CHIGNIK LAKES SCALE PATTERN ANALYSIS, RUN APPORTIONMENT, AND SOCKEYE SALMON CATCH SAMPLING RESULTS, 2001

By

Mark J. Witteveen

Regional Information Report[1] No. 4K02-2

Alaska Department of Fish and Game
Division of Commercial Fisheries
211 Mission Road
Kodiak, Alaska 99615

January 2002

[1] The Regional Information Report Series was established in 1987 to provide an information access system for all unpublished division reports. These reports frequently serve diverse ad hoc informational purposes or archive basic uninterpreted data. To accommodate timely reporting of recently collected information, reports in this series undergo only limited internal review and may contain preliminary data; this information may be subsequently finalized and published in the formal literature. Consequently, these reports should not be cited without prior approval of the author or the Division of Commercial Fisheries.

AUTHOR

Mark J. Witteveen is a Region IV Finfish Research Biologist for the Alaska Department of Fish and Game, Division of Commercial Fisheries, 211 Mission Road, Kodiak, AK 99615.

ACKNOWLEDGMENTS

The author would like to thank the Chignik and Kodiak catch sampling staff for collecting the data, Mike Daigneault who aged most of the scales and coordinated sampling efforts, and George Pappas who helped coordinate test fisheries and managed Chignik area staff. Matt Foster provided analytical expertise, Lucinda Neel provided publication support, and Patti Nelson provided supervisory support and advice throughout the season.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES (Cont.)

LIST OF FIGURES

ABSTRACT

Two distinct sockeye salmon *Oncorhynchus nerka* runs enter the Chignik River system and temporally overlap during late June and July creating the need to differentiate between the runs to effectively manage the commercial salmon fishery. Scale pattern analysis was performed and applied to a discriminant analysis model to separate the early and late runs. A common logistic function was utilized to smooth the model output which was then applied to the escapement estimates to determine if each run's escapement goals were met. The run apportionment is used both inseason for commercial fisheries management purposes and postseason for run reconstruction and run forecasting. The analysis indicated a slightly earlier than average transition timing from the early to late runs. Scale samples were taken in the Chignik Lagoon for the run apportionment estimate procedure as well as in the Western, Central, and Eastern Districts to record the age compositions present.

INTRODUCTION

The Chignik Management Area (CMA) is located on the south side of the Alaska Peninsula between Kilokak Rocks to the north and Kupreanof Point to the south and supports a large sockeye salmon *Oncorhynchus nerka* commercial fishery (Figure 1). The Chignik River system is the major sockeye salmon producer in the CMA and supports two distinct runs. The Chignik River system is composed of Black Lake in the upper portion of the watershed which empties into the Black River and then into Chignik Lake (Figure 2). Chignik Lake discharges into Chignik Lagoon and the ocean via Chignik River. The majority of the "early run" ascends, mostly during June and July, via Black River to spawn in Black Lake and the upper watershed. The majority of the "late run" ascends to Chignik Lake mostly during July and August. There is substantial overlap of the two runs each year during late June and July as fish pass the Alaska Department of Fish and Game (ADF&G) counting weir in the Chignik River below Chignik Lake.

These runs support almost the entire salmon fishery for the Chignik area, which includes the five villages of Chignik Bay, Chignik Lagoon, Chignik Lake, Perryville, and Ivanof Bay (Figure 1). A number of fishery management plans in the CMA, Kodiak Management Area (KMA), and South Alaska Peninsula Salmon Management Area (Area M) are impacted by the apportionment of the two runs. The local manager's ability to effectively distribute spawning escapement between the Black Lake and Chignik Lake spawning stocks depends upon the ability to distinguish the two runs of fish inseason.

Estimating the catch and escapement's contribution to each of the runs has been accomplished in the past through several methods. Tagging studies conducted in the late 1960s, in which tags were applied at the weir and then recovered on the spawning grounds, were used to estimate each run's contribution to the total escapement (Lechner 1965; Dahlberg 1968; Phinney and Lechner 1969). Average time of entry curves (ATOE) were developed based on several of the tagging studies to apportion the runs into early and late components during years in which tagging did not occur. The ATOE curves are still used in cases when the current method proves to be unreliable.

Currently, scale pattern analysis (SPA), based on differential freshwater growth between the two main stocks, is utilized with a discriminate analysis model to provide estimates of individual run strength. The analysis is performed inseason to ensure that early and late-run escapement goals are met and any surplus can be harvested. Postseason analysis is performed to more accurately apportion the escapement and catches as well as reconstruct the run.

METHODS

Model Overview

The run strength estimates are derived from a discriminant analysis model based on the studies of Conrad (1983 and 1984) and Swanton (1992). The model is based on measurements of freshwater scale growth characteristics (focus to each circulus of freshwater growth), referred to as scale pattern analysis. This modeling is conducted both inseason (generally using age 2.3 fish) and postseason (using age 1.3 and age 2.3 fish). These two sockeye salmon age classes typically predominate both runs.

Annually, the formation of each model requires two initial data sets, one to represent each of the two runs involved. These data sets are established with attempts to provide "pure" data from each stock of origin and are referred to as *standards*, or *knowns*. The standard data files are age class specific and are composed of measurements of freshwater growth characteristics from a goal of 200 individuals of each of the two runs. For the inseason models, scales for the early run standard generally come from age 2.3 fish captured at the outlet of Black Lake in late June. Because late run fish are not available for inseason analysis, the late run standard generally comes from age 2.2 fish of the prior year's late season (late July to early September) catch in the Chignik Bay District fishery. However, during the 2001 season, there was a low proportion of age 2.3 fish in the Black Lake spawning population and, as a result, age 1.3 fish collected from the Black Lake outlet in 2001 and age 1.2 fish from Chignik Lagoon catch sampled collected during the 2000 season were the standards used for the inseason model.

The use of the late season catch as a Chignik Lake standard is based on Conrad (1983 and 1984) who respectively used post July 24 and 27 Chignik Lagoon catch samples as their source. This was based on the assumption that the Black Lake run is has passed Chignik Lagoon by late July. Currently, post July 31 Chignik Lagoon catch samples are considered to be 100% Chignik Lake stock. The Chignik Lake late run model is also based on the assumption that age 2.2 fish during year y and age 2.3 fish during year $y+1$ (or age 1.2 and 1.3 as in the case of the 2001 season have similar freshwater growth patterns.

There are two types of variables used in the models. The first variable is the total number of freshwater circuli from the scale measurement. This variable usually describes most of the variation between the standards. The other variable is the distance from the scale focus to the outside edge of each freshwater circulus (eg. focus to 1st circulus). While a particular scale may have many focus-to-circuli measurements, the model uses the same number of variables for analyzing each sample, so the scale measurement with the least number of circuli is used to set the maximum number of variables in the analysis.

To account for the misclassification inherent in the model, the Cook and Lord (1978) correction factor is applied to the model output. Using a polynomial discriminant method, classification errors for known samples from each stock are considered and a correction factor is applied (Cook and Lord 1978). The correction factor basically utilizes the error structure, produced when the known standards are applied to the model, to adjust the model estimates. A DOS based computer program automates the correction factor procedure.

For postseason run reconstruction, scales for the early run *standard* come from the Black Lake escapement sample as described above. Scales for the late run *standard* come from fish collected in August from the current season's catch. Once the model is established, it is then applied to mixed stock, or *unknown* data sets. Each *unknown* data file consists of age class specific measurements of 100 individuals randomly sampled (but of sufficient quality to measure) from the catch. The fishery catch is sampled (and *unknown* SPA data files recorded) at regular intervals throughout the season. Sampling frequency varies, ranging from once every 2 to 3 days during the period of transition between the two runs (i.e. June 26 to July 9), to once each week at the end of the season. These mixed run fishery files are analyzed throughout the season. Results provide estimates of percent composition of the Black Lake early run and the Chignik Lake late run. Estimates of run contribution and time-of-entry curves are established and maintained as the season progresses.

2001 Season

Scale Sample Collection

Sockeye salmon catches were sampled for age (scales) during the 2001 season by the Chignik weir crew approximately every three days during the transition period (June 26 through July 15 since the transition seemed to be late) and once per week after the Chignik Lake stock dominated the samples. All catch sampling was representative and random. There was no pre-selection of fish for length, sex, condition, or any other factor. The targeted size per catch sample was 600 fish, which assumes a conservative estimate of at least 88.5% readable scales. This generally results in an adequate number of age 1.3 and/or 2.3 scales of sufficient quality to achieve the goal of measuring 100 per age class.

When catch samples were available, samples were taken at one of the two processing plants in Chignik Bay (Figure 2) or from tender or seine vessels. When the fishery was closed or samples were not available, the department chartered a commercial seiner and conducted a test fishery to obtain the scale samples. When personnel and pure catch samples were available, sampling was conducted on catches from the outside Chignik districts including the Eastern, Central and Western Districts (Figure 1).

Inseason Model

Age compositions from the escapement samples collected from Black Lake during late June revealed that there was a low proportion of age 2.3 sockeye salmon (Table 1) with numbers well below the early run *standard* goal size of 200 scales. Constructing a model with a low number of age 2.3 sockeye salmon scale samples would result in low confidence in model estimates. Low proportions of age 2.3 fish were also found in department conducted test fishery catches in the Chignik Lagoon during mid June (Table 2). The low numbers of age 2.3 sockeye salmon available for SPA from the test fishery resulted in a model with little resolution. Therefore, it was determined that inseason SPA using age 2.3 sockeye salmon was not feasible.

Age 1.3 sockeye salmon were in sufficient abundance to meet the Black Lake *standard* sample goal of 200 scales. Examination of scale samples from catches after July 31 during 2000 (Table 3) revealed that 60 age 1.2 sockeye salmon were readable and of sufficient quality to perform SPA. While the goal of 200 scales for the Chignik Lake standard was not met, the number of scales available was sufficient to perform inseason SPA on age 1.3 sockeye salmon.

Discriminant analysis models were developed with Chignik Lagoon age 1.2 catch samples from the 2000 season and Black Lake age 1.3 sockeye salmon escapement samples from the 2001 season as standards. Both linear and quadratic models were evaluated using the SAS™ statistical software package. After the model parameters were developed, the known standards were applied to the model and a "resubstitution" or "classification" accuracy was determined by the amount of known samples that were apportioned to the correct stock. The model with the highest classification accuracy was used. Both backward and forward stepwise analysis were performed on the model to determine if classification accuracy of the model could be improved if one or more variables were removed. The established model was applied to the unknown samples (with a sample size goal of 100 per event) to determine the proportions of Black and Chignik Lakes stocks.

Logistic Function Smoothing

Because there was significant variability in the run composition of any particular sample as well as between samples, a smoothing mechanism was necessary to interpret the transition from the early run to the late run.

In past years, the model's stock composition estimate of each sample was smoothed with a moving average of three data points. The stock composition on May 23 was assumed to be 0% Chignik Lake fish. The first sample was averaged using (0 + first value + second value)/3. The second and following samples were a simple moving average of three; however, the last sample was averaged with the assumption that on July 31, 100% of the fish were attributable to Chignik Lake. The stock composition for a specific day was then estimated by interpolation between the previously averaged values. An application consisting of an R:base™ database and program and a C++™ program was used to estimate inseason escapement proportions. .

During 2001, to estimate the proportion of the total escapement attributable to the Chignik and Black Lake stocks, the stock proportion data (estimated from SPA) were fit to the common logistic function (Quinn and Deriso 1999). A nonlinear weighted (by sample size) least squares optimizing scheme was used to fit the model to the Chignik stock proportion data (assuming 100% Chignik run by 31 July, as per past seasons). Stock proportion data through July 31 were fit to the logistic function and the resultant model used to estimate the actual daily stock proportions. As incoming data were analyzed (via SPA and the model) the logistic model was refit to the entire data set and a new logistic curve was utilized to estimate the daily stock proportions between the date of the previous and most current samples (Figure 3). Using this method, previous escapement estimates that were released to the public remained unchanged, yet the entire logistic curve was refit to incorporate incoming data and only the new portion of the refit curve was used to apportion the run.

The logistic curve method was developed this year so that each escapement proportion data point was estimated using the entire data set, which likely resulted in inherently more accurate results than the previously utilized three point smoothing method.

The daily proportion of Chignik and Black Lake stocks was applied to the daily escapement and the total escapement for each stock was estimated. Due to the time involved in pressing, aging, measuring, and analyzing samples, the escapement proportions were generally not available until two to three days after a sample was taken.

The apportioned escapement information was then used by commercial salmon fishery managers to monitor escapement and to consequently regulate the commercial fishery to ensure achievement of escapement goals and harvest of surplus fish.

Postseason 1.3 Model

After all of the scale samples were collected from commercial harvests for the season, the postseason models were developed. The standard for the age 1.3 postseason model for the Chignik Lake stock was developed from the scale samples of age 1.3 sockeye salmon sampled from the commercial salmon fishery in Chignik Lagoon after July 31. The standard for the Black Lake stock was developed from the age 1.3 sockeye salmon sampled from the Black Lake escapement. Linear and quadratic postseason models were then developed using SAS™ and backward and forward stepwise analysis was performed to evaluate discriminating power of each variable and to determine if classification accuracy could be increased by the removal of any variables. The model and variables with the highest classification accuracy were used. Each sample from the commercial fishery or department test fishery was then run through the model and stock proportions of age 1.3 sockeye salmon were estimated for each sample. The logistic function was then used to smooth the data and provide daily estimates of age 1.3 sockeye salmon stock apportions.

Postseason 2.3 Model

Concurrent to the development of the age 1.3 postseason model, the age 2.3 postseason model was developed. The standards for the age 2.3 post season model for the Chignik Lake stock developed from the scale samples of age 2.3 sockeye salmon sampled from the commercial salmon fishery in Chignik Lagoon after July 31 and from the age 2.3 sockeye salmon sampled from the Black Lake escapement for the Black Lake stock. Similar stepwise analysis were performed and the model and variables with the highest classification accuracy was used. Unknown fishery samples were then run through to the model to estimate age 2.3 stock composition of each sample and the logistic function was used to smooth the output.

Catch and Escapement Apportionment

An R:base™ application was used to automate the apportionment of catches and escapement to each stock. Prior to apportionment, the R:base™ application shifted catches from all outside districts, the Cape Igvak Section in the KMA, the Southeastern District Mainland (SEDM) in Area M, and escapement from the Chignik weir to account for different travel time to the Chignik Lagoon so that all catches were standardized to the day that they would have passed through the Chignik Lagoon fishery. The estimated travel time to the Chignik Lagoon for each area is summarized in Table 4 (Conrad 1983).

