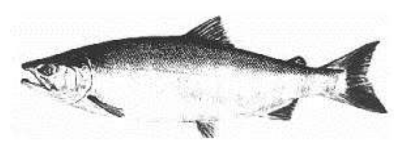
ALASKA DEPARTMENT OF FISH AND GAME
DIVISION OF COMMERCIAL FISHERIES
NEWS RELEASE

Sam Cotten, Commissioner
Scott Kelley, Director



Contact:
Steve Moffitt, PWS Finfish Research Biologist
Stormy Haught, PWS Finfish Research/Management Biologist
Phone: (907) 424-3212
Fax: (907) 424-3235

Cordova ADF&G
401 Railroad Avenue
PO Box 669
Cordova, AK 99574
Date Issued: 1/20/2017

2017 PRINCE WILLIAM SOUND AND COPPER RIVER SALMON DETAILED FORECAST

Forecast Area: Prince William Sound
Species: Pink Salmon (natural run only)

Preliminary Forecast of the 2017 Run

Natural Production	Forecast Estimate (thousands)	Forecast Range (thousands)
Prince William Sound General Districts		
Total Run	21,097	11,770–30,424
Escapement Target [a]	1,450	
Common Property Harvest[b]	19,647	12,764–26,530

[a] PWS pink salmon escapement target is the sum of the median historical odd-years (1965–2009) escapement for each district in Prince William Sound with a sustainable escapement goal (SEG). Escapement goals were changed in 2011 from a single sound-wide SEG to district and brood line specific SEGs (first implementation in 2012). The sum of district specific SEG ranges is 0.99–2.28 million pink salmon (median of 1.45 million) for the odd-year brood line and 0.79–1.70 million pink salmon (median of 1.16 million) for the even-year brood line.

[b] Common property harvest includes harvests from commercial, subsistence, and sport fisheries.

FORECAST METHODS

Total natural run by year was estimated as the total natural (non-hatchery) contribution to commercial harvests combined with the stream escapement index. The stream escapement index is calculated as the area under the curve of weekly aerial escapement surveys adjusted for estimates of stream life. Beginning in 2015, the number of index streams surveyed was reduced from 214 to 134 streams. Because escapement goals established in 2011were based on the 214 index streams, the 2015 escapement index from the reduced subset of index streams was expanded using average escapement index proportion (1995–2013 odd years) represented by the 134 streams. No adjustments to the escapement index were made for aerial observer efficiency, the proportion of the total escapement represented by the index streams, or the number of hatchery strays in streams. Natural pink salmon contributions to the Commercial Common Property Fishery (CCP) were estimated by subtracting hatchery contributions from the CCP total. Hatchery contributions were determined from thermal marked otolith recoveries (1997–2016), coded wire tag recoveries (1985–1996), or average fry-to-adult survival estimates multiplied by fry release numbers and estimated exploitation rates (1977–1984).

The 2017 forecast is based on the average of 3 recent odd-year returns (2011, 2013, and 2015). Prior to 1997, forecast methods employed surveys of pre-emergent fry; however, these surveys ended in 1995. The 2017 forecast model was selected by comparing the mean absolute percentage error (MAPE) and the standard deviation of the MAPE for retrospective forecasts of each model examined for odd-years, 1961–2015. Approximate 80% prediction interval for the total run forecast was calculated using the squared deviations between the 1995–2015 odd-broodline retrospective forecasts and actual runs as the forecast variance:

$$\hat{y} \pm t_{\alpha/2,n-1} \times MSE,$$

where $\hat{y}$ is the forecast prediction from the average of the recent 3 odd-year returns, t is the critical value, n is the sample size and MSE is the mean squared error.

