, except that, due to scheduling problems, the Blake's Drift coho test was not conducted during Week 45. The Spudhouse test during Week 45 was also not conducted due to the death of Floyd Williams—Upper Skagit Tribe elder and Fish Committee Chair. Only one Bay test fishery occurred in Week 44 and two in Week 45; both were commercial openings and specific catch data from one fisher was used as test fishery data. A new site, Blakes Drift, was chosen to evaluate chum abundance in-season and scheduled for Weeks 44 and 45. This was the second year this test fishery was conducted. Due to safety reasons the sockeye test fishery, the Highway 9 Bridge, River Area 2, was suspended after a third week of fishing. This was the first year for this test fishery. Chinook catches in the test fisheries were more than expected during the spring (catch was 78; expected catch was 51) and summer/fall run timing (catch was 410; expected catch was 330). Sockeye directed test fisheries encountered 63 Chinook, released 11 with a 52.4% release mortality for a total mortality of 58 fish—5 spring run and 53 summer/fall run Chinook. Chinook directed test fisheries accounted for 73 spring and 200 summer/fall Chinook and had predicted 49 spring and 175 summer/fall Chinook preseason. Coho test fisheries accounted for 230 summer/fall Chinook while 189 were predicted preseason (Table 5).

The Baker sockeye run was approximately 3,950, substantially lower than the preseason forecast of 12,692—the lack of two ocean age fish in the age composition pointed to poor ocean return from outmigration year 2005. The Upper Skagit Tribal gillnet fishery was conducted for 1 and 0.292 days (July 5 and July 10) from the mouth of the Baker River downriver to the Spudhouse Drift in Area 78C. Though 44 Chinook were projected preseason (1 spring and 43 summer/fall), 23 (1 spring and 22 summer/fall Chinook) were caught and retained. The sockeye run was six days earlier than the last five odd-year average, and sockeye catches were 686 for the July 5 opening and 86 sockeye for the July 10 opening.

The Swinomish, Sauk-Suiattle, and Upper Skagit Tribes were scheduled to open the pink fishery in Weeks 35 and 36; however the ISU in Week 35 indicated that the run was lower than the escapement goal and the second week of the fishery was cancelled. Chinook catch was higher than projected during pink fishing even though only one day was fished rather than the two days planned. Swinomish caught 50 Chinook, three more than expected. Sauk-Suiattle did not fish during pink and there were 14 Chinook expected to be caught. Upper Skagit caught 173 Chinook when 127 were expected.

The coho fishery was scheduled in Weeks 40 through 42; delaying the fishery until a meaningful ISU could take place given the pre-abundance “Critical” status. In Week 39 however, the test fishery was conducted early in the week and the use of that data in the ISU indicated a run that was much larger than the PSF (ISU of 69,772, opposed to a PSF

of TRS of about 26,000). Consequently all three Skagit River Tribes opened up a fishery for two days in Week 39 (Table 2.5). However, the fishery ran concurrent with a crab fishery and reduced effort, particularly with Swinomish, in the coho fishery. The coho run, with a final test fishery regression-generated ISU of 78,769 fish was larger than predicted preseason and fishing opportunity was expanded to harvest all allowable fish. The Swinomish Tribe opened two days in Week 39, two days in Week 40 as planned preseason, three days in Week 41—one day more than planned, two days in Week 42 as planned, and 4 days in Week 43 in addition to the preseason plan. The Upper Skagit Tribe also opened in Week 39 for two days, increased their preseason fishery plan during the second week (Week 40), though only slightly by four hours to 2.167 days. The third week (Week 41) of fishing was also increased to 2.5 days from two days, while the Week 42 opening was decreased to only seven hours from the preseason plan of two days due to allocation. Sauk-Suiattle Tribe fished under Swinomish invitation with the same coho schedule as Swinomish. Chinook encounters were higher than predicted preseason during coho because the number of open days in the preseason plan had been greatly reduced to take into account the “Critical” abundance status (Table 5). Swinomish Tribe was expected to catch 17 Chinook when 47 were actually harvested. Sauk-Suiattle Tribe harvested no Chinook during coho and none were expected. The Upper Skagit Tribe's Chinook catch was higher than predicted preseason, 795 Chinook when 47 were expected.

Chum fishing was delayed until Week 45 per the preseason plan to provide conservation to the expected “Critical” abundance coho return. Two to three weeks of chum fisheries were planned preseason with few Chinook mortalities (10) projected. As the coho run return much larger than expected, the Swinomish and Sauk-Suiattle chum fishery opened in Week 44, one week earlier than planned preseason, while Upper Skagit opened in Week 45 as planned—coho impacts were an issue and thus the reason the Tribe observed the preseason plan schedule. The Skagit chum return appeared to return larger than the expected preseason abundance as estimated by inseason updates, and fisheries were expanded to harvest allowable returns. Swinomish expanded from the preseason fishing plan to a Week 44 fishery opening for two days. Swinomish kept with the open days scheduled in week 45—two days, and expanded to three days in Week 46 from 2 days. The Sauk-Suiattle Tribe reduced their open days inseason from preseason, opening Weeks 45 and 46 with a schedule of 2 and 3 days rather than the preseason schedule of Weeks 45 through 48—5, 4, 4, 4 days. The Upper Skagit Tribe fished Weeks 45 through 47 per the plan, though modified the open days schedule from 2, 2, 2, 1 days to 1.333, 2.093, 2.375, and 1.167 days. Twenty-three Chinook were caught in these fisheries rather than the ten calculated preseason.

There were 1,843 total observed Chinook mortalities estimated in Skagit terminal area test and commercial net fisheries during the adult accounting period. Test fisheries accounted for 478 Chinook: 58 in the sockeye test fishery; Blakes Chinook test caught 200 Chinook; Blakes coho test caught 88 Chinook; Spudhouse coho test caught 53 Chinook; the River Area 2 test caught 89 Chinook. The C&S fishery accounted for 243. The commercial fisheries accounted for 1,112 Chinook: 23 in the river sockeye fishery; 223 in the pink fishery; 842 in coho fisheries; 23 in chum fisheries; and one caught during week 51 in the steelhead fishery. In comparison, preseason impacts were projected at 1,436 total Chinook mortalities in Skagit terminal area net fisheries: 381 in test fisheries (51 spring and 330 summer/fall run Chinook), 750 in the C&S fisheries, 44 during the river sockeye fishery (1 spring and 43 summer/fall run Chinook), 188 during the pink fishery, 63 during the coho fishery, and 10 during the chum fishery. Thus, post-season observed Chinook mortalities were 407 more than what was projected preseason, though C&S catch was lower than targeted (243, rather than 750), and commercial catches were higher than modeled (1112, rather than 305) due largely to run size update increases for coho and

chum. This increase in mortalities for summer/fall Chinook occurred primarily during the coho fishery where the preseason forecast and the observed terminal run differed greatly—preseason forecasted much lower than observed, while spring Chinook catches were more than predicted, however this occurred in the test fishery. Later Chinook run timing then normal also contributed to the increase in Chinook catches where observed mid and upriver water levels were low and fish were more available to the fishery. Commercial catch during the Upper Skagit sockeye fishery (23 Chinook) was a bit lower than the 44 Chinook projected preseason. Additionally, effort during the C&S fishery was lower than expected, 243 catch compared to the 750 identified preseason. Of the post-season estimated mortalities in tribal fisheries, all were landed catch, because Chinook retention was allowed during all tribal fisheries—though 11 Chinook were released during the sockeye test fishery.

Non-treaty commercial effort was limited to fisheries targeting chum salmon. Participation was very limited, with 14 gillnet and no purse seine landings occurring. No Chinook were landed in the non-treaty fishery in 2007.

Spawning escapement of Skagit wild spring Chinook (613) was higher than the Lower Abundance Threshold (576)—terminal run size was 683. Assuming all other fisheries and abundances remained as modeled preseason, the lower terminal area catch of 59 spring Chinook (44 test and treaty commercial, and 15 recreational mark selective fishery), would have increased the preseason estimate of exploitation rate on Skagit wild spring Chinook from 25.4% to 25.7%, which is under the Recovery Exploitation Rate (RER) ceiling of 38%.

Spawning escapement of Skagit wild summer/fall Chinook plus the wild indicator stock groups (11,661) was lower than the Upper Management Threshold (UMT), of 14,500, which means that the spawning escapement did not exceed the level above which fisheries can be directed at wild Chinook—the terminal size (TRS), 14,901 was higher than the preseason expectation of 10,421. Assuming all other fisheries and abundances remained as modeled preseason, the higher terminal area catch of 1998 Chinook would have increased the Southern U.S. exploitation rate on Skagit summer/fall wild Chinook from the preseason estimate of 14% to 16.2%, which is under the Southern U.S. ER ceiling of 17%.

Table 5. Projected (FRAM3907) and actual landed catch and total mortality of Chinook in terminal-area fisheries in Skagit Bay/Saratoga Passage (Area 8) and the Skagit River (lower/Area 78C and upper/Area 78D) in 2007.

	Preseason Projected			Post-season Observed/Estimated			Difference (Post-minus Pre-season)	
Fishery	Schedule	Landed Catch	Total Mortality	Schedule	Landed Catch	Total Mortality	Landed Catch	Total Mortality
Test:								
Chinook	1 site, wks 19-35	175	175	Same	200	200	25	25
Sockeye	4 site, wks 25-31	17	17	4 site, wks 25-31	63	58	46	41
Coho	3 sites, wks 34-45	189	189	Same	230	230	41	41
Baker Sockeye:								
Week 28	1 day	43	43	Same	19	19	-24	-24
Week 29	1 day	1	1	0.292 days	4	4	3	3
Area 8/78C/78D Chinook C&S Swinomish, Sauk-Suiattle, Upper Skagit Tribes:								
Summer/Fall Chinook Timing	Variable to target	750	750	Variable to target	243	243	-507	-507
Area 8/78C Pink Swinomish/Sauk-Suiattle Tribes:								
Week 35	1 day	37	37	Same	50	50	13	13
Week 36	1 day	24	24	None	0	0	-24	-24
Area 78C and 78D Pink Upper Skagit Tribes:								
Week 35	1 days	67	67	1 days	173	173	106	106
Week 36	1 days	60	60	None	0	0	-60	-60
Week 37	None	0	0	Same	0	0	0	0
Week 38	None	0	0	Same	0	0	0	0
Area 8/78C Coho Swinomish/Sauk-Suiattle Tribes:								
Week 39	None	0	0	2 days/2 days	39	39	39	39
Week 40	2 days/2 days	11	11	2 days/2 days	4	4	-7	-7
Week 41	2 days/2 days	4	4	3 days/3 days	3	3	-1	-1
Week 42	2 days/2 days	2	2	2 days/2 days	0	0	-2	-2
Week 43	None	0	0	4 days/4 days	1	1	1	1
Area 78C and 78D Coho Upper Skagit Tribe:								
Week 39	None	0	0	1.167 days	190	190	190	190
Week 40	2 days	21	21	2.167 days	375	375	354	354
Week 41	2 days	24	24	2.042 days	194	194	170	170
Week 42	2 days	1	1	0.292 days	36	36	35	35
Week 43	None	0	0	None	0	0	0	0
Area 8/78C Swinomish/Sauk-Suiattle Tribes Chum:								
Week 44	None	0	0	2 day/0 day	0	0	0	0
Week 45	2 days/5 days	4	4	2 days/2 days	0	0	-4	-4
Week 46	2 days/4 days	5	5	3 days/3 days	0	0	-5	-5
Week 47	0 days/4 days	0	0	None	0	0	0	0
Week 48	0 days/4 days	0	0	None	0	0	0	0
Area 78C and 78D Chum Upper Skagit Tribe:								
Week 44	None	0	0	None	0	0	0	0
Week 45	2 days	1	1	1.333 days	22	22	21	21
Week 46	2 days	0	0	2.093 days	1	1	1	1
Week 47	2 days	0	0	2.375 days	0	0	0	0
Week 48	1 day	0	0	1.167 days	1	1	1	1
Total Skagit Terminal Area		1436	1436		1848	1843	412	407

2.4 Stillaguamish/Snohomish Terminal Area

Chinook catches in all fisheries in 2007 were substantially below what was anticipated, with the exception of the treaty chum fishery in Area 8A, but only four Chinook were caught in this fishery (Table 6). Forty-nine Chinook were caught as part of the ceremonial fishery, and only 16 were caught incidentally during the coho fishery in area 8A.

Tribal fisheries in Area 8D occurred as planned, with a catch relatively close to the number predicted.