The R:Base application then applied the stock apportionment output from the logistic function curve for age 1.3 sockeye salmon to apportion the age 1.3 fish from the harvests and escapement to each stock. The procedure was repeated for the age 2.3 logistic function curve and catch and escapement numbers. Age 1.2 sockeye salmon were apportioned to Black and Chignik Lake stocks in the same proportions as the age 1.3 fish, while the age 2.2 sockeye salmon were apportioned the same as the age 2.3 fish. All other age classes were apportioned to the Black and Chignik Lakes stocks using an average of the age 1.3 and 2.3 proportions. The resultant output consisted of daily estimates of the catch, escapement, and total run apportioned to Chignik and Black Lakes by day.

Inseason/Postseason Standard Evaluation

To test some of the assumptions made for the run apportionment, statistical tests were performed on the standards. An analysis of variance (ANOVA) was performed on the inseason Chignik Lake age 1.2 (from the 2000 season) scale measurement standard versus the postseason Chignik Lake age 1.3 scale measurement standard to test the assumption that the age 1.2 freshwater scale pattern would be analogous to the freshwater scale pattern of an age 1.3 scale from the same stock in a subsequent year. In the case of this analysis, a high p-value would indicate that the two stocks were similar and the assumption was valid.

ANOVAs were also performed for the inseason standards (Chignik Lake age 1.2 scale measurements versus the Black Lake age 1.3 scale measurements) and the postseason standards (Chignik Lake age 1.3 versus Black Lake age 1.3 scale measurements) to ensure that the measurements were statistically different between the different stocks. In the case of this analysis, a low p-value would indicate that the stocks being tested were indeed statistically different and were useful for discriminating unknown samples.

The two variables selected to test the similarity of the scales were the total number of circuli measured and maximum freshwater growth measurement. The total number of circuli measured was selected because it was the variable from the discriminant analysis that explained the highest level of difference between each standard. The maximum freshwater measurement was selected because, although not necessarily used in the discriminant analysis, it represents the entire growth during the freshwater residence of the fish and is likely indicative of a particular stock's freshwater residence characteristics (time spent in freshwater and growth rate).

RESULTS

Scale Sampling

The baseline scale sampling for the Black Lake stock was conducted on June 20-23 by Chignik weir staff (Table 1). Catches from the commercial fishery and department conducted test fisheries in the Chignik Lagoon were sampled for scales on 23 occasions during the 2001 season (Table 2). Due to difficult logistics associated with attaining pure samples (samples that were from a single area without fish mixed in from other areas) from outside districts, only one sample was taken from the Eastern District (Table 5) and two samples each from the Western (Table 6) and Central (Table 7) Districts.

The Chignik Lagoon samples indicated a dominance of age 1.3 sockeye salmon in the early part of the run with a transition to a dominance of age 2.3 fish in August (Table 2). The Black Lake scale samples had a similar age composition to that of the early portion of the Chignik Lagoon samples (Table 1 and 2). The outer districts had similar age compositions to that of Chignik Lagoon samples during the same time periods with the exception of the Western District which had a high proportion of age 2.2 fish that did not occur in the Chignik Lagoon samples (Tables 5-7).

Inseason Model

When the data used to develop the age 1.3 inseason models were resubstituted into the linear and quadratic models, the resultant classification accuracy indicated that the quadratic model performed better than the linear model in correctly apportioning more of the known standards to the correct stock than the linear model. The classification accuracy of the quadratic model was estimated at 84.5% for the Black Lake stock and 86.7% for the Chignik Lake stock (Table 8). Stepwise analysis further indicated that the model classification accuracy was highest when all eight variables were used. The variables used were the number of freshwater circuli and the focus-to-circuli measurements to the first seven circuli.

The model output indicated an initial Chignik Lake stock composition of between 0% and 10% during early June, increasing to a level of 10% to 30% during late June and early July (Table 9). The July 13 sample indicated a Chignik Lake stock composition of approximately 50% and an abrupt transition into the second run occurred in the subsequent samples.

The results of the smoothing from the inseason logistic function curve estimated the 50% date on July 15 and the same relatively abrupt transition period (Table 10; Figure 3) as the unsmoothed estimate. The Chignik Lake stock was estimated to compose 100% of the run on July 31 as one of the assumptions of the model.

Postseason 1.3 Model

The age 1.3 postseason model was similar to the inseason model in that the highest classification accuracy was attained with a quadratic model with all seven variables included. The seven variables used were the number of freshwater circuli and the focus-to-circuli measurements for the first six circuli. It is likely though, that since the age 1.3 postseason model only utilized seven variables instead of eight used inseason, it subsequently had a lower classification accuracy. When the data used to create the model were resubstituted back into the model, the classification accuracy was 85.5% for Black Lake and 74.6% for Chignik Lake (Table 8).

The model output for the age 1.3 postseason model exhibited a similar trend to that of the inseason model with early June estimates of the Chignik Lake stock ranging from zero to 13% of the entire run (Table 11). The late June estimates increased to from 11% to 35% Chignik Lake stock and gradually continued to increase until they exceeded 50% on July 9 after which they abruptly increased to 100% by July 20.

The smoothed logistic curve estimated equal proportions of Chignik and Black Lake stocks on July 6, approximately nine days earlier than that of the inseason model (Table 10; Figure 4). The transition from the early to late run estimated by the logistic curve was even more abrupt than that estimated by the inseason. Chignik Lake fish were estimated to comprise 100% of the catch and escapement by July 20.

Postseason 2.3 Model

The age 2.3 postseason model using the quadratic function with all of the 11 possible variables exhibited the highest classification accuracy. The variables used were the number of freshwater circuli and the focus-to-circuli measurements for the first ten circuli. The classification accuracy was 92.4% for the Black Lake stock and 94.0% for the Chignik Lake stock (Table 8).

Since the sample sizes of age 2.3 fish from the early catches were low, the samples from June through July 6 were pooled to increase sample size. While the first sample period (June 6 to 16) resulted in 0% Chignik Lake stock, the second (June 19 to 25) and third (June 28 to July 6) sample periods resulted in respective Chignik Lake stock composition estimates of 26.4% and 24.0% (Table 12). These estimates were generally higher during June than either age 1.3 model. The July 9 sample was composed of 65.8% Chignik Lake stock. The model estimated that the Chignik Lake stock comprised well above 90% of the entire run on and after July 31, but it did not achieve 100% until August 30.

After the logistic function was applied to smooth the data, the 50% stock composition date was estimated to be July 12 (Table 10; Figure 5). The date at which the Chignik Lake stock composed 100% of the run was estimated to be August 3.

Catch and Escapement Apportionment

The results of the postseason run apportionment indicated that the transition between the Black Lake and Chignik Lake stock occurred earlier than was indicated by the inseason model (Tables 13 and 14). The date at which the two run were at equal proportions (the 50/50 date) was estimated as July 6 (Table 15), a full nine days earlier than the inseason estimate. The resultant change in transition timing resulted in an overall Black Lake escapement of 744,013 sockeye salmon and an overall catch of 563,076 sockeye salmon (Table 13). The Chignik Lake escapement was estimated at 392,905 sockeye salmon and catch was estimated at 1,214,403 sockeye salmon (Table 14).

The estimated age composition of the Black Lake escapement was characterized by a high proportion of age 1.3 sockeye salmon during the early portion of the season with a decreasing proportion as the season progressed (Table 16). The estimated age composition of the Black Lake catch exhibited a similar trend (Table 17). The Chignik Lake escapements had a higher than usual proportion of age 1.3 sockeye salmon early in the run, however the dominating age class switched to age 2.3 fish by July 26 (Table 18). The Chignik Lake catches were similar in age composition to the escapement as they are derived from the same samples (Table 19).

Inseason/Postseason Standard Evaluation

The ANOVAs performed on the two Chignik Lake 1.x standards from the 2000 versus 2001 seasons (assumed by the model to not be statistically different), revealed that they were significantly different (number of circuli: $p=1.63 \times 10^{-4}$, maximum freshwater growth: $p=1.15 \times 10^{-6}$;Table 20).

The test for differences between the inseason standards indicated that the maximum freshwater growth variable for Black Lake age 1.3 standard was not significantly different than that of the Chignik Lake age 1.2 standard (p=0.248). The number of circuli between the two standards was significantly different (p=1.41 x 10^{-3}; Table 20).

The largest difference between standards was for those used in the postseason age 1.3 analysis. The Black Lake age 1.3 standard and the Chignik Lake age 1.3 were significantly different both in number of circuli (p=6.56 x 10^{-19}) and maximum freshwater growth (p=2.50 x 10^{-14}; Table 20).

DISCUSSION

The 2001 season was characterized by a slightly earlier than average transition timing from the Black Lake early run to the Chignik Lake late run, according to the postseason analysis. The timing coupled with large escapement early in the season, due to a price dispute that limited commercial fishing effort, resulted in an estimated escapement to Black Lake of 744,013 sockeye salmon (Table 13). This escapement level exceeded the upper end of the escapement goal range of 400,000 sockeye salmon by 344,013 fish. The total catch from the Chignik Area, the Cape Igvak Section of the KMA, and the SEDM of Area M attributed to the Black Lake run was approximately 563,076 sockeye salmon (Table 13) which was 32% of the total catch from both runs combined (Table 21).

The late run escapement to Chignik Lake was estimated at 392,905 sockeye salmon and had a higher than average age 1.3 component (Tables 14 and 18). The total catch attributed to the Chignik Lake run from the Chignik Area, the Cape Igvak Section of the KMA, and the SEDM of Area M was approximately 1,214,403 sockeye salmon. This harvest accounted for approximately 68% of the total Chignik River system harvest (Table 21).

The transition timing was estimated inseason to be later than usual with a "50/50 date" (the date on which the early and late runs were of equal proportion) estimated to be July 15. When the postseason models were employed, the 50/50 date was estimated at July 12 by the age 2.3 model for the age 2.3 sockeye salmon and at July 6 for the age 1.3 sockeye salmon by the age 1.3 model. Since age 1.3 sockeye salmon dominated the catch and escapement during the transition, the overall 50/50 date was heavily weighted toward the results of the age 1.3 model. The overall 50/50 date for both models when applied to the catch and escapements was estimated on July 6.

The date that the Chignik Lake stock was estimated to comprise 100% of the run was August 3 (Table 14). This is contrary to the inseason assumption that the run is composed of 100% Chignik Lake on after July 31, however, the small proportion of Black Lake sockeye salmon that occur after July 31 (2% on August 1) are not significant.

The ANOVA indicated that the two Chignik Lake scale standards were statistically different (Table 20) despite the assumption that the age 1.2 Chignik Lake sockeye salmon scales from one season are analogous to the Chignik Lake age 1.3 scale measurements from the subsequent season. The relative dissimilarity of the Chignik Lake age 1.2 and age 1.3 growth patterns may explain the discrepancy between the estimates of transition timing between the two runs by the inseason model and the postseason model which used different standards. While the inseason model did successfully partition the two runs, the precision of the model was likely affected by the fact that the Chignik Lake standards were relatively different.

When the inseason Chignik Lake standard (age 1.2) was tested against the Black Lake standard (age 1.3), the ANOVAs indicated that the number of circuli was statistically different and the maximum freshwater growth was not statistically different. These two standards were used to represent the two different stocks for the inseason analysis and the larger the difference between them, the more likely the model will be a powerful tool for apportioning the unknown samples to their stock of origin. Because the maximum freshwater measurement growth variable was not statistically different between the inseason standards and that variable is likely to be characteristic of a particular stock, it was not used as a variable in SPA. The fact that this variable was not statistically different between the two samples could have been caused by the lower than desired sample size from the age 1.2 standard (60 fish). Further, the Black Lake and Chignik Lake stocks are thought to share freshwater rearing area for a portion of their freshwater residence (Narver 1966, Parr 1972). If they share rearing area during the same time, their growth patterns are likely to be more similar thereby making apportionment by scale pattern more difficult.

The fact that the Chignik Lake siblings had significant differences in growth patterns and that the age 1.2 Chignik Lake sockeye salmon were relatively similar to the age 1.3 Black Lake sockeye salmon scales (although still significantly different for purposes of SPA) could have contributed to a later estimated transition timing when the age 1.2 Chignik Lake standard was used inseason as opposed to the timing estimated when the postseason Chignik Lake age 1.3 standard was used. The fact that the Black Lake age 1.3 standard was significantly different (for the variables tested) than the Chignik Lake age 1.3 standard infers that the postseason model utilizing those two standards would produce a more reliable estimate than the estimate provided by the inseason model.

Since the inseason model performed less accurately than desired with a nine day discrepancy between the inseason and postseason models, efforts were made during the 2001 season to improve the model for the 2002 season. Catch sampling frequency during the late portion of the season, from which the age x.2 scale samples will be used for the inseason age x.3 standards for the Chignik Lake stock next year, was increased. Further, efforts were made to collect size selective samples for smaller fish to get a higher number of age x.2 scale samples. These efforts should improve the amount of scale samples available for the 2002 Chignik Lake standard thereby achieving the sample goal and reducing the variability of the model.

LITERATURE CITED

Conrad, R.H. 1983. Management applications of scale pattern analysis methods for the sockeye salmon runs to Chignik, Alaska. M.S. Thesis, University of Washington, Seattle.

Conrad, R.H. 1984. Stock composition of the 1983 sockeye salmon (Oncorhynchus nerka) run to the Chignik Lakes estimated using scale patterns and linear discriminant functions. Alaska Department of Fish and Game, Division of Commercial Fisheries, Anchorage.

Cook, R.C. and G.A. Lord. 1978, Identification of Bristol Bay sockeye salmon by evaluating scale patterns with a polynomial discriminant method. U.S. Fish and Wildlife Service, Fisheries Bulletin 76(2):415-23.

Dahlberg, M.L. 1968. Analysis of the dynamics of sockeye salmon returns to the Chignik Lakes, Alaska. Ph.D. Dissertation, University of Washington, Seattle.

Lechner, B.J. 1965. Chignik River Tagging Programs. Memorandum Dated November 17, 1965 to Robert J. Simon, Regional Supervisor, Division of Commercial Fisheries, Alaska Department of Fish and Game, Kodiak.

Narver, D.W. 1966. Pelagial ecology and carrying capacity of sockeye in the Chignik Lakes, Alaska. Ph.D. Thesis. Univ. of Washington, Seattle. 348 p.