FORECAST DISCUSSION

The predicted natural total run of pink salmon in 2017 uses the recent 3 odd-brood-years total run average. Beginning in 2004, the department stopped producing hatchery pink salmon forecasts because the hatchery operators were already producing forecasts for their releases. Forecast methods examined for the 2017 natural run included: 1) previous odd-year total run (most naïve forecast method), 2) total run averages with 2–10 years of data (odd years), and 3) linear regression of log-transformed total Prince William Sound (PWS) escapement index versus log-transformed total PWS return by brood line. The 2017 forecast (average of 3 recent odd-years total runs) had the lowest MAPE (52%) and standard deviation of the MAPE (70%) for models examined with 1995–2015 odd-years data.

The brood year 2015 escapement index (6.14 million) was the largest on record, followed by 4.74 million in 2005 and 4.68 million in 2013. This was well above the sum of the current district-specific SEG ranges (0.99 million–2.28 million) for the odd-years broodline and greater than the 1.70 million average of observed odd-year escapement indices since 1961 (median = 1.39 million). If the 2017 total run forecast (harvest + escapement index = 21.09 million) is realized, it will almost triple the 7.48 million average odd-year return since 1961 (median = 4.94 million) and will rank as the 2nd largest natural run on record.

Environmental factors, which probably play a significant role in determining pink salmon run size in PWS, have been variable in recent years. Pacific Decadal Oscillation (PDO) values were positive throughout 2015 and 2016, corresponding with above average sea surface temperatures throughout the Gulf of Alaska (http://research.jisao.washington.edu/pdo/PDO.latest). Weak La Niña conditions beginning in early summer 2016 followed strong El Niño conditions from late winter of 2015 through spring 2016. A transition to neutral conditions during January-March 2017 is anticipated (http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/enso.shtml).

Steve Moffitt, Area Finfish Research Biologist, Cordova
Stormy Haught, Finfish Management/Research Biologist, Cordova

Forecast Area: Prince William Sound
Species: Chum Salmon (natural run only)

Preliminary Forecast of the 2017 Run

Natural Production	Forecast Estimate (thousands)	Forecast Range (thousands)
Prince William Sound General Districts		
Total Run	371	241-501
Escapement Target[a]	200	
Common Property Harvest[b]	171	41–301

[a] The department intends to manage for the long-term average escapement to districts with escapement goals; a total of 200,000 chum salmon for the Eastern, Northern, Coghill, Northwestern, and Southeastern districts combined. The sum of the lower bound sustainable escapement goals for these districts is 91,000.

[b] Common property harvest includes harvests from commercial, subsistence, and sport fisheries.

FORECAST METHODS

We evaluated several naïve methods for the 2017 PWS natural chum salmon forecast, including average run size for the previous 2, 3, 4, 5, and 10 years and total run size from the previous year. From these models, the recent 2-year average run size had the smallest MAPE in retrospective forecasts and was chosen as the forecasting method for 2017. Total natural run by year was calculated as the natural chum salmon commercial harvest contribution from all PWS districts combined with the chum salmon escapement index. The escapement index is calculated as the area under the curve of weekly aerial escapement surveys adjusted for estimates of stream life. The number of index streams surveyed in 2015 was reduced from 214 to 134 and the chum index was expanded as described earlier in the pink salmon methods. No adjustments to the escapement index were made for aerial observer efficiency, the proportion of the total escapement represented by the index streams, or the number of hatchery strays in streams. CCP harvest contributions of natural stock chum salmon were estimated using pre-hatchery average natural runs (2002 and 2003) or thermally marked otolith estimates (2004–2016) for each district in PWS. An approximate 80% prediction interval for the total run forecast was calculated using the squared deviations between the 2007–2016 retrospective forecasts and actual runs using the method described for pink salmon.

FORECAST DISCUSSION

Beginning in 2004, the department stopped producing hatchery chum salmon forecasts because the hatchery operators were already producing forecasts for their releases. Our ability to accurately forecast natural chum salmon stocks is limited because of the limited data available. Estimates of natural chum salmon contributions to CCP were not consistently available prior to otolith thermal marking. Natural chum salmon contribution estimates based on thermally marked otoliths are available for the Coghill and Montague districts since 2003 and from other PWS districts since 2004. Historical natural chum salmon age data from escapements and CCP harvests are unavailable for most PWS districts. If the 2017 natural chum salmon forecast of 371,000 is realized, it would be 3rd smallest in the last 20 years. For comparison, the estimated total run size of natural chum salmon was greater than 1.3 million from 1981–1988, but has not exceeded 1 million since 1988.