Non-treaty fisheries had very small Chinook impacts in areas 8A and 8D. No boats participated in the planned area 8A limited-participation coho fishery, meaning that Chinook impact was zero. No Chinook were landed by gillnet fishers in either area during 2007. On-the-water monitoring of purse seine fishers showed that Chinook encounter rates were low during the chum fishery, with only 1 Chinook observed in the 40 purse seine sets sampled.

Table 6. Projected (FRAM 3907) and actual Chinook net harvest in the Stillaguamish - Snohomish terminal area non-treaty commercial and treaty fisheries in 2007.

Area		Projected ^{1/}	Actual ^{2/}	Difference
8A Chinook	Trty	100	49	-51
	Ntrty	NA		
8A Pink	Trty	296	11	-285
	Ntrty	NA		
8A Coho	Trty	122	16	-106
	Test	20	0	-20
	Ntrty	2	0	-2
8A Chum	Trty	0	4	4
	Test	0	0	0
	Ntrty	4	0	-4
8D Chinook	Trty	7,052	6,118	-934
	Ntrty	NA		
8D Coho	Trty	23	3	-20
	Ntrty	0	0	0
8D Chum	Trty	0	0	0
	Ntrty	0	0	0
Stillaguamish R. Chinook, Pink, Coho, & Chum	Treaty	26	0	-26
Total		7,645	6,201	-1,444

^{1/} FRAM 3907.

^{2/} TFT database, March 13, 2008.

2.5 South Puget Sound Terminal Areas

2.5.1 Marine areas 10 & 11

Chinook catches in test and commercial net fisheries occurring in marine areas 10 & 11 were much lower than projected in 2007. Projected and actual catches in Treaty fisheries in Marine Areas 10 and 11 are presented in Table 7, along with numbers for South Sound extreme terminal areas. Chinook encounters in the non-treaty purse seine chum fishery in areas 10 and 11 were very low, with 4 Chinook seen in the 61 sets observed by WDFW staff. Only one Chinook was landed by non-treaty gillnet during the chum fishery.

Table 7. Projected (FRAM 3907) and actual catches in Treaty 2007 South Puget Sound net fisheries.

Area	Management Period	Projected	Actual	Difference
Area 9	Chinook (C&S)	714	N/A	N/A
	Chum	Included in Area 10		
Areas 10&11	Coho (test)	129	56	-73
	Chum (test)	115	82	-33
	Sockeye			
	Pink		53	
	Coho	627	10	-564
	Chum			
Area 10E	Chinook	4,860	4,100	-760
Area 10A	Chinook (test)	590	287	-303
	Chinook		1,372	
	Coho	4,553	47	-3,134
	Chum		0	
Duwamish River	Chinook		8,447	
	Coho	5,312	748	3,883
	Chum		0	
Lake Washington/ Ship Canal	Sockeye (C&S)		28	
	Coho	853	1,575	750
Puyallup River	Spring Chinook (C&S)	49	176	127
	Fall Chinook (C&S)		120	
	Fall Chinook (test)	263	290	147
	Coho	1,306	2,448	1,142
White River	Spring Chinook (C&S)	493	389	-104
Areas 13, 13D-K	Chinook/Coho/Chum	4,407	8,427	4,020
Area 13A	Chinook/Coho/Chum	2,429	8,673	6,244
Areas 13C/Chambers	Chinook	3,638	11,614	7,976
Nisqually River	Chinook/coho	12,634	22,996	10,362

2.5.2 Lake Washington

The Lake Washington sockeye return in 2007 was below goal, meaning that the only sockeye fisheries opened were for ceremonial & subsistence purposes. The Suquamish Tribe caught a total of 21 Chinook in C&S sockeye openings in Area 10F below the

Ballard Locks. The Muckleshoot Tribe caught an additional 7 Chinook in C&S sockeye fisheries above the locks.

The coho return to Lake Washington was large enough to allow treaty commercial openings in the Ship Canal and in Lake Washington. The Suquamish Tribe caught 140 incidental Chinook during their coho fishery in the marine portion of the Ship Canal, while the Muckleshoot Tribe caught 1,435 Chinook during their coho-directed fisheries within freshwater areas of the Ship Canal and Lake Washington. 6,227 Chinook were also taken during Muckleshoot tribal Chinook-directed fisheries in Lake Sammamish (10D).

2.5.3 Elliott Bay/Duwamish River

The Muckleshoot and Suquamish tribes conducted three 12-hour commercial openings in Elliott Bay and the Duwamish River, on August 9th, 16th, and 20th. Additional openings for coho occurred later in the season. Total catches for the season were 1,419 in Elliott Bay (10A) and 9,195 in the Duwamish River (80B). In total, Chinook catch was about 749 higher than the pre-season projection.

2.5.4 Area 10E (Sinclair Inlet)

The Chinook returning to Area 10E are the result of Chinook supplementation programs operating out of several Suquamish Tribal hatchery stations on and off the reservation. The Sinclair Inlet terminal fishery was open 24 hours/day, 7 days /week, and was conducted on the same schedule as the agreed upon pre-season fishing plan. Effort is usually modest with 3-5 gill-netters and 5-8 set-netters. Overall tribal Chinook catch was approximately 4,000, lower than the pre-season estimate of 4,860.

Intensive sampling of the commercial fishery and in-stream surveys have consistently illustrated an estimated mark rate for Chinook returning to Sinclair Inlet of over 75% and 83%, respectively. Past analyses have demonstrated that over 90% of the CWT's recovered originated from Suquamish tribal hatchery facilities. Coded-wire tag data recovered from commercial fisheries during the 2007 season verified that 91% of the tagged fish originated from Suquamish tribal fish rearing facilities.

Likewise, stream surveys demonstrated an 82% mark rate with 97% of the tagged fish (164/170) being associated with Suquamish hatchery production. Escapement for Area 10E streams was estimated at 2,081 Chinook. Suquamish Tribal stream survey crews were able to mark sample 96% of the Chinook returning to freshwater systems throughout Area 10E waters. Gorst Creek, which sees the largest return in Sinclair Inlet had 2,003 Chinook return. Other misc. 10E streams saw a total of 78 Chinook return. A total of 170 CWT's were recovered from Chinook sampled on East Kitsap spawning grounds in 2007.

2.5.5 Puyallup River

Ceremonial & subsistence fisheries in the Puyallup and White rivers caught a total of 565 spring Chinook, and 120 fall Chinook. A one-day per week gillnet test fishery operated in the Puyallup from weeks 30-34, and caught a total of 290 Chinook. Commercial gillnet fisheries opened in the Puyallup in week 36, at the start of the coho management period. 2,448 Chinook were caught during the coho fishery, compared to a pre-season projection of 1,306. The higher catch reflects a runsize that was larger than forecast, as the harvest rate was closer to the pre-season prediction.

2.5.6 Marine area 13 & sub areas (Deep South Sound)

Deep South Sound. Tribal fisheries in Area 13C and Chambers Creek, Carr Inlet (Area 13A), and in Areas 13, and 13D-K, were conducted on the same schedule agreed-to in the pre-season plan. Actual fishing effort was again higher than projected, however, so the Chinook catch exceeded the pre-season projections in all areas. Actual catch for these areas combined was 28,714, substantially higher than the projected catch of 10,474 (Table 7).

Fishing effort varies annually in deep South Sound fisheries, dependent on abundance of returning fish, market conditions, and availability of other fishing opportunities. The lack of a directed Chinook fishery in the Puyallup River again in 2007 prompted Puyallup fishermen to direct more of their fishing effort into areas 13A and 13C, and higher prices for Chinook also led to heightened effort by Squaxin Island tribal fishermen.

2.5.7 Nisqually River

The treaty Chinook fishery in the Nisqually River was open as planned, three days per week for management weeks 28 – 37 (July 7 - September 9), then closed for weeks 38, 39, and 40 to reduce total harvest rate and assure meeting the natural-spawner escapement goal. The fishery was re-opened three days per week beginning October 7, during the Coho management period, through November 22nd.

Nisqually tribal and WDFW technical staff calculated four in-season updates of Chinook terminal abundance, based on catch rates observed in the river fishery. The first update, made on August 19th, was 37,001. The second update on August 21st was 46,611. A third update on August 23rd suggested a runsize of 39,877. From these updates, it was agreed that abundances were high enough to continue the commercial fishery as planned. A fourth update on August 30 indicated a terminal run size of 45,820. Post-season total runsize to the river was around 38,800, with a total treaty Chinook catch of 22,996, around twice the pre-season projected catch of 12,634. This equates to a harvest rate of around 59%, compared to a pre-season expectation of 44%. Harvest rates were above average, likely due to increased effort (caused by high market price and higher abundance of Chinook). Data collected during the fishery shows that catch was composed of about 10% unmarked fish.

2.6 Hood Canal

Total Chinook catch in Hood Canal treaty terminal fisheries, was approximately 36% less than predicted, due primarily to lower than expected catches in Area 12H. Chinook catch in the Skokomish River (including Purdy Creek) was 9,241, with catch and exploitation rates higher than the preseason predictions. The Skokomish Tribe also conducted a fishery in Purdy Creek to harvest surplus hatchery Chinook, with a catch of 3,973 Chinook. Catch in Area 12C was slightly higher than projected (Table 8) with incidental Chinook catch in other net fisheries in Hood Canal being close to projected levels.

Chinook harvest and mortality from non-treaty fisheries was less than projected pre-season. Non-treaty gillnets landed 2 Chinook during 2007 in Hood Canal. Observers on non-treaty purse seine boats observed only one Chinook captured in the 86 sets observed during the fishery, meaning that Chinook mortality was low.

Table 8. Projected (FRAM 3907) and actual Chinook catch and exploitation rates in Hood Canal terminal area net fisheries, 2007

Area	Target Species	Projected catch	Actual catch	Projected E.R.	Actual E.R.
Hood Canal Marine Net (12-12D,9A) (T)	Chinook, Coho, Chum	2,076	2,734	0.04201	0.06967
Hood Canal Marine Net (12-12B,9A) (NT)	Chum, Coho	25	2	0.00051	0.00005
12H Net (T)	Chinook, Chum	16,997	4,433	0.34399	0.11296
Skokomish River (82G/J) (T)	Chinook, Coho, Chum	6,356	9,241	0.12863	0.23548

2.7 Strait of Juan de Fuca

Chinook catch in terminal and extreme-terminal fisheries in the Strait region were very low, in accordance with pre-season projections (Table 9).

Table 9. Projected (FRAM 3907) and actual catches of Chinook in Strait of Juan de Fuca terminal commercial fisheries, 2007.

Terminal Area	Projected	Actual
Area 6D & Dungeness River Treaty	0	0
Area 6D Non-Treaty	0	0
Elwha River Treaty (C&S)	8	4
Hoko River Treaty	0	0

2.8 Non-treaty commercial monitoring data

Because non-treaty vessels are required to release non-target species in many fisheries, WDFW conducts on-water monitoring to provide data on encounters of non-target species. In 2007, efforts were concentrated on openings in Areas 7/7A, 8A, 10/11, and 12/12B. Summaries of observer data for 2007 are presented in Table 10. Although expanded estimates of encounters are not presented here, encounters and encounter rates were generally lower than predicted pre-season for non-treaty commercial fisheries.

Table 10. Summary of non-treaty commercial fishery observation data for 2007 fisheries.									
Area 7					Directed Species: PINK				
Mgmt Wk	Gear type	# Of sets observed	SO	PK	CK	CO	CM	STHD	Birds
35	PS	15	381	9,113	4	20	0	0	0
36	PS	1	1	82	0	0	0	0	0
Total	PS	16	382	9,195	4	20	0	0	0
Area 7A					Directed Species: PINK				
Mgmt Wk	Gear type	# Of sets observed	SO	PK	CK	CO	CM	STHD	Birds
35	PS	45	288	14,945	88	30	0	0	0
36	PS	8	4	594	3	2	0	0	0
37	PS	15	39	4,944	45	64	2	0	0
Total	PS	68	331	20,483	95	96	2	0	0
Area 7					Directed Species: CHUM				
Mgmt Wk	Gear type	# Of sets observed	SO	PK	CK	CO	CM	STHD	Birds
41	PS	15	0	0	0	50	211	0	0
42	PS	1	0	0	0	0	0	0	0
Total	PS	16	0	0	0	50	211	0	0
Area 7A					Directed Species: CHUM				
Mgmt Wk	Gear type	# Of sets observed	SO	PK	CK	CO	CM	STHD	Birds
41	PS	22	0	3	4	293	1,124	0	0
42	PS	3	0	0	0	0	1	0	0
43	PS	4	0	0	0	1	1	2	0
Total	PS	29	0	3	4	294	1,126	2	0
Areas 7B & 7C					Directed Species: CHINOOK				
Mgmt Wk	Gear type	# Of sets observed	SO	PK	CK	CO	CM	STHD	Birds
34	GN	8	0	0	157	0	0	0	0
Total	GN	8	0	0	157	0	0	0	0

Table 9, continued. Summary of non-treaty commercial fishery observation data for 2007 fisheries.