Parr, W.H., Jr. 1972. Interactions between sockeye salmon and resident lake fish in the Chignik Lakes, Alaska. M. Sc. thesis. Univ. of Washington, Seattle. 103 p.

Phinney, D.E. and J. Lechner. 1969. Studies of adult Chignik sockeye salmon in 1967. Informational leaflet 130. Alaska Department of Fish and Game, Juneau.

Quinn, T. J., II, and R. B. Deriso. 1999. Quantitative fish dynamics. Oxford University Press, New York. 480p.

Swanton, C.O. 1992. Stock interrelationships of sockeye salmon runs, Alitak Bay District, Kodiak Island Alaska. M.S. Thesis, University of Washington, Seattle.

Table 1. Age composition of Black Lake sockeye salmon escapement samples, 2001.

		Ages								
Date		0.3	0.4	1.2	1.3	1.4	2.2	2.3	2.4	Total
6/20/01	Numbers	1	0	12	323	0	3	28	0	367
	Percent	0	0	3	88	0	1	8	0	
6/21/01	Numbers	2	1	14	452	1	0	36	1	507
	Percent	0	0	3	89	0	0	7	0	
6/22/01	Numbers	3	1	17	429	4	4	33	0	491
	Percent	1	0	3	87	1	1	7	0	
6/23/01	Numbers	1	1	21	424	0	0	6	0	453
	Percent	0	0	5	94	0	0	1	0	
Total	Numbers	7	3	64	1,628	5	7	103	1	1,818
	Percent	0	0	4	90	0	0	6	0	

Table 2. Age composition of Chignik Lagoon sockeye salmon commercial catch and test fishery samples, 2001.

		Ages													
Date		0.2	0.3	0.4	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.2	3.3	Total
6/6/01	[a] Numbers	0	4	0	0	10	284	1	0	2	10	0	0	0	311
	Percent	0	1	0	0	3	91	0	0	1	3	0	0	0	
6/11/01	[a] Numbers	0	3	0	0	7	283	2	0	0	18	1	0	0	314
	Percent	0	1	0	0	2	90	1	0	0	6	0	0	0	
6/13/01	[a] Numbers	0	8	1	0	15	476	4	0	3	23	1	0	0	531
	Percent	0	2	0	0	3	90	1	0	1	4	0	0	0	
6/16/01	Numbers	0	6	0	0	18	380	7	0	5	17	0	0	0	433
	Percent	0	1	0	0	4	88	2	0	1	4	0	0	0	
6/19/01	Numbers	0	2	0	0	12	400	2	0	4	26	0	0	0	446
	Percent	0	0	0	0	3	90	0	0	1	6	0	0	0	
6/20/01	Numbers	0	4	2	1	15	457	7	0	0	8	1	0	0	495
	Percent	0	1	0	0	3	92	1	0	0	2	0	0	0	
6/22/01	Numbers	0	2	0	1	24	480	0	0	3	7	0	0	0	517
	Percent	0	0	0	0	5	93	0	0	1	1	0	0	0	
6/25/01	Numbers	0	3	0	0	32	439	1	0	3	22	0	0	0	500
	Percent	0	1	0	0	6	88	0	0	1	4	0	0	0	
6/28/01	[a] Numbers	0	1	0	0	18	393	2	1	3	13	0	0	0	431
	Percent	0	0	0	0	4	91	0	0	1	3	0	0	0	
7/1/01	[a] Numbers	0	1	0	0	27	400	1	1	6	21	0	0	0	457
	Percent	0	0	0	0	6	88	0	0	1	5	0	0	0	
7/3/01	Numbers	0	4	0	0	19	481	2	1	6	15	0	0	0	528
	Percent	0	1	0	0	4	91	0	0	1	3	0	0	0	
7/6/01	Numbers	0	1	0	0	16	442	3	0	6	7	0	0	0	475
	Percent	0	0	0	0	3	93	1	0	1	1	0	0	0	
7/9/01	Numbers	1	0	1	0	12	319	2	0	3	111	0	0	0	449
	Percent	0	0	0	0	3	71	0	0	1	25	0	0	0	

-Continued-

Table 2. (page 2 of 2)

Date		Ages													
		0.2	0.3	0.4	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.2	3.3	Total
7/13/01	Numbers	0	1	0	1	12	336	3	0	7	117	0	0	0	477
	Percent	0	0	0	0	3	70	1	0	1	25	0	0	0	
7/16/01 [a]	Numbers	0	4	0	1	10	319	3	0	2	140	0	0	1	480
	Percent	0	1	0	0	2	66	1	0	0	29	0	0	0	
7/20/01 [a]	Numbers	0	0	0	0	7	306	1	0	8	157	0	0	0	479
	Percent	0	0	0	0	1	64	0	0	2	33	0	0	0	
7/25/01 [a]	Numbers	0	0	0	0	12	274	0	0	18	150	2	0	0	456
	Percent	0	0	0	0	3	60	0	0	4	33	0	0	0	
7/31/01	Numbers	0	0	0	2	19	117	1	2	39	296	2	0	1	479
	Percent	0	0	0	0	4	24	0	0	8	62	0	0	0	
8/6/01	Numbers	0	0	0	1	5	102	0	1	20	295	2	1	0	427
	Percent	0	0	0	0	1	24	0	0	5	69	0	0	0	
8/13/01	Numbers	0	1	0	0	2	78	1	0	8	391	0	0	0	481
	Percent	0	0	0	0	0	16	0	0	2	81	0	0	0	
8/21/01	Numbers	0	1	0	1	0	39	0	1	6	409	0	2	3	462
	Percent	0	0	0	0	0	8	0	0	1	89	0	0	1	
8/24/01	Numbers	0	1	0	0	0	31	0	1	3	424	2	3	1	466
	Percent	0	0	0	0	0	7	0	0	1	91	0	1	0	
8/30/01	Numbers	0	0	0	0	1	37	0	0	24	405	1	8	0	476
	Percent	0	0	0	0	0	8	0	0	5	85	0	2	0	
Total	Numbers	1	47	4	8	293	6,873	43	8	179	3,082	12	14	6	10,570
	Percent	0	0	0	0	3	65	0	0	2	29	0	0	0	

[a] Sample was collected from the department's test fishery.

Table 3. Age composition of Chignik Lagoon catch samples by day, post July 31, 2000.

Date		Ages													Total
		0.2	0.3	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3	
8/1/00	Numbers	3	10	0	26	174	1	0	17	235	2	0	0	0	468
	Percent	1	2	0	6	37	0	0	4	50	0	0	0	0	
8/10/00	Numbers	1	2	1	8	71	2	0	31	205	1	1	0	0	323
	Percent	0	1	0	2	22	1	0	10	63	0	0	0	0	
8/13/00	Numbers	1	6	0	19	100	0	1	36	266	0	0	0	0	429
	Percent	0	1	0	4	23	0	0	8	62	0	0	0	0	
8/21/00	Numbers	0	1	0	15	66	3	0	17	159	0	0	0	0	261
	Percent	0	0	0	6	25	1	0	7	61	0	0	0	0	
8/26/00	Numbers	0	7	0	33	121	1	0	55	255	1	0	0	0	473
	Percent	0	1	0	7	26	0	0	12	54	0	0	0	0	
8/30/00	Numbers	0	0	0	21	65	2	2	64	140	4	0	0	2	300
	Percent	0	0	0	7	22	1	1	21	47	1	0	0	1	
Total	Numbers	5	26	1	122	597	9	3	220	1,260	8	1	0	2	2,254
	Percent	0	1	0	5	26	0	0	10	56	0	0	0	0	100

Table 4. Estimated delay time for sockeye salmon traveling to Chignik Lagoon.

Location	Delay Days	Statistical Areas
Weir Count	-1	
Chignik Lagoon	0	27110
Outer Chignik Bay Section	1	27220-27250
Cape Kumlik Section	2	27262-27264
Eastern District	3	27260, 27270-27296
Cape Igvak	5	26275-26295
Western District	2	27370-27394
Perryville District	3	27540-27560
Stepovak	5	28115-28155, 28170-28190

Table 5. Age composition of Eastern District (CMA) sockeye salmon catch samples, 2001.

Period		Ages 1.2	1.3	2.2	2.3	2.4	3.2	Total
8/11/01	Numbers	2	3	13	213	1	3	235
	Percent	1	1	6	91	0	1	
Total	Numbers	2	3	13	213	1	3	235
	Percent	1	1	6	91	0	1	

Table 6. Age composition of Western District (CMA) sockeye salmon catch samples, 2001.

		Ages												
Date		0.3	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.2	3.3	4.2	Total
7/27/01	Numbers	2	0	76	58	4	2	192	110	0	23	23	3	493
	Percent	0	0	15	12	1	0	39	22	0	5	5	1	
8/5/01	Numbers	0	1	39	27	1	6	185	124	1	51	39	5	479
	Percent	0	0	8	6	0	1	39	26	0	11	8	1	
Total	Numbers	2	1	115	85	5	8	377	234	1	74	62	8	972
	Percent	0	0	12	9	1	1	39	24	0	8	6	1	

Table 7. Age composition of Central District (CMA) sockeye salmon catch samples, 2001.

Date		Ages								Total
		0.3	0.4	1.2	1.3	2.2	2.3	2.4	3.2	
7/13/01	Numbers	2	1	12	191	9	275	1	1	492
	Percent	0	0	2	39	2	56	0	0	
7/31/01	Numbers	1	0	8	58	34	372	2	0	475
	Percent	0	0	2	12	7	78	0	0	
Total	Numbers	3	1	20	249	43	647	3	1	967
	Percent	0	0	2	26	4	67	0	0	

Table 8. Classification accuracy for Chignik and Black Lake inseason and postseason run apportionment scale pattern analysis models.

	Model Classification Accuracy					
	Age 1.3 Inseason		Age 1.3 Postseason		Age 2.3 Postseason	
Actual Destination	Black Lake	Chignik Lake	Black Lake	Chignik Lake	Black Lake	Chignik Lake
Black Lake	84.5%	15.5%	85.5%	14.5%	92.4%	7.6%
Chignik Lake	13.3%	86.7%	25.5%	74.6%	6.0%	94.0%

Table 9. Results from the Chignik River system age 1.3 sockeye salmon inseason SPA model.[a]

					Second Order Estimate - Cook and Lord					
			Model Results		Black Lake			Chignik Lake		
Sample Number	Catch Date	Unknown Sample Size	Black L	Chignik L	Low	Point	High	Low	Point	High
1	6-Jun	74	0.81	0.19	0.83	0.95	1.07	0.00	0.05	0.17
2	11-Jun	73	0.78	0.22	0.78	0.91	1.03	0.00	0.09	0.22
3	13-Jun	100	0.78	0.22	0.80	0.91	1.02	0.00	0.09	0.20
4	16-Jun	100	0.86	0.14	0.92	1.02	1.12	0.00	0.00	0.08
5	19-Jun	100	0.68	0.32	0.65	0.77	0.89	0.11	0.32	0.35
6	20-Jun	100	0.76	0.24	0.77	0.88	0.99	0.01	0.12	0.23
7	22-Jun	99	0.83	0.16	0.89	0.99	1.09	0.00	0.01	0.11
8	25-Jun	100	0.76	0.24	0.77	0.88	0.99	0.01	0.12	0.23
9	28-Jun	100	0.65	0.35	0.61	0.73	0.85	0.15	0.27	0.40
10	1-Jul	100	0.73	0.27	0.72	0.84	0.95	0.05	0.16	0.28
11	3-Jul	100	0.75	0.25	0.75	0.87	0.98	0.02	0.13	0.25
12	6-Jul	77	0.71	0.29	0.69	0.82	0.95	0.05	0.18	0.31
13	9-Jul	95	0.71	0.30	0.68	0.80	0.92	0.08	0.20	0.32
14	13-Jul	100	0.49	0.51	0.63	0.50	0.37	0.37	0.50	0.63
15	16-Jul	100	0.47	0.53	0.34	0.47	0.61	0.40	0.53	0.66
16	20-Jul	100	0.24	0.76	0.02	0.15	0.28	0.72	0.85	0.98
17	25-Jul	100	0.29	0.71	0.09	0.22	0.36	0.65	0.78	0.91
18	31-Jul	49	0.33	0.67	0.10	0.27	0.45	0.55	0.73	0.90
19	6-Aug	22	0.36	0.64	0.08	0.33	0.57	0.43	0.67	0.92
20	13-Aug	25	0.52	0.48	0.31	0.54	0.78	0.22	0.46	0.69
21	21-Aug	9	0.56	0.44	0.21	0.59	0.98	0.02	0.41	0.79
22	24-Aug	4	0.25	0.75	-0.34	0.17	0.68	0.33	0.83	1.00
23	30-Aug	None Measurable								

[a] The second order point estimate for the Chignik Lake stock is used to calculate the logistic curve and estimate the stock composition.

Table 10. Estimated daily proportion of Chignik River sockeye salmon to Chignik Lake smoothed by the common logistic function, using age 1.3 scales inseason and age 1.3 and 2.3 scales postseason.