Environmental factors that may influence chum salmon abundance include warm North Pacific waters from 2014 through early 2016 followed by moderately cooler or average temperatures in the latter part of 2016. Average weight and length at age of PWS chum salmon harvested in 2016 showed a substantial increase following 2 years of steep decline. However, an overall trend in declining weight and length at age in chum salmon harvested in PWS is evident across the historical time series.

Steve Moffitt, Area Finfish Research Biologist, Cordova
Stormy Haught, Finfish Management/Research Biologist, Cordova

Forecast Area: Prince William Sound
Species: Sockeye Salmon (natural run only)

Preliminary Forecast of the 2017 Run

Natural Production	Forecast Estimate (thousands)	Forecast Range (thousands)
Prince William Sound, Coghill Lake		
Total Run	74	50–130
Escapement Target[a]	30	
Harvest Estimate[b]	44	20–100

[a] The escapement target of 30,000 for Coghill Lake is the median of historical escapement estimates and is within the sustainable escapement goal (SEG) range is 20,000–60,000. The upper end of the SEG was increased in 2011 from 40,000 to 60,000 (implemented in 2012).

[b] Includes harvests from commercial, subsistence, and sport fisheries.

FORECAST METHODS

The natural sockeye salmon run forecast to Coghill Lake is the total of estimates for 5 age classes. Natural run by year was estimated as the total commercial harvest contribution combined with the Coghill River weir escapement count. A linear regression model with natural log-transformed data was used to predict returns of age-1.3 sockeye salmon. This linear regression model was parameterized using the historical relationship between returns of age-1.3 sockeye salmon and returns of the age-1.2 fish one year previous (sibling model), which are from the same brood year. For example, the model to predict the return of age-1.3 sockeye salmon in 2017 used the return of age-1.2 fish in 2016 as the input parameter. Predicted returns of age-1.1, -1.2, -2.2, and -2.3 sockeye salmon were calculated as the 2007–2016 mean return of that age class.

Harvest, escapement, and age composition data are available for Coghill Lake sockeye salmon runs since 1962; however, inclusion of escapements prior to the installation of a full weir in 1974 reduced forecast reliability. Therefore, only data collected since 1974 were used to estimate model parameters, calculate individual age class forecasts, and generate 80% prediction intervals. Historically, sibling model estimates of age-1.3 returns to Coghill Lake have a much smaller MAPE (~31.4%) than the sibling model used to predict returns of age-1.2 fish (~85%). The Coghill Lake total run 80% prediction intervals were calculated as the sum of the individual age class forecast point estimates plus/minus the square root of the sum of the squared differences between the age class forecast point estimates and age class forecast 80% prediction intervals. Prediction intervals were calculated using data from 2007-2016 for mean run forecasts and 1974-2016 for the sibling model forecast. The harvest forecast is the total run forecast minus escapement target. No formal forecast was generated for the 2017 run of Eshamy Lake sockeye salmon due to incomplete escapement information since 2012.

