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Pacific Salmon Escapement Estimation Methods and Data for Alaska

by

Eric C. Volk and Andrew R. Munro

Alaska Department of Fish and Game
333 Raspberry Road
Anchorage, Alaska 99518, USA

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Abstract

At the 2014 annual meeting of NPAFC, Stock Assessment Working Group members agreed to provide a summary of salmon escapement estimation methods, assumptions and potential biases associated with each, and preliminary escapement information. This document provides that summary for Alaskan salmon stocks.

Introduction

The Alaska Department of Fish and Game manages salmon fisheries to achieve spawning escapement goals or targets which provide sustained yields and ensure long-term viability of salmon stocks. A large number of assessment projects are positioned on river systems throughout the state to provide annual information on abundance of spawners for management. Escapement is assessed through a variety of methods including weirs (fences), counting towers, sonar, boat and foot surveys, mark and recapture projects, and aerial surveys. Some of these methods provide fairly accurate counts of fish passage while others provide an index of total abundance. All methods carry various assumptions, caveats and context which must be understood to correctly interpret data.

The length of any escapement data time series in Alaska varies dramatically. Many projects are relatively new, reflecting recent management needs, while others may date back to statehood (1959) or beyond. A number of projects have partial or interrupted escapement time series for all or some species where the effort has been periodically discontinued for a variety of reasons. For many escapement assessments with a sufficiently long history and management need, formal escapement goals have been established using the data to estimate the number of spawners that provides for sustained yields to the fishery and a measure of security that escapements are sustainable into the future. There are approximately 300 established escapement goals in Alaska as of this writing (Munro and Volk, 2014).

The purpose of this paper is to 1) provide an overview of field and analytical approaches used to estimate escapements in Alaska, 2) review assumptions, qualifiers and issues associated with those methods, and 3) provide recent escapement data for all assessment projects tied to formal escapement goals as an example of what might be included in a database useful to the Stock Assessment Working Group and NPAFC.

Escapement Assessment Methods

Weirs or Fences

Weirs, or fences, are commonly used to obtain counts of adult salmon migrating upstream to spawn. In Alaska, about 25% of escapement goals are based on and assessed using weirs or a combination of weirs and other assessment information and are used for all five species of Pacific salmon. Fish are counted directly as they pass through an opening in the weir, or are allowed through in a controlled manner using a gate. In some cases, fish are counted using video (e.g. Chignik River weir) as they pass through the weir. Weirs are considered the most accurate escapement estimation method and are often used as the standard to which other assessment methods are compared (Cousens et al. 1982). Accurate counts are obtained when the entire width of the river is blocked, the weir is fish tight and there are no breaches during the season. The weir also needs to be installed for the entire season with all fish directly counted and accurately identified to species. In Alaska, it is difficult to always meet these assumptions. Often, weirs are installed after migration has started or prior to it ending because of weather and the logistics of installing or removing the weirs. Therefore, the entire run may not be counted. Once installed, weirs may be breached by high water, damaged by ice and debris, or sections of weir may be removed to avoid damage during high-flow events. An unknown number of fish may pass by the weir during these periods. Additionally, some weirs are operated so only a portion of the run is counted even when operating properly. For example, Chignik River weir uses a video system for observing fish and fish are counted for 10 minutes out of every hour, similar to the method used for counting towers (see below). Another consideration is accounting for recreational and subsistence harvest above the weir, which are estimated post-season from surveys, logs, or permits. In some systems this harvest is sizable and may be taken into account when developing escapement goals. However, the estimated sport and subsistence harvests are typically not compiled until a year or more afterwards, thus delaying a final estimate of escapement for a given season. Not accounting for escapement during periods in which a weir is inoperable or not installed, biases the escapement low, whereas not accounting for harvest upriver of the assessment project will bias the escapement high. Correcting these biases introduces some uncertainty in escapement estimates as does expanding counts for assessment projects that only count a portion of the escapement during normal operation.

Counting Towers

Counts of salmon are made from towers, or other elevated positions, at a location in the river where most migrating fish can be observed. In Alaska, counting towers are used primarily to assess sockeye and Chinook salmon escapements, although some projects in the Norton Sound area use towers to count chum, coho and pink salmon. About 6% of escapement goals in Alaska are based on and assessed using towers. Typically, fish are counted for 10 minutes of every hour on one or both banks of the river. Counts are then expanded to hourly counts and summed to estimate daily and seasonal total escapement (Seibel 1967, Cousens et al. 1982). Project placement and installing “flash” panels on the river bed to provide a contrasting background that

the fish have to pass over, improves fish visibility and species identification. The accuracy and precision of counts are affected by factors such as weather, water conditions, characteristics of the migration, observer variability, and the systematic sampling design; therefore, counting towers do not provide error-free estimates of escapement. The effects of these factors on the uncertainty of count estimates are difficult to measure, but are assumed to be minimal. In addition, underestimation of escapement (i.e. downward bias) may be introduced if the counting project starts after the start of the run or ends before the run is complete. However, this bias, which is often not formally estimated, is considered small and escapement estimates are generally not corrected for this. The systematic sampling method used to collect escapement data from towers provides an unbiased estimate of total escapement, but influences uncertainty in the estimate and bias of the uncertainty estimate (Woody 2007). Sampling error (i.e. counting 10 minutes out of each hour) can be estimated (Reynolds et al. 2007), but it is not necessarily estimated on a regular basis.

A variation on the traditional manned counting tower that is successfully being used in two systems in Alaska is remote video counting stations. These remote stations are being used to count escapement of sockeye salmon into Chenik and Mikfik Lakes in Lower Cook Inlet. Escapements of Chenik Lake sockeye salmon derived from the video were compared with weir counts and were found to have a strong correlation (Otis et al 2010).

Sonar

Escapement is derived from sonar by counting fish that are detected by their echoes as they swim through a pulsed sonar beam. These counts are then apportioned to species, when possible. In Alaska, about 6% of escapement goals are based on and assessed using sonar (or a combination of sonar and other methods). Sonars are primarily used to assess escapement of sockeye, chum and Chinook salmon where these are the dominant species in the river, or in the case of Chinook salmon, readily identified by size of the echo. Species composition is estimated from other sampling methods, such as fish wheels or drift gillnets. This sampling also provides biological information on the age, sex and length composition of the escapement. Size selective sampling can be an issue with these methods so efforts are made to limit this (e.g., using a variety of mesh sizes for drift gillnets). The variance of the escapement estimates are routinely estimated and account for uncertainty in species apportionment and the variance due to sampling. Sonar counts are stratified by time period with associated species apportionment sampling, but the sampling can be incomplete or limited by low catch so the true uncertainty in the escapement may be underestimated. Bias in the escapement estimate based on sonar counts can be introduced if fish migrate beyond the range of detection of the sonar units (or behind the units). However, careful project placement and updating to newer sonar technology may help minimize these biases. As with weir and tower projects, biases can also be introduced if the project is not operational for the full run. For most sonar projects, it is assumed that only a small proportion of the run at the beginning and end are missed and no corrections are made.

Aerial Surveys

In aerial surveys, observations of adult salmon in rivers are made from slow flying aircraft (fixed wing or helicopters) at low altitudes so that an experienced observer can visually identify and count individual fish or estimate the number in dense concentrations of fish. Aerial surveys of spawning salmon are useful where access is difficult and stock aggregates include many widespread spawning streams. They also can provide immediate rough estimates of spawner abundance for management purposes. The method is most effective in shallow lake areas or clear-water streams, with little or no overhanging vegetation (Cousens et al. 1982). About 49% of escapement goals in Alaska are based on aerial survey data and assessed by aerial surveys. All 5 Pacific salmon species are assessed using aerial surveys in Alaska, with 56% to 67% of the assessed stocks/systems for Chinook, chum and pink salmon conducted by aerial surveys (coho and sockeye salmon are 24% and 31% respectively). Peak aerial surveys employ one or more surveys near peak migration with the highest (or single) count used as an index of escapement or expanded to estimate total escapement. Alternatively, multiple surveys at short intervals throughout the migration can index escapement through expansions using the area under the curve method (e.g. Johnson and Barrett 1988, Bue et al. 1998). The area under the curve method also incorporates estimates of stream life and observer efficiency to estimate total escapement. In some cases in Alaska, however, a single average stream life estimate is used for a broader area (e.g., PWS pink salmon) and counts might not be adjusted for observer efficiency so escapement is still an index and not estimated in terms of total escapement. In some areas within Alaska where systems that support spawning salmon are too numerous to survey completely, escapement is assessed as an aggregate of a subset of streams (e.g., PWS and SEAK pink salmon).