Area 8A			Directed Species: CHUM						
Mgmt Wk	Gear type	# Of sets observed	SO	PK	CK	CO	CM		Birds
44	PS	17	0	0	0	4	304	0	0
45	PS	20	0	0	0	2	95	0	0
46	PS	3	0	0	1	0	97	2	0
Total	PS	40	0	0	1	6	496	2	0
Area 10			Directed Species: CHUM						
Mgmt Wk	Gear type	# Of sets observed	SO	PK	CK	CO	CM	STHD	Birds
43	PS	4	0	0	0	3	559	0	0
44	PS	15	0	0	1	15	1,259	0	0
45	PS	6	0	0	0	11	3,706	0	0
Total	PS	25	0	0	1	29	5,524	0	0
Area 11			Directed Species: CHUM						
Mgmt Wk	Gear type	# Of sets observed	SO	PK	CK	CO	CM	STHD	Birds
43	PS	8	0	0	0	84	3,894	1	0
44	PS	21	0	0	1	46	5,858	0	0
45	PS	7	0	0	2	11	2,326	0	0
Total	PS	36	0	0	3	141	12,078	1	0
Area 12A			Directed Species: COHO						
Mgmt Wk	Gear type	# Of sets observed	SO	PK	CK	CO	CM	STHD	Birds
37	SkGN	2	0	0	0	4	0	0	0
38	SkGN	3	0	0	0	6	3	0	0
Total	SkGN	5	0	0	0	10	3	0	0
Areas 12 & 12B			Directed Species: CHUM						
Mgmt Wk	Gear type	# Of sets observed	SO	PK	CK	CO	CM	STHD	Birds
44	PS	39	0	0	1	272	6,546	0	0
45	PS	22	0	0	0	45	2,999	0	0
46	PS	25	0	0	0	26	3,305	0	0
Total	PS	86	0	0	1	343	12,850	0	0

2.9 Commercial Catch 1997-2006

Table 11 and Table 12 show recent commercial catches, including ceremonial and subsistence and take home catches reported on fish tickets. The total commercial harvest for treaty and non-treaty fleets has ranged from 58,000 to 125,000 over the 10 years included. . The total of 129,332 in 2007 represents the fourth straight year with total catch greater than 100,000.

AREA (TROLL)	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Troll 4B May-Sept	1,299	272	663	587	7,044	1,459	87	7,103	4,534	2,619
Non-PFMC Troll	829	338	540	332	1,974	1,783	436	20,627	5,344	1,056
AREA (NET CATCH)										
4B/5/6/6C	492	264	589	659	931	1,074	908	592	175	957
7/7A	18,476	3,302	3	780	953	1,870	4,761	5,108	4,196	5,096
6D	0	1	0	0	0	0	1	0	2	0
Elwha R.	7	2	17	0	0	0	0	0	4	4
7B,C,D	9,054	9,593	22,796	17,510	30,896	20,701	9,977	5,332	6,090	11,920
Nooksack R.	1,749	405	2,248	997	806	408	562	272	647	636
8	229	0	35	0	21	1	33	5	155	4
Skagit R.	850	303	328	289	211	286	245	545	2,457	1,701
8A/8D	8,626	7,227	15,438	7,726	5,458	5,520	9,257	6,121	7,881	5,247
Stillaguamish R.	0	5	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	135	27	106
10	53	569	69	280	246	91	214	157	47	195
10A	473	1,858	646	3,558	2,565	1,657	1,113	3,997	742	2,292
Green R.	167	1,670	2,152	4,105	6,940	9,877	2,876	4,776	1,230	5,861
10C,D,F,G	58	4	0	12	2,721	99	396	826	834	2,014
10E	1,932	2,958	5,261	3,764	6,561	4,870	8,192	3,356	3,718	5,087
11	0	0	0	0	0	0	1	0	0	0
11A	109	107	25	0	148	0	0	0	0	0
Puyallup R.	2,700	1,581	1,884	1,982	6,712	4,749	2,290	3,600	2,576	2,468
White R.	0	9	0	3	83	0	115	6	0	0
13	5	413	153	4,458	120	152	65	3	739	53
Nisqually R./McAll.	7,675	8,405	16,395	4,531	10,528	17,027	17,788	13,743	8,803	21,400
13A	75	259	3,836	2,430	2,380	1,013	2,166	1,045	2,953	6,499
13C	1,148	4,860	559	1,408	336	689	922	3,786	3,913	4,449
Chambers Creek	67	0	0	0	0	0	0	0	0	0
13D-K	339	373	1,358	2,387	650	32	1,146	883	3,331	4,015
12, 12B	1	0	0	0	34	10	0	0	12	13
9A, 12A	11	76	99	0	0	4	2	23	68	80
12C,D,H	6	1,059	6,522	9,147	8,561	22,039	18,345	13,859	34,689	16,260
Skokomish R.	0	1	978	254	2,020	2,927	3,016	8,494	10,778	12,151
Total	56,430	45,914	82,594	67,199	98,899	98,338	84,914	104,394	105,945	112,183

Area	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
7/7A	11,117	496	0	61	17	61	66	25	162	145
7B/7C	10,690	11,910	9,243	11,369	18,002	17,564	8,406	5,008	6,064	13,151
8	14	0	0	0	8	0	0	0	0	0
8A/8D	0	0	4	0	0	0	0	1	0	0
10/11	70	12	247	30	2	0	93	8	7	2
9A	0	10	15	8	0	3	2	0	0	0
12/12B	3	0	3	0	0	0	0	0	3	0
Total	23,891	14,426	11,511	11,468	18,029	17,628	8,567	5,042	6,236	13,298

3 Recreational Harvest

This chapter summarizes expected recreational catch in Puget Sound marine waters and freshwater tributaries for the 2007-2008 management year, and presents catch estimates available from creel studies for that period. Due to the cycle of recovery and analysis of Catch Record Cards (CRCs) used by recreational anglers, complete catch estimates for all areas are not yet available. Since complete catch estimates were not available for all areas in the annual report covering the previous management cycle, projected and actual recreational catches for the 2006-2007 management year are also included here.

3.1 2006-2007 Recreational Catch

Total Recreational Chinook harvest in 2006-2007, estimated from a combination of Catch Record Cards (CRC) and creel estimates where available, was around 48,800, compared to a preseason projection of 44,400. Catches were much lower than projected in marine waters of South Puget Sound (Areas 10, 10A, 11, and 13). Catches were higher than projected in several extreme terminal areas with large concentrations of hatchery Chinook (Samish, Puyallup, Nisqually, and Skokmish rivers, Areas 10E and 12). Projected and actual catches by area are presented in Table 13.

Table 13. Projected (FRAM 3006) and actual Chinook catches in Puget Sound Recreational Fisheries during the 2006-2007 season.

Area/Fishery	Projected	Actual
Area 5-6		
MSF (July-August)	3,500	3,666
Other	1,063	1,499
Strait Tributaries	0	0
Area 7	3,543	4,168
Nooksack/Samish FW	2,959	6,669
Area 8-1 & 8-2		
MSF	1,921	1,210
Skagit River		
Spring MSF	336	495
Other	20	12
Area 8D SAF	1,407	781
Stillaguamish River	6	6
Snohomish River		
Skykomish MSF	359	78
Other	12	12
Area 9	3,343	2,676
Area 10 & 11	13,315	9,981
Area 10E SAF	763	1,639
Lake Washington/Sammamish	125	176
Area 10A SAF	3,000	2,078
Green River	26	12
Puyallup River		
Carbon R MSF	742	1,216
Other	189	507
Area 13	2,821	2,195
Nisqually/McAllister	744	2,227
Area 12	1,050	2,167
Skokomish River	3,167	5,299

3.2 2007-2008 Recreational Catch

3.2.1 Expected catch

Projected Chinook catches in 2007-2008 recreational fisheries are listed in Table 14. Total projected catch was 49,020. The recreational fishing regime included mark selective fisheries (MSF) for portions of the year in marine areas 5, 6, 8-1, and 8-2, 7, 9, 10, and 13, and in the Skagit, Skykomish, Puyallup, Carbon and Nisqually rivers. For those fisheries where creel survey estimates of harvest are available, those estimates are listed as actual catches in Table 14. Creel surveys were conducted on freshwater fisheries in the Carbon, Skagit, and Skykomish Rivers. In addition, intense sampling efforts were applied to marine area selective fisheries throughout the year, meaning that creel estimates available for the majority of those fisheries. Brief summaries of results of the sampling programs are included below. In-depth analyses of sampling and statistical methods are available in

a series of reports produced by WDFW, the majority of which were still in draft status at the time of this report.

Table 14. Projected (FRAM 3907) and actual Chinook catches (where available) in Puget Sound Recreational Fisheries during the 2007-2008 season.		
Area/Fishery	Projected	Actual
Area 5-6		
MSF (July-August)	4,000	4,096
Other	1,090	
Strait Tributaries	0	
Area 7	2,656	
Nooksack/Samish FW		
Area 8-1 & 8-2		
MSF	1,842	
Skagit River		
Spring MSF	394	724
Other	20	
Area 8D SAF	1,407	
Stillaguamish River	6	
Snohomish River		
Skyokomish MSF	215	663
Other	12	
Area 9		
Summer MSF	5,300	4,938
Other	1,871	
Area 10		
Area 10 Summer MSF	1,700	1,507
Area 10 other	737	
Area 11		
Area 11 MSF	8,531	10,641
Area 11 other	1,013	
Area 10E SAF	850	
Lake Washington/Sammamish	169	
Area 10A SAF	3,500	2,095
Green River	600	
Puyallup River		
Carbon R MSF	1,719	1,287
Puyallup R MSF	899	
Area 13		
Area 13 Summer MSF	1,744	
Area 13 other	849	
Nisqually/McAllister	1,057	
Area 12	1,657	
Skokomish River	5,182	

3.2.2 Marine areas 5 & 6 summer MSF

2007 was the 5th year of a pilot mark-selective fishery in marine areas 5 & 6. During the summers of 2003 through 2007, sampling programs were implemented in Areas 5 and 6 in order to collect the data necessary to estimate daily estimates of total catch (landed and released) and total effort which could be expanded to weekly, monthly, and ultimately season-total values. Sampling programs incorporated comprehensive and complementary data collection strategies, including: 1) dockside-based angler interviews and catch sampling (“creel sampling”); 2) on-the-water total (instantaneous) effort surveys; 3) test fishing; and 4) voluntary reports of completed trips provided by charter boats and private anglers.

For 2007, an estimated 4,096 Chinook were harvested, compared to a pre-season quota of 4,000. In spite of slightly exceeding the quota, total mortalities in the fishery (estimate of 4,957 to 5,592 depending on method used) was estimated to be less than expected pre-season (6,527).

3.2.3 Marine area 7 winter MSF

A mark-selective fishery occurred for the first time in Area 7 during February 2008, and was also intensively monitored. An estimated 1,406 Chinook were harvested in Area 7 during February. Total mortality estimates ranged from 1,624 to 1,713 depending on the method used. Marked Chinook mortality exceeded pre-season FRAM expectation by 150%, while unmarked impacts were 10-20% less than FRAM expectations.

3.2.4 Marine areas 8-1 & 8-2 winter MSF

2007 represented the 3rd year of winter mark-selective fishing in areas 8-1 & 8-2, with the season running from November 1, 2007 through April 30, 2008. At the time of this report, data were available from November through the end of February. An estimated 1,188 Chinook were harvested, and an additional 4,378 were released. Unmarked Chinook mortalities through February were estimated at 197 and 267, depending on method of estimation, compared to a pre-season expectation of 1,134 mortalities.

3.2.5 Marine areas 9 & 10 summer MSF

A recreational mark-selective fishery occurred beginning July 16th, 2007 in areas 9 and 10, with a combined quota of 7,000 Chinook for both areas. The fishery was open for 16 days in area 9, with an estimated catch of 4938 Chinook, and 13 days in area 10, with a catch estimate of 1,507 Chinook. Estimates of release mortality range from 8,155 (9% unmarked) to 9,870 (6% unmarked), depending on the calculation method used. Either approach resulted in total and class-specific estimates that were similar to the predicted mortalities of 680 unmarked legal-size and 543 unmarked sub-legal Chinook from FRAM 3907.