FORECAST DISCUSSION

Beginning in 2004, the department stopped forecasting hatchery runs of sockeye salmon to Main Bay Hatchery (MBH) because hatchery operators were already producing forecasts. Coghill Lake has dynamic limnological characteristics that significantly impact the sockeye salmon population. Studies conducted in the mid-1980s and early 1990s indicated the lake may be zooplankton limited. As a result, the biological escapement goal (BEG) midpoint was lowered in 1992 (from 40,000 to 25,000) to allow zooplankton populations to recover. Fertilizers were added to the lake (1993–1996) in a cooperative project with the U.S. Forest Service to improve the forage base for rearing sockeye salmon juveniles. In 2005, current data were reviewed and the midpoint escapement goal remained unchanged, but the goal type was changed from a BEG to an SEG. In 2002 the department began collecting limnological data to monitor basic lake characteristics. In 2011, the upper end of the Coghill Lake SEG was increased from 40,000 to 60,000 (new range = 20,000–60,000). In 2012 the department began managing for the long-term median escapement of 30,000. The Coghill Lake natural run escapement was within or above the escapement goal range every year since 1995 before failing to meet escapement in 2013, 2015 and 2016. If achieved, the 2017 total run forecast midpoint (74,000) would be the 15th largest run in the last 20 years and less than the median run size of 110,000 in the last 20 years. The largest proportion (35,423, ~47%) of the overall Coghill Lake sockeye salmon forecast is predicted to come from age-1.3 fish (5 years old) from the 2012 brood year. The number of age-1.1 (jacks) observed in 2016 was higher than the recent ten year average and could indicate a strong run of age-1.2 (4 year old) sockeye salmon in 2017. However, there is considerable uncertainty in models used to estimate this component of the run. This forecast uses the average total return of age-1.2 sockeye salmon (34,000) rather than sibling model estimates (40,000). Environmental factors that may influence the Coghill Lake sockeye salmon run in 2016 are as discussed for the pink and chum salmon forecasts.

Historically, Eshamy Lake was the largest natural stock contributor to CCP harvests of sockeye salmon in PWS outside of the Coghill District, and contributed to a substantial incidental harvest by the purse seine fishery in the Southwestern District. Eshamy Lake escapement has been enumerated at a weir since 1950, except 1987, 1998 and 2012–present because of budget constraints. Weir operations at Eshamy are not anticipated to resume in the near future. The biological escapement goal range for Eshamy Lake is 13,000–28,000 (midpoint 20,500).

Steve Moffitt, Area Finfish Research Biologist, Cordova
Stormy Haught, Finfish Management/Research Biologist, Cordova

Forecast Area: Copper River
Species: Chinook Salmon

Preliminary Forecast of the 2017 Run

Natural Production	Forecast Estimate (thousands)	Forecast Range (thousands)
Total Run	29	3-55
Escapement Goal[a]	24	
Harvest Estimate[b]	5	0-31

[a] The Chinook salmon spawning escapement goal of 24,000 is a lower bound sustainable escapement goal.

[b] Maximum harvest by all fisheries (subsistence, personal use, sport, and commercial) that allows achieving the lower bound sustainable escapement goal of 24,000. The maximum projected commercial common property harvest for 2017 is 3,500.

FORECAST METHODS

The total run forecast of Copper River Chinook salmon for 2017 was estimated using the previous year's (2016) total run size. Total run size was calculated as the sum of commercial and subsistence harvests of Chinook salmon below Miles Lake and the mark-recapture point estimate of Chinook salmon inriver abundance. Forecast methods examined for the Chinook salmon forecast included: 1) the previous year's run size (most naïve method), 2) mean total run size estimates (2, 3, 4, and 5 year averages), and 3) pseudo-sibling (no age data from escapements) models that examined linear relationships between log-transformed returns of younger fish to predict returns of fish from the same brood class the following year (e.g., returns of age 1.2 fish to predict returns of age 1.3 fish). Historically, sibling model estimates of age-1.3 returns to the Copper River have a much smaller MAPE (~38%) than the sibling model used to predict returns of age-1.4 fish (~68%); therefore, the only sibling model evaluated was to predict returns of age 1.3 fish. Retrospective forecasts of Chinook salmon total run using the previous year's run size had the second smallest MAPE (29%) and a smaller standard deviation of the MAPE (21%) than other forecast models examined and was used as the forecast for 2017. The total run forecast range was calculated using the methods described earlier for Coghill Lake sockeye salmon forecast except 1999–2016 Chinook salmon retrospective forecasts and actual data were used in the calculation. The harvest forecast is the Copper River Chinook salmon total run forecast minus the lower bound sustainable escapement goal of 24,000 Chinook salmon.