It is recognized that unexpanded peak counts are indices and are naturally biased low relative to the true escapement. During the protracted spawning run, salmon are continuously spawning and dying and consequently lost to aerial observers. Therefore, the number of fish present in the stream at any given time is less than the actual escapement. Even with perfect aerial observation, the observed peak count is a very conservative estimate of escapement. Other factors such as observer experience, weather conditions, lighting (i.e., time of day), and water conditions (e.g., high flows, turbidity after heavy rains), can affect the accuracy and precision of survey counts. Furthermore, species identification can be problematic in certain situations, such as similarly sized pink and chum salmon migrating together. When one species is significantly more abundant than another, over-counting of the more abundant species and under counting the less abundant one is likely (Pirtle 1977).

ADF&G has conducted many studies that pair aerial count data from multiple surveys with escapement enumeration based on other methods such as weirs, tower counts, mark-recapture projects and direct measurement of stream life. These studies have been used to provide stream life estimates to be used for area under the curve calculations and estimates of expansion factors to estimate total escapement from peak counts (e.g. Eggers et al. 2012a,b).

Foot and Boat Surveys

Visual surveys of salmon on spawning grounds to estimate escapement from counts of live and/or dead fish either by foot or on a boat is one of the oldest methods used (Cousens et al. 1982). In Alaska, about 12% of escapement goals are based on and assessed through foot and boat surveys (or in combination with other assessment methods). Foot and boat surveys are primarily used to count sockeye and coho salmon and to a limited extent for chum and Chinook salmon, but there are no examples of pink salmon escapement being assessed using boat or foot survey – at least for systems with escapement goals. Surveys are often conducted on smaller tributaries or stream segments that are easier to count accurately and can be used as an index of a broader area. As with aerial surveys, single or multiple counts may be made around the time of peak spawning. Survey counts may include live and/or dead fish and some estimate of spawner stream life is usually required when analyzing multiple counts. As with aerial surveys, obtaining accurate and unbiased counts is affected by timing of survey, observer experience, weather and light conditions, water conditions, and stream characteristics (Cousens et al. 1982).

Mark and Recapture Projects

Mark-recapture projects are used to estimate escapement through marking or tagging of a representative portion of the spawning population and later examining a random sample of fish for marks. The number of fish marked, the number later examined for marks, and the number of marked fish recovered can then be used to estimate the escapement using the Petersen method (or one of its many modifications). Mark-recapture projects are generally expensive and labor intensive and produce estimates of similar accuracy and precision as other methods such as weirs and counting towers (Cousens et al. 1982). Therefore, in Alaska, mark-recapture projects are limited to larger systems with major stocks that cannot be effectively assessed using other means or are used to assess and calibrate other escapement estimation methods. About 5% of escapement goals are based on and assessed through mark-recapture projects or in combination with other assessment methods. Chinook salmon are the primary species for which this method is used in Alaska, but there are also escapement goals for chum, coho and sockeye salmon that use mark-recapture. Unlike other assessment methods, the number of tagged fish needed and the number of fish needed to be examined at the recovery stage can be estimated beforehand to achieve a given level of accuracy and precision as long as the underlying assumptions are met. Some of these assumptions include: 1) fish have an equal probability of being marked or inspected, 2) there is no recruitment to the population between marking and recovery, 3) there is no tag mortality, and 4) fish do not lose their marks and all marks are identifiable. Assumptions to obtaining good estimates of escapements fall into two main categories 1) biasing of the ratio of tagged to untagged fish and 2) distribution of tagged fish within the population and recovery sample examined for tags (Cousens et al. 1982). Modifications of the data analysis methods and adjustments can be made as long as violations of these assumptions are identified. If undetected and not accounted for, loss of tags or tagged fish from the recovery stage can lead to over

estimation of escapement. Precision of estimates is mainly influenced by ability to tag and recover a sufficient number of fish relative to the size of the spawning population.

Escapement Data for Projects Tied to Escapement Goals

For approximately 300 salmon stocks across Alaska, spawning escapements are estimated in some manner so that they may be compared to a formal escapement goal designed to produce sustained fishery yields and ensure viability of the stocks into the future. In tables 1 to 4, we present a record of those data for the most recent 10 years (2005-2014) to offer an example of what might be included in a data base hosted by NPAFC. The data is organized by ADF&G commercial fisheries management regions, species and stock. A series of footnotes following each regional table provides important meta-data which is essential for evaluating the context and meaning of the escapement estimate.

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Table 1.—Provisional Southeast Region, Alaska Chinook, chum, coho, pink, and sockeye salmon escapements, 2005 to 2014.

System/Goal	Enumeration Method	Escapement									
		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
CHINOOK SALMON^a											
Blossom River	Peak Aerial Survey	445	339	135	257	123	363	147	205	255	217
Keta River	Peak Aerial Survey	497	747	311	363	219	475	223	241	493	439
Unuk River	Mark-Recapture	4,742	5,645	5,668	3,104	3,157	3,835	3,195	956	1,135	1,691 ^c
Chickamin River	Peak Aerial Survey	924	1,330	893	1,111	611	1,156	853	444	468	652
Andrew Creek	Expanded Peak Aerial Survey	1,979	2,124	1,736	981	628	1,205	936	587	920	1,261
Stikine River	Mark-Recapture	39,833	24,405	14,560	18,352	12,803	15,116	14,480	22,327	16,735	25,472 ^b
King Salmon River	Expanded Peak Aerial Survey	143	150	181	120	109	158	192	155	94	68
Taku River	Mark-Recapture	38,599	42,296	14,749	26,645	29,797	28,769	27,523	19,429	18,002	23,532 ^b
Chilkat River	Mark-Recapture	3,366	3,039	1,445	2,905	4,429	1,815	2,688	1,744	1,730	1,534 ^b
Klukshu (Alek) River	Weir Count	1,034	568	676	466	1,466	2,159	1,667	693	1,261	832 ^b
Alek River ^d	Weir Count	4,478	2,323	2,827	1,885	6,239	9,518	6,668	2,660	5,044	3,425 ^b
Situk River	Weir Count	610	747	677	413	902	166 ^c	240	322	912	475
CHUM SALMON											
Southern Southeast Summer	Peak Aerial Survey	66,000	76,000	132,000	13,000	41,000	47,000	157,000	144,000	84,000	42,000
Northern Southeast Inside Summer	Peak Aerial Survey	185,000	282,000	149,000	99,000	107,000	77,000	125,000	177,000	278,000	93,000
Northern Southeast Outside Summer	Peak Aerial Survey	77,000	57,000	34,000	46,000	15,000	24,000	23,000	28,000	18,000	22,000
Cholmondeley Sound Fall	Peak Aerial Survey	15,000	54,000	18,000	49,500	39,000	76,000	93,000	54,000	13,000	48,000
Port Camden Fall	Peak Aerial Survey	2,110	2,420	505	1,400	1,711	5,400	1,800	3,750	2,000	4,000
Security Bay Fall	Peak Aerial Survey	2,750	15,000	5,400	11,700	5,100	6,500	5,100	9,800	3,000	6,000
Excursion River Fall	Peak Aerial Survey	1,100	2,203	6,000	8,000	1,400	6,100	3,000	2,000	8,000	11,000
Chilkat River Fall	Mark-Recapture/Fish Wheel	202,000	681,000	320,000	437,000	326,000	88,000	356,000	284,000	165,000	142,000
COHO SALMON											
Hugh Smith Lake	Weir Count	1,732	891	1,244	1,741	2,281	2,878	2,137	1,908	3,048	4,110
Klawock River	Weir Count	9,876	6,800	NA	6,210	5,415	9,707	5,572	7,507	8,323	7,698
Taku River	Mark-Recapture	135,558	122,384	74,369	95,360	103,950	126,830	70,745	70,742	68,118	124,171 ^b
Auke Creek	Weir Count	450	581	352	600	360	417	517	837	736	1,533
Montana Creek	Foot Survey	351	1,110	324	405	698	630	709	394	367	911
Peterson Creek	Foot Survey	139	439	226	660	123	467	138	190	126	284
Ketchikan Survey Index	Peak Aerial Survey	14,840	6,912	4,488	16,680	8,226	4,656	5,202	11,950	11,549	16,675

