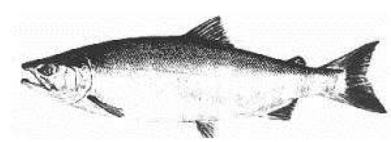
ALASKA DEPARTMENT OF FISH AND GAME
DIVISION OF COMMERCIAL FISHERIES
NEWS RELEASE

Sam Cotten, Commissioner
Jeff Regnart, Director



Contact:
Steve Moffitt, PWS Finfish Research Biologist
Rich Brenner, PWS Assistant Finfish Research Biologist
Phone: (907) 424-3212
Fax: (907) 424-3235

Cordova ADF&G
401 Railroad Avenue
PO Box 669
Cordova, AK 99574
Date Issued: 1/16/2015

2015 PRINCE WILLIAM SOUND AND COPPER RIVER SALMON DETAILED FORECAST

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

Preliminary Forecast of the 2015 Run

Natural Production	Forecast Estimate (thousands)	Forecast Range (thousands)
Prince William Sound General Districts		
Total Run	16,800	6,900–26,900
Escapement Goal [a]	1,450	
All Harvests [b]	15,400	5,400–25,400

[a] PWS pink salmon escapement goal is the sum of the median historical even-years (1966–2010) 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] Total includes the 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. 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 by thermal marked otolith recoveries (1997–2015), 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 2015 forecast is based on an exponential smoothing technique that is heavily dependent upon the total run size of the previous brood year (2013). This forecast method differs from the 2013 forecast that used the average of the two previous brood year returns (2009 and 2011) and the 1997–1999 method that used linear regressions of adult production versus brood year escapement index. Prior to 1997, forecast methods employed surveys of pre-emergent fry; however, these surveys ended in 1995. The forecast model for 2015 was selected by comparing the mean absolute percentage error (MAPE) and the standard deviation of the MAPE among the models examined (odd return years 1965–2013). The range for the total run forecast was calculated by:

$$(\hat{y}_{t+1}/(\sigma_{\text{min/max}}+1))$$

with

$$\sigma_i = (\hat{y}_i - y_i)/y_i$$

where $\hat{y}_{t+1}$ is the forecast for the following year based on the method described above, $\sigma_{min/max}$ is the minimum and maximum proportional forecast error from all previous forecasts using this same method (1965–2013), σ_i is the proportional forecast error for individual past years and y_i and $\hat{y}_i$ are the actual and forecast total run sizes for individual previous years using this same method, respectively.

FORECAST DISCUSSION

The predicted natural total run of pink salmon in 2015 is a naïve forecast that uses a lag 1 exponential smoothing to minimize MAPE. 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 2015 natural run included: 1) previous even brood year total run (most naïve forecast method), 2) total run averages with 2–10 years of data (even years), 3) linear regression of log-transformed total Prince William Sound (PWS) escapement versus log-transformed total PWS return by brood line, and 4) lag 1 exponential smoothing and 5) lag 1 exponential smoothing with dampening. The 2015 forecast (lag 1 exponential smoothing) had the lowest MAPE for even brood year models examined, and lowest standard deviation of MAPE. None of the models examined for natural pink salmon returning in odd-years produced forecasts with MAPE values below 70%, resulting in considerable uncertainty in the forecast point estimate.

The brood year 2013 escapement index (4.68 million) was above the sum of the current district-specific SEG ranges (0.99 million–2.28 million) and was greater than the median of the observed odd-year escapement indices since 1961 (1.52 million). If the 2015 total run forecast (16.8 million) is realized, it will also be greater than median odd brood year return since 1961 (7.98 million). Environmental factors, which likely play a significant role in determining pink salmon returns in PWS, have been quite dynamic during the past 7–8 years. A warm regime, coinciding with generally high productivity of salmon, began in approximately 1977. However, beginning in 2007, ocean temperatures at GAK1 along the Seward line were well below average (http://www.ims.uaf.edu/gak1/). The last several years have also been one of the longest periods of cold conditions, as measured by PDO index values, since the 1970s (http://jisao.washington.edu/pdo/). An El Niño event that spanned 2009–2010 corresponded to a period of positive PDO index values (http://www.elnino.noaa.gov/index.html) and the large number of pink salmon returning to PWS in 2010 spent much of their ocean lives in warmer El Niño conditions. With the passing of the 2009–2010 El Niño, PDO values again became negative in June of 2010 and remained negative through December 2013. PDO values were positive throughout 2014, corresponding with above average water sea surface temperatures throughout the Gulf of Alaska during this period.