FORECAST DISCUSSION

The department did not generate a formal Chinook salmon total run forecast between 1998 and 2007 because of inadequate estimates of inriver abundance or spawning escapement. Forecasts made prior to 1998 used aerial survey indices adjusted to approximate the total escapement. These forecasts performed poorly, especially after the number of aerial surveys was significantly reduced in 1994. In 1999 the Sport Fish Division of the Alaska Department of Fish and Game began a mark-recapture program to estimate the inriver abundance of Chinook salmon. The Native Village of Eyak became a collaborator on the project and eventually took the lead role. There are currently 18 years (1999–2016) of inriver abundance estimates. Thus, while estimates of commercial harvest of Chinook salmon to the Copper River date to 1890, only data collected since 1999 were used to estimate model parameters, calculate individual age class forecasts, and calculate the ranges.

This forecast assumes that all historical commercial harvest in the Copper River District originates from the Copper River. In 2016, Chinook salmon in the commercial harvest were examined for clipped adipose fins and coded-wire tags. Approximately 5% of the fish scanned in 2016 were clipped, down from 15% in 2015. All decoded tags originated from hatchery stocks outside of the Copper River.

The 2017 Chinook salmon total run forecast point estimate of 29,000 is ~34,000 less than the 18-year average total run size (1999–2016 average = 63,000). If realized, the 2017 forecast total run would tie with 2016 as the smallest runs since 1980.

Steve Moffitt, Area Finfish Research Biologist, Cordova
Stormy Haught, Finfish Management/Research Biologist, Cordova

Forecast Area: Copper River
Species: Sockeye Salmon

Preliminary Forecast of the 2017 Run

Natural Production	Forecast Estimate (thousands)	Forecast Range (thousands)
Total Run	1,510	1,070–1,960
Escapement Target[a]		
Upper Copper River	450	
Copper River Delta	169	
Common Property Harvest[b]	890	490–1,300
Hatchery and Supplemental Production		
PWSAC - Gulkana Hatchery		
Hatchery Run	300	210–380
Broodstock Needs	20	
Supplemental Escapement[c]	70	
Common Property Harvest[b]	210	110–300
Total Production		
Run Estimate	1,810	1,280–2,340
Natural Escapement Goal	619	
Broodstock Needs	20	
Supplemental Escapement [c]	70	
Upper Copper River Inriver Goal [d]	700	
Common Property Harvest [e]	1,100	700–1,510

[a] The upper Copper River escapement target of 450,000 sockeye salmon is the historical average spawning escapement (1979–2010). The sustainable escapement goal (SEG) adopted in 2011 is 360,000–750,000. The adjusted Copper River Delta escapement target is the average peak count from aerial surveys (84,500) multiplied by 2 to adjust for proportion of the total number of fish estimated by aerial observers. The SEG (55,000–130,000) was calculated from the sum of unadjusted peak counts of index streams.

[b] Includes harvests from commercial, subsistence, personal use, and sport fisheries.

[c] Hatchery production that will not be harvested to ensure that natural escapement to the upper Copper River is achieved, because natural stocks cannot sustain the higher exploitation rates of hatchery stocks.

[d] Upper Copper River inriver goal categories include spawning escapement (sockeye and other salmon); sport, subsistence, and personal use fishery harvests; and hatchery broodstock and supplemental escapement (5 AAC 24.360 (b)). The inriver goal estimate is preliminary until final upriver harvest estimates from 2016 are available.

[e] Commercial common property harvest midpoint estimate is 890,000 sockeye salmon and the 80% prediction interval is 480,000–1,290,000. The point estimate for the total common property harvest is calculated as the forecast total run estimate minus the sockeye salmon portion of the inriver goal and the Copper River Delta escapement goal.