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System/Goal	Enumeration Method	Escapement									
		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Sitka Survey Index	Foot Survey	1,668	2,647	1,066	1,117	1,156	1,273	2,222	1,157	1,414	2,161
Ford Arm Lake	Weir Count	4,257	4,737	2,567	5,173	2,181	1,610	1,908	2,282	1,573	3,025
Berners River	Mark-Recapture	5,220	5,470	3,915	6,870	4,230	7,520	6,050	5,480	6,280	15,480
Chilkat River	Mark-Recapture/Foot Survey	38,589	80,683	25,493	57,376	48,867	89,124	66,557	38,677	51,324	130,200
Lost River	Foot Survey/Boat Survey	1,241	3,500	2,542	NA	3,581	2,393	1,221	2,200	2,593	3,555
Situk River	Boat Survey	2,514	7,950	5,763	NA	5,814	11,195	3,652	3,007	14,853	8,226
Tsiu/Tsivat Rivers	Peak Aerial Survey	16,600	14,500	14,000	25,200	28,000	11,000	21,000	11,000	47,000	27,000
PINK SALMON											
Southern Southeast	Peak Aerial Survey	9,400,000	4,330,000	10,590,000	6,290,000	7,200,000	5,940,000	5,500,000	6,470,000	14,450,000	9,650,000
Northern Southeast Inside	Peak Aerial Survey	6,680,000	3,960,000	4,740,000	1,470,000	3,650,000	3,210,000	6,030,000	2,110,000	5,400,000	1,380,000
Northern Southeast Outside	Peak Aerial Survey	3,840,000	1,960,000	2,310,000	1,730,000	1,820,000	2,010,000	2,730,000	2,470,000	5,340,000	2,750,000
Situk River	Weir Count	281,135	114,779	229,033	1,232 ^f	62,787	89,301 ^f	169,908			
Situk River	Weir Index								30,548	133,656	28,238
SOCKEYE SALMON											
Hugh Smith Lake	Weir Count ^g	23,872	42,112	33,743	3,588	9,483	15,646	22,029	13,353	5,946	10,397
McDonald Lake	Expanded Foot Survey	61,043	31,357	29,086	20,700	51,000	72,500	113,000	57,000	15,400	43,400
Mainstem Stikine River	Weir Count ^h	34,788	27,606	20,865	16,802	24,575	25,185	33,569	32,752	32,689	26,513 ^b
Tahltan Lake ^h	Weir Count	43,046	53,455	20,874	10,416	30,323	22,702	34,248	13,687	15,828	39,745
Speel Lake	Weir Count	7,549	4,165	3,099	1,763	3,689	5,640	4,777	5,681	6,426	5,059
Taku River	Mark-Recapture	112,739	145,572	87,763	68,059	74,339	88,428	112,187	112,564	75,323	92,463 ^b
Redoubt Lake	Weir Count	65,653	103,953	66,938	10,146	12,851	17,119	21,806	40,903	48,355	18,694
Chilkat Lake	Sonar/Mark-Recapture	84,000	73,000	68,000	71,735	150,033	61,906	63,628	107,723	110,979	70,470
Chilkoot Lake	Weir Count	51,178	96,203	72,678	33,117	33,705	71,657	65,915	118,166	46,140	105,467
East Alsek-Doame River	Peak Aerial Survey	50,000	29,000	40,100	8,000	12,000	19,500	27,300	21,500	26,500	15,300
Klukshu River	Weir Count	3,167	12,890	8,310	2,741	5,509	18,546	20,769	17,176	3,800	12,148
Lost River	Foot/Boat Survey	1,476	1,018	180	200	NA	1,525	1,006	453	587	NA
Situk River	Weir Count	66,476	90,351	61,799	22,520	83,959	47,865	89,943	62,500	118,635	102,318

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Note: NA = data not available.

^a Goals are for large (≥ 660 mm MEF, or fish age 1.3 and older) Chinook salmon, except the goals for the Klukshu and Alsek rivers, which are germane to fish age 1.2 and older and can include fish < 660 mm MEF.

^b Preliminary data.

^c 2012 and 2013 Unuk River Chinook salmon escapement estimate based on expanded aerial survey index because mark-recapture studies failed.

^d Klukshu River Chinook salmon escapement is the metric used to manage Chinook salmon for the Alsek River system, which includes the Klukshu River. Alsek River Chinook salmon escapement is estimated using an expansion of the Klukshu River escapement (expansion factor = 4.0, SE=1.98).

^e Incomplete weir count due to inseason problems with weir (e.g., breach of weir).

^f Situk River weir was pulled well before peak of pink salmon run so adequate assessment was not possible.

^g Hugh Smith Lake sockeye salmon escapement includes wild and hatchery fish.

^h Mainstem Stikine River sockeye salmon escapement uses a combination of weir counts and harvest to develop a run reconstruction.

ⁱ Tahltan sockeye salmon escapement count includes fish collected for broodstock.

Table 2.—Provisional Central Region (Bristol Bay, Cook Inlet, and Prince William Sound/Copper River) Chinook, chum, coho, pink, and sockeye salmon escapement goals and escapements, 2005 to 2014.