3.2.6 Marine area 9 winter MSF

A winter mark-selective fishery occurred for the first time in Area 9 from January 16, 2008 through April 15, 2008. At the time of this report, preliminary harvest and mortality estimates were available through the end of February. An estimated total of 1,072 Chinook were harvested during that period, and an additional 1,457 were released. Unmarked mortalities were below what was modeled for this period (152), with estimates for actual mortalities ranging from 99 to 106.

3.2.7 Marine area 10 winter MSF

A winter mark-selective fishery occurred for the first time in area 10 from December 1, 2007, through January 31, 2008. An estimated 644 Chinook were harvested, and an additional 2,233 released during this season. Release mortality for unmarked Chinook was estimated between 97 and 107, depending on method used. Estimated total marked Chinook mortality was below FRAM predictions by 24-28%, whereas estimated unmarked impacts were 64-67% less than FRAM expectations.

3.2.8 Area 11 summer MSF

A recreational mark-selective fishery was implemented for the first time in Area 11 in 2007, running from June 1 through September 30. A total of 10,642 Chinook were harvested during the fishery (10,546 marked, and 95 unmarked). Total mortalities estimates ranged from 12,884 to 15,792, depending on method used, compared to a pre-season FRAM projection of 12,701. When analyzed by size and mark status, the excess mortality was due to retention of marked Chinook. Estimates of legal and sub-legal unmarked Chinook mortalities were less than or comparable to pre-season projections.

3.2.9 Carbon River Creel

The Washington Department of Fish and Wildlife (WDFW) conducted a fifth year of creel surveys during the recreational Chinook selective fishery on the Carbon River in the fall of 2007. This survey was designed to estimate angler effort, numbers of salmon retained and released by species, and percent of Chinook that were marked (adipose fin clipped). Anglers retained an estimated 1,235 adult and 52 jack (<24") Chinook in the Carbon MSF. An additional 2,426 Chinook were released. The estimated mark rate of retained Chinook was greater than 99 percent during the fishery. Samplers did observe two unmarked Chinook that were retained.

3.2.10 Skagit Spring Creel

In 2007, a mark-selective fishery targeting hatchery spring Chinook occurred on the upper Skagit River from the Highway 530 Bridge in Rockport to the mouth of the Cascade River from June 1 to July 8th. An additional area from the mouth of the Cascade River to the Rockport-Cascade Road, first opened in 2006, was again open this season in an attempt to increase harvest opportunities.

WDFW staff conducted a creel survey on the Skagit River during this selective Chinook fishery. Sampling for catch data and effort occurred on every day during the fishery. Data were collected from 2151 anglers interviewed during the survey. Anglers reported catching a total of 423 marked Chinook, with 64 of that total reported to have been released. The total estimated catch for the season was 891, with 167 released, for a total retention of 724 fish. 17.7% of the total were jacks. A total of 244 unmarked Chinook were reported landed and released, resulting in a season estimate of 500, of which 26.6 % were jacks. The season mark rate is calculated to be 64.0%. There were no incidences of unmarked fish being retained recorded this year. A summary of effort and catch estimates is presented in Table 15.

Table 15. 2007 Skagit River spring Chinook sport fishery creel effort, landed catch, and release estimates.							
	# Anglers	# Hours	# Angling Hours	Marked Chinook	Estimated Marked	Unmarked Chinook	Unmarked Chinook
	Sampled	Sampled	Estimated	Observed	Landed	Observed	Released
Week 1	396	1612	2867	83	158	33	63
Week 2	407	1728	3850	79	162	47	99
Week 3	445	1781	4043	74	187	58	129
Week 4	418	1974	3389	92	182	56	115
Week 5	349	1394	2852	73	168	31	69
Week 6 *	136	502	797	22	33	19	25
Totals	2151	8991	17798	423	890	244	500
* Three Days							

3.2.11 Skykomish River Creel

Results of the Skykomish River creel survey are presented in Table 16. Total numbers of Chinook harvested and released were up considerably from past years, and greater than pre-season expectations. Effort was up slightly from past years, but the higher number of fish harvested appears to be a result of greater angler success, rather than an increase in effort.

EFFORT SUMMARY:	JUNE		JULY		COMBINED		
	BOAT	SHORE	BOAT	SHORE	BOAT	SHORE	TOTAL
NO. ANGLER INTERVIEWS	654	38	296	41	950	79	1,029
TOTAL HOURS OF FISHING	3,711.7	477.0	1,926.3	165.9	5,638.1	642.9	6,280.9
EST. TOTAL EFFORT (HOURS)	12,536.1	6,658.2	10,234.1	3,789.2	22,770.2	10,447.4	33,217.6
EST. AVERAGE TRIP LENGTH (HOURS)	5.7	4.0	6.6	4.4	NA	NA	NA
EST. NUMBER OF ANGLER TRIPS	2,208	1,682	1,553	858	3,761	2,540	6,301

HARVEST & CATCH SUMMARY:	JUNE		JULY		COMBINED		
	BOAT	SHORE	BOAT	SHORE	BOAT	SHORE	TOTAL
NUMBER OF FISH CHECKED							
Chinook	106	2	63	1	169	3	172
Chinook-Jack	4	1	0	0	4	1	5
NUMBER OF FISH RELEASED							
Chinook	31	0	24	1	55	1	56
Chinook-Jack	1	0	4	0	5	0	5
ESTIMATED HARVEST							
Chinook	283	29	314	11	597	40	637
Chinook-Jack	11	15	0	0	11	15	26
ESTIMATED NUMBER RELEASED							
Chinook	261	0	302	25	563	25	588
Chinook-Jack	8	0	50	0	58	0	58

3.3 1997-2006 Recreational Catch

Landed catches of Chinook by recreational fisheries by area from 1996 through 2006 are presented in Table 17. In general, Chinook catches were up in marine and freshwater areas in 2006, as compared to the 2004 and 2005.

Marine Area	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
5	2,670	9,921	836	282	346	3,202	2,510	3,893	3,865	1,955	4,350
6	2,155	2,317	1,323	1,096	999	1,129	439	1,159	1,135	470	954
7	12,674	9,155	3,069	2,747	3,435	6,613	5,512	3,319	2,265	2,099	3,325
8.1	1,810	1,225	508	590	615	901	560	505	406	493	427
8.2	4,398	5,894	1,029	1,151	1,796	4,314	2,274	3,248	2,057	1,411	1,732
9	18,023	10,641	3,118	4,076	3,189	5,640	2,574	1,513	1,591	1,710	1,141
10	12,244	8,920	3,486	1,569	2,957	5,165	4,262	4,888	4,282	2,732	4,370
11	15,316	9,602	9,154	12,822	7,619	14,423	9,814	9,513	8,318	7,477	9,143
12	380	592	347	1,346	1,084	446	1,450	1,423	2,017	2,556	1,881
13	2,399	2,158	3,244	3,060	1,639	2,589	1,505	1,475	1,185	1,855	2,189
Marine total	74,065	62,422	28,112	30,738	25,679	46,423	32,902	32,939	29,125	24,763	31,518
Freshwater Region											
Straits	4	18	0	6	0	0	75	47	19	17	0
Nook-Sam-Whatcom	1,568	2,929	6,532	2,896	1,871	5,083	6,170	3,433	1,061	4,069	6,645
Skagit	13	96	40	48	19	6	70	265	35	141	648
Stilly-Sno	17	21	41	35	7	54	367	339	177	217	233
South Sound	2,364	1,857	2,488	4,180	2,493	3,530	3,774	3,577	2,529	3,340	4,282
Hood Canal	2	8	10	993	600	3,170	3,113	3,237	1,964	4,460	5,313
Freshwater total	3,968	4,929	9,111	8,158	4,990	11,843	13,569	10,898	5,785	12,244	17,121
Marine + FW total	78,033	67,351	37,223	38,896	30,669	58,266	46,471	43,837	34,910	37,007	48,639

4 Spawning escapement

This section presents natural Chinook escapement estimates for 2007, and compares them to projections from FRAM 3907. Table 18 summarizes upper and lower management thresholds, predicted escapement, and actual 2007 escapement for Puget Sound Chinook management units.

In general, pre-season projections are made for natural escapement (the number of natural- and hatchery-origin Chinook spawning naturally), however there are important differences in some populations. Depending on the methods used in forecasting abundance, natural-origin adults that are used for hatchery broodstock may be included in the projection of natural escapement. FRAM projects natural-origin escapement for the Nooksack, Stillaguamish, Skagit Spring, and Snohomish populations, so hatchery-origin fish must be subtracted from total escapement, and the number of natural-origin fish used for broodstock added, to obtain an estimate comparable to the FRAM projections. Separating hatchery-origin from natural-origin fish may require analyses of scale, otolith, or CWT data obtained from carcass sampling, which are not completed for all 2007 escapement. The comparisons in Table 18 represent the best currently available data for comparing predicted and actual escapements.

Escapement was less than predicted for all MUs from the Snohomish north, except for Skagit summer/falls. The return to the Nooksack was below the lower management threshold, as projected pre-season. The Stillaguamish return was also slightly below the lower threshold, while escapement was projected to be slightly above the threshold. The Sauk summer and Suiattle spring populations in the Skagit were below their lower thresholds, although the aggregate Skagit summer/fall and spring MUs were both above their lower thresholds. The remaining North Sound MUs all had escapements between the lower and upper thresholds.

Escapement to MUs south of the Snohomish (Lake Washington, Green, White River, Puyallup, and Nisqually) exceeded projections, and also exceeded upper management thresholds. Finally escapement to Hood Canal and Strait of Juan de Fuca MUs were all below projections, with the Skokomish, Dungeness, and Hoko also falling below their lower management thresholds.

Details for each escapement estimate, including information on hatchery/natural-origin composition where available, are in the following sections.

Table 18. Management thresholds, predicted 2007 escapement, and actual 2007 escapement for Puget Sound Chinook management units.

Management Unit	Upper Management Threshold	Lower Management Threshold	Predicted escapement	Actual escapement
Nooksack	4,000		565 ¹	
North Fork	2,000	1,000		334 ¹
South Fork	2,000	1,000		29 ²
Skagit summer / fall	14,500	4,800	9,115	11,291
Upper Skagit summer		2,200		9,855
Sauk summer		400		383
Lower Skagit fall		900		1,053
Skagit spring	2,000	576	1,576 ¹	613 ¹
Upper Sauk		130		282
Cascade		170		223
Suiattle		170		108
Stillaguamish	900	650	782 ¹	609 ³
North Fork summer	600	500		569
South Fork & MS fall	300			40
Snohomish	4,600	2,000	9,552 ¹	3,982 ³
Skykomish	3,600	1,745		2,648
Snoqualmie	1,000	521		1,334
Lake Washington				
Cedar River	1,200	200	590	1,729
North Lake Tributaries				161 (index only)
Green	5,800	1,800	6,352	7,186
White River spring	1,000	200	4500	4,551
Puyallup fall		500	1,250	2,626
South Prairie Creek	500			
Nisqually	1,100		1,682	1,743
Skokomish	3,650 aggregate; 1,650 natural	1,300 aggregate; 800 natural	1,454	429
Mid-Hood Canal	750	400	114	73
Dungeness	925	500	1,101	403
Elwha	2,900	1,000	2,409	1,146
Western SJDF	850	500	848	570

1. Natural-origin only.
2. Natural-origin, South Fork early Chinook only.
3. Natural- and hatchery-origin.

4.1 Escapement surveys and estimation methods

4.2 North Puget Sound

4.2.1 Nooksack River

North/Middle Fork early Chinook

Middle Fork Chinook escapement has been estimated separately from North Fork escapement since 2005. In past years this estimate had been derived by multiplying total accounted-for carcasses from both the North and Middle Forks by a 3.48 expansion factor (derived from a five-year average of cumulative redd count-based escapement estimates divided by total carcass counts).

Due to lower water flows and higher riverbank exposure, we believe that the surveys on the Middle Fork accounted for the majority of carcasses and redds in that section of the river. In order to avoid over-inflating the Chinook estimate, it was decided to calculate the Middle Fork estimates by using fish per redd (using a standard 2.5 fish per redd expansion factor) and to apply the 3.48 expansion factor to estimate the North Fork carcass counts only.

Using this method, the 2007 North/Middle Fork Nooksack early Chinook estimated natural-spawning escapement estimate is 1,438 fish, including 1,173 to the North Fork, and 264 to the Middle Fork. Of the 1,438 total escapement, 334 fish were estimated to be natural-origin recruits. Kendall Creek Hatchery escapement was 665 spring Chinook (see distribution below). This includes 150 Chinook that were flushed (unsampled) out of the holding pond and into Kendall Creek after egg take was achieved and spawner surveys were nearly complete. These fish are not included in the spawning ground carcass counts.