	Model		
Date	1.3 inseason	1.3 postseason	2.3 postseason
25-May	0.3%	0.8%	4.4%
26-May	0.3%	0.8%	4.7%
27-May	0.4%	0.9%	5.0%
28-May	0.4%	1.1%	5.2%
29-May	0.5%	1.2%	5.5%
30-May	0.6%	1.3%	5.9%
31-May	0.6%	1.5%	6.2%
1-Jun	0.7%	1.6%	6.6%
2-Jun	0.8%	1.8%	6.9%
3-Jun	0.9%	2.0%	7.3%
4-Jun	1.0%	2.3%	7.7%
5-Jun	1.2%	2.5%	8.2%
6-Jun	1.3%	2.8%	8.6%
7-Jun	1.5%	3.1%	9.1%
8-Jun	1.7%	3.5%	9.6%
9-Jun	1.9%	3.9%	10.1%
10-Jun	2.1%	4.3%	10.7%
11-Jun	2.4%	4.8%	11.3%
12-Jun	2.7%	5.3%	11.9%
13-Jun	3.0%	5.9%	12.6%
14-Jun	3.4%	6.6%	13.3%
15-Jun	3.8%	7.3%	14.0%
16-Jun	4.2%	8.1%	14.7%
17-Jun	4.7%	9.0%	15.5%
18-Jun	5.3%	10.0%	16.4%
19-Jun	6.0%	11.0%	17.2%
20-Jun	6.7%	12.2%	18.2%
21-Jun	7.5%	13.5%	19.1%
22-Jun	8.3%	14.9%	20.1%
23-Jun	9.3%	16.4%	21.1%
24-Jun	10.4%	18.1%	22.2%
25-Jun	11.6%	19.9%	23.4%
26-Jun	12.9%	21.8%	24.5%
27-Jun	14.3%	23.9%	25.8%
28-Jun	15.8%	26.2%	27.1%
29-Jun	17.5%	28.6%	28.4%
30-Jun	19.3%	31.2%	29.8%

-Continued-

Table 10. (page 2 of 2)

	Model		
Date	1.3 inseason	1.3 postseason	2.3 postseason
1-Jul	18.1%	34.0%	31.2%
2-Jul	20.0%	36.9%	32.7%
3-Jul	21.9%	40.0%	34.2%
4-Jul	24.0%	43.2%	35.8%
5-Jul	26.3%	46.6%	37.5%
6-Jul	28.7%	50.1%	39.2%
7-Jul	27.6%	53.7%	41.0%
8-Jul	30.0%	57.4%	42.8%
9-Jul	32.5%	61.2%	44.6%
10-Jul	35.9%	65.0%	46.5%
11-Jul	38.7%	68.9%	48.5%
12-Jul	41.5%	72.7%	50.5%
13-Jul	44.5%	76.6%	52.6%
14-Jul	47.4%	80.4%	54.7%
15-Jul	49.4%	84.2%	56.8%
16-Jul	52.3%	87.9%	59.0%
17-Jul	55.2%	91.5%	61.2%
18-Jul	62.9%	95.0%	63.5%
19-Jul	65.9%	98.3%	65.8%
20-Jul	68.9%	100.0%	68.1%
21-Jul	71.7%		70.5%
22-Jul	71.1%		72.8%
23-Jul	74.5%		75.2%
24-Jul	77.9%		77.6%
25-Jul	81.3%		80.0%
26-Jul	84.7%		82.5%
27-Jul	88.1%		84.9%
28-Jul	91.4%		87.3%
29-Jul	94.6%		89.7%
30-Jul	97.8%		92.1%
31-Jul	100.0%		94.5%
1-Aug			96.9%
2-Aug			99.3%
3-Aug			100.0%

Table 11. Results from the Chignik River system age 1.3 sockeye salmon postseason SPA model.[a]

Sample		Unknown	Model Results		Second Order Estimate - Cook and Lord					
					Black Lake			Chignik Lake		
Number	Catch Date	Sample Size	Black L	Chignik L	Low	Point	High	Low	Point	High
1	6-Jun	74	0.78	0.22	0.74	0.88	1.03	-0.03	0.12	0.26
2	11-Jun	73	0.80	0.21	0.75	0.90	1.04	-0.04	0.10	0.25
3	13-Jun	100	0.74	0.26	0.67	0.81	0.94	0.06	0.13	0.33
4	16-Jun	100	0.86	0.14	0.89	1.01	1.12	0.00	0.00	0.11
5	19-Jun	100	0.71	0.29	0.62	0.76	0.90	0.10	0.24	0.38
6	20-Jun	100	0.74	0.26	0.67	0.81	0.94	0.06	0.19	0.33
7	22-Jun	99	0.79	0.21	0.76	0.89	1.02	0.00	0.11	0.24
8	25-Jun	100	0.74	0.26	0.67	0.81	0.94	0.06	0.19	0.33
9	28-Jun	100	0.64	0.36	0.50	0.64	0.79	0.21	0.36	0.50
10	1-Jul	100	0.73	0.27	0.66	0.79	0.93	0.07	0.21	0.34
11	3-Jul	100	0.60	0.40	0.43	0.58	0.72	0.28	0.42	0.57
12	6-Jul	77	0.63	0.37	0.46	0.62	0.79	0.22	0.38	0.54
13	9-Jul	95	0.50	0.51	0.24	0.40	0.56	0.44	0.60	0.76
14	13-Jul	100	0.38	0.62	0.05	0.21	0.37	0.63	0.79	0.95
15	16-Jul	100	0.33	0.67	0.00	0.13	0.29	0.71	0.87	1.00
16	20-Jul	100	0.11	0.89	0.00	0.00	0.07	1.07	1.00	1.00
17	25-Jul	100	0.11	0.89	0.00	0.00	0.07	1.07	1.00	1.00
18	31-Jul	49	0.20	0.80	0.00	0.00	0.12	0.88	1.00	1.00
19	6-Aug	22	0.32	0.68	0.00	0.11	0.40	0.60	0.89	1.00
20	13-Aug	25	0.27	0.73	0.00	0.03	0.29	0.71	0.97	1.00
21	21-Aug	9	0.33	0.67	0.00	0.14	0.58	0.42	0.87	1.00
22	24-Aug	4	0.25	0.75	0.00	0.00	0.60	0.40	1.00	1.00
23	30-Aug	None Measurable								

[a] The second order point estimate for the Chignik Lake stock is used to calculate the logistic curve and estimate the stock composition.

Table 12. Results from the Chignik River System age 2.3 sockeye salmon postseason SPA model.[a]

Sample Number	Catch Date	Unknown Sample Size	Model Results		Second Order Estimate - Cook and Lord					
					Black Lake			Chignik Lake		
			Black L	Chignik L	Low	Point	High	Low	Point	High
1	6-Jun [b]	4	0.93	0.07	0.91	1.00	1.00	0.00	0.00	0.09
2	11-Jun [b]	11	0.93	0.07	0.91	1.00	1.00	0.00	0.00	0.09
3	13-Jun [b]	16	0.93	0.07	0.91	1.00	1.00	0.00	0.00	0.09
4	16-Jun [b]	11	0.93	0.07	0.91	1.00	1.00	0.00	0.00	0.09
5	19-Jun [b]	7	0.70	0.30	0.58	0.74	0.90	0.11	0.26	0.42
6	20-Jun [b]	5	0.70	0.30	0.58	0.74	0.90	0.11	0.26	0.42
7	22-Jun [b]	6	0.70	0.30	0.58	0.74	0.90	0.11	0.26	0.42
8	25-Jun [b]	15	0.70	0.30	0.58	0.74	0.90	0.11	0.26	0.42
9	28-Jun [b]	8	0.72	0.28	0.62	0.76	0.91	0.09	0.24	0.39
10	1-Jul [b]	9	0.72	0.28	0.62	0.76	0.91	0.09	0.24	0.39
11	3-Jul [b]	8	0.72	0.28	0.62	0.76	0.91	0.09	0.24	0.39
12	6-Jul [b]	14	0.72	0.28	0.62	0.76	0.91	0.09	0.24	0.39
13	9-Jul	45	0.36	0.64	0.20	0.34	0.48	0.52	0.66	0.80
14	13-Jul	63	0.46	0.54	0.34	0.46	0.59	0.41	0.54	0.66
15	16-Jul	66	0.35	0.65	0.22	0.33	0.45	0.55	0.67	0.78
16	20-Jul	75	0.41	0.59	0.30	0.41	0.52	0.48	0.59	0.70
17	25-Jul	56	0.23	0.77	0.09	0.20	0.31	0.69	0.80	0.91
18	31-Jul	100	0.11	0.89	0.00	0.06	0.13	0.88	0.94	1.00
19	6-Aug	84	0.10	0.91	0.00	0.04	0.11	0.89	0.96	1.00
20	13-Aug	79	0.20	0.80	0.07	0.17	0.26	0.74	0.84	0.93
21	21-Aug	84	0.08	0.92	0.00	0.03	0.09	0.91	0.97	1.00
22	24-Aug	83	0.10	0.90	0.00	0.04	0.11	0.89	0.96	1.00
23	30-Aug	81	0.04	0.96	0.00	0.00	0.03	0.97	1.00	1.00

[a] The second order point estimate for the Chignik Lake stock is used to calculate the logistic curve and estimate the stock composition.

[a] Due to small sample sizes, the June 6-16, June 19-25, and June 28 - July 6 samples were pooled and only one estimate was calculated from each pooled group.

Table 13. Daily and cumulative sockeye salmon catch and escapement as determined by postseason scale pattern analysis for the Black Lake system stock, 2001.

Date	Escapement Counts	Catch	Daily Total	Cumulative Catch and Escapement	Cumulative Percent	Daily Proportion of Entire run
24-May	34	0	34	34	0	100%
25-May	181	0	181	215	0	99%
26-May	188	0	188	403	0	99%
27-May	67	0	67	470	0	99%
28-May	846	0	846	1,316	0.1	99%
29-May	891	0	891	2,207	0.2	99%
30-May	862	0	862	3,069	0.2	99%
31-May	383	0	383	3,452	0.3	98%
1-Jun	273	0	273	3,725	0.3	98%
2-Jun	2,920	0	2,920	6,645	0.5	98%
3-Jun	6,642	0	6,642	13,287	1.0	98%
4-Jun	5,027	0	5,027	18,314	1.4	98%
5-Jun	1,199	0	1,199	19,513	1.5	97%
6-Jun	6,980	361	7,341	26,854	2.1	97%
7-Jun	15,058	0	15,058	41,912	3.2	97%
8-Jun	13,922	0	13,922	55,834	4.3	96%
9-Jun	10,431	29	10,460	66,294	5.1	96%
10-Jun	16,405	0	16,405	82,699	6.3	95%
11-Jun	17,472	387	17,859	100,558	7.7	95%
12-Jun	20,751	0	20,751	121,309	9.3	94%
13-Jun	17,746	1,700	19,446	140,755	10.8	94%
14-Jun	29,857	0	29,857	170,612	13.1	93%
15-Jun	35,673	0	35,673	206,285	15.8	92%
16-Jun	34,503	5,640	40,143	246,428	18.9	92%
17-Jun	21,303	0	21,303	267,731	20.5	91%
18-Jun	25,703	0	25,703	293,434	22.5	90%
19-Jun	54,319	1,729	56,048	349,482	26.8	89%
20-Jun	53,080	31,388	84,468	433,950	33.2	88%
21-Jun	43,057	0	43,057	477,007	36.5	86%
22-Jun	32,569	21,940	54,509	531,516	40.7	85%
23-Jun	23,956	35,918	59,874	591,390	45.3	83%
24-Jun	25,962	23,526	49,488	640,878	49.1	82%
25-Jun	24,560	0	24,560	665,438	51.0	80%
26-Jun	19,924	3,297	23,221	688,659	52.7	78%
27-Jun	26,303	13,115	39,418	728,077	55.8	76%
28-Jun	24,368	885	25,253	753,330	57.7	74%
29-Jun	12,740	41,332	54,072	807,402	61.8	71%
30-Jun	31,173	27,063	58,236	865,638	66.2	69%
1-Jul	44,783	34,549	79,332	944,970	72.3	66%
2-Jul	10,524	28,889	39,413	984,383	75.3	63%
3-Jul	1,946	30,521	32,467	1,016,850	77.8	60%
4-Jul	631	30,352	30,983	1,047,833	80.1	57%
5-Jul	1,243	29,087	30,330	1,078,163	82.5	54%
6-Jul	1,653	26,099	27,752	1,105,915	84.6	50%
7-Jul	1,456	22,214	23,670	1,129,585	86.4	50%

-Continued-

Table 13. (page 2 of 2)

Date	Escapement Counts	Catch	Daily Total	Cumulative Catch and Escapement	Cumulative Percent	Daily Proportion of Entire run
8-Jul	766	19,925	20,691	1,150,276	88	46%
9-Jul	885	21,615	22,500	1,172,776	89.7	43%
10-Jul	446	20,289	20,735	1,193,511	91.3	40%
11-Jul	343	16,866	17,209	1,210,720	92.6	36%
12-Jul	232	9,124	9,356	1,220,076	93.3	33%
13-Jul	137	17,073	17,210	1,237,286	94.7	30%
14-Jul	465	10,835	11,300	1,248,586	95.5	27%
15-Jul	2,137	8,165	10,302	1,258,888	96.3	24%
16-Jul	2,459	2,755	5,214	1,264,102	96.7	21%
17-Jul	2,554	4,044	6,598	1,270,700	97.2	19%
18-Jul	2,957	1,760	4,717	1,275,417	97.6	16%
19-Jul	1,103	1,088	2,191	1,277,608	97.7	13%
20-Jul	833	281	1,114	1,278,722	97.8	11%
21-Jul	1,407	0	1,407	1,280,129	97.9	11%
22-Jul	1,787	0	1,787	1,281,916	98.1	10%
23-Jul	2,197	0	2,197	1,284,113	98.2	9%
24-Jul	1,864	0	1,864	1,285,977	98.4	8%
25-Jul	1,328	199	1,527	1,287,504	98.5	7%
26-Jul	182	10,410	10,592	1,298,096	99.3	12%
27-Jul	81	3,115	3,196	1,301,292	99.6	11%
28-Jul	54	2,338	2,392	1,303,684	99.7	9%
29-Jul	25	1,333	1,358	1,305,042	99.8	7%
30-Jul	17	1,047	1,064	1,306,106	99.9	5%
31-Jul	44	669	713	1,306,819	100	4%
1-Aug	113	113	226	1,307,045	100	2%
2-Aug	33	11	44	1,307,089	100	1%
3-Aug	0	0	0	1,307,089	100	0%
Total	744,013	563,076	1,307,089			

Table 14. Daily and cumulative sockeye salmon catch and escapement as determined by postseason scale pattern analysis for the Chignik Lake system stock, 2001.