System	Enumeration Method	Escapement									
		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
CHINOOK SALMON											
<i>Bristol Bay</i>											
Nushagak River	Sonar	223,950	117,364	50,960	91,364	74,781	56,092	101,995	167,618	104,746	63,981 ^a
Naknek River	Single Aerial Survey	NS	NS	5,498	6,559	3,305 ^b	NS	NS	NS	NS	NS
Alagnak River	Single Aerial Survey	5,084	4,278	3,455	1,825	1,957	NS	NS	NS	NS	NS
<i>Upper Cook Inlet</i>											
Alexander Creek	Single Aerial Survey	2,140	885	480	150	275	177	343	181	588	911
Campbell Creek	Single Foot Survey	1,097	1,052	588	439	554	290	260	NS	NS	274
Chuitna River	Single Aerial Survey	1,307	1,911	1,180	586	1,040	735	719	502	1,690	1,398
Chulitna River	Single Aerial Survey	2,838	2,862	5,166	2,514	2,093	1,052	1,875	667	1,262	1,011
Clear (Chunilna) Creek	Single Aerial Survey	1,924	1,520	3,310	1,795	1,205	903	512	1,177	1,471	1,390
Crooked Creek	Weir Count	1,909	1,516	965	879	617	1,088	654	631	1,103	1,411
Deshka River	Weir Count	37,725	31,150	18,714	7,533	11,967	18,594	19,026	14,010	18,531	16,335
Goose Creek	Single Aerial Survey	468	306	105	117	65	76	80	57	62	232
Kenai River - Early Run	Sonar	16,650	13,270	9,856	6,570	6,163	6,393	8,448	5,044	2,148	5,311
Kenai River - Late Run	Sonar	60,060	48,970	36,950	32,290	21,390	16,210	19,680	27,710	15,395	16,263
Lake Creek	Single Aerial Survey	6,345	5,300	4,081	2,004	1,394	1,617	2,563	2,366	3,655	3,506
Lewis River	Single Aerial Survey	441	341	0 ^c	120	111	56	92	107	61	61
Little Susitna River	Single Aerial Survey	2,095	1,855	1,731	1,297	1,028	589	887	1,154	1,651	1,759
Little Willow Creek	Single Aerial Survey	1,784	816	1,103	NC	776	468	713	494	858	684
Montana Creek	Single Aerial Survey	2,600	1,850	1,936	1,357	1,460	755	494	416	1,304	953
Peters Creek	Single Aerial Survey	1,508	1,114	1,225	NC	1,283	NC	1,103	459	1,643	1,443
Prairie Creek	Single Aerial Survey	3,862	3,570	5,036	3,039	3,500	3,022	2,038	1,185	3,304	2,812
Sheep Creek	Single Aerial Survey	760	580	400	NC	500	NC	350	363	NC	262
Talachulitna River	Single Aerial Survey	4,406	6,152	3,871	2,964	2,608	1,499	1,368	847	2,285	2,256
Theodore River	Single Aerial Survey	478	958	486	345	352	202	327	179	476	312
Willow Creek	Single Aerial Survey	2,411	2,193	1,373	1,255	1,133	1,173	1,061	756	1,752	1,335
<i>Lower Cook Inlet</i>											
Anchor River	Sonar/Weir Count	11,156	8,945	9,622	5,806	3,455	4,449	3,545	4,509	4,388 ^a	2,497 ^a
Deep Creek	Single Aerial Survey	1,076	507	553	205	483	387	696	447	475	601
Ninilchik River	Weir Count	1,259	1,013	543	586	528	605	668	555	571 ^a	891 ^a
<i>Prince William Sound</i>											
Copper River	Mark-Recapture	21,528	58,454	34,575	32,487	27,787	16,771	27,994	27,835	29,012	NA ^d

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Table 2.–Page 2 of 5.

System	Enumeration Method	Escapement									
		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
CHUM SALMON											
<i>Bristol Bay</i>											
Nushagak River	Sonar	456,025	661,002	161,483	326,300	438,481	273,914	248,278	395,165	628,134	555,568
<i>Upper Cook Inlet</i>											
Clearwater Creek	Peak Aerial Survey	530	8,300	NS	4,630	8,300	13,700	11,630	5,300	9,010	3,110
<i>Lower Cook Inlet</i>											
Port Graham River	Multiple Foot Surveys	743	2,231	1,882	1,802	1,029	1,395	1,764	699	1,944	3,735
Dogfish Lagoon	Multiple Foot Surveys	2,746	5,394	4,919	6,200	4,380	12,703	12,936	8,842	9,300	11,205
Rocky River	Multiple Aerial or Foot Surveys	6,060	11,200	1,600	3,763	2,500	1,271	4,480	3,165	8,148	6,863
Port Dick Creek	Multiple Aerial or Foot Surveys	4,848	2,786	2,753	11,774	5,592	2,439	7,087	8,400	4,133	1,829
Island Creek	Multiple Aerial or Foot Surveys	20,666	5,615	3,092	12,935	9,295	3,408	11,755	14,863	8,772	2,699
Big Kamishak River	Multiple Aerial Surveys	25,717	58,173	14,787	4,495	15,026	NS	5,532	12,400	3,280	5,676
Little Kamishak River	Multiple Aerial Surveys	12,066	42,929	15,569	21,265	4,213	18,414	19,310	30,250	6,744	15,069
McNeil River	Multiple Aerial Surveys	22,496	17,403	21,629	10,617	18,766	10,520	30,977	10,388	9,498	17,475
Bruin River	Multiple Aerial Surveys	21,208	7,000	3,055	17,535	10,071	6,200	3,486	16,795	8,942	3,583
Ursus Cove	Multiple Aerial Surveys	12,176	15,663	20,897	6,502	12,946	11,765	10,636	2,840	10,339	5,308
Cottonwood Creek	Multiple Aerial Surveys	17,914	13,243	12,522	11,561	19,405	15,848	4,730	4,111	5,206	7,079
Iniskin Bay	Multiple Aerial Surveys	16,461	15,640	5,340	20,042	30,821	19,252	16,522	3,049	5,928	13,020
<i>Prince William Sound^e</i>											
Eastern District	Multiple Aerial Surveys	113,135	141,999	144,941	82,068	150,051	146,613	240,321	97,362	140,806	93,491
Northern District	Multiple Aerial Surveys	30,657	60,265	54,709	50,666	30,296	59,530	64,743	23,818	41,058	27,680
Coghill District	Multiple Aerial Surveys	11,979	23,987	14,738	48,221	8,290	84,840	19,617	14,075	14,414	9,491
Northwestern District	Multiple Aerial Surveys	12,696	22,742	12,570	34,107	15,826	34,300	11,951	9,360	4,995	5,041
Southeastern District	Multiple Aerial Surveys	25,547	38,091	71,595	20,300	150,974	138,442	112,507	31,029	43,000	30,177
COHO SALMON											
<i>Bristol Bay</i>											
Nushagak River	Sonar								329,946	207,222	483,219
<i>Upper Cook Inlet</i>											
Fish Creek (Knik)	Weir Count	3,011 ^f	4,967 ^f	6,868 ^f	4,868 ^f	8,214	6,977	1,428 ^f	1,237	7,593	10,283
Jim Creek	Single Foot Survey	1,464	2,389	725	1,890	1,331	242	229	213	987	122
Little Susitna River	Weir Count	16,839 ^g	8,786 ^g	17,573	18,485	9,523	9,214	4,826 ^g	6,779	13,583	24,211
<i>Lower Cook Inlet</i>											
There are no coho salmon stocks with escapement goals in Lower Cook Inlet											

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Table 2.–Page 3 of 5.