South Fork early Chinook

Total escapement was estimated by multiplying the number of unique redds identified during regular surveys (every 5 to 10 days up to October 1) by 2.5. In 2007, 129 redds were identified, giving an estimate of 323 Chinook spawning prior to October 1. In addition, 25 Chinook were collected for use as broodstock in the SF Chinook supplementation program, bringing the total escapement to the system to 348. Carcasses sampled prior to October 7 were analyzed using CWT, adipose clip, otolith mark, and DNA data to determine their origin. Based on analysis of carcasses sampled in 2007, 147 of the escapement were of hatchery-origin (Table 19). Of the natural-origin spawners, 44 were NF Nooksack NORs, 128 were fall stock NORs, and 29 were Native South Fork spring NORs.

Stock of Origin	Natural Spawners	Broodstock Removals	Total Escapement
NF Hatchery	109	3	112
Other Hatchery	35	-	35
NF NOR	38	6	44
Fall NOR	115	13	128
SF NOR	26	3	29
Total	323	22	348

4.2.2 Skagit River

As has occurred in recent years, low flows throughout most of the 2007 Spring Chinook survey season provided excellent visibility and survey conditions. The only exceptions occurred in the Suiattle tributaries Downey and Sulfur Creeks, located high in the basin, and the last round of surveys late in the season on the Upper Sauk River (B. Barkdull, WDFW, personal communication). Summer/Fall survey conditions were excellent in the Skagit above the mouth of the Sauk River where the three Seattle City Light hydroelectric projects maintain constant flows, and the hydrology of the region is dominated by snowmelt and rainfall. The lower Skagit Falls and Lower Sauk surveys were more problematic, as usual, because of glacial melt and turbidity from the Suiattle and White Chuck Rivers draining Glacier Peak.

The shifted spawning timing pattern of the upper Sauk Springs and upper Skagit Summers continued in 2007; these two populations are now regularly exhibiting a spawning timing two weeks later than historic timing. Spawning timing of the populations where hydrologic conditions are dominated by glacial melt continue to be near normally timed. Populations across the basin were markedly down from recent years, in due mostly to the late October 2003 flood that greatly reduced egg survival of the four-year-old component, and negatively impacted yearling smolt production that would have made up much of the five-year-old component of spring Chinook.

Suiattle spring Chinook

Survey coverage in 2007 was hampered somewhat due to access problems caused by washed out roads and hiking trails. Tributaries Downey, Lime and Sulphur were not surveyed at the usual frequency of every 10 days. Circle Creek was not surveyed at all, but because of its small size, generally low flows and infrequency of redds built in this tributary, it was assumed no redds were built in 2007. Because of the complete inaccessibility to Milk Creek, an expansion was made to account for redds built in that tributary. The escapement estimate for 2007 is probably conservative, but even with complete coverage the population estimate in 2007 would still be a new record low for this population. This population in particular probably suffered the greatest loss due to the devastating effects of the estimated 130-year flood event that occurred in October of 2003. Because a high proportion (typically >50%) of Suiattle springs are yearling migrants, both the 2002 and 2003 broods would have been negatively impacted.

The areas surveyed, which represent the total known spawning distribution of the population, includes all the larger clear water tributaries in the basin. The estimate normally assumed no redds in the turbid portion of the mainstem. Redds observed at the tributary junctions are included in the totals for the tributary. The streams surveyed include Big, Tenas, Straight, Buck, Circle, Lime, Downey, Sulphur, and Milk Creeks.

The current escapement estimation method has been in use since 1994. A cumulative redd count, conducted by foot of all redds built throughout the entire known spawning area is expanded by 2.5 fish per redd to calculate the escapement estimate. Surveys are typically conducted from late July until September 10th.

The cumulative total of 43.2 redds, including a calculated expansion of 3.2 redds for Milk Creek was expanded by 2.5 fish per redd to estimate escapement of 108. This poor escapement total far exceeded the previous low escapement estimate in 1994 of 167.

Upper Cascade spring Chinook

Survey coverage in 2007 was excellent and complete due to low flows encountered through out the survey season. The Cascade River spring population suffered reduced survival due to factors outlined in the Suiattle population, although flooding was not as severe for this system.

The area surveyed for this population represents the total known spawning distribution of the population. The mainstem Cascade River from river mile 8.1 to 18.6, the lower reaches of the north and south forks of the Cascade, and tributaries Marble, Found, and Kindy creeks are regularly surveyed. Surveys are typically conducted from early August until September 20th.

The current escapement methodology was implemented in 1992. A cumulative redd count, conducted by foot or pontoon boat of all redds built throughout the entire known spawning area is expanded by 2.5 fish per redd to calculate the escapement estimate.

The total number of redds observed in 2007 was 89, with 88 of them located in Cascade River. The redd count was expanded by 2.5 fish per redd to estimate escapement of 223.

Upper Sauk spring Chinook

There was good survey coverage as a result of relatively low flows throughout most the season. The run timing was again very late, with peak redd counts occurring in late September surveys. Historic spawn timing occurred from early August into late September, with the peak occurring in early September. In recent years extremely few redds have been built before September 1, with spawning occurring well into October, and the peak near September 20th.

The area surveyed, which represents the total known spawning distribution of the population, is from river mile 30.0 which is 0.9 miles below the mouth of the White Chuck river to river mile 39.7 at the confluence of the North and South forks. In addition the North Fork Sauk from the mouth upstream to the falls, and the South Fork Sauk from the mouth to about RM 2.5 are regularly surveyed. Surveys are typically conducted from Mid August until October 7th.

The current escapement estimation method has been in use since 1994. A cumulative redd count, conducted by foot or pontoon boat, of all redds built throughout most of the entire known spawning area is expanded by 2.5 fish per redd to calculate the escapement estimate. The AUC method, assuming 21-day redd life is used only for a 0.9 mile reach (RM 31.0 – 31.9) that is flown.

A total of 104 redds were observed within the reaches walked or floated, and another 8.6 redds were calculated from aerial surveys conducted from river mile 30 to 30.9. For 2007 the total redds estimated is 112.6, which was expanded using a factor of 2.5 fish per redd to yield a population estimate of 282.

Upper Skagit summer Chinook

Survey conditions throughout the season were excellent due to the low flow conditions experienced. Four flights were conducted on the mainstem and tributaries were surveyed regularly so complete coverage was accomplished. As is experienced on most odd years where large number of pinks salmon are present, difficulties counting redds on the mainstem from the helicopter arose. Odd shaped curves, drawn for area under the curve redd estimates were attributable to the large numbers of Pink redds that may have obscured/influenced aerial counts. Upper Skagit summers in recent years have been exhibiting a later spawning timing of approximately two weeks than historical in the mainstem. Tributary spawning has not shown the same shift.

The areas surveyed, which represent nearly the total known spawning distribution of the population, (some limited tributary spawning areas may be missed some years) include the mainstem from the mouth of the Sauk River, to Gorge powerhouse, river miles 67.2 to 94.3 and tributaries Cascade River (RM 0.0 to 4.2) and Illabot, Diobsud, Bacon, Falls and Goodell creeks. Surveys are typically conducted from early September until late October on the mainstem, and early September until mid October on the tributaries.

The current escapement estimation method has been in use since at least 1974. The mainstem is flown by helicopter multiple times (four times in 2007) and the area under the curve is calculated (AUC method). Beginning and end points for the curve are estimated using either field observations of redd construction or historical data. The area under the curve is divided by an assumed redd life of 21 days (Schuller 1974) to calculate total redds. Added to this total is a cumulative redd count, conducted by foot or pontoon boat, of all redds built in the tributary streams. Redds are then multiplied by 2.5 fish per redd to calculate escapement.

The total redd estimate for the Skagit River in 2007 was 3,857. In addition another 85 redds were estimated to be built in the tributaries, for a total redd estimate of 3942. Using an expansion of 2.5 fish per redd yields an escapement estimate of 9855 fish. For the second year counts of early redds built in the tributaries were not included in the total estimate. Carcass recoveries show that these fish are hatchery strays from the Marblemount hatchery spring Chinook program, so they are enumerated separately.

Lower Sauk summer Chinook

As usual, turbidity from glacial flour from the Whitechuck River, and more extensively from the Suiattle River limited our ability to conduct aerial counts on the mainstem Sauk. The estimate in 2007 is based off of only one flight below the mouth of the Suiattle, three flights from the Suiattle to the Darrington Bridge, and two flights above the Darrington Bridge to river mile 30. Flow in Dan Creek was very low again in 2007, too low for fish use.

The October 2003 flood dramatically changed the spawning habitat in the Sauk River and there has been a radical change in distribution of spawning. The same change in spawning distribution has been observed with other species, most noticeably steelhead. Prior to the 2003 season very few redds were typically observed above the Darrington Bridge at River mile 21.0 (spawning ground database), but since the flood an increased amount of gravel is present in this upper reach, and a corresponding loss of suitable gravel has occurred below the Suiattle river due to the increased presence of fine sediment. In recent years as much as 26% of the Sauk Summer population has utilized the spawning habitat above the Darrington Bridge. Fewer redds are now built on an annual basis in the reach from the mouth of the Sauk up to the mouth of the Suiattle River at river mile 13.0

The area surveyed, which represents the total known spawning distribution of the population, is from the mouth of the Sauk, to river mile 30.0 where a reach of high gradient with no spawning habitat is assumed to separate the spring and summer stock distributions. Dan's Creek is also surveyed for Chinook use. Surveys are typically conducted from early September until late October.

The current escapement estimation method has been in use since at least 1974. The mainstem is flown by helicopter multiple times and the area under the curve is calculated (AUC method). Beginning and end points for the curve are estimated using either field observations of redd construction or historical data. The area under the curve is divided by an assumed redd life of 21 days (Schuller 1974) to calculate total redds. Added to this total is a cumulative redd count, conducted by foot of all redds built in the tributary streams. Redds are then multiplied by 2.5 fish per redd to calculate escapement.

In 2007 a total of 153 redds were estimated to have been built in the Lower Sauk River, Using an expansion of 2.5 fish per redd yields an escapement estimate of 383 fish.

Lower Skagit fall Chinook

As usual, turbidity from glacial flour from the Whitechuck River, and more extensively from the Suiattle River hindered our ability to conduct aerial counts on the mainstem Skagit. Three flights were conducted on the Skagit from the mouth of the Sauk River down to the confluence with the Baker River, visibility was better below the Baker River due to the influx of clear water where four flights were conducted. Rainfall in mid October reduced our ability to survey Finney Creek; otherwise tributaries were adequately surveyed.

The areas surveyed, which represent nearly the total known spawning distribution of the population, (some limited tributary spawning areas may be missed some years) include the mainstem from the approximately river mile 24.5 (highway 9 bridge) to the mouth of the Sauk River. Tributaries Finney, Day, Hansen, Jones, Alder and Pressentin creeks are regularly surveyed, and in addition Jackman, Grandy, O'Toole and East Fork Nookachamps creeks are occasionally surveyed. Surveys are typically conducted from late September until early November.

The current escapement estimation method has been in use since at least 1974. The mainstem is flown by helicopter or fixed wing multiple times and the area under the curve is calculated (AUC method). Beginning and end points for the curve are estimated using either field observations of redd construction or historical data. The area under the curve is divided by an assumed redd life of 21 days (Schuller 1974) to calculate total redds. Added to this total is a cumulative redd count, conducted by foot of all redds built in the tributary streams. Redds are then multiplied by 2.5 fish per redd to calculate escapement.

In 2007 a total of 379 redds were estimated in the mainstem Skagit, and a cumulative total of 42 redds were built in the tributaries, for a grand total of 421 redds. Using an expansion of 2.5 fish per redd yields an escapement estimate of 1053 fish.

Skagit Hatchery Spring Chinook Stray Rate Study

In 2006 and again in 2007 a study to determine the number of hatchery spring Chinook spawning in natural spawning areas prior to the onset of spawning by native summer Chinook was conducted in association with the Skagit River System Cooperative (SRSC), the management body for the Swinomish and Sauk-Suiattle tribes of Indians. Prior to 2005, no attempt was made to enumerate the number of strays that did not enter the hatchery.

Starting in mid July, weekly surveys were conducted by foot or pontoon boat in the Lower Cascade River and Boulder Creek, a tributary to the Cascade River where hatchery strays were known to spawn. In addition carcasses were sampled for coded wire tags to ascertain origin. Tributaries to the upper Skagit River, Bacon, Illabot and Diobsud creeks were also surveyed by foot to determine whether strays were spawning in those streams

It was determined from carcass recoveries that redds built before September 1 in all the sites surveyed could be reasonably expected to have been built by hatchery strays. A cumulative total of 123 redds were observed in the Cascade River, and another 50 redds were observed in the various tributaries for a total of 163 redds. Using an expansion of 2.5 fish per redd yields an escapement estimate of 408 fish.