FORECAST METHODS

Copper River sockeye salmon forecast models include data from harvests, escapements, age compositions; and natural and Gulkana Hatchery stock contributions to fishery harvests. Harvests are summarized from commercial fishery fish tickets, state and federal subsistence permits, state personal use permits, and a sport fishing mail survey. Since 1978, spawning escapements of sockeye salmon above the Miles Lake sonar site have been estimated as the sonar count minus an estimate of the Chinook salmon inriver abundance, all upper Copper River harvests of sockeye salmon, and the Gulkana Hatchery sockeye salmon broodstock and hatchery-excess fish at Crosswind Lake, Summit Lake, and the Gulkana I and Gulkana II sites. Prior to 1978, sockeye salmon escapements above Miles Lake were estimated from either mark-recapture projects or expanded aerial surveys after subtracting Chinook salmon, upper Copper River removals of sockeye salmon, and an estimate of sockeye salmon hatchery stocks. Escapements of sockeye salmon to the Copper River Delta below Miles Lake are estimated from the peak counts of approximately weekly aerial surveys of index streams adjusted for observer efficiency of 0.5 (from limited aerial survey and weir count comparisons in the 1970s). Sockeye salmon age compositions are estimated from scales or otoliths collected from the commercial fishery; upper Copper River subsistence and personal use fisheries; and Copper River Delta spawning escapements. Contributions of natural and Gulkana Hatchery sockeye salmon to commercial and upper Copper River personal use and subsistence fisheries are estimated from otoliths marked with strontium chloride (Sr) (2004–2016), coded wire tags (1995–2003); and fry-to-adult survival, age composition at return and estimated exploitation rates (1977–1994). Natural and hatchery contributions of sockeye salmon to sport fishery harvests are estimated using contribution proportions from the upper Copper River subsistence and personal use fisheries samples. Prior to 2003 contributions of unmarked sockeye salmon released from Gulkana Hatchery sites into Paxson Lake were calculated using assumptions of 1% fry-to-adult survival and adult returns at 17% age 4 and 83% age 5. Total natural runs of sockeye salmon (adult salmon returning in a given year) are estimated as the sum of all natural fishery harvests of sockeye salmon below Miles Lake and the Miles Lake sonar count minus an estimate of Chinook salmon inriver abundance and an estimate of the upper Copper River Gulkana Hatchery sockeye salmon run (broodstock and excess). Total natural brood year returns (an aggregation of adult salmon returning over several years from a single brood year) are estimated as the sum of all sockeye salmon returns by age minus the Gulkana Hatchery returns of sockeye salmon by age.

Forecast models examined for natural Copper River sockeye salmon for 2017 included 1) previous year's run size (most naïve method), 2) mean total run size estimates (2, 3, 4, 5, 10, and all year averages), 3) mean return of individual age classes, and 4) regression models of sibling relationships. The forecast of natural sockeye salmon to the Copper River is the total of estimates for 6 age classes. Linear regression models with log-transformed data were used to predict returns for age 1.2, 1.3 and 2.2 sockeye salmon. These 3 age classes were predicted from the relationship between returns of that age class and returns of the age class one year younger from the same brood year (sibling model). Predicted return of age 1.1, 0.3, and 2.3 sockeye salmon were calculated as the 5-year (2012–2016) mean return of those age classes. The total common property harvest forecast was calculated by subtracting the Gulkana Hatchery broodstock, hatchery surplus, and wild stock escapement goal needs (upriver and Copper River Delta) from the total run forecast. The commercial common property estimate was calculated by subtracting from the total run a preliminary estimate of the inriver goal categories (5 AAC 24.360(b)) and the Copper River Delta spawning escapement goal. The 80% prediction bounds for the Copper River natural sockeye salmon total run and harvest forecasts were calculated using the method described previously for Coghill Lake sockeye salmon, except data from 1983–2016 were used for sibling model forecasts and data from 2011-2016 were used for mean run forecasts.

The 2017 run to Gulkana Hatchery was estimated as the recent 3-year average fry-to-adult survival estimate (1.35%) from all Gulkana I and Gulkana II hatcheries releases combined (onsite and remote). The run was apportioned to brood year using a maturity schedule of 17% age 4 and 83% age 5. An estimated exploitation rate of 70% was used to project the total harvest of Gulkana Hatchery stocks in 2017. The 80% prediction intervals for the forecast of Gulkana Hatchery sockeye salmon production and harvest were calculated as described above for Coghill Lake sockeye salmon, except data from the years 2007–2016 were used.