System	Enumeration Method	Escapement									
		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
<i>Prince William Sound</i>											
Copper River Delta	Peak Aerial Survey	101,082	89,270	53,820	76,892	41,294	41,077	38,495	37,010	34,680	42,530
Bering River	Peak Aerial Survey	44,542	33,192	33,062	28,932	22,141	21,311	18,890	15,605	18,820	26,475
PINK SALMON											
<i>Bristol Bay</i>											
Nushagak River	Sonar								1,214,960	NA	2,277,430
<i>Upper Cook Inlet</i>											
There are no pink salmon stocks with escapement goals in Upper Cook Inlet.											
<i>Lower Cook Inlet</i>											
Humpy Creek	Multiple Foot Surveys	93,756	48,368	53,989	90,870	5,207	70,686	1,670	67,934	6,749	44,369
China Poot Creek	Multiple Foot Surveys	9,223	7,242	6,235	5,086	1,120	2,220	3,462	8,392	7,119	1,409
Tutka Creek	Multiple Foot Surveys	133,600	25,824	5,664	14,144	3,770	2,141	21,974	10,436	9,541	10,152
Barabara Creek	Multiple Foot Surveys	14,440	3,554	25,168	16,557	2,583	13,935	8,186	1,412	17,377	3,558
Seldovia Creek	Multiple Foot Surveys	98,602	70,045	69,405	53,484	14,619	25,886	46,231	44,722	36,824	35,895
Port Graham River	Multiple Foot Surveys	69,095	31,173	25,595	24,720	13,996	16,586	20,883	34,486	11,893	32,295
Dogfish Lagoon Creeks	Multiple Aerial or Foot Surveys	22,300	8,000	4,100	8,000	9,200	6,300	3,900	11,400	26,448	8,848
Port Chatham	Multiple Foot Surveys	44,389	24,210	14,451	16,354	25,291	2,992	15,830	5,430	57,447	10,290
Windy Creek Right	Multiple Foot Surveys	22,174	17,146	18,339	12,491	15,012	6,408	1,722	5,823	11,704	5,710
Windy Creek Left	Multiple Foot Surveys	72,031	65,155	32,297	64,068	57,263	24,241	12,210	11,691	47,849	10,147
Rocky River	Multiple Foot Surveys	198,671	67,840	189,992	90,876	173,583	27,045	22,706	15,684	75,791	17,114
Port Dick Creek	Multiple Aerial or Foot Surveys	122,236	51,500	44,170	34,228	41,681	41,090	16,868	18,057	55,828	48,732
Island Creek	Multiple Aerial or Foot Surveys	26,404	107,683	87,235	49,719	44,527	69,525	10,181	20,079	26,004	50,402
S. Nuka Island Creek	Multiple Aerial or Foot Surveys	11,199	5,100	6,645	12,300	19,934	NS	NS	1,250	8,442	11,000
Desire Lake Creek	Multiple Aerial Surveys	45,980	74,774	11,820	9,546	73,926	2,978	600	2,260	56,921	443
Bruin River	Multiple Aerial Surveys	98,346	515,114	350,420	150,717	1,067,351	40,256	4,534	31,800	15,020	121,569
Sunday Creek	Multiple Aerial Surveys	116,170	70,037	394,797	20,434	106,296	6,607	844	1,348	6,132	7,665
Brown's Peak Creek	Multiple Aerial Surveys	60,983	35,703	249,383	17,400	63,605	3,092	2,035	2,800	4,061	4,048
<i>Prince William Sound</i>											
All Districts Combined ^h	Multiple Aerial Surveys	5,778,266	952,477	1,915,040	860,944	2,338,923	1,910,357	3,826,378			
Eastern District	Multiple Aerial Surveys								301,709	1,266,783	270,244
Northern District	Multiple Aerial Surveys								106,568	328,896	105,333
Coghill District	Multiple Aerial Surveys								172,611	640,414	63,290
Northwestern District	Multiple Aerial Surveys								117,795	203,444	67,030
Eshamy District	Multiple Aerial Surveys								1,052	12,145	12,400
Southwestern District	Multiple Aerial Surveys								90,156	348,012	83,581

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Table 2.–Page 4 of 5.

System	Enumeration Method	Escapement									
		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Montague District	Multiple Aerial Surveys								77,756	411,373	24,917 ^g
Southeastern District	Multiple Aerial Surveys								258,047	1,472,633	185,072
SOCKEYE SALMON											
<i>Bristol Bay</i>											
Kvichak River	Tower Count	2,320,332	3,068,226	2,810,208	2,757,912	2,266,140	4,207,410	2,264,352	4,164,444	2,088,576	4,458,540
Alagnak River	Tower Count	4,218,990	1,773,966	2,466,414	2,180,502	970,818	1,187,730	883,794	861,747	1,095,950	200,500
Naknek River	Tower Count	2,744,622	1,953,228	2,945,304	2,472,690	1,169,466	1,463,928	1,177,074	900,312	938,160	1,474,428
Egegik River	Tower Count	1,621,734	1,465,158	1,432,500	1,259,568	1,146,276	927,054	961,200	1,233,900	1,113,630	1,382,466
Ugashik River	Tower Count	799,612	1,003,158	2,599,186	596,332	1,364,338	830,886	1,029,853	670,578	898,110	640,158
Wood River	Tower Count	1,496,550	4,008,102	1,528,086	1,724,676	1,319,232	1,804,344	1,098,006	764,202	1,183,348	2,764,614
Igushik River	Tower Count	365,712	305,268	415,452	1,054,704	514,188	518,040	421,380	193,770	387,036	340,590
Nushagak River	Sonar	1,049,246	548,410	518,041	492,546	484,149	468,696	428,191	432,438	894,172	618,477
Togiak River	Tower Count	149,178	312,126	269,646	205,680	313,946	188,298	190,970	203,148	128,058	151,934
<i>Upper Cook Inlet</i>											
Fish Creek (Knik)	Weir Count	14,215	32,562	27,948	19,339	83,480	126,836	66,678	18,813	18,912	43,915
Kasilof River	Sonar	346,516	387,769	364,261	324,880	324,783	293,765	243,767	372,523	487,700	438,238
Kenai River ^j	Sonar	1,114,618	1,876,180	957,430	703,979	843,255	1,015,106	1,275,369	1,197,518	987,189	1,151,629
Packers Creek	Weir Count	22,000	NS	46,637	25,247	16,473	NS	NS	NS	NA	19,242
Russian River - Early Run	Weir Count	52,903	80,524	27,298	30,989	52,178	27,074	29,129	24,115	35,776	44,920
Russian River - Late Run	Weir Count	59,473	89,160	53,068	46,638	80,088	38,848	41,529	54,911	31,364	52,277
Chelatna Lake	Weir Count		18,433	41,290	73,469	17,721	37,784	70,353	36,577	70,555	26,212
Judd Lake	Weir Count		40,633	58,134	54,304	44,616	18,361	39,997	18,303	14,088	22,416
Larson Lake	Weir Count	9,751	57,411	47,736	35,040	40,933	20,324	12,413	16,708	21,821	12,040
<i>Lower Cook Inlet</i>											
English Bay	Peak Aerial Survey/Weir Count	7,574	16,533	16,487	11,996	18,176	12,253	9,920	3,574	10,891 ^f	6,995
Delight Lake	Peak Aerial Survey/Weir Count	15,200	10,929	43,963	23,933	12,700	23,775	20,190	10,887	5,961	22,289
Desire Lake	Peak Aerial Survey	4,820	18,600	10,000	10,700	16,000	6,320	9,630	8,840	8,400	11,480
Bear Lake	Weir Count	10,285	8,338	8,575	9,264	10,364	8,880	9,608	8,031	8,999	9,233
Aialik Lake	Peak Aerial Survey	5,250	4,760	5,370	4,200	3,100	5,315	3,480	2,140	3,530	450
Mikfik Lake	Video	5,970	14,983	10,975	10,000	20,965	5,221	291	3,131	4,042	18,062
Chenik Lake	Peak Aerial Survey/Video	12,771	8,507	17,417	10,653	15,264	17,312	10,330	16,505	11,333	17,797
Amakdedori Creek	Peak Aerial Survey	1,710	300	3,830	3,200	2,160	1,210	3,412	770	1,540	4,280

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Table 2.–Page 5 of 5.

System	Enumeration Method	Escapement									
		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
<i>Prince William Sound</i>											
Upper Copper River	Sonar	515,599	579,552	612,083	480,597	468,725	502,995	607,657	954,272	860,934	NA ^k
Copper River Delta	Peak Aerial Survey	58,406	98,896	88,285	67,950	68,622	82,835	72,367	66,850	75,705	64,205
Bering River	Peak Aerial Survey	30,890	14,671	21,170	18,196	13,471	4,367	28,530	18,290	23,900	14,985
Coghill Lake	Weir Count	30,313	23,479	70,001	29,298	23,186	24,312 ^f	102,359	73,978	17,231	21,836
Eshamy Lake ^l	Weir Count	23,523	42,473	17,196	18,495	24,025	16,291	24,129	NA	4,500	7,500

Note: NA = data not available; NC = no count; NS = no survey.

^a Preliminary data.

^b In 2009, aerial surveys were only flown on Big Creek (2,834 Chinook salmon) and King Salmon River (471 Chinook salmon). Mainstem Naknek River and Paul's Creek were not surveyed in 2009.

^c Lewis River diverged into swamp 1/2 mi. below bridge. No water in channel.