Date	Escapement Counts	Catch	Daily Total	Cumulative Catch and Escapement	Cumulative Percent	Daily Proportion of Entire run
24-May	0	0	0	0	0	0%
25-May	2	0	2	2	0	1%
26-May	2	0	2	4	0	1%
27-May	1	0	1	5	0	1%
28-May	10	0	10	15	0	1%
29-May	12	0	12	27	0	1%
30-May	13	0	13	40	0	1%
31-May	6	0	6	46	0	2%
1-Jun	5	0	5	51	0	2%
2-Jun	60	0	60	111	0	2%
3-Jun	152	0	152	263	0	2%
4-Jun	128	0	128	391	0	2%
5-Jun	34	0	34	425	0	3%
6-Jun	218	11	229	654	0	3%
7-Jun	542	0	542	1,196	0.1	3%
8-Jun	556	0	556	1,752	0.1	4%
9-Jun	462	1	463	2,215	0.1	4%
10-Jun	806	0	806	3,021	0.2	5%
11-Jun	953	21	974	3,995	0.2	5%
12-Jun	1,245	0	1,245	5,240	0.3	6%
13-Jun	1,184	113	1,297	6,537	0.4	6%
14-Jun	2,223	0	2,223	8,760	0.5	7%
15-Jun	2,956	0	2,956	11,716	0.7	8%
16-Jun	3,185	521	3,706	15,422	1	8%
17-Jun	2,219	0	2,219	17,641	1.1	9%
18-Jun	2,981	0	2,981	20,622	1.3	10%
19-Jun	7,022	223	7,245	27,867	1.7	11%
20-Jun	7,443	4,401	11,844	39,711	2.5	12%
21-Jun	6,772	0	6,772	46,483	2.9	14%
22-Jun	5,740	3,867	9,607	56,090	3.5	15%
23-Jun	4,786	7,175	11,961	68,051	4.2	17%
24-Jun	5,809	5,265	11,074	79,125	4.9	18%
25-Jun	6,162	0	6,162	85,287	5.3	20%
26-Jun	5,599	926	6,525	91,812	5.7	22%
27-Jun	8,312	4,144	12,456	104,268	6.5	24%
28-Jun	8,670	315	8,985	113,253	7	26%
29-Jun	5,109	16,576	21,685	134,938	8.4	29%
30-Jun	14,101	12,242	26,343	161,281	10.0	31%
1-Jul	22,891	17,660	40,551	201,832	12.6	34%
2-Jul	6,112	16,777	22,889	224,721	14.0	37%
3-Jul	1,284	20,140	21,424	246,145	15.3	40%
4-Jul	476	22,904	23,380	269,525	16.8	43%
5-Jul	1,073	25,106	26,179	295,704	18.4	46%
6-Jul	1,637	25,861	27,498	323,202	20.1	50%
7-Jul	1,481	22,589	24,070	347,272	21.6	50%

-Continued-

Table 14. (page 2 of 3)

Date	Escapement Counts	Catch	Daily Total	Cumulative Catch and Escapement	Cumulative Percent	Daily Proportion of Entire run
8-Jul	887	23,053	23,940	371,212	23.1	54%
9-Jul	1,169	28,567	29,736	400,948	24.9	57%
10-Jul	673	30,627	31,300	432,248	26.9	60%
11-Jul	598	29,368	29,966	462,214	28.8	64%
12-Jul	468	18,449	18,917	481,131	29.9	67%
13-Jul	326	40,419	40,745	521,876	32.5	70%
14-Jul	1,237	28,824	30,061	551,937	34.3	73%
15-Jul	6,754	25,801	32,555	584,492	36.4	76%
16-Jul	9,363	10,492	19,855	604,347	37.6	79%
17-Jul	10,933	17,311	28,244	632,591	39.4	81%
18-Jul	15,663	9,323	24,986	657,577	40.9	84%
19-Jul	7,448	7,347	14,795	672,372	41.8	87%
20-Jul	6,742	2,269	9,011	681,383	42.4	89%
21-Jul	11,473	0	11,473	692,856	43.1	89%
22-Jul	15,995	0	15,995	708,851	44.1	90%
23-Jul	21,773	0	21,773	730,624	45.5	91%
24-Jul	20,668	0	20,668	751,292	46.7	92%
25-Jul	16,663	2,495	19,158	770,450	47.9	93%
26-Jul	1,278	73,074	74,352	844,802	52.6	88%
27-Jul	671	25,874	26,545	871,347	54.2	89%
28-Jul	547	23,586	24,133	895,480	55.7	91%
29-Jul	318	16,921	17,239	912,719	56.8	93%
30-Jul	296	17,692	17,988	930,707	57.9	95%
31-Jul	1,080	16,567	17,647	948,354	59.0	96%
1-Aug	4,809	4,809	9,618	957,972	59.6	98%
2-Aug	6,154	2,060	8,214	966,186	60.1	99%
3-Aug	6,846	480	7,326	973,512	60.6	100%
4-Aug	8,529	6,580	15,109	988,621	61.5	100%
5-Aug	1,442	14,241	15,683	1,004,304	62.5	100%
6-Aug	755	15,989	16,744	1,021,048	63.5	100%
7-Aug	742	17,937	18,679	1,039,727	64.7	100%
8-Aug	539	19,552	20,091	1,059,818	65.9	100%
9-Aug	660	20,609	21,269	1,081,087	67.3	100%
10-Aug	682	17,494	18,176	1,099,263	68.4	100%
11-Aug	826	23,342	24,168	1,123,431	69.9	100%
12-Aug	837	21,282	22,119	1,145,550	71.3	100%
13-Aug	1,032	21,995	23,027	1,168,577	72.7	100%
14-Aug	8,464	10,284	18,748	1,187,325	73.9	100%
15-Aug	20,014	5,345	25,359	1,212,684	75.4	100%
16-Aug	5,379	24,946	30,325	1,243,009	77.3	100%
17-Aug	1,127	20,413	21,540	1,264,549	78.7	100%
18-Aug	1,506	26,891	28,397	1,292,946	80.4	100%
19-Aug	1,678	19,479	21,157	1,314,103	81.8	100%
20-Aug	2,924	6,899	9,823	1,323,926	82.4	100%
21-Aug	2,779	23,319	26,098	1,350,024	84.0	100%

-Continued-

Table 14. (page 3 of 3)

Date	Escapement Counts	Catch	Daily Total	Cumulative Catch and Escapement	Cumulative Percent	Daily Proportion of Entire run
22-Aug	3,194	31,218	34,412	1,384,436	86.1	100%
23-Aug	2,365	22,421	24,786	1,409,222	87.7	100%
24-Aug	3,338	30,739	34,077	1,443,299	89.8	100%
25-Aug	2,101	26,356	28,457	1,471,756	91.6	100%
26-Aug	1,923	17,050	18,973	1,490,729	92.7	100%
27-Aug	2,281	25,897	28,178	1,518,907	94.5	100%
28-Aug	1,944	22,345	24,289	1,543,196	96.0	100%
29-Aug	2,531	25,350	27,881	1,571,077	97.7	100%
30-Aug	2,047	16,224	18,271	1,589,348	98.9	100%
31-Aug	0	15,780	15,780	1,605,128	99.9	100%
1-Sep	0	82	82	1,605,210	99.9	100%
2-Sep	0	0	0	1,605,210	99.9	100%
3-Sep	0	0	0	1,605,210	99.9	100%
4-Sep	0	0	0	1,605,210	99.9	100%
5-Sep	0	0	0	1,605,210	99.9	100%
6-Sep	0	2,098	2,098	1,607,308	100.0	100%
Total	392,905	1,214,403	1,607,308			

Table 15. Individual and total run size and estimated 50/50 date, 1983-2001.

Year	Total Black Lake Run	Total Chignik Lake Run	Total Run Size	Estimated 50/50 Date
1983	1,282,459	1,694,542	2,977,001	2-Jul
1984	3,517,697	880,936	4,398,633	20-Jul
1985	1,027,796	815,241	1,843,037	unknown
1986	1,922,067	803,108	2,725,175	23-Jul
1987	2,536,237	634,436	3,170,674	20-Jul
1988	692,654	809,481	1,502,136	8-Jul
1989	618,238	1,486,709	2,104,947	3-Jul
1990	1,017,070	2,083,295	3,100,365	7-Jul
1991	2,374,343	1,038,463	3,412,806	13-Jul
1992	1,107,022	1,181,066	2,288,088	5-Jul
1993	1,291,154	1,532,166	2,823,319	5-Jul
1994	2,364,641	613,821	2,978,462	28-Jul
1995	1,033,295	1,689,287	2,722,582	8-Jul
1996	2,152,972	990,046	3,143,018	20-Jul
1997	631,160	914,141	1,545,301	9-Jul
1998	723,686	1,107,320	1,831,006	5-Jul
1999	2,479,777	1,982,458	4,462,235	9-Jul
2000	2,111,996	844,681	2,956,677	14-Jul
2001	1,307,089	1,607,308	2,914,397	6-Jul
10-year Average 1991-2000	1,627,005	1,189,345	2,816,349	11-Jul

Table 16. Estimated age composition of Black Lake sockeye salmon escapement by week estimated using postseason scale pattern analysis, 2001.

Period		Ages 0.2	1.1	0.3	1.2	2.1	1.3	2.2	1.4	2.3	3.2	2.4	3.3	Other	Total
22	Number	0	0	39	99	0	2,807	19	10	95	0	0	0	0	3,069
5/24-5/30	Percent	0.0	0.0	1.3	3.2	0.0	91.5	0.6	0.3	3.1	0.0	0.0	0.0	0.0	100.0
23	Number	0	0	301	755	0	21,437	143	75	713	0	0	0	0	23,424
5/31-6/06	Percent	0.0	0.0	1.3	3.2	0.0	91.5	0.6	0.3	3.0	0.0	0.0	0.0	0.0	100.0
24	Number	0	0	1,280	2,731	0	100,937	203	757	5,498	0	306	0	73	111,785
6/7-6/13	Percent	0.0	0.0	1.1	2.4	0.0	90.3	0.2	0.7	4.9	0.0	0.3	0.0	0.1	100.0
25	Number	0	107	2,271	8,524	0	228,491	1,925	2,823	9,975	0	107	0	214	254,438
6/14-6/20	Percent	0.0	0.0	0.9	3.4	0.0	89.8	0.8	1.1	3.9	0.0	0.0	0.0	0.1	100.0
26	Number	0	146	847	10,226	107	178,054	1,150	364	5,436	0	0	0	0	196,331
6/21-6/27	Percent	0.0	0.1	0.4	5.2	0.1	90.7	0.6	0.2	2.8	0.0	0.0	0.0	0.0	100.0
27	Number	0	0	346	6,718	274	111,640	1,524	358	5,303	0	0	0	0	126,165
6/28-7/4	Percent	0.0	0.0	0.3	5.3	0.2	88.5	1.2	0.3	4.2	0.0	0.0	0.0	0.0	100.0
28	Number	7	2	8	191	0	5,196	85	37	1,260	0	0	0	7	6,792
7/5-7/11	Percent	0.1	0.0	0.1	2.8	0.0	76.5	1.3	0.5	18.6	0.0	0.0	0.0	0.1	100.0
29	Number	0	11	43	104	0	3,642	248	45	6,836	0	0	11	0	10,941
7/12-7/18	Percent	0.0	0.1	0.4	0.9	0.0	33.3	2.3	0.4	62.5	0.0	0.0	0.1	0.0	100.0
30	Number	0	0	0	2	0	91	1,005	4	9,381	0	36	0	0	10,519
7/19-7/25	Percent	0.0	0.0	0.0	0.0	0.0	0.9	9.6	0.0	89.2	0.0	0.3	0.0	0.0	100.0

-Continued-

Table 16. (page 2 of 2)

Stat Week		Ages 0.2	1.1	0.3	1.2	2.1	1.3	2.2	1.4	2.3	3.2	2.4	3.3	Other	Total
31	Number	0	2	0	0	2	0	53	1	455	0	2	1	0	516
7/26-8/1	Percent	0.0	0.4	0.0	0.0	0.4	0.0	10.3	0.2	88.2	0.1	0.4	0.2	0.0	100.0
32	Number	0	0	0	0	0	0	2	0	31	0	0	0	0	33
8/1-8/8	Percent	0.0	0.2	0.0	0.0	0.2	0.0	6.3	0.0	92.7	0.2	0.5	0.0	0.0	100.0
Total	Number	7	268	5,135	29,350	383	652,295	6,357	4,474	44,983	0	451	12	294	744,013
	Percent	0.0	0.0	0.7	3.9	0.1	87.7	0.9	0.6	6.0	0.0	0.1	0.0	0.0	100.0

Note: Rounding errors (fractions of fish dropped or added during printing) often cause weekly totals to differ from the sum of the age classes. Lake destination (Black Lake or Chignik Lake) is estimated from samples of fish of ages 1.3 and 2.3 only. The age composition of catch and escapement (c/e) is estimated and the destination of age 1.3 fish is applied to the c/e of age 1.3 and 1.2 fish. Similarly, the destination of age 2.3 fish is applied to 2.3 and 2.2 fish. The average of these four age classes is used to estimate the destination of all other ages. These estimates are calculated for each day in double precision numbers. The results are summed by week and rounded for printing.

Table 17. Estimated age composition of Black Lake sockeye salmon catch by week estimated using postseason scale pattern analysis, 2001.

Period		Ages													Total
		0.2	1.1	0.3	1.2	2.1	1.3	2.2	1.4	2.3	3.2	2.4	3.3	Other	
23	Number	0	0	5	12	0	330	2	1	11	0	0	0	0	361
5/31-6/06	Percent	0.0	0.0	1.3	3.2	0.0	91.5	0.6	0.3	3.0	0.0	0.0	0.0	0.0	100.0
24	Number	0	0	30	57	0	1,905	9	15	91	0	5	0	3	2,116
6/7-6/13	Percent	0.0	0.0	1.4	2.7	0.0	90.0	0.4	0.7	4.3	0.0	0.2	0.0	0.2	100.0
25	Number	0	63	340	1,234	0	35,537	75	543	774	0	63	0	127	38,757
6/14-6/20	Percent	0.0	0.2	0.9	3.2	0.0	91.7	0.2	1.4	2.0	0.0	0.2	0.0	0.3	100.0
26	Number	0	42	480	5,521	38	87,708	569	195	3,242	0	0	0	0	97,796
6/21-6/27	Percent	0.0	0.0	0.5	5.6	0.0	89.7	0.6	0.2	3.3	0.0	0.0	0.0	0.0	100.0
27	Number	0	0	741	9,261	340	172,887	2,544	646	7,173	0	0	0	0	193,591
6/28-7/4	Percent	0.0	0.0	0.4	4.8	0.2	89.3	1.3	0.3	3.7	0.0	0.0	0.0	0.0	100.0
28	Number	142	78	194	4,225	0	115,378	2,102	865	32,968	0	0	0	142	156,095
7/5-7/11	Percent	0.1	0.0	0.1	2.7	0.0	73.9	1.3	0.6	21.1	0.0	0.0	0.0	0.1	100.0
29	Number	0	100	237	868	0	26,056	965	313	25,173	0	0	45	0	53,756
7/12-7/18	Percent	0.0	0.2	0.4	1.6	0.0	48.5	1.8	0.6	46.8	0.0	0.0	0.1	0.0	100.0
30	Number	0	0	0	2	0	90	83	3	1,389	0	1	0	0	1,568
7/19-7/25	Percent	0.0	0.0	0.0	0.1	0.0	5.7	5.3	0.2	88.6	0.0	0.1	0.0	0.0	100.0
31	Number	0	80	0	0	80	0	2,172	40	16,533	0	80	40	0	19,025
7/26-8/1	Percent	0.0	0.4	0.0	0.0	0.4	0.0	11.4	0.2	86.9	0.0	0.4	0.2	0.0	100.0

-Continued-

Table 17. (page 2 of 2)

Stat Week		Ages 0.2	1.1	0.3	1.2	2.1	1.3	2.2	1.4	2.3	3.2	2.4	3.3	Other	Total
32	Number	0	0	0	0	0	0	1	0	10	0	0	0	0	11
8/2-8/8	Percent	0.0	0.2	0.0	0.0	0.2	0.0	6.3	0.0	93.1	0.2	0.5	0.0	0.0	100.0
Total	Number	142	363	2,027	21,180	458	439,891	8,522	2,621	87,364	0	149	85	272	563,076
	Percent	0.0	0.1	0.4	3.8	0.1	78.1	1.5	0.5	15.5	0.0	0.0	0.0	0.0	100.0

Note: Rounding errors (fractions of fish dropped or added during printing) often cause weekly totals to differ from the sum of the age classes. Lake destination (Black Lake or Chignik Lake) is estimated from samples of fish of ages 1.3 and 2.3 only. The age composition of catch and escapement (c/e) is estimated and the destination of age 1.3 fish is applied to the c/e of age 1.3 and 1.2 fish. Similarly, the destination of age 2.3 fish is applied to 2.3 and 2.2 fish. The average of these four age classes is used to estimate the destination of all other ages. These estimates are calculated for each day in double precision numbers. The results are summed by week and rounded for printing.