Steve Moffitt, Area Finfish Research Biologist, Cordova
Rich Brenner, Finfish Research Biologist, Cordova

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

Preliminary Forecast of the 2015 Run

Natural Production	Forecast Estimate (thousands)	Forecast Range (thousands)
Prince William Sound General Districts		
Total Run	484	185–888
Escapement Goal[a]	200	
Harvest Estimate[b]	284	0–688

[a] The department intends to manage for the long-term average escapement to those 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] Includes the harvests from commercial, subsistence, and sport fisheries.

FORECAST METHODS

We evaluated several naïve methods for the 2015 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, total run size from the previous year had the lowest MAPE and was chosen as the forecasting method for 2015. Total natural run by year was estimated as the total commercial harvest contribution combined with the escapement index. The escapement index is calculated as the area under the curve of weekly aerial escapement surveys adjusted for estimates of stream life. 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 (2004–2012) for each district in PWS. The range for the total run forecast was calculated by:

$$(\hat{y}_{t+1}/(\sigma_{\min/\max}+1))$$

with

$$\sigma_i = (\hat{y}_i - y_i)/y_i$$

where $\hat{y}_{t+1}$ is the forecast for the following year based on the method described above, $\sigma_{min/max}$ is the minimum and maximum proportional forecast error from all previous forecasts using this same method (1990–2014), σ_i is the proportional forecast error for individual past years and y_i and $\hat{y}_i$ are the actual and forecast total run sizes for individual previous years using this same method, respectively.

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 by the small amount of data available. Estimates of natural stock contributions to CCP were unavailable prior to 2003. From 2003 through 2014 natural chum salmon contribution estimates based on thermally marked otoliths were available for the Coghill and Montague districts. Contribution estimates from thermally marked otoliths in other districts have been available since 2004. Historical natural chum salmon age data from escapements and CCP harvests are unavailable for most districts of PWS. If the 2015 natural chum salmon forecast of 484,200 is realized, it would be the 34th largest since 1970. For comparison, the estimated total run size was greater than 1.3 million from 1981–1988, but has not surpassed 1 million since 1988.

Cold ocean temperatures and negative PDO index values discussed previously for pink salmon may also negatively affect the run of chum salmon in 2015. However, North Pacific waters have been significantly warmer throughout 2014.

Steve Moffitt, Area Finfish Research Biologist, Cordova
Rich Brenner, Finfish Research Biologist, Cordova

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

Preliminary Forecast of the 2015 Run

Natural Production	Forecast Estimate (thousands)	Forecast Range (thousands)
Prince William Sound, Coghill Lake		
Total Run	123	74–246
Escapement Goal[a]	30	
Harvest Estimate[b]	93	44–216
Prince William Sound, Eshamy Lake		
Total Run	53	29–77
Escapement Goal[c]	21	
Harvest Estimate[b]	32	9–57
Total Production		
Run Estimate	176	120–300
Escapement Goal	51	
Common Property Harvest[b, d]	126	70–250

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

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

[c] The escapement goal of 20,500 for Eshamy Lake is the midpoint of the biological escapement goal range (13,000 – 28,000).

[d] The total harvest estimate does not include the 10-year average annual commercial harvest of approximately 5,700 sockeye salmon in Unakwik District.

FORECAST METHODS

The natural sockeye salmon run forecast to Coghill Lake is the total of estimates for 5 age classes. 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 2015 used the return of age-1.2 fish in 2013 as the input parameter. Predicted returns of age-1.1, -1.2, -2.2, and -2.3 sockeye salmon were calculated as the 1974–2014 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. An approximate 80% prediction interval for the total run forecast was calculated using the squared deviations between the 2007–2013 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 linear regression model described above, t is the critical value, n is the sample size and MSE is the mean squared error. Historically, sibling model estimates of age-1.3 returns to Coghill Lake have a much lower MAPE (~32.5%) than the sibling model used to predict returns of age-1.2 fish (~88%).

The forecast of the natural sockeye salmon run to Eshamy Lake has historically been based on an apparent 4-year cycle with leap years being the strongest run year. However, this cycle has diminished in recent years, and the 2015 forecast is simply the average annual runs since 1989. Eshamy Lake escapement has been enumerated at a weir since 1950, except

1987, 1998 and 2012–present. Commercial harvest data are available for the same period, but age composition data are available for only some years after 1962. Data collected since 1970, excluding 1987, 1998, 2012, and 2013 were used to calculate the forecast. Starting in 2012 a video monitoring system was tested to enumerate the sockeye salmon run to Eshamy Lake. The 80% prediction interval was calculated using the equation described for Coghill Lake sockeye salmon.