FORECAST DISCUSSION

Forecasts prior to 1998 relied on the relationship between numbers of spawners and subsequent returns, using return-per-spawner values for parent year abundance similar to the predominant age class (age 5) of the forecast year. Because average return-per-spawner values do not reflect recent production trends, and because returns are still incomplete from the recent brood years, linear regressions of brood year sibling returns were used for forecasts beginning in 1998. Additionally, more precise estimates of survival and contributions from hatchery production for brood years and release locations were available from coded wire tag recoveries in harvests and escapements for brood years 1995–1998.

Historical estimates of Gulkana Hatchery production prior to 1995 are considered imprecise. Improved contribution estimates for brood years 1995–1998 indicated large contributions from supplemental production and smolt-to-adult survival estimates for Crosswind Lake releases that averaged about 20%. Fish with strontium chloride (Sr) marked otoliths began returning in 2003 (age-4 fish) and the majority of the adult run (age-4 and age-5 fish) was marked beginning in 2004. Fish from all release locations (Gulkana I and Gulkana II hatchery sites and Crosswind and Summit lakes) are now marked, but all fish have the same mark. We can estimate the total contribution of enhanced fish from all

Gulkana Hatchery releases, but until different marks for individual releases locations can be developed, forecasts of enhanced sockeye salmon runs to Crosswind and Summit lakes using smolt-to-adult survival estimates are no longer possible.

Spawning escapement goals for the upper Copper River and Copper River Delta natural sockeye salmon were reviewed in 2014 and no changes were made to the existing goals. The upper Copper River spawning escapement goal was changed in 2011 from an SEG of 300,000–500,000 to 360,000–750,000. This change was because of the conversion of Bendix sonar counts to DIDSON sonar equivalent counts and an update in the years used in the goal calculation. There was no change to the Copper River Delta SEG of 55,000–130,000.

The Gulkana Hatchery run of sockeye salmon will include fish from Crosswind Lake smolt migrations of 0.12 million in 2014 (2nd smallest in previous 20 years) and 1.09 million in 2015. For brood years 1994–2013 the average migration from Crosswind Lake was 1.16 million smolt. Summit Lake outmigration counts of 0.18 million in 2014 and 0.12 million in 2015 were below the average of 0.37 million from the most recent 20 years with outmigration counts. No estimates are made for Paxson Lake smolt migrations because they are mixed with large numbers of wild sockeye salmon smolt.

The 2017 total run forecast of natural and enhanced sockeye salmon (1.81 million) is below the recent 10-year average total run (2.55 million). If realized, the 2017 forecast total run would be the 24th largest in the last 38 years (since 1980). The 1.51 million natural run would be below the recent 10-year average (2.24 million), and a 0.29 million Gulkana Hatchery enhanced run would be similar to the recent 10-year average (0.30 million). Copper River total run forecast errors have averaged 26.6% over the last 10 years (Range = 0.5% to 38.1%). The 2017 run of natural sockeye salmon to the Copper River will be composed primarily of returns from brood years 2012 and 2013. Five-year-old fish (brood year 2012) are expected to predominate Copper River Delta and upper Copper River runs and compose ~63% of the total natural run forecast in 2017. The enhanced run forecast is influenced by small smolt outmigration numbers from both Crosswind and Summit lakes. Returns of Copper River sockeye salmon that entered the ocean beginning in 2008 have had excellent survival so far, but the significantly Warm North Pacific waters through 2015 and into early 2016, with a return to more normal temperatures in the second half of 2016 will increase the uncertainty in the 2017 run projection. Copper River sockeye salmon in 2016 were the smallest in the 1966–2016 time series. It is unknown if the short period of moderate cooling in 2016 will result in increased growth and survival for the 2017 run.

Steve Moffitt, Area Finfish Research Biologist, Cordova
Stormy Haught, Finfish Management/Research Biologist, Cordova