4.2.3 Stillaguamish River

Escapement estimates for the North Fork summer population used cumulative redd counts from aerial surveys of the North Fork to plot visible redds versus survey date (AUC method: redd days divided by 21-day redd life), and total redd counts from ground surveys of North Fork tributaries. Although there were some discrepancies between redd counts from flights and those from foot and float surveys, Hahn (2001) concluded that estimates of Chinook redds and of female spawners were precise and accurate. Aerial and ground counts of the North Fork and its tributaries resulted in an estimated 227 redds, which, expanded by 2.5, gives the escapement estimate of 567. There were three aerial surveys conducted in 2007. The AUC method resulted in an estimate of 189 redds. Ground-based redd counts in tributaries (including Squire, French and Grant creeks and Boulder River) and the North Fork between river miles 30.0 and 34.4 yielded an additional 38 redds.

Fall Chinook escapement to the South Fork in 2007 was determined using ground-based, foot and float, redd counts multiplied by 2.5 fish per redd. Sixteen redds were observed in the South Fork and tributaries in 2007, which expand to an estimated escapement of 40. Tributaries surveyed include Pilchuck, Jim and Canyon creeks. One redd was detected below the confluence of the North and South forks during a single flight when visibility was adequate for the survey. Hahn et al (2001) concluded that the precision and accuracy of the fall Chinook estimate was uncertain. The primary problem in the AUC method is due to the inability to measure redd life. Low redd density and poor visibility at times also contribute to this uncertainty. The current methodology is believed to underestimate fall Chinook escapement.

4.2.4 Snohomish River

Skykomish

Spawning occurs throughout the mainstem Skykomish and Snohomish rivers, Wallace River, Bridal Vail Creek, Sultan River, Elwell Creek and in the North and South forks of the Skykomish, including fish passed above Sunset Falls. Many of the spawners in the Wallace River originate from the hatchery, located at the mouth of May Creek.

Escapement estimates are from aerial redd-count surveys of the Skykomish mainstem and the South Fork to Sunset Falls, and foot and float redd-count surveys of the tributaries, and Chinook passed above Sunset Falls fish trap. Surveyed tributaries include: Wallace and Sultan rivers, Bridal Vail, Elwell and Olney creeks. Aerial surveys provided total visible redd counts per survey flight and were plotted against survey date for the area-under-curve (AUC) method to give total redd days. Total redd days were then

divided by the assumed standard 21-day redd life to yield the estimated cumulative redds from aerial surveyed reaches. The cumulative redd count was adjusted by 0.95 to account for false redds, and then expanded by 2.5 (fish per redd). Cumulative ground counted redds were expanded by 2.5 to estimate escapement in the tributaries. Added to this is the number of fish trucked above Sunset Falls.

The 2007 estimated escapement for Skykomish Chinook was 2,295 fish. Of these, 565 were estimated from aerial surveys of mainstem reaches, 1,024 were estimated from ground counts of tributary reaches, and, 706 were trapped at Sunset Falls and passed upstream. Not included in the escapement estimate are 85 adults and two jacks captured at Sunset Falls and transferred to Wallace Hatchery for use as broodstock.

Snoqualmie

Snohomish fall Chinook spawn in the Snoqualmie River and its tributaries, including the Tolt and Raging rivers and Tokul Creek. Spawning also occurs in the Pilchuck and Sultan rivers. Spawning occurs from mid-September through October. The escapement estimate is based on aerial surveys of a 10.1 mile index reach of the mainstem below Snoqualmie Falls, and ground surveys of mainstem and tributary reaches. Aerial counts using the AUC method assume a 21-day Redd life to produce cumulative redd counts. The cumulative redd count is adjusted by 0.95 to account for false redds. Cumulative redds from aerial and ground counts are expanded by 2.5 to yield the escapement estimate. In years where water conditions allow adequate mainstem ground-based surveys, ground counts may be used instead aerial surveys, or some combination of both.

In 2007, a total escapement of 1,687 Chinook was estimated for this stock.

4.3 South Puget Sound

4.3.1 Lake Washington

Cedar River

Escapement is based on live counts made by floating the entire river below Landsburg Dam, and applying the AUC method. Redds have been enumerated since 1999, and those data may be used in the future for estimating escapement. Since 2003, Chinook have been passed above Landsburg Dam, and AUC estimates have been adjusted to account for fish that may have been counted during surveys in the lower river, but then later passed above Landsburg.

In 2007, the estimate for Chinook escapement to the Cedar, including fish passed over Landsburg, was 1,729, well above the pre-season projection of 590. There were 606 adult Chinook carcasses sampled in the Cedar, of which 543 (89.6%) were unmarked.

North Lake Washington Tributaries

There are long-established spawning ground index areas in Bear and Cottage Creeks. Since 1998, other portions of the Bear Creek watershed have been surveyed annually, but these data have not been included in the estimate. There is no expansion for unsurveyed areas in other tributaries. Escapement to Bear and Cottage Creeks is based on live counts, and uses the AUC method. In 2007, there were an estimated 50 spawners in Bear Creek, and 111 in the Cottage Creek index. An additional 115 were estimated in upper Cottage, above the index. A total of 148 adult carcasses were sampled in Bear and

Cottage, of which 27 (25%) were unmarked. Additional natural spawning occurs in Issaquah Creek. In 2007, an estimated 1,024 Chinook spawned in lower Issaquah Creek, and 195 additional unmarked fish were released above the hatchery and allowed to spawn naturally.

4.3.2 Green River

The 2007 escapement estimate for the mainstem Green was based on peak redd counts from aerial surveys, adjusted to represent total peak redd counts based on studies conducted from 2000-2002. Ratios of total females to adjusted peak redd counts (3.109 from the base years study), and a sex ratio of 1.5 males per female are used to expand the peak redd count to a total mainstem escapement estimate. In 2007, the mainstem estimate was 6,818.

For Newaukum Creek, cumulative redds are counted in the index area (0.0 to 1.0), and estimated for the area above the index (1.0 to 2.8) using peak redd count, and an expansion factor for cumulative redds based on data from the index area. The sum of cumulative redds for both areas is used as the female escapement estimate, and a sex ratio of 1.5 males to females is used to estimate total escapement. In 2007, the total estimate for Newaukum Creek was 368 Chinook, making the total estimate for the Green 7,186.

In 2007, 331 carcasses were sampled for marks and tags in the mainstem Green, and 263 were sampled in Newaukum Creek. Based on estimates of 47.4% and 30.8% natural origin spawners in the Green and Newaukum respectively, the total escapement was estimated to be 46.6% (or 3,347 fish) natural origin, and 53.4% (or 3,839 fish) hatchery origin.

4.3.3 White River

The escapement estimate for White River spring Chinook is derived from trap counts at the Army Corps of Engineer's Buckley Diversion Dam fish trap and the White River hatchery. The Buckley Diversion Dam is a migration barrier to anadromous fish and contains a fish trapping facility where fish are trapped and trucked upstream of Mud Mountain dam, or transferred to the White River Hatchery. The White River Hatchery also operates a trap on the opposite bank of the river. The majority of the fish volunteering into the hatchery trap are returning adults from the hatchery program.

This trap facility allows for the enumeration of all fish transported to the upper watershed. However, precise counts are dependent upon accurate species identification and record keeping. Records of trap and haul operations conducted in the absence of state or tribal fisheries managers have been the subject of ongoing concern, and discrepancies do exist between the various trapping datasets. The total number of Chinook trapped at the Buckley Diversion Dam Trap in 2007 was 5,631, including 229 jacks (Table 20). Forty-two of the NOR Chinook caught at Buckley trap were taken to the White River hatchery for NOR incorporation into the hatchery production. The remaining NOR and acclimation pond fish were hauled and released into the White River upstream of Mud Mountain Dam. An additional 1,011 fish returned to the White River Hatchery trap. The total return of 6,642 spring Chinook to the White River traps was much higher than the FRAM projection of 3,687. The total return of 4,551 NOR & acclimation pond fish to the Buckley trap was very close to the pre-season forecast of 4,500 for those groups.

Table 20. Chinook returns to the Buckley fish trap and White River Hatchery trap in 2007.

Origin	Adults			Jacks			Totals
	Trap		Total	Trap		Total	
	Corps	Hatchery		Corps	Hatchery		
NOR	2,796	36	2,832	43	15	58	2,890
Acclimation Pond	1,677	42	1,719	47	12	59	1,778
Hatchery	929	757	1,686	139	149	288	1,974
Total	5,402	835	6,237	229	176	405	6,642

White River spring Chinook also return to Minter Creek, as a result of releases from the Hupp Springs Hatchery program. The return of spring Chinook to the Minter Creek/Hupp Springs hatchery in 2007 was 2,134 adults and 100 jacks, for a total of 2,234. This return is not projected by FRAM.

4.3.4 Puyallup River

The Puyallup Tribal Fisheries (PTF) and Washington Department of Fish and Wildlife (WDFW) staffs agreed to use redd count-based methodology to estimate escapement for Chinook in the Puyallup River basin during even years. The estimated natural spawning fall Chinook escapement into the Puyallup River basin in 2007 is **2,626** fish.

South Prairie Creek

There is consensus that South Prairie Creek (SPC) is the most productive Chinook water in the basin and its component escapement estimate is critical. In the 1999 review, it was agreed that even-year SPC Chinook escapements would be based on cumulative redd counts and odd-year escapements would be based on the area under the spawning curve (AUC). Survey coverage was very good in 2007.

The co-managers agreed that odd-year SPC escapement estimates would be based on live count AUC adjusted by the mean South Prairie redd-based estimate/AUC-based estimate ratio. This is necessary because pink returns in odd years often preclude objective Chinook redd accounting and historic live count-based estimates have been very conservative when compared to redd-based estimates in this system. The co-managers agreed to an adjustment factor to expand AUC estimates using 1994 to 1999 data and update with each even year data. The updated adjustment factor, using even year data through 2006, is 2.23. The 2007 AUC spawner curve yielded an escapement estimate of **528** spawners for South Prairie Creek. Expanding the South Prairie Creek AUC-based escapement (**528 X 2.23**) yielded a SPC escapement of **1,177**.

Wilkeson Creek contributed **17** Chinook to the escapement estimate based on total dead count. The total dead count may best represent escapement into Wilkeson Creek. The total live/dead count was only 13 on October 1, the AUC escapement methodology yielded 12 fish, and only one redd was recorded during survey visits.

The SPC sub-basin total Chinook escapement estimate for 2007 is **1,194** spawners. Based on mark-sampling of carcasses observed, about 44 percent of these fish were of hatchery origin.

Carbon River

In 1999, there were good redd count data for the Carbon River. River reaches with complete data tracked the SPC spawn timing remarkably well. Therefore, reaches with

incomplete data were expanded using the SPC spawning timing curve with a high degree of confidence. Suitable survey conditions never occurred on the Carbon River during the 2007 spawning period. Consistent with the last seven Puyallup fall Chinook escapement estimates; PTF and WDFW staff presumed that the Carbon River 1999 and current year relative returns were similar to the South Prairie observations. Therefore, the 2007/1999 South Prairie Chinook escapement ratio ($1194 / 1422 = 0.8397$) was applied to the 1999 Carbon River escapement (250) to estimate the 2007 value. This method estimated **209** Chinook spawning in the Carbon during 2007 ($250 * 0.8397 = 209$) (Table 2).

Mainstem Puyallup River Tributaries

An analysis of the spawning ground data justifies the use of different methodologies for escapement estimates in mainstem Puyallup River tributaries in 2007. An AUC estimate is used for Fennel Creek escapement. Different methodologies produced comparable results, estimates were 171, 132, and 138 fish respectively for AUC, redd accounting, and peak live/dead count calculations. Only four fish were observed in Canyon Falls in 2007, thus this is the escapement. No redds were observed and no dead fish were sampled. The escapement to Kapowsin Creek in 2007 was 30 based on total dead counts. Only eight redds were observed and a total of only nine live fish were recorded. The total peak live/dead count during one survey visit was 12 fish. The 30 dead fish were individually sampled fish. The escapement to Clear Creek was 18 fish based on peak live/dead counts. No redds were observed and live fish were only observed during two survey visits. Clarks Creek escapement was 500 fish in 2007 based on an AUC calculation. The peak live/dead count was 449 fish and only 11 redds were observed. As a note, the 500 fish escapement probably includes some or all of the 355 Chinook that returned to Clark's Creek hatchery and were passed upstream.