^d The Copper River Chinook salmon spawning escapement estimate is not available. An inriver estimate is generated from a mark-recapture project run by the Native Village of Eyak and LGL Consulting. The spawning escapement estimate is generated by subtracting the upper Copper River state and federal subsistence, state personal use, and sport fishery harvest estimates from the mark-recapture estimate of the inriver abundance. The estimates for the federal and state subsistence and the state personal use fishery harvests are generally not available for about 6 months after the fishery is closed. Additionally, the sport fishery harvest estimate is based on the mail-out survey and is generally available about 12 months after the fishery ends.

^e No estimates for chum salmon escapements are included for the Unakwik, Eshamy, Southwestern, or Montague districts because there are no escapement goals for those districts.

^f Incomplete counts for Fish Creek (Knik) coho salmon in 2006-2008, and 2011 because weir was pulled in mid-August.

^g Incomplete counts for Little Susitna River coho salmon in 2006 and 2011 due to breach of weir.

^h Starting in 2012 Prince William Sound pink salmon escapement are reported at district level because sound-wide escapement goal was replaced with district goals. Odd-year pink salmon escapements do not include Unakwik District escapements, due to absence of an escapement goal and an average escapement estimate of a few thousand fish.

ⁱ Fewer than 3 surveys were flown in half the index streams in the Montague District in 2014, so they were not used in calculating the area under the curve index.

^j Uses the best estimate of sport harvest upstream of sonar.

^k The 2014 upper Copper River sockeye salmon spawning escapement estimate is preliminary pending the estimates of personal use, subsistence, and sport fishery harvests; and final mark-recapture estimate of upper Copper River Chinook salmon.

^l The Eshamy River weir was not operated in 2012-2014. A pilot project to assess the use of video for monitoring in 2013 did not provide a comparable total escapement estimate, but did provide a minimum estimate of sockeye salmon.

Table 3.—Provisional Arctic-Yukon-Kuskokwim Region Chinook, chum, coho, pink, and sockeye salmon escapement goals and escapements, 2005 to 2014.

System	Enumeration Method	Escapement									
		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
CHINOOK SALMON											
<i>Kuskokwim Area</i>											
North (Main) Fork Goodnews River	Single Aerial Survey	NS	NS	NS	2,155	NS	NS	853	378	NS	630
Middle Fork Goodnews River	Weir Count	4,633	4,572	3,914	2,223	1,669	2,176	2,045	524	1,187	750
Kanektok River	Single Aerial Survey	14,202	NS	NS	NS	NS	1,208	NS	NS	2,277	1,840
Kuskokwim River (entire area)	Run Reconstruction	275,598	214,004	174,943	128,978	118,478	49,073	72,097	76,074	47,315	123,987
Kogrukluk River	Weir Count	22,000	20,205	NA	9,750	9,528	5,812	6,731	NA	1,819	3,732
Kwethluk River	Weir Count	NA	17,619	12,927	5,275	5,744	1,667	4,079	NA	845	3,187
George River	Weir Count	3,845	4,355	4,011	2,563	3,663	1,498	1,547	2,201	1,292	2,993
Kisaralik River	Single Aerial Survey	2,206	4,734	692	1,074	NS	235	NS	588	599	622
Aniak River	Single Aerial Survey	NS	5,639	3,984	3,222	NS	NS	NS	NS	754	3,201
Salmon River (Aniak R)	Single Aerial Survey	4,097	NS	1,458	589	NS	NS	79	49	154	497
Holitna River	Single Aerial Survey	1,760	1,866	NS	NS	NS	NS	NS	NS	670	NS
Cheeneetnuk River (Stony R)	Single Aerial Survey	1,155	1,015	NS	290	323	NS	249	229	138	340
Gagaryah River (Stony R)	Single Aerial Survey	788	531	1,035	177	303	62	96	178	74	359
Salmon River (Pitka Fork)	Single Aerial Survey	1,801	862	943	1,033	632	135	767	670	469	1,865
<i>Yukon River</i>											
East Fork Andreafsky River	Weir Count	2,239	6,463	4,504	4,242	3,004	2,413	5,213	2,517	1,998	5,949
West Fork Andreafsky River	Peak Aerial Survey	1,492	824	976	NS	1,678	858	1,173	NS	1,090	1,695
Anvik River	Peak Aerial Survey	2,421	1,876	1,529	992	832	974	642	722	940	1,584
Nulato River (forks combined)	Peak Aerial Survey	553	1,292	2,583	922	2,260	711	1,401	1,373	1,118	NS
Chena River	Tower, Mark-Recapture	NS	2,936	3,806	3,208	5,253	2,382	NS	2,200 ^a	1,859	4,358
Salcha River	Tower, Mark-Recapture	5,988	10,679	6,425	5,415	12,774	6,135	7,200 ^b	7,165	5,465	NS
Canada Mainstem ^c	Sonar	67,985	62,630	34,904	33,883	65,278	32,014	46,307	32,656	28,669	63,331
<i>Norton Sound</i>											
Fish River/Boston Creek	Peak Aerial Survey	46	NS	NS	NS	NS	NS	NS	NS	44	NS
Kwiniuk River	Tower Count	342	195	258	237	444	135	57	54	15	429
North River (Unalakleet R)	Tower Count	1,015	906	1,948	903	2,355	1,256	864	996	564	2,328
Unalakleet/Old Woman River	Peak Aerial Survey	510 ^e	NS	821	NS	1,368	NS	105	NS	NS	NS
CHUM SALMON											
<i>Kuskokwim Area</i>											
Middle Fork Goodnews River	Weir Count	26,690	54,689	50,232	39,548	19,236	24,789	19,974	9,065	27,682	11,518
Kogrukluk River	Weir Count	197,723	188,003	52,961	44,744	82,483	69,258	76,823	NA	65,644	30,763
Aniak River	Sonar	1,151,505	1,108,626	696,801	427,911	479,531	429,643	345,630	NA	NA	NA

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Table 3.–Page 2 of 4.

System	Enumeration Method	Escapement									
		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
<i>Yukon River Summer Chum</i>											
East Fork Andreafsky River	Weir Count	20,127	102,260	69,642	57,259	8,770	72,839	100,473	56,680	61,234	37,793
Anvik River	Sonar	525,391	605,485	460,121	374,928	193,099	396,173	642,528	483,972	571,690	399,223
<i>Yukon River Fall Chum</i>											
Yukon River Drainage	Calculated - Multiple Surveys	1,990,000	890,000	921,000	681,000	483,000	527,000	883,000	573,000	867,000	800,000 ^d
Tanana River ^e	Mark-Recapture	373,000	233,000	357,000	264,000	160,000	213,000	271,000	102,000	275,000	217,000
Delta River	Multiple Foot Surveys	28,000	14,000	19,000	23,000	13,000	18,000	24,000	9,000	32,000	32,480
Upper Yukon River Tributaries	Sonar & Weir Count	1,178,000	436,000	327,000	248,000	NA	196,000	406,000	333,000	392,000	297,000
Chandalar River	Sonar	497,000	245,000	228,000	178,000	NA	158,000	295,000	206,000	253,000	226,000
Sheenjek River	Sonar	562,000	160,000	65,000	50,000	54,000	22,000	98,000	105,000	113,000 ^f	56,000 ^f
Fishing Branch River (Canada)	Weir Count	119,000	31,000	32,000	20,000	26,000	16,000	13,000	22,000	33,000 ^g	15,000 ^g
Yukon R. Mainstem (Canada)	Mark-Recapture	438,000	221,000	255,000	176,000	94,000	118,000	206,000	138,000	200,000	156,000
<i>Norton Sound</i>											
Subdistrict 1 Aggregate	Calculated - Multiple Surveys	38,808	87,222	76,940	32,177	21,368	97,798	66,122	51,459	108,120	97,234
Nome River	Weir Count	5,584	5,678	7,034	2,607	1,565	5,906	3,582	1,982	4,811	5,589
Snake River	Tower/Weir Count	2,948	4,128	8,147	1,244	891	6,973	4,343	651	2,755	3,983
Eldorado River	Peak Aerial Survey (Expanded)	10,426	41,985	21,312	6,746	4,943	42,612	16,227	13,393	26,121	27,054
Niukluk River	Tower Count	25,598	29,199	50,994	12,078	15,879	48,561	23,607	19,576	NS	NA
Kwiniuk River	Tower Count	12,083	39,519	27,756	9,483	8,739	71,388	31,604	5,577	5,631	39,753
Tubutulik River	Peak Aerial Survey (Expanded)	1,336	NS	7,045	NS	3,161	16,097	14,127	NS	NS	NS
Unalakleet/Old Woman River	Peak Aerial Survey	1,530	NS	1,902	NS	NS	NS	NS	NS	2,496	NS
<i>Kotzebue Sound</i>											
Noatak and Eli rivers	Peak Aerial Survey	NS	39,785	NS	270,747	69,872	NS	NS	NS	NS	453,284
Upper Kobuk w/ Selby River	Peak Aerial Survey	NS	48,750	NS	42,622	45,155	NS	NS	NS	NS	65,653
Salmon River	Peak Aerial Survey	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Tutuksuk River	Peak Aerial Survey	1,736	NS	NS	NS	NS	NS	NS	NS	NS	NS
Squirrel River	Peak Aerial Survey	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
COHO SALMON											
<i>Kuskokwim Area</i>											
Middle Fork Goodnews River	Weir Count	15,683	26,909	19,442	37,690	19,123	26,287	24,668	NA	NA	NA
Kogrukluk River	Weir Count	24,116	16,268	26,423	29,237	22,289	14,689	21,800	13,421	21,207	52,975
Kwethluk River	Weir Count	NS	25,667	19,473	48,049	21,911	NA	NA	20,895	NA	43,945