PWS total run and common property harvest forecasts were calculated from the sum of Coghill and Eshamy lakes midpoint forecasts. The 80% prediction intervals were calculated as the sum of the point estimates plus/minus the square root of the sum of the squared differences between the individual point estimates and 80% prediction intervals for Coghill and Eshamy lakes.

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 has been within or above the escapement goal range every year since 1995, except 2013. If achieved, the 2015 total run forecast midpoint (123,300) would be the 12th largest run since 1988 and slightly below the median run size of 127,000. The majority (77,300) of the overall Coghill Lake sockeye salmon forecast is predicted to come from age-1.3 fish (5 years old) from the 2010 brood year. Relatively few age-1.1 (jacks) were observed in 2014 compared to other years, which could indicate a small run of age-1.2 (4 year old) sockeye salmon in 2015. However, there is considerable uncertainty in models used to estimate this component of the run, and we opted to use the average total return of age-1.2 sockeye salmon (35,500) rather than sibling model estimates (22,600) for the 2015 forecast. Environmental factors that may influence the Coghill Lake sockeye salmon run in 2015 are as discussed for the pink salmon forecast.

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. Although escapements into Eshamy River were counted at a weir for 50 years, only periodic collection of age, sex, and size data has occurred for the Eshamy and Southwestern districts CCP harvests because of inconsistent harvest and delivery locations outside of Cordova. Contributions to CCP harvests in western PWS of sockeye salmon produced by the MBH have been estimated by recovery of coded wire tags and thermally marked otoliths. However, not all harvests can be adequately sampled, which increases the uncertainty of total run estimates for all natural and enhanced sockeye salmon stocks in western PWS. Age composition data and weir counts were not collected in 1987, 1998 and 2012–present because of budget constraints and are not anticipated to resume in the near future.

The escapement goal for Eshamy Lake was reviewed in 2008 and the range was changed. The new BEG range is 13,000–28,000 (midpoint 20,500). The old range was 20,000–40,000.

Steve Moffitt, Area Finfish Research Biologist, Cordova
Rich Brenner, Finfish Research Biologist, Cordova

Forecast Area: Copper River
Species: Chinook Salmon

Preliminary Forecast of the 2015 Run

Natural Production	Forecast Estimate (thousands)	Forecast Range (thousands)
Total Run	35.5	22–58
Escapement Goal[a]	27	
Harvest Estimate[b]	8.5	0–31

[a] The Chinook salmon spawning escapement goal of 24,000 is a lower bound sustainable escapement goal. ADF&G intends to manage for the estimated long-term average escapement of 27,000 Chinook salmon.

[b] The maximum harvest by all fisheries (subsistence, personal use, sport, and commercial) that allows achieving the average spawning escapement of 27,000. The projected commercial common property harvest is 5,500.

FORECAST METHODS

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 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 lower 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 using the previous year's run size had a smaller MAPE (26%) and a smaller standard deviation of the MAPE (14%) than other mean run forecasts and was used as the forecast for 2015.

The range for the total run forecast was calculated as:

$$(\hat{y}_{t+1}/(\sigma_{\min/\max}+1))$$

with

$$\sigma_i = (\hat{y}_i - y_i)/y_i$$

where $\hat{y}_{t+1}$ is the forecast for the following year based on the previous year total run size, $\sigma_{min/max}$ is the minimum and maximum proportional forecast error from all previous forecasts using this same method (2000–2014), σ_i is the proportional forecast error for individual past years and y_i and $\hat{y}_i$ are the actual and forecast total run sizes for individual previous years using this same method, respectively.

The harvest forecast is the total run estimate minus the average escapement of 27,000 since 1980 as determined from catch-age analysis and mark-recapture point estimates. The commercial harvest was calculated with the projected total harvest multiplied by the 5-year average proportion of harvest by the commercial fishery (~0.65).

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 16 years (1999–2014) 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.

The 2015 total run forecast point estimate of 35,500 is ~28,800 less than the 16-year average total run size (1999–2014 average = 64,400). If realized, the 2015 forecast total run would rank 33 of the 36 annual runs since 1980.