Puyallup River tributaries:	Redd based escapement estimate:
Fennel Creek (WRIA 10.0406)	171
Canyon Falls Creek (10.0410)	4
Kapowsin Creek (10.0600)	30
Clear Creek (10.0022)	18
Clarks Creek (10.0027)	500
Tributary total	723

Mainstem Puyallup River

As we experienced in the Carbon River, there were not suitable survey conditions in the Puyallup River during the 2007 Chinook spawning period. The PTF and WDFW staff did not think that the 1999 Carbon River estimation method was appropriate for the Puyallup. It is believed that Puyallup River mainstem spawning escapement trend is more closely related to the tributaries. Applying this ratio (2.5664) to the estimated 1999 Puyallup mainstem escapement (195) produces a 2007 Puyallup River mainstem escapement estimate of **500** Chinook ($195 * 2.5664 = 500$) (Table 3).

The 2007 Chinook natural spawning escapement into Clark's Creek is not used in the development of the tributary to Puyallup River mainstem ratio. Unfortunately, many of the Chinook produced and released from Clark's Creek hatchery are not marked and the identification of origin of natural spawners cannot be made. Since 1999 is used as the base year, the 1999 natural spawning escapement estimate for Clark's Creek is used instead.

Total Escapement

The total 2007 estimated Puyallup River natural-spawning fall Chinook escapement is **2,626** fish (Table 1). It is estimated that 724 are Natural Origin Recruits (NOR), based on

mark sampling of carcasses observed. The estimate of NORs assumes the proportion of hatchery versus natural origin spawners is the same between Puyallup River tributaries and the Puyallup River mainstem.

We would reiterate the statement we have made the last several years that there is a "need to develop some means of adjusting historical escapements to make them relative and comparable to the 1999-2007 method and to make sure those revisions are incorporated into and accounted for in stock management and harvest management planning and modeling exercises." At this point in time, 1999 is the only survey year that has sufficient survey data to potentially serve as a point of reference for historical adjustments. We would be much more comfortable if there were additional years with suitable survey conditions that could be used to develop historical adjustment protocols.

4.3.5 Nisqually River

The survey conditions in the Nisqually River during the fall of 2007 were typical for this river. Viewing conditions in the main-stem Nisqually were ~1-2 feet. Depth remained stable, with little exception, during the entire survey season. No surveys were canceled due to poor conditions.

The summer/fall escapement estimate to the Nisqually River and tributaries is calculated using a method developed by Herrington-Tweit and Newman (1986). The estimate is calculated as:

$$\text{Escapement} = 6.81 * ((\text{peak L+D Mashel index}) + (2.5 * (\text{peak L+D Nisqually mainstem index}))).$$

Mainstem Nisqually River

The Nisqually River summer/fall chinook escapement index area is located between river mile (RM) 21.6 and 26.2. The index area was surveyed by the Nisqually Indian Tribe six times, approximately every seven days, between September 25th and October 31st.

Surveys were conducted using four rafts, two on each side of the river. Live and dead fish were counted, examined for marks (adipose fin clipped or un-clipped), and sampled for coded wire tags (CWTs). All dead fish were also sexed, measured, and had scales removed to determine brood-year.

The peak live and dead count (40 live and 16 dead) was documented on October 17th. Approximately 59% of the 58 fish sampled in 2007 were adipose clipped. None of the fish sampled contained a CWT. A supplemental survey was also conducted on September 25th from RM 32.9-39.6. During this survey eighteen live fish and no dead fish were observed.

Mashel River

The Mashel River summer/fall chinook escapement index area is located between RM 0.5 and 3.2. The index area was surveyed four times, approximately every seven days, from October 2nd and October 23rd. Low water prevented surveys prior to October 2nd. In addition to the index reach, areas between RM 3.2-3.4, RM 4.5-5.2, RM 5.2-6.0, and RM 6.0-6.6, were each surveyed four times.

A two-person crew performed surveys, one on each side of the river, by walking downstream. Live and dead fish were counted, examined for marks (adipose fin clipped

or un-clipped), and sampled for CWTs. All dead fish were identified by sex, measured to the nearest centimeter, and had scales removed to determine age.

The peak live and dead count (87 live and 29 dead) was documented in the index reach on October 9th. A total of 121 dead summer/fall chinook were sampled in the Mashel River during 2007. Of the fish sampled, 55 were adipose marked and 66 were unmarked. Coded wire tags were collected from two of the adipose clipped fish and two of the un-marked fish.

Supplemental Surveys

Supplemental surveys were conducted on Ohop Creek from RM 4.5-5.7, and RM 5.7-6.1, 4 and 5 times, respectively, during 2007. During all surveys of Ohop Creek 58 dead fish were sampled. Of these fish, 38 were adipose clipped and 20 were un-marked. In addition, CWTs were collected from one adipose clipped fish and two un-marked fish.

Escapement

The 2007 Nisqually River summer/fall Chinook natural escapement estimate is 1,743 fish. The estimate exceeds the co-managers agree-to escapement goal of 1,200 fish, as described in the Nisqually Chinook Recovery Plan (2001). Escapement to Clear Creek Hatchery was 12,627 adults and 6,636 jacks. Escapement to Kalama Creek Hatchery was 1,435 and 321 jacks.

Discussion

The Nisqually River summer/fall Chinook escapement estimate methodology was developed in 1986 (Herrington-Tweit and Newman) using data collected prior to the construction of the Clear Creek Hatchery and may not be an accurate description of the naturally spawning population in terms number or origin. Survey data indicates that most of the fish spawning naturally in the Nisqually River are hatchery origin. Estimates of natural origin contributions to escapement are complicated by relatively low mark rates on hatchery releases (85-92% in recent years), and difficulty in adequately sampling all spawning areas. In 2007, 46% of carcasses sampled in the system were unmarked. When roughly adjusted for unmarked hatchery releases and stratified by spawning areas, the estimate of NOR contribution is about 25%. In the future, efforts should be made to mark all hatchery Chinook released into the Nisqually River.

4.4 Hood Canal

Mid-Hood Canal Tributaries

The Mid-Hood Canal management unit is comprised of Chinook produced in the Hamma Hamma, Duckabush, and Dosewallips watersheds. In the Hamma Hamma River, most of the Chinook spawning area is currently being surveyed. A cooperative supplementation program was initiated in 1995 to rebuild Chinook abundance. Since 1998, escapement was estimated from counts of cumulative new redds and/or from live Chinook using the area-under-the curve (AUC) method.

In the Dosewallips and Duckabush rivers, the lower reaches surveyed are spawning and transit areas. Upper reaches of each river have been regularly surveyed in the Dosewallips and Duckabush since 1998, but few adults have been observed. Current

escapement estimates are derived from a combination of counts of live Chinook adults and Chinook redds.

Summer chum salmon and pink salmon (in odd years) spawn at the same time as Chinook in the lower reaches of these three streams. Consequently, it can be difficult to distinguish any Chinook redds from summer chum or pink redds unless Chinook are actively spawning and observed on redds. Pink salmon spawn predominately downstream of RM 6.7 on the Dosewallips, downstream of RM 2.6 on the Duckabush and throughout the reaches surveyed on the Hamma Hamma. Summer chum salmon spawn predominately downstream of RM 3.6 on the Dosewallips, downstream of RM 2.6 on the Duckabush and throughout the reaches surveyed on the Hamma Hamma. It has been possible to count Chinook redds in the upper Dosewallips and Duckabush River reaches (especially in years without pink salmon).

During 2007, spawner surveys were conducted by WDFW on the Dosewallips, Duckabush, and Hamma Hamma rivers every 7 to 10 days from late August or early September through October. The escapement estimate to all three systems combined was 73 adults: 9, 4, and 60 Chinook in Dosewallips, Duckabush, and Hamma Hamma rivers, respectively. The FRAM preseason escapement estimate was 114 Chinook in Mid-Hood Canal (PNPTC and WDFW 2007). During 2007, it is possible that some Chinook redds were not identifiable on the Dosewallips and Duckabush rivers in areas with summer chum spawning. However, based on the number of Chinook redds and adults observed during surveys, the escapement estimates are considered good.

It has been assumed that many of the naturally-spawning Chinook in Mid-Hood Canal rivers are from hatchery strays (or, in past years, from adult returns from hatchery fry released into these rivers). Sampling for CWTs and age information indicate that some hatchery adults have been recovered in natural spawning areas. For example, in 2007 one fish sampled in the Duckabush River had a CWT from a Hoodspout Hatchery release. To better assess natural Chinook and chum production and productivity, a screw trap was installed on the Hamma Hamma River beginning in 2002 and a screw trap is being installed on the Duckabush River in 2008.

The Dosewallips River was surveyed from RM 0 to RM 2.3, RM 3.6 to RM 6.7, and RM 7 to RM 11; Rockybrook Creek, a tributary, was surveyed from RM 0 to RM 0.3. Three Chinook redds and nine live Chinook were observed and the escapement estimate is 9 Chinook in the Dosewallips River during 2007. The Duckabush River was surveyed from RM 0 to RM 2.6 and RM 4.8 to RM 6; Hatchery Creek, a tributary, was surveyed from RM 0 to RM 0.1. One Chinook redd and four live Chinook were observed and the escapement estimate is 4 Chinook in the Duckabush River during 2007. The Hamma Hamma River was surveyed from RM 0.3 to RM 1.8; John Creek, a tributary, was not accessible to Chinook until early October due to extremely low flows at the mouth. A total of 3 Chinook redds were observed and from 2 to 22 live Chinook were observed weekly from August 22 through October 4. Total escapement to the Hamma Hamma River system is estimated as 60 Chinook during 2007.

Skokomish River

Chinook spawning takes place in the mainstem Skokomish River up to the confluence with the South and North Forks at RM 9, in the South Fork (primarily up to RM 5.5), and in the North Fork from RM 9 to 17 (where Cushman Dam blocks further access). Natural escapement estimates are based on counts of Chinook redds in index areas in the mainstem Skokomish (RM 2.2 to 9.0), North Fork (R.M. 9.0 to 15.6), and South Fork (R.M.

0 to 2.2). In addition, escapement estimates are made for tributaries including Purdy Creek, McTaggart Creek, Vance Creek, and Hunter Creek.

Live and dead adults, along with visible redds, were counted in Skokomish River index areas during foot and raft surveys (e.g., see Smith and Castle 1994). Surveys are conducted every seven to ten days from late August through October. A cumulative new redd count for each section of the river was tabulated at the end of the season and multiplied by 2.5 fish per redd to estimate total Chinook escapement. In addition, foot surveys are made in Hunter, Vance and McTaggart creeks to better determine escapement there. Escapements to these tributaries are estimated based on redd counts and/or live Chinook observed.

During 2007, the Skokomish River again experienced very low flows at the beginning of the season and Chinook were not able to pass upstream of the confluence of Reichert Springs and the North Fork Skokomish (RM 8) until early October. Consequently, there was no spawner escapement in the South Fork mainstem and only 1 redd was observed in Vance Creek, a tributary, during 2007.

Spawner escapement estimates include 303 Chinook in the mainstem Skokomish (including 34 Chinook in Hunter Creek), 123 Chinook in the North Fork Skokomish (including 0 Chinook in McTaggart Creek), and 3 Chinook in the South Fork Skokomish (with all 3 Chinook in Vance Creek) for a total escapement of 429 Chinook in the Skokomish River system during 2007. The FRAM pre-season escapement prediction was 1,563 Chinook (PNPTC and WDFW 2007).

Hood Canal Chinook Mark Sampling

Mass marking is being implemented for Hood Canal hatchery Chinook, including releases from George Adams Hatchery, Hoodspout Hatchery, and Endicott Ponds. However, it will be several years before most hatchery Chinook adults returning to Hood Canal will be marked and/or tagged. The proportion of all hatchery Chinook released that were either tagged and/or marked has incrementally increased since brood year 2003. For example, about 33%, 48%, 75%, 85% and 95% of brood year 2003 through brood year 2007 releases, respectively, were either tagged and/or marked. These Chinook will return to Hood Canal predominately as age 3 and age 4 fish from 2006 through 2011.

Coded-wire tag (CWT) data and age and sex composition data have been routinely collected for Chinook returning to George Adams Hatchery since 1988 and Double Index tag groups of Chinook have been released since 1998.

More intensive sampling of Chinook on the natural spawning grounds has been done since 1998. During 2007, there again was a high effort to sample Chinook for marks and CWTs throughout Hood Canal.

A total of 7 Chinook were sampled in the Hamma Hamma and 3 fish had CWTs, with all originating from the Hamma Hamma supplementation program. No Chinook carcasses were observed or sampled in the Dosewallips River. One Chinook was sampled in the Duckabush River, an age 3 fish released from Hoodspout Hatchery. Of the total escapement of 73 Mid-Hood Canal Chinook, 8 (11%) were mark sampled during 2007 (Table 21).