Table 18. Estimated age composition of Chignik Lake sockeye salmon escapement by week estimated using postseason scale pattern analysis, 2001.

Stat Week		Ages													
		0.2	1.1	0.3	1.2	2.1	1.3	2.2	1.4	2.3	3.2	2.4	3.3	Other	Total
22	Number	0	0	1	1	0	32	1	0	5	0	0	0	0	40
5/24-5/30	Percent	0.0	0.0	1.3	2.8	0.0	79.5	2.7	0.3	13.4	0.0	0.0	0.0	0.0	100.0
23	Number	0	0	8	18	0	504	12	2	60	0	0	0	0	603
5/31-6/06	Percent	0.0	0.0	1.3	2.9	0.0	83.6	2.0	0.3	9.9	0.0	0.0	0.0	0.0	100.0
24	Number	0	0	68	133	0	4,794	28	39	667	0	15	0	5	5,748
6/7-6/13	Percent	0.0	0.0	1.2	2.3	0.0	83.4	0.5	0.7	11.6	0.0	0.3	0.0	0.1	100.0
25	Number	0	15	230	872	0	24,350	345	294	1,878	0	15	0	30	28,029
6/14-6/20	Percent	0.0	0.1	0.8	3.1	0.0	86.9	1.2	1.0	6.7	0.0	0.1	0.0	0.1	100.0
26	Number	0	24	181	2,216	32	38,716	328	98	1,585	0	0	0	0	43,180
6/21-6/27	Percent	0.0	0.1	0.4	5.1	0.1	89.7	0.8	0.2	3.7	0.0	0.0	0.0	0.0	100.0
27	Number	0	0	169	3,142	126	52,096	663	163	2,285	0	0	0	0	58,643
6/28-7/4	Percent	0.0	0.0	0.3	5.4	0.2	88.8	1.1	0.3	3.9	0.0	0.0	0.0	0.0	100.0
28	Number	8	3	8	227	0	6,192	60	41	970	0	0	0	8	7,518
7/5-7/11	Percent	0.1	0.0	0.1	3.0	0.0	82.4	0.8	0.5	12.9	0.0	0.0	0.0	0.1	100.0
29	Number	0	38	146	862	0	32,585	398	169	10,510	0	0	36	0	44,744
7/12-7/18	Percent	0.0	0.1	0.3	1.9	0.0	72.8	0.9	0.4	23.5	0.0	0.0	0.1	0.0	100.0
30	Number	0	0	0	2,738	0	67,387	3,021	30	27,206	0	381	0	0	100,762
7/19-7/25	Percent	0.0	0.0	0.0	2.7	0.0	66.9	3.0	0.0	27.0	0.0	0.4	0.0	0.0	100.0

-Continued-

Table 18. (page 2 of 2)

Stat Week		Ages 0.2	1.1	0.3	1.2	2.1	1.3	2.2	1.4	2.3	3.2	2.4	3.3	Other	Total
31	Number	0	29	0	240	29	2,298	551	9	5,784	11	40	9	0	8,999
7/26-8/1	Percent	0.0	0.3	0.0	2.7	0.3	25.5	6.1	0.1	64.3	0.1	0.4	0.1	0.0	100.0
32	Number	0	56	3	284	56	5,883	1,132	3	17,425	56	111	0	0	25,007
8/1-8/8	Percent	0.0	0.2	0.0	1.1	0.2	23.5	4.5	0.0	69.7	0.2	0.4	0.0	0.0	100.0
33	Number	0	62	70	17	62	3,059	437	8	28,493	123	0	185	0	32,515
8/9-8/15	Percent	0.0	0.2	0.2	0.1	0.2	9.4	1.3	0.0	87.6	0.4	0.0	0.6	0.0	100.0
34	Number	0	33	40	0	40	1,512	220	0	16,533	87	14	107	0	18,587
8/16-8/22	Percent	0.0	0.2	0.2	0.0	0.2	8.1	1.2	0.0	89.0	0.5	0.1	0.6	0.0	100.0
35	Number	0	0	12	23	12	1,217	580	0	14,361	218	47	12	0	16,483
8/23-8/29	Percent	0.0	0.0	0.1	0.1	0.1	7.4	3.5	0.0	87.1	1.3	0.3	0.1	0.0	100.0
36	Number	0	0	0	4	0	159	103	0	1,742	34	4	0	0	2,047
8/30-9/5	Percent	0.0	0.0	0.0	0.2	0.0	7.8	5.0	0.0	85.1	1.7	0.2	0.0	0.0	100.0
Total	Number	8	260	936	10,777	357	240,784	7,879	856	129,504	529	627	349	43	392,905
	Percent	0.0	0.1	0.2	2.7	0.1	61.3	2.0	0.2	33.0	0.1	0.2	0.1	0.0	100.0

Note: Rounding errors (fractions of fish dropped or added during printing) often cause weekly totals to differ from the sum of the age classes. Lake destination (Black Lake or Chignik Lake) is estimated from samples of fish of ages 1.3 and 2.3 only. The age composition of catch and escapement (c/e) is estimated and the destination of age 1.3 fish is applied to the c/e of age 1.3 and 1.2 fish. Similarly, the destination of age 2.3 fish is applied to 2.3 and 2.2 fish. The average of these four age classes is used to estimate the destination of all other ages. These estimates are calculated for each day in double precision numbers. The results are summed by week and rounded for printing.

Table 19. Estimated age composition of Chignik Lake sockeye salmon catch by week estimated using postseason scale pattern analysis, 2001.

Stat Week		Ages													Total
		0.2	1.1	0.3	1.2	2.1	1.3	2.2	1.4	2.3	3.2	2.4	3.3	Other	
23	Number	0	0	0	0	0	10	0	0	1	0	0	0	0	11
5/31-6/06	Percent	0.0	0.0	1.3	3.1	0.0	86.7	1.9	0.3	9.4	0.0	0.0	0.0	0.0	100.0
24	Number	0	0	2	3	0	115	1	1	13	0	0	0	0	135
6/7-6/13	Percent	0.0	0.0	1.4	2.6	0.0	85.1	1.0	0.7	9.4	0.0	0.2	0.0	0.2	100.0
25	Number	0	9	44	159	0	4,662	14	72	160	0	9	0	18	5,145
6/14-6/20	Percent	0.0	0.2	0.9	3.1	0.0	90.6	0.3	1.4	3.1	0.0	0.2	0.0	0.3	100.0
26	Number	0	7	101	1,175	12	18,954	161	48	918	0	0	0	0	21,377
6/21-6/27	Percent	0.0	0.0	0.5	5.5	0.1	88.7	0.8	0.2	4.3	0.0	0.0	0.0	0.0	100.0
27	Number	0	0	431	4,877	172	96,301	1,194	388	3,250	0	0	0	0	106,614
6/28-7/4	Percent	0.0	0.0	0.4	4.6	0.2	90.3	1.1	0.4	3.0	0.0	0.0	0.0	0.0	100.0
28	Number	165	126	234	5,482	0	149,851	1,586	1,031	26,532	0	0	0	165	185,171
7/5-7/11	Percent	0.1	0.1	0.1	3.0	0.0	80.9	0.9	0.6	14.3	0.0	0.0	0.0	0.1	100.0
29	Number	0	259	666	3,555	0	112,320	1,187	833	31,662	0	0	135	0	150,619
7/12-7/18	Percent	0.0	0.2	0.4	2.4	0.0	74.6	0.8	0.6	21.0	0.0	0.0	0.1	0.0	100.0
30	Number	0	0	0	229	0	8,547	207	20	3,098	0	11	0	0	12,111
7/19-7/25	Percent	0.0	0.0	0.0	1.9	0.0	70.6	1.7	0.2	25.6	0.0	0.1	0.0	0.0	100.0
31	Number	0	736	0	7,698	736	48,226	13,742	362	105,902	11	747	362	0	178,523
7/26-8/1	Percent	0.0	0.4	0.0	4.3	0.4	27.0	7.7	0.2	59.3	0.0	0.4	0.2	0.0	100.0

-Continued-

Table 19. (page 2 of 2)

Stat Week		Ages 0.2	1.1	0.3	1.2	2.1	1.3	2.2	1.4	2.3	3.2	2.4	3.3	Other	Total
32	Number	0	92	78	617	92	15,482	2,466	78	57,657	92	184	0	0	76,839
8/1-8/8	Percent	0.0	0.1	0.1	0.8	0.1	20.1	3.2	0.1	75.0	0.1	0.2	0.0	0.0	100.0
33	Number	0	34	252	435	34	18,301	1,945	218	98,964	68	0	101	0	120,351
8/9-8/15	Percent	0.0	0.0	0.2	0.4	0.0	15.2	1.6	0.2	82.2	0.1	0.0	0.1	0.0	100.0
34	Number	0	264	331	0	331	12,371	1,785	0	136,362	729	134	859	0	153,165
8/16-8/22	Percent	0.0	0.2	0.2	0.0	0.2	8.1	1.2	0.0	89.0	0.5	0.1	0.6	0.0	100.0
35	Number	0	0	114	246	114	12,631	6,241	0	147,915	2,309	474	114	0	170,158
8/23-8/29	Percent	0.0	0.0	0.1	0.1	0.1	7.4	3.7	0.0	86.9	1.4	0.3	0.1	0.0	100.0
36	Number	0	0	0	67	0	2,494	1,618	0	27,300	539	67	0	0	32,086
8/30-9/5	Percent	0.0	0.0	0.0	0.2	0.0	7.8	5.0	0.0	85.1	1.7	0.2	0.0	0.0	100.0
37	Number	0	0	0	4	0	163	106	0	1,785	35	4	0	0	2,098
9/6-9/12	Percent	0.0	0.0	0.0	0.2	0.0	7.8	5.0	0.0	85.1	1.7	0.2	0.0	0.0	100.0
Total	Number	165	1,527	2,253	24,547	1,491	500,428	32,253	3,051	641,519	3,783	1,630	1,571	183	1,214,403
	Percent	0.0	0.1	0.2	2.0	0.1	41.2	2.7	0.3	52.8	0.3	0.1	0.1	0.0	100.0

Note: Rounding errors (fractions of fish dropped or added during printing) often cause weekly totals to differ from the sum of the age classes. Lake destination (Black Lake or Chignik Lake) is estimated from samples of fish of ages 1.3 and 2.3 only. The age composition of catch and escapement (c/e) is estimated and the destination of age 1.3 fish is applied to the c/e of age 1.3 and 1.2 fish. Similarly, the destination of age 2.3 fish is applied to 2.3 and 2.2 fish. The average of these four age classes is used to estimate the destination of all other ages. These estimates are calculated for each day in double precision numbers. The results are summed by week and rounded for printing.

Table 20. Results of analysis of variance tests to evaluate similarities between age 1.x standards for the Chignik run apportionment model.

	Variable tested	
	Maximum Freshwater Growth	
P Value	Chignik 1.2	Chignik 1.3
Chignik 1.3	1.15E-06	[redacted]
Black Lake 1.3	0.248	2.50E-14

	Variable tested	
	Number of Circuli	
P Value	Chignik 1.2	Chignik 1.3
Chignik 1.3	1.63E-04	[redacted]
Black Lake 1.3	1.41E-03	6.56E-19

Table 21. Chignik sockeye salmon daily escapement, catch by area, and total run adjusted to Chignik Lagoon date, 2001.