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Table 3.–Page 3 of 4.

System	Enumeration Method	Escapement									
		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
<i>Yukon River</i>											
Delta Clearwater River	Boat Survey	34,293	16,748	14,650	7,500	16,850	5,867 ^b	8,772	5,230	6,222	4,285
<i>Norton Sound</i>											
Kwiniuk River	Peak Aerial Survey	NS	NS	5,174	2,676	NS	2,925	1,331	NS	NS	NS
Niukluk River ⁱ	Tower Count	2,727	11,169	3,498	13,779	6,861	9,042	2,405	1,729	NS	NA
North River (Unalakleet R.)	Peak Aerial Survey	1,963	NS	2,349	2,744	2,830	NS	898	NS	867	NS
PINK SALMON											
<i>Kuskokwim Area</i>											
There are no escapement goals for pink salmon in the Kuskokwim Management Area.											
<i>Yukon River</i>											
There are no escapement goals for pink salmon in the Yukon River drainage.											
<i>Norton Sound</i>											
Nome River	Weir Count	285,759	578,555	24,395	1,186,554	16,490	171,760	14,403	149,119	10,257	96,396
Kwiniuk River	Tower Count	341,048	1,347,090	54,255	1,444,213	42,962	634,220	30,913	393,302	13,212	326,522
Niukluk River	Tower Count	270,424	1,371,919	43,617	669,234	24,204	434,205	15,425	249,412	NA	NA
North River	Tower Count	1,670,934	2,169,890	580,935	240,286	190,291	150,807	123,892	147,674	46,668	143,658
SOCKEYE SALMON											
<i>Kuskokwim Area</i>											
North (Main) Fork Goodnews River	Single Aerial Survey	NS	NS	NS	32,500	NS	NS	14,140	16,710	NS	NS
Middle Fork Goodnews River	Weir Count	113,809	127,245	73,768	43,879	27,494	36,574	19,643	29,531	23,545	41,473
Kanektok River	Single Aerial Survey	110,730	NS	NS	NS	NS	16,180	NS	NA	51,517	136,400
Kogruklu River	Weir Count	37,939	61,382	17,211	19,675	22,826	17,139	7,974	NA	7,808	6,413
<i>Yukon River</i>											
There are no escapement goals for Sockeye in the Yukon River drainage.											
<i>Norton Sound</i>											
Salmon Lake/Grand Central River	Peak Aerial Survey	42,250	41,780	20,612	11,672	322	762	5,144	5,830	6,781	5,303
Glacial Lake	Peak Aerial Survey	3,730	5,810	1,505	540	169	154	NS	NS	1,366	2,330

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Note: NA = data not available; NS = no survey.

^a 2012 Chena River Chinook salmon escapement estimate includes an expansion for missed counting days based on two DIDSON sonars used to assess Chinook salmon passage.

^b 2011 Salcha River Chinook escapement is based on an aerial survey because high water prevented tower counting most of the season.

^c Canadian Yukon River Mainstem Chinook salmon escapements take into account Canadian harvest above assessment project.

^d Bayesian estimate of drainage-wide escapement for Yukon River fall chum salmon. This was the first year of reporting the Bayesian estimate. Bayesian estimates are higher than estimates using the former method because the Kantishna River component is included in the Bayesian analysis.

^e Tanana River fall chum salmon escapement estimated using mark-recapture 1995-2007, then based on relationship to either the Delta River or Mainstem Yukon River escapements from 2008 to present.

^f Sheenjek River sonar project was discontinued in 2013; estimate is based on a linear regression between earlier Sheenjek two bank counts and Fishing Branch River weir counts.

^g Weir assessment project for Fishing Branch River fall chum salmon not operated after 2012; escapement for 2013 and 2014 are rough estimates based on border sonar estimate minus community harvest assuming most fish migrate to Fishing Branch River.

^h Delta Clearwater River coho salmon 2010 escapement index is not a peak count.

ⁱ Niukluk River coho salmon numbers tower counts and do not take into consideration upstream harvest.

Table 4.—Provisional Westward Region (Alaska Peninsula/Aleutian Islands, Kodiak, and Chignik areas) Chinook, chum, coho, pink and sockeye salmon escapement goals and escapements, 2005 to 2014.

System/Goal	Enumeration Method	Escapement									
		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
CHINOOK SALMON											
<i>AK Peninsula</i>											
Nelson River	Weir, Peak Aerial Survey	4,993	2,516	2,492	5,012	2,048	2,767	1,704	1,192 ^a	1,421 ^a	3,801 ^a
<i>Chignik</i>											
Chignik River	Weir Count	6,037	3,175	1,675	1,620	1,590	3,845	2,490	1,404	1,185	2,895 ^b
<i>Kodiak</i>											
Karluk River	Weir Count	4,684	3,673	1,697	752	1,306	2,917	3,420	3,197 ^c	1,824 ^c	1,182 ^c
Ayakulik River	Weir Count	8,175	2,937	6,232	3,071	2,615	5,197	4,251	4,556	2,304	789 ^d
CHUM SALMON											
<i>AK Peninsula</i>											
Northern District	Peak Aerial Survey	103,675	382,583	243,334	228,537	154,131	145,310	96,952	140,418	137,251	191,586
Northwestern District	Peak Aerial Survey	192,965	193,460	335,450	241,750	84,460	144,100	151,400	140,000	92,800	54,525
Southeastern District ^e	Peak Aerial Survey	412,500	405,300	201,451	277,450	106,500	62,612	145,300	31,072	184,350	82,300
South Central District	Peak Aerial Survey	235,700	119,600	126,000	140,450	18,600	85,600	169,000	86,190	155,050	95,000
Southwestern District	Peak Aerial Survey	317,910	231,935	398,010	171,250	385,730	142,650	176,425	87,230	163,200	130,745
<i>Chignik</i>											
Entire Chignik Area	Peak Aerial Survey	308,700	93,489	238,216	197,259	214,959	177,220	278,145	210,973	335,907	101,378
<i>Kodiak</i>											
Mainland District	Peak Aerial Survey	22,500	346,140	82,600	72,000	91,106	124,500	128,700	127,850	107,400	80,961
Kodiak Archipelago Aggregate	Peak Aerial Survey	141,850	419,000	166,060	83,040	177,490	160,290	192,400	159,825	291,250	116,800
COHO SALMON											
<i>AK Peninsula</i>											
Nelson River	Peak Aerial Survey	24,000	19,000	19,000	24,000	22,000	15,000	21,000	19,160	22,000	25,000
Ilnik River	Peak Aerial Survey	NA	31,000	22,000	27,000	NA	19,600	22,000	14,800	13,000	33,000
<i>Chignik</i>											
There are no coho salmon stocks with escapement goals in Chignik Area											
<i>Kodiak</i>											
Pasagshak River	Foot Survey	3,773	937	1,896	3,875	2,385	1,971	1,083	3,132	1,648	4,934
Buskin River	Weir Count	16,235	12,560	8,375	8,176	9,583	6,239	5,298	4,906	4,401	8,413 ^f
Olds River	Foot Survey	2,495	1,912	868	656	697	NA	1,003	624	2,145	1,320
American River	Foot Survey	339	2,033	307	700	639	NA	1,061	427	841	1,595