Of the estimated 429 natural Chinook spawners in the Skokomish River, 75 (18%) were mark sampled on the spawning grounds during 2007. Two Chinook sampled had CWTs

(Table 21): one 4-year old adult originating from fingerling releases at George Adams Hatchery and one 3-year old adult originating from releases at Hoodsport Hatchery.

During 1988 through 2006, hatchery-origin Chinook comprised an estimated 20% to 80% (with an average of 60%) of natural escapement in the Skokomish River system (Skokomish Tribe and WDFW 2007). No estimate is currently available for 2007. As the proportion of hatchery Chinook releases that are marked increases, estimates of hatchery-origin natural spawners will continue to improve.

Spawner surveys and sampling of Chinook were also done in other Hood Canal streams during 2007, including Dewatto, Tahuya, Union, and Lilliwaup rivers. Out of 8 Chinook sampled, two were coded wire tagged (Table 21).

Overall, about 16% of natural Chinook spawner escapement to Hood Canal was sampled for CWTs during 2007 (Table 21).

Table 21. Chinook salmon sampled for coded-wire tags (CWTs) in Hood Canal rivers, 2007.

River	Spawner escapement	Chinook sampled		CWTs sampled
		Number	%	
Dewatto R.	36	8	22.20%	2
Tahuya R.	5	0	0.00%	0
Union R.	16	0	0.00%	0
Mainstem Skokomish R.	303	62	20.50%	2
N.F. Skokomish R.	123	12	9.80%	0
S.F. Skokomish R.	3	1	33.30%	0
Skokomish River total	429	75	17.50%	2
Lilliwaup R.	2	0	0.00%	0
Hamma Hamma R.	60	7	11.70%	3
Duckabush R.	4	1	25.00%	1
Dosewallips R.	9	0	0.00%	0
Mid-Hood Canal total	73	8	11.00%	4
Hood Canal total	561	91	16.20%	8

4.5 Strait of Juan de Fuca

Dungeness

Since 1986, surveys have been conducted throughout the spawning season from RM 0 to 18.8 in the mainstem Dungeness, and from RM 0 to 5.0 in the Gray Wolf mainstem, to generate a cumulative redd count for the season. Counts are multiplied by 2.5 to estimate total number of adults. In 2007, 110 redds were counted in the Dungeness (275 adults), and 12 were counted in the Gray Wolf (30 adults). There were 88 adults used for broodstock in the hatchery program, including 5 pond mortalities. An additional 10 fish

were observed as pre-spawn mortalities in the river, or as mortalities in the lower river trap, bringing the total estimated return to the river to 403, below the FRAM predicted escapement of 1,101. There were 130 carcasses sampled, 67 without CWT's, and 63 with CWT's. Two of the fish with CWT's were from programs outside the basin (Morse Creek and Elwha River). Based on the CWT results and scale samples analyzed, the preliminary HOR/NOR composition for RY2007 was 52.0% HOR, 0.8% NOR, and 47.2% classified as Unknown. Chinook were classified as Unknown if a positive identification could not be made. The age of the Chinook for RY2007 consisted of 26.8% age 3, 23.6% age 4, 44.7% age 5, and 4.9% age 6.

Elwha River

Chinook spawning in the Elwha is limited to the 4.8 miles below the dam, with most natural spawning concentrated between RM 2.8 and 4.4. Adult escapement in the mainstem is estimated by producing an AUC estimate of redd-days, which is divided by an assumed 21-day redd life to estimate total redds. That total is added to the number of redds counted in the 1-mile long Hunt's Road side channel index surveyed by the Lower Elwha Klallam Tribe. This redd total is multiplied by 2.5 to estimate total adults. For 2007, the estimate of natural spawning Chinook was 380. An additional 574 Chinook were removed from the river by gaff and used as broodstock for the hatchery program. 183 Chinook volunteered into the hatchery trap, and were also used as broodstock for the hatchery. Nine pre-spawn mortalities were observed, bringing the total return to the river to 1,146 Chinook, well below the FRAM prediction of 2,409. WDFW field staff collected otolith samples from 366 adult Chinook. Otoliths were collected to help distinguish between hatchery and wild fish based on the presence or absence of otolith marks. The otoliths have not been analyzed for marks at this time.

A total of 342 Chinook were sampled for scales. Twenty-four Chinook were identified as 2 year olds. Excluding the 2 year old Chinook, the age composition consisted of 22% age 3, 68% age 4, 9.1% age 5 and 0.9% age 6.

Hoko

Escapement estimates are done using WDFW and Makah Fisheries ground surveys of cumulative redd counts for the mainstem and tributaries found between river miles 1.5 to 21.7, which represents the entire range of Chinook spawning in the Hoko basin. Redd counts are multiplied by 2.5 adults/redd. There are ten mainstem reaches plus 13 reaches in tributaries, which include the Little Hoko River, a tributary to the lower mainstem, and Browne's, Herman, North Fork Herman, Ellis, Bear, and Cub creeks, which are tributaries to the upper mainstem. WDFW conducted three surveys in the mainstem Hoko River from RM 3.4 to RM 10.2 during the 2007 return year. WDFW attempted to survey the lower mainstem after November 5 but was unsuccessful due to high flows and poor water visibility.

No surveys were conducted in river sections RM 1.5 to RM 3.4 and RM 11.0 to RM 13.0 during the 2007 season. We did not expand to RM 1.5 to RM 3.4 section because of the extremely low spawning density between RM 3.4 to RM 5.6 (n=1). Most of the Chinook spawned in the lower mainstem Hoko upstream of RM 5.6. The early rainfall and high stream flows in October helped Chinook reach the upper river. In contrast, the Chinook never made it to the upper reaches of the mainstem Hoko and tributaries the previous year because of low flows. The mainstem Hoko from RM 11.0 to 13.0 was not surveyed during the season, so the estimate for number of redds in that section was estimated by applying the proportion of total redds observed in this section in 2001, 2003, and 2004.

The 2007 Chinook escapement was estimated to be 570 adults, below last year's escapement of 880, and below the FRAM prediction of 848. The escapement estimates for the upper mainstem Hoko River (RM 10.1 to 21.7), lower mainstem Hoko River (RM 1.9 to 10.1), and all tributaries were 105, 145, and 213, respectively. An additional 107 adult Chinook were collected for broodstock by the Makah Hatchery staff.

5 Coded-wire Tag Sampling

Commercial and recreational catch is sampled to recover coded-wire tagged Chinook and coho. General objectives are to sample 20% of commercial catch in each area and week, and 10% of recreational catch in each area and month. Sampling rates from 2006 are presented here. Sampling rates in commercial fisheries were generally good (Table 22), with a total of 41,441 Chinook sampled for CWT, compared to an estimate of 116,606 total catch. Several individual areas did fall short of the 20% target for the year. Areas 12C/12H (Hood Canal) and the Skokomish River were the areas with the most substantial catches, but with sampling rates below 20%. All marine area recreational fisheries were sampled at rates between 10% and 41% for the year as a whole (Table 23), with a total of 6,039 sampled from an estimated 29,539 caught.

Table 22. Chinook coded-wire tag sampling rates for commercial fisheries in 2006.			
Catch Area	Catch	# sampled	Sample rate
BELLINGHAM BAY 7B	12,271	5,170	42.1%
SAMISH BAY 7C	12,681	6,004	47.3%
LUMMI BAY 7D	119	16	13.4%
NOOKSACK R 01.0120	762	327	42.9%
SKAGIT BAY (AREA 8)	4	0	0.0%
SKAGIT R 03.0176	1,701	1,057	62.1%
SARATOGA PASSAGE 8A	215	24	11.1%
TULALIP BAY 8D	5,046	1,710	33.8%
PORT GAMBLE BAY 9A	51	29	56.9%
QUILCENE + DABOB 12A	29	1	3.4%
CNTRL HOOD CANAL 12B	13	0	0.0%
AREAS 12C AND 12H	16,260	719	4.4%
PURDY CR 16.0005	6,837	155	2.3%
SKOKOMISH R 16.0001	5,314	514	9.7%
10 (SEATTLE)	245	226	92.2%
ELLIOTT BAY 10A	2,602	2,064	79.3%
EAST KITSAP 10E	5,087	3,230	63.4%
DUWAMISH R 09.0001	5,864	3,040	51.8%
LK WASHINGTON -S	143	0	0.0%
LK SAMMAMISH	783	194	24.7%
AREA 10F SHIP CANAL	1,245	1,022	82.0%
LK WASHINGTON -N	41	5	12.1%
PUYALLUP R 10.0021	2,473	1,312	53.0%
WHITE R 10.0031	232	0	0.0%
NISQUALLY 13	60	0	0.0%
CARR INLET 13A	6,579	1,881	28.5%
CHAMBERS BAY 13C	4,449	553	12.4%
SOUTH SOUND PASS 13D	1,457	10	0.6%
BUDD INLET 13F	2,559	66	2.5%
NISQUALLY R 11.0008	21,443	7,926	36.9%
ADMIRALTY INLET 9	107	70	65.4%
NEAH BAY NET AREA 4	1	0	0.0%
NEAH BAY 4B	1	0	0.0%
CLALLAM BAY 5	956	379	39.6%
PORT ANGELES 6	37	0	0.0%
7 & 7A	5,241	3,735	71.2%
ELWHA R 18.0272	4	0	0.0%
SOOES R 20.0015	2,528	0	0.0%

Table 23. Chinook coded-wire tag sampling rates for recreational fisheries in 2006.			
Catch Area	Catch	# sampled	Sample rate
Area 5 - West SJF	4,350	955	21.9%
Area 6 - East SJF	965	333	34.5%
Area 7 - San Juan Islands	3,325	523	15.7%
Area 8.1 - Skagit Bay	427	174	40.7%
Area 8.2 - Port Gardiner	1,732	634	36.6%
Area 9 - Admiralty Inlet	1,141	249	21.8%
Area 10 - Central Puget Sound	4,370	1,467	33.5%
Area 11 - Central Puget Sound	9,155	1,240	13.5%
Area 12 - Hood Canal	1,885	189	10.0%
Area 13 - South Puget Sound	2,189	275	12.5%

6 Pacific Salmon Treaty Compliance / ISBM Index Rates

The terms of the 1999 Chinook Annex to the PST requires that ISBM fisheries be managed to contribute to the achievement of MSY escapement or other agreed, biologically-based escapement objective for indicator Chinook stocks or management units. Furthermore, the general obligation of southern U.S. ISBM fisheries is to achieve an overall 40% reduction in their combined exploitation rate, relative to the base period, on management units for which escapement is projected not to achieve the escapement goal.

Lack of technical agreement on escapement goals for Puget Sound stocks precludes a formal assessment of compliance with the agreement. However, from the Puget Sound co-managers' perspective, most Puget Sound Chinook stocks are depressed, some critically depressed, such that most have not achieved their escapement goals, so they have assumed that the Chinook Agreement obligation for ISBM fisheries is operative.

ISBM fisheries in southern U.S. waters include marine and freshwater commercial and recreational fisheries in Puget Sound, the Strait of Juan de Fuca, and the Washington coast. They also include commercial and recreational fisheries in the Columbia River and on the Oregon coast, though these fisheries have little impact on Puget Sound Chinook stocks.

The Joint Chinook Technical Committee (CTC) performs a pre-season assessment to inform PST annual fisheries planning. With few exceptions, the pre-season CTC assessment indicates compliance with the obligation (Table 24), i.e. exploitation rate indices on the indicator stocks were projected to be less than 0.600. These pre-season model projections should be viewed cautiously, because the model output is sensitive at exploitation rates less than 20%. The low abundance of most of the Puget Sound indicator stocks also confounds this assessment.

The CTC also completed post-season assessment of ISBM indices using CWT analysis through 2005 (TCChinook (08)-1). However, assessments are not available for the majority of Puget Sound indicator stocks in most years, due to insufficient data (lack of stock specific tag code, base period CWT recoveries, etc.), so they are not presented here.

Indicator Stock	2002	2003	2004	2005	2006	2007
Skagit S/F	0.27	0.406	0.157	0.195	0.258	0.325
Stillaguamish	0.2	0.184	0.224	0.185	0.493	0.152
Snohomish	0.15	0.072	0.11	0.889	0.199	0.138
Lake Washington	1.25	0.768	0.411	0.373	0.613	0.391
Green	0.35	0.263	0.26	0.202	0.361	0.278
Nooksack Early	0	0.121	0.974	0.222	0.121	NA
Skagit Spring	0.06	0.119	0.663	0.213	0.161	NA
Hoko	0.48	0.682	0.966	0.444	0.442	0.401

7 Literature Cited

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