		Catch									Daily
		Chignik	Hook Bay		Eastern	Cape	Western	Perryville	Southeast	Total	Run
Date	Escapement	Lagoon	/Kujulik	Aniakchak	District	Igvak	District	District	Mainland	Catch	Total
24-May	34	0	0	0	0	0	0	0	0	0	34
25-May	183	0	0	0	0	0	0	0	0	0	183
26-May	190	0	0	0	0	0	0	0	0	0	190
27-May	68	0	0	0	0	0	0	0	0	0	68
28-May	856	0	0	0	0	0	0	0	0	0	856
29-May	903	0	0	0	0	0	0	0	0	0	903
30-May	875	0	0	0	0	0	0	0	0	0	875
31-May	389	0	0	0	0	0	0	0	0	0	389
1-Jun	278	0	0	0	0	0	0	0	0	0	278
2-Jun	2,980	0	0	0	0	0	0	0	0	0	2,980
3-Jun	6,794	0	0	0	0	0	0	0	0	0	6,794
4-Jun	5,155	0	0	0	0	0	0	0	0	0	5,155
5-Jun	1,233	0	0	0	0	0	0	0	0	0	1,233
6-Jun	7,198	372	0	0	0	0	0	0	0	372	7,570
7-Jun	15,600	0	0	0	0	0	0	0	0	0	15,600
8-Jun	14,478	0	0	0	0	0	0	0	0	0	14,478
9-Jun	10,893	30	0	0	0	0	0	0	0	30	10,923
10-Jun	17,211	0	0	0	0	0	0	0	0	0	17,211
11-Jun	18,425	408	0	0	0	0	0	0	0	408	18,833
12-Jun	21,996	0	0	0	0	0	0	0	0	0	21,996
13-Jun	18,930	1,813	0	0	0	0	0	0	0	1,813	20,743
14-Jun	32,080	0	0	0	0	0	0	0	0	0	32,080
15-Jun	38,629	0	0	0	0	0	0	0	0	0	38,629
16-Jun	37,688	6,161	0	0	0	0	0	0	0	6,161	43,849
17-Jun	23,522	0	0	0	0	0	0	0	0	0	23,522
18-Jun	28,684	0	0	0	0	0	0	0	0	0	28,684
19-Jun	61,341	1,952	0	0	0	0	0	0	0	1,952	63,293
20-Jun	60,523	35,789	0	0	0	0	0	0	0	35,789	96,312
21-Jun	49,829	0	0	0	0	0	0	0	0	0	49,829
22-Jun	38,309	25,807	0	0	0	0	0	0	0	25,807	64,116
23-Jun	28,742	43,093	0	0	0	0	0	0	0	43,093	71,835
24-Jun	31,771	28,791	0	0	0	0	0	0	0	28,791	60,562
25-Jun	30,722	0	0	0	0	0	0	0	0	0	30,722
26-Jun	25,523	4,223	0	0	0	0	0	0	0	4,223	29,746
27-Jun	34,615	17,259	0	0	0	0	0	0	0	17,259	51,874
28-Jun	33,038	1,200	0	0	0	0	0	0	0	1,200	34,238
29-Jun	17,849	14,882	4,910	0	0	38,116	0	0	0	57,908	75,757
30-Jun	45,274	0	0	0	0	37,455	0	0	1,850	39,305	84,579
1-Jul	67,674	1,662	0	0	0	50,547	0	0	0	52,209	119,883
2-Jul	16,636	45,666	0	0	0	0	0	0	0	45,666	62,302
3-Jul	3,230	40,596	10,065	0	0	0	0	0	0	50,661	53,891

-Continued-

Table 21. (page 2 of 3)

Date	Escapement	Catch: Chignik Lagoon	Catch: Hook Bay /Kujulik	Catch: Aniakchak	Catch: Eastern District	Catch: Cape Igvak	Catch: Western District	Catch: Perryville District	Catch: Southeast Mainland	Catch: Daily Run	Daily Run Total
4-Jul	1,107	20,204	29,051	4,001	0	0	0	0	0	53,256	54,363
5-Jul	2,316	16,943	24,436	12,814	0	0	0	0	0	54,193	56,509
6-Jul	3,290	30,838	11,541	9,581	0	0	0	0	0	51,960	55,250
7-Jul	2,937	25,141	12,793	6,869	0	0	0	0	0	44,803	47,740
8-Jul	1,653	26,996	5,489	10,493	0	0	0	0	0	42,978	44,631
9-Jul	2,054	29,878	7,832	12,472	0	0	0	0	0	50,182	52,236
10-Jul	1,119	24,596	7,428	7,402	11,490	0	0	0	0	50,916	52,035
11-Jul	941	22,760	9,879	7,126	6,469	0	0	0	0	46,234	47,175
12-Jul	700	16,509	5,787	2,866	2,411	0	0	0	0	27,573	28,273
13-Jul	463	17,926	3,981	2,602	2,074	29,320	0	0	1,589	57,492	57,955
14-Jul	1,702	8,167	4,608	2,141	281	12,247	0	0	12,215	39,659	41,361
15-Jul	8,891	0	3,328	627	0	17,458	0	0	12,553	33,966	42,857
16-Jul	11,822	1,330	0	31	0	11,886	0	0	0	13,247	25,069
17-Jul	13,487	0	0	0	0	18,183	0	0	3,172	21,355	34,842
18-Jul	18,620	0	0	0	0	0	0	0	11,083	11,083	29,703
19-Jul	8,551	0	0	0	0	0	0	0	8,679	8,679	17,230
20-Jul	7,575	2,550	0	0	0	0	0	0	0	2,550	10,125
21-Jul	12,880	0	0	0	0	0	0	0	0	0	12,880
22-Jul	17,782	0	0	0	0	0	0	0	0	0	17,782
23-Jul	23,970	0	0	0	0	0	0	0	0	0	23,970
24-Jul	22,532	0	0	0	0	0	0	0	0	0	22,532
25-Jul	17,991	2,694	0	0	0	0	0	0	0	2,694	20,685
26-Jul	1,460	83,484	0	0	0	0	0	0	0	83,484	84,944
27-Jul	752	26,530	2,459	0	0	0	0	0	0	28,989	29,741
28-Jul	601	15,147	7,526	426	0	0	2,824	1	0	25,924	26,525
29-Jul	343	8,249	5,705	1,638	0	0	2,662	0	0	18,254	18,597
30-Jul	313	8,735	7,880	1,889	0	0	235	0	0	18,739	19,052
31-Jul	1,124	9,950	4,602	1,472	0	0	1,212	0	0	17,236	18,360
1-Aug	4,922	0	2,049	1,358	0	0	1,515	0	0	4,922	9,844
2-Aug	6,187	0	0	591	141	0	1,339	0	0	2,071	8,258
3-Aug	6,846	0	0	480	0	0	0	0	0	480	7,326
4-Aug	8,529	6,580	0	0	0	0	0	0	0	6,580	15,109
5-Aug	1,442	13,009	1,232	0	0	0	0	0	0	14,241	15,683
6-Aug	755	12,220	2,891	461	0	0	417	0	0	15,989	16,744
7-Aug	742	12,006	1,823	2,418	1	0	1,689	0	0	17,937	18,679
8-Aug	539	12,326	1,990	1,578	41	0	3,066	551	0	19,552	20,091
9-Aug	660	12,494	4,163	2,810	138	0	482	522	0	20,609	21,269
10-Aug	682	9,487	2,495	4,141	61	0	1,310	0	0	17,494	18,176
11-Aug	826	12,725	6,986	3,615	16	0	0	0	0	23,342	24,168

-Continued-

Table 21. (page 3 of 3)

Date	Escapement	Catch: Chignik Lagoon	Catch: Hook Bay /Kujulik	Catch: Aniakchak	Catch: Eastern District	Catch: Cape Igvak	Catch: Western District	Catch: Perryville District	Catch: Southeast Mainland	Catch: Daily Catch	Daily Run Total
12-Aug	837	13,485	1,810	5,987	0	0	0	0	0	21,282	22,119
13-Aug	1,032	16,309	2,519	2,377	0	0	790	0	0	21,995	23,027
14-Aug	8,464	0	7,555	1,547	1,109	0	73	0	0	10,284	18,748
15-Aug	20,014	0	0	3,507	1,779	0	59	0	0	5,345	25,359
16-Aug	5,379	22,885	0	0	2,061	0	0	0	0	24,946	30,325
17-Aug	1,127	15,520	4,893	0	0	0	0	0	0	20,413	21,540
18-Aug	1,506	15,587	9,535	1,769	0	0	0	0	0	26,891	28,397
19-Aug	1,678	13,786	4,237	1,456	0	0	0	0	0	19,479	21,157
20-Aug	2,924	763	4,619	1,517	0	0	0	0	0	6,899	9,823
21-Aug	2,779	21,570	482	962	305	0	0	0	0	23,319	26,098
22-Aug	3,194	29,787	1,431	0	0	0	0	0	0	31,218	34,412
23-Aug	2,365	20,149	2,272	0	0	0	0	0	0	22,421	24,786
24-Aug	3,338	28,434	1,890	415	0	0	0	0	0	30,739	34,077
25-Aug	2,101	19,972	4,237	2,147	0	0	0	0	0	26,356	28,457
26-Aug	1,923	14,269	2,157	624	0	0	0	0	0	17,050	18,973
27-Aug	2,281	19,430	2,300	4,167	0	0	0	0	0	25,897	28,178
28-Aug	1,944	16,557	2,831	2,957	0	0	0	0	0	22,345	24,289
29-Aug	2,531	21,560	3,790	0	0	0	0	0	0	25,350	27,881
30-Aug	2,047	15,219	1,005	0	0	0	0	0	0	16,224	18,271
31-Aug	0	15,516	264	0	0	0	0	0	0	15,780	15,780
1-Sep	0	0	82	0	0	0	0	0	0	82	82
2-Sep	0	0	0	0	0	0	0	0	0	0	0
3-Sep	0	0	0	0	0	0	0	0	0	0	0
4-Sep	0	0	0	0	0	0	0	0	0	0	0
5-Sep	0	0	0	0	0	0	0	0	0	0	0
6-Sep	0	2,098	0	0	0	0	0	0	0	2,098	2,098
7-Sep	0	0	0	0	0	0	0	0	0	0	0
8-Sep	0	0	0	0	0	0	0	0	0	0	0
9-Sep	0	0	0	0	0	0	0	0	0	0	0
10-Sep	0	0	0	0	0	0	0	0	0	0	0
11-Sep	0	0	0	0	0	0	0	0	0	0	0
12-Sep	0	0	0	0	0	0	0	0	0	0	0
13-Sep	0	0	0	0	0	0	0	0	0	0	0
14-Sep	0	0	0	0	0	0	0	0	0	0	0
15-Sep	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1,136,918	1,082,074	250,838	131,334	28,377	215,212	17,673	1,074	51,141	1,777,723	2,914,641

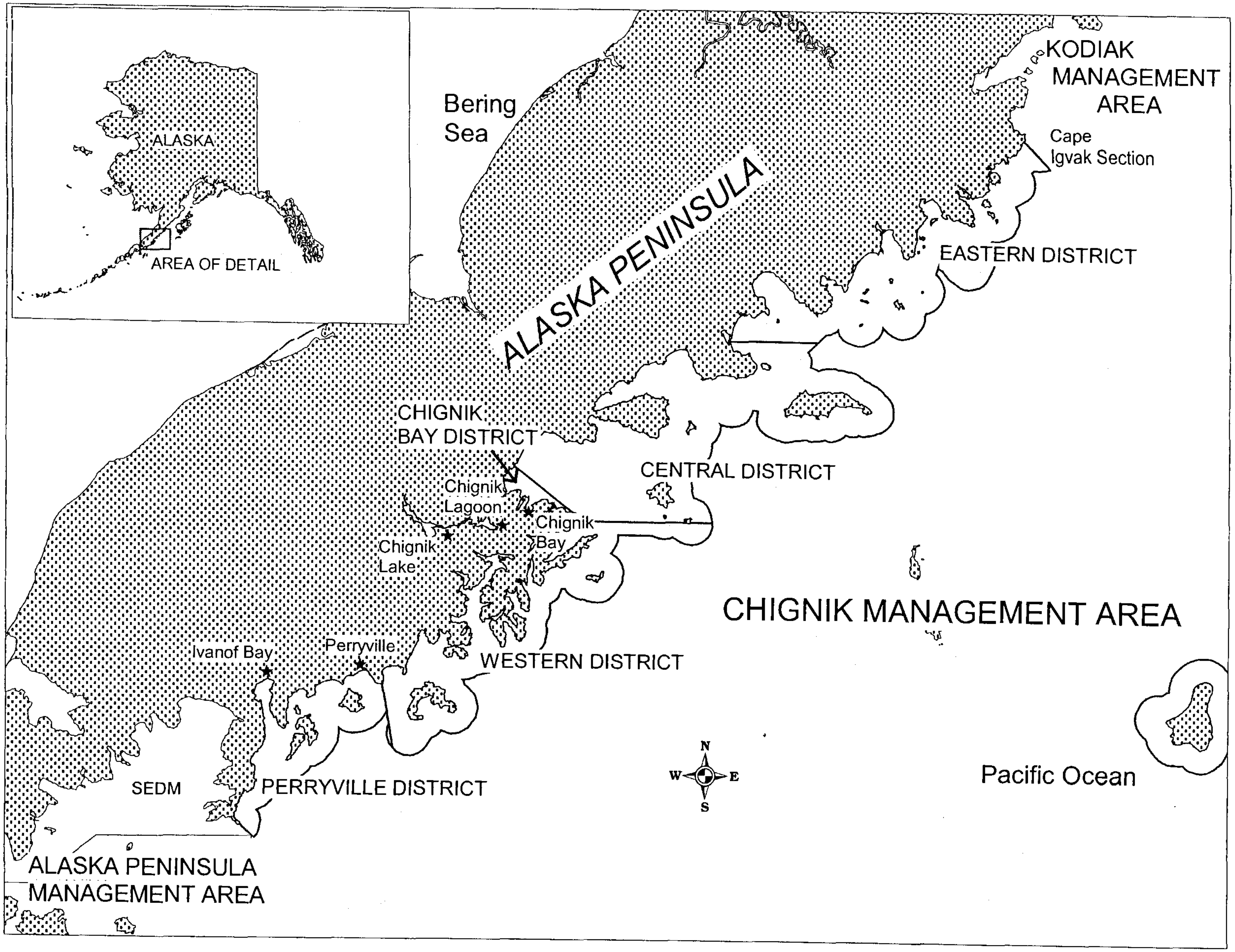

Figure 1. Map of the Chignik Management Area.