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Table 4.–Page 2 of 3.

System/Goal	Enumeration Method	Escapement									
		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
PINK SALMON											
<i>AK Peninsula</i>											
South Peninsula Total	Peak Aerial Survey	6,165,634	2,862,250	2,680,213	3,338,370	3,067,000	742,912	2,494,950	478,910	2,320,790	1,340,380
<i>Chignik</i>											
Entire Chignik Area	Peak Aerial Survey, Weir Count	1,414,050	356,425	1,237,528	863,031	869,063	330,570	986,248	302,699	863,991	235,159
<i>Kodiak</i>											
Mainland District	Peak Aerial Survey	268,050	778,200	315,300	236,500	430,100	265,650	273,500	413,325	620,480	254,650
Kodiak Archipelago	Peak Aerial Survey	3,688,158	5,086,372	2,208,678	2,924,708	4,707,894	3,378,483	2,506,714	5,111,049	4,450,711	2,733,282
SOCKEYE SALMON											
<i>AK Peninsula</i>											
Cinder River	Peak Aerial Survey	141,000	101,100	142,000	129,800	133,600	108,900	106,000	76,620	95,000	104,500
IlNIK River	Weir Count	154,000	88,000	93,000	44,300	66,000	59,000	43,000	61,000	51,000	59,000
Meshik River	Peak Aerial Survey	111,100	138,010	57,400	83,250	88,000	63,700	93,900	50,900	85,800	114,700
Sandy River	Weir Count	101,000	48,000	44,700	32,200	36,000	37,000	37,500	27,100	42,000	59,000
Bear River Early Run	Weir Count	332,248	262,995	206,233	125,526	216,237	226,534	207,451	173,158	219,074	259,046
Bear River Late Run	Weir Count	221,752	182,005	224,767	195,474	133,263	142,966	132,549	116,442	196,926	206,954
Nelson River	Weir Count	303,000	215,000	180,000	141,600	157,000	108,000	89,000	103,300	248,000	250,000
Christianson Lagoon	Peak Aerial Survey	54,500	41,505	48,100	114,000	48,100	27,900	35,200	40,000	16,500	32,600
Swanson Lagoon	Peak Aerial Survey	2,400	376	9,200	5,500	1,000	1,700	1,000	3,500	3,000	1,500
North Creek	Peak Aerial Survey	45,000	7,530	16,800	38,000	8,000	18,500	10,200	18,000	8,500	7,500
Orzinski Lake	Weir Count	44,797	18,000	10,643	36,839	21,457	18,039	16,764	17,243	17,386	13,600
Mortensen Lagoon	Peak Aerial Survey	21,703	14,688	6,200	5,600	25,000	6,600	500	5,000	4,000	500
Thin Point Lake	Peak Aerial Survey	21,000	11,510	21,550	18,900	33,500	12,400	14,500	19,000	5,700	8,600
McLees Lake	Weir Count	12,097	12,936	21,428	8,661	10,120	32,842	36,602	15,111	15,687	12,424
<i>Chignik</i>											
Chignik River Early Run	Weir Count	355,091	366,497	361,091	377,579	391,476	432,535	488,930	353,441	386,782	360,381
Chignik River Late Run ^e	Weir Count	225,366	368,996	293,883	328,479	328,586	311,291	264,887	358,948	369,319	291,228
<i>Kodiak</i>											
Malina Creek	Peak Aerial Survey	3,180 ^b	6,400	1,900	3,690	1,400	4,000	3,800	4,100	3,800	4,900
Afognak (Litnik) River	Weir Count	21,577	22,933	21,070	26,874	31,358	52,255	49,193	41,553	42,153	36,345
Uganik Lake	Peak Aerial Survey	7,500	26,700	35,000	64,700	53,700	30,700	37,900	22,200	26,000	14,000
Karluk River Early Run	Weir Count	283,860	202,366	294,740	82,191	52,798	71,453	87,049	188,085	234,880	252,097
Karluk River Late Run	Weir Count	498,102	288,007	251,835	164,299	277,280	276,649	230,273	314,605	336,479	403,969

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Table 4.–Page 2 of 3.

System/Goal	Enumeration Method	Escapement									
		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Ayakulik River Early Run	Weir Count	139,246	59,315	169,596	96,912	200,648	201,933	177,480	213,501	214,969	210,040
Ayakulik River Late Run	Weir Count	112,660	28,465	113,446	65,976	114,536	60,394	83,661	114,753	67,195	87,671
Upper Station River Early Run	Weir Count	60,349	24,997	31,895	38,800	34,585	42,060	28,759	25,487	27,712	36,823
Upper Station River Late Run	Weir Count	156,401	153,153	149,709	184,856	161,736	141,139	101,893	149,325	125,573	181,411
Frazer Lake	Weir Count	136,948	89,516	120,186	105,363	101,845	94,680	134,642	148,884	136,059	200,296
Saltery Lake ⁱ	Weir Count	28,500	28,000	17,200	47,467	43,468	24,102	27,803	25,155	35,939	29,047
Pasagshak River ^j	Peak Aerial Survey	22,000	6,300	14,300	14,900	1,400	4,800	8,100	2,600	9,750	NA
Buskin Lake	Weir Count	15,468	17,734	16,502	5,900	7,757	9,800	11,982	8,565	16,189	13,976

Note: NA = data not available.

^a 2012-2014 Nelson River Chinook salmon sportfishing was catch and release only so escapement is weir count.

^b Chignik River Chinook salmon escapement is the weir count, sport harvest from Statewide Harvest Survey not available at this time.

^c 2012-2014 Karluk River Chinook salmon escapements are the weir count; no upriver harvest due to fishery closure.

^d Ayakulik River Chinook salmon escapement is the weir count, sport harvest from Statewide Harvest Survey not available at this time.

^e Southeastern District chum salmon escapement goal includes Shumagin Islands Section and Southeastern District Mainland.

^f 2014 Buskin River coho salmon escapement is weir count. Statewide Harvest Survey data are not available yet.

^g The Chignik late-run sockeye escapement objective includes the late-run sockeye salmon SEG (200,000 – 400,000) plus an additional 25,000 fish in August and 25,000 fish from September 1-15 to ensure inriver harvest opportunities above the weir.

^h 2005 Malina Creek sockeye salmon escapements are weir counts. All other escapements are peak aerial survey indices.

ⁱ Saltery Lake sockeye salmon escapements are weir counts minus fish removed for egg-takes. The 2005-2007 escapements are peak aerial survey indices. All other escapements are weir counts.

^j 2010-2014 Pasagshak River sockeye salmon escapements are weir counts. All other escapements are peak aerial survey indices, which the current goal is based on.