Steve Moffitt, Area Finfish Research Biologist, Cordova
Rich Brenner, Finfish Research Biologist, Cordova

Forecast Area: Copper River
Species: Sockeye Salmon

Preliminary Forecast of the 2015 Run

Natural Production	Forecast Estimate (thousands)	Forecast Range (thousands)
Total Run	2,750	1,960–3,530
Escapement Goal[a]		
Upper Copper River	450	
Copper River Delta	169	
Common Property Harvest[b]	2,130	1,480–2770
Hatchery and Supplemental Production		
PWSAC - Gulkana Hatchery		
Hatchery Run	450	320–570
Broodstock Needs	20	
Supplemental Escapement[c]	100	
Common Property Harvest[b]	310	220–410
Total Production		
Run Estimate	3,190	2,280–4,100
Natural Escapement Goal	619	
Broodstock Needs	20	
Supplemental Escapement [c]	110	
Upper Copper River Inriver Goal [d]	715	
Common Property Harvest [e]	2,440	1,760–3,120

[a] The upper Copper River escapement goal 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 SEG 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.

[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 upriver harvest estimates for 2014 are available.

[e] Commercial common property harvest midpoint estimate is 2,240,000 sockeye salmon and the 80% prediction interval is 1,560,000–2,910,000. 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

Forecast methods examined for natural Copper River sockeye salmon for 2015 included 1) the 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, and -2.2 sockeye salmon while untransformed data were used to predict the return of age 1.3 fish. 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). The predicted return of age-1.1, -0.3, and -2.3 sockeye salmon were calculated as the 5-year (2010–2014) 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 total run and harvest forecast were calculated using the method described previously for Coghill Lake sockeye salmon, except only the years 1983–2014 were used in the calculation of mean squared error.

Forecast models examined to predict the 2015 run to Gulkana Hatchery included 1) age specific smolt-to-adult survival estimate averages (3, 5, 10, and 36 years) applied to all releases combined. The selected forecast used the recent 5-year average fry-to-adult survival estimate (2.10%) from all Gulkana I and Gulkana II hatcheries released combined (onsite and remote). The run was apportioned to brood year using a maturity schedule of 13% age 4 and 87% age 5. An estimated exploitation rate of 70% was used to project the total harvest of Gulkana Hatchery stocks in 2015. The 80% prediction interval for the forecast of supplemental production was calculated using the mean square error estimate of the total run as described above for Coghill Lake sockeye salmon.

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 dominant 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 marked with strontium chloride (Sr) 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 unless different marks for individual releases can be developed, forecasts using smolt-to-adult survival estimates will no longer be possible.

The spawning escapement goals for the upper Copper River and Copper River Delta 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 2015 run will be composed primarily of returns from brood years 2010 and 2011. Five-year-old fish (brood year 2010) are expected to predominate Copper River Delta and upper Copper River runs. The Copper River Delta escapement indices for 2010 (83,300) and 2011 (76,500) were within the SEG range of 55,000 to 130,000.

The Gulkana Hatchery run will include fish from Crosswind Lake smolt migrations of 0.97 million fish in 2012 (13th largest in 25 years) and 0.85 million in 2013 (16th largest). For brood years 1993–2012 the average migration from Crosswind Lake was 1.2 million smolt. The run will also include 5-year-old fish from a moderate Summit Lake smolt outmigration (314,900 or 12th largest in 30 years). No smolt data are available for Summit Lake outmigration in 2013.

The 2015 total run forecast (3.19 million) is similar to the recent 4-year average total run (3.18 million). If realized, the 2015 forecast total run would be the 5th largest in the last 36 years (since 1980). The 2.75 million natural run would be similar to the recent 4-year average (2.68 million), and a 0.45 million Gulkana Hatchery run would be below the recent 4-year average (0.49 million). The natural run forecast is driven by the large 4-year-old (age-1.2) fish estimate in 2014 (696,000; largest since 1965) and the subsequent prediction for 5-year-old (age-1.3) fish in 2015. There have been 8 additional years with run estimates of age-1.2 fish greater than ~400,000. The return of age-1.3 fish the following year has been significantly larger than expected in 5 of the 8 years. The enhanced run forecast is driven by moderate smolt outmigration numbers from both Crosswind and Summit lakes that have had good survivals in recent years. Returns of salmon that entered the ocean in 2012 have had excellent survival so far, but the significantly warmer North Pacific waters in 2014 will increase the uncertainty in the 2015 run projection. However, the main factor in the uncertainty of this forecast is that the number of age 1.2 fish used as input to the model to predict the age-1.3 return is outside the range of our historical data.

Steve Moffitt, Area Finfish Research Biologist, Cordova
Rich Brenner, Finfish Research Biologist, Cordova