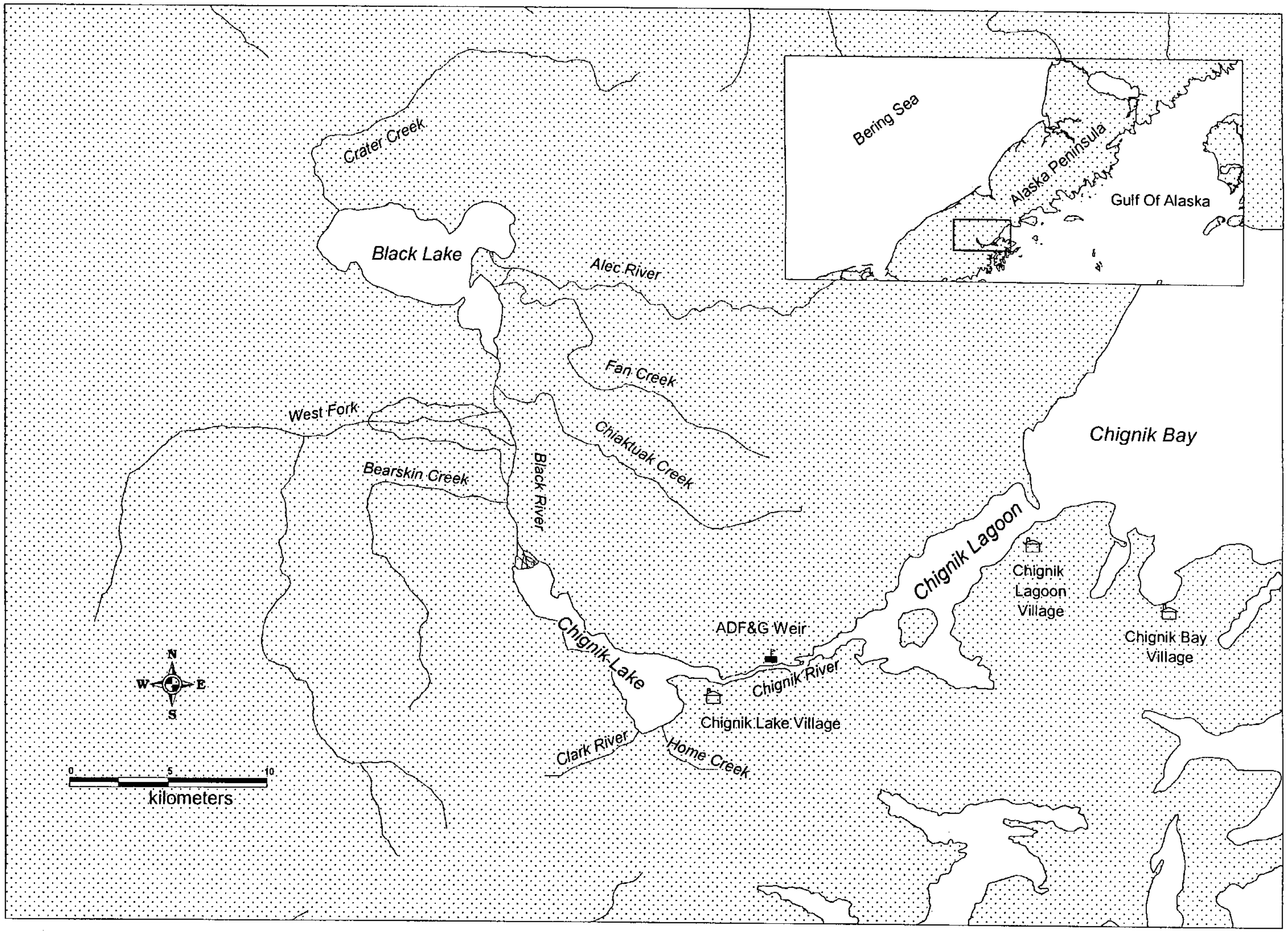

Figure 2. Map of the Chignik watershed including Black and Chignik Lakes.

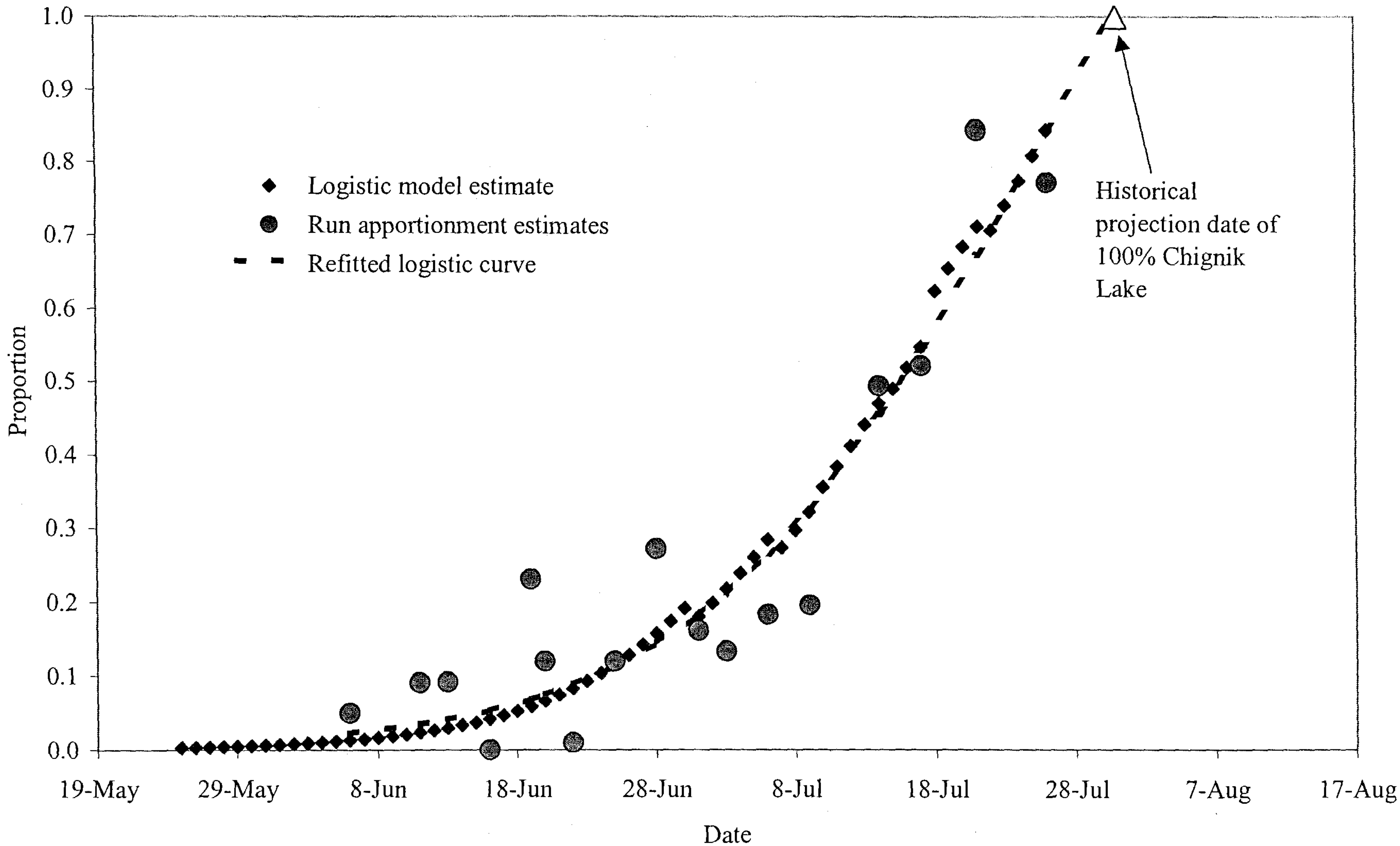

Figure 3. Estimated proportion of Chignik Lake sockeye salmon in the Chignik River system by day using a weighted logistic function fit to the age 1.3 model output data and refit for each sample inseason.

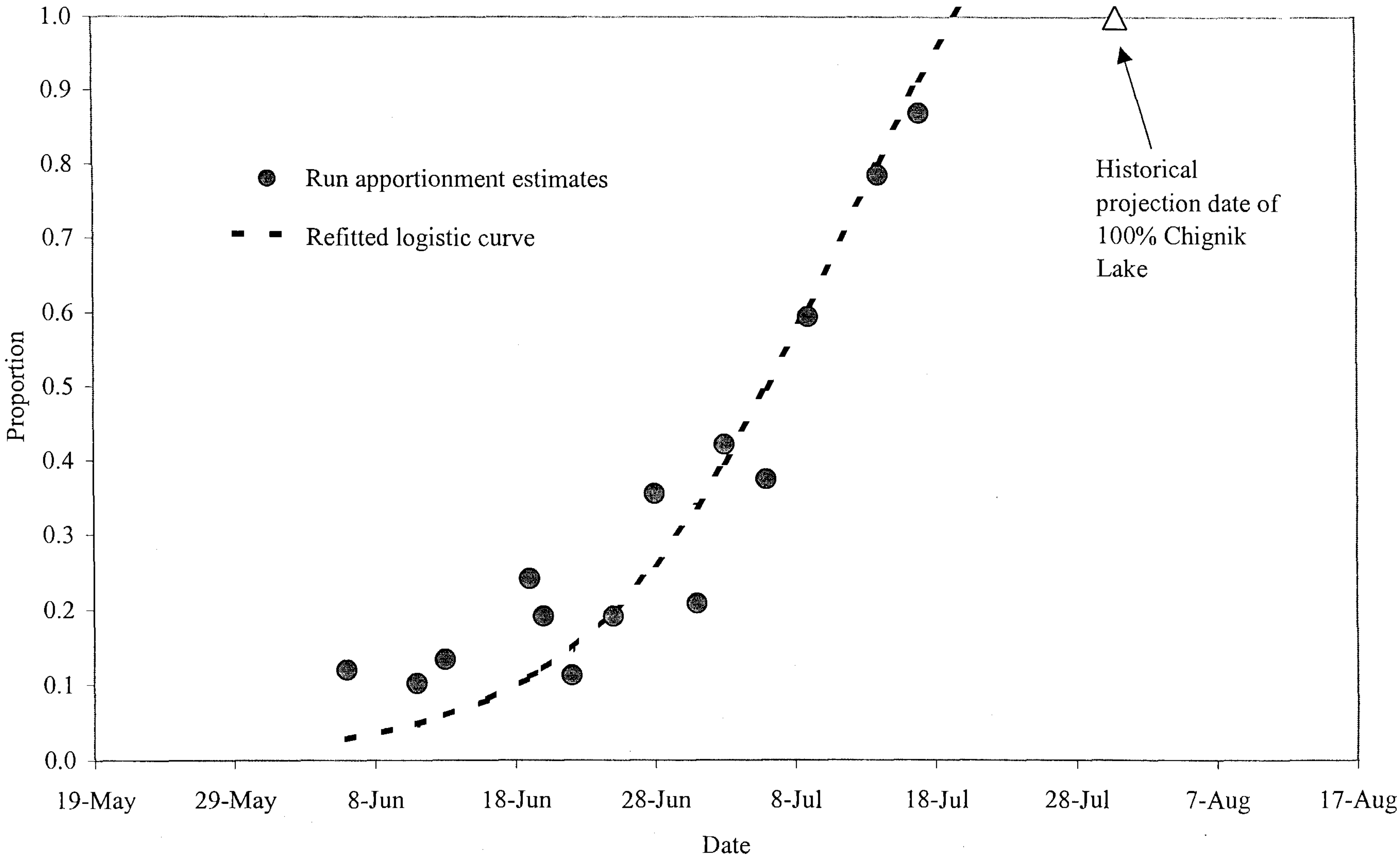

Figure 4. Estimated proportion of Chignik Lake sockeye in Chignik River System by day using a weighted logistic function fit to the Age 1.3 SPA model estimated run apportionment, postseason.

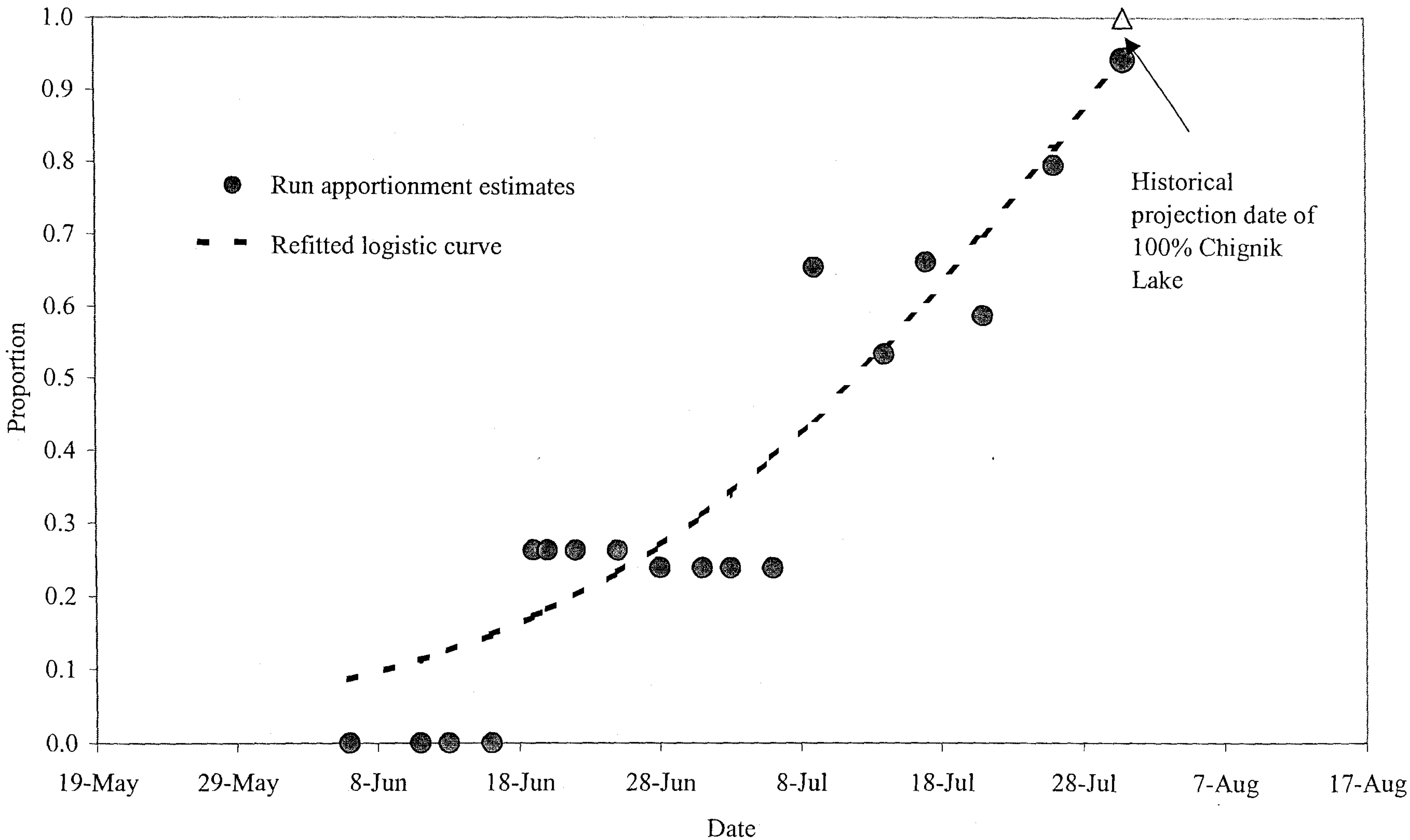

Figure 5. Estimated proportion of Chignik Lake sockeye in Chignik River system by day using a weighted logistic function fit to the age 2.3 SPA model estimated run apportionment, postseason.