ADF&G TECHNICAL DATA REPORT NO. 112
(Limited Distribution)

STATE OF ALASKA
Bill Sheffield, Governor

STOCK COMPOSITION OF THE 1983 SOCKEYE SALMON (Oncorhynchus nerka) RUN TO THE CHIGNIK LAKES ESTIMATED USING SCALE PATTERNS AND LINEAR DISCRIMINANT FUNCTIONS

By:
Robert H. Conrad

April 1984

ALASKA DEPARTMENT OF FISH AND GAME
P.O. Box 3-2000, Juneau, Alaska 99802

Don W. Collinsworth
Commissioner

ADF&G TECHNICAL DATA REPORTS

This series of reports is designed to facilitate prompt reporting of data from studies conducted by the Alaska Department of Fish and Game, especially studies which may be of direct and immediate interest to scientists of other agencies.

The primary purpose of these reports is presentation of data. Description of programs and data collection methods is included only to the extent required for interpretation of the data. Analysis is generally limited to that necessary for clarification of data collection methods and interpretation of the basic data. No attempt is made in these reports to present analysis of the data relative to its ultimate or intended use.

Data presented in these reports is intended to be final, however, some revisions may occasionally be necessary. Minor revisions will be made via errata sheets. Major revisions will be made in the form of revised reports.

STOCK COMPOSITION OF THE 1983 SOCKEYE SALMON *(Oncorhynchus nerka)* RUN TO THE CHIGNIK LAKES ESTIMATED USING SCALE PATTERNS AND LINEAR DISCRIMINANT FUNCTIONS

By

Robert H. Conrad

Alaska Department of Fish and Game
Division of Commercial Fisheries
Anchorage, Alaska

April 1984

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ABSTRACT

The stock composition of the 1983 sockeye salmon *(Oncorhynchus nerka)* run to the Chignik River system, Alaska, was estimated using scale patterns and linear discriminant function analysis. Scale samples collected in Chignik Lagoon were used to estimate the age and stock composition of the commercial catch and daily escapements. The stock composition of the 1.2, 1.3, and 2.3 age classes was monitored throughout the period of transition from the Black Lake stock to the Chignik Lake stock (5 June to 22 July). Mean classification accuracies of the age-specific linear discriminant functions for the 1.2, 1.3, and 2.3 age classes were 83%, 71%, and 83%, respectively. The total return of sockeye salmon to the Chignik lakes in 1983 was 2,977,012 fish, which was the largest return since 1947. The estimated escapement and commercial catch totals for each stock were: Black Lake, 426,177 escapement, 856,292 catch, and 1,282,469 total run; and Chignik Lake, 409,458 escapement, 1,285,085 catch, and 1,694,543 total run. The contribution of the 1.2 age class to the Black Lake run was the largest ever recorded, both in number (487,004) and by percent of run (38%).

KEY WORDS: Chignik, Black Lake, stock composition, linear discriminant function, age composition, catch, escapement

INTRODUCTION

The Chignik lakes watershed is 274 km west of Kodiak Island on the south side of the Alaska Peninsula. There are two large, interconnected lakes in the watershed, Black Lake and Chignik Lake, with a single outlet river which empties into a nearly enclosed estuary, Chignik Lagoon (Figure 1). The two major sockeye salmon *(Oncorhynchus nerka)* stocks in the Chignik River system spawn in different areas and have a different time of spawning migration, length of freshwater residence as juveniles, and age at maturity (Higgins 1934; Narver 1963). The returning adults of one stock pass through the fishery mostly in June and spawn in the tributaries to Black Lake (Black Lake stock). Adults from the other stock pass through the fishery mostly in July and spawn in the tributaries to Chignik Lake, including Black River, and Chignik Lake beach areas (Chignik Lake stock).

Narver (1966) and Dahlberg (1968) independently estimated the optimum escapement goals for the Chignik stocks as 400,000 for Black Lake and 200,000 for Chignik Lake. Since 1966, the sockeye salmon run to Chignik has been managed to ensure that these escapement goals are met. The effectiveness of this management strategy is evident from the increases in the annual Chignik sockeye salmon runs during the last 30 years (Figure 2). For the three most recent ten-year periods, the average total annual returns are:

1953-1962, 0.87 million;
1963-1972, 1.28 million;
1973-1982, 2.04 million.

The recovery of the Chignik sockeye salmon run from a period of record low abundance strongly supports the continuation of present management strategies.

Although the periods of peak passage of the Chignik sockeye salmon stocks are usually two or three weeks apart, enumerating the catch and escapement of each stock is complicated because there is a period of overlap, from about mid-June to mid-July, when both stocks pass through the fishery and enter the escapement. To manage the run for optimum escapements for two stocks simultaneously, in-season estimates of the numbers of each stock in the daily escapement are required. Post-season estimates of the total catch and escapement for each stock, and the age composition of each of these components, are needed to compile brood-year tables for each stock and to forecast the return by stock in subsequent years.

Dahlberg (1968) developed the first technique for separating the two stocks in the catch and escapement using data from tagging experiments conducted from 1962-1966. The proportion of each stock present on each day of the run was estimated by fitting a logistic curve to a year's tagging data. These curves are usually referred to as time-of-entry (TOE) curves. Conrad (1984) summarized Dahlberg's method of developing a TOE curve from a year's tagging data and summarized the methodology by applying stock composition estimates to the run to estimate the total numbers and age composition of each stock in the catch and escapement. A TOE curve which is the average of the curves calculated from the 1962-1969 tagging experiments has been used to estimate the stock composition of the Chignik sockeye salmon run until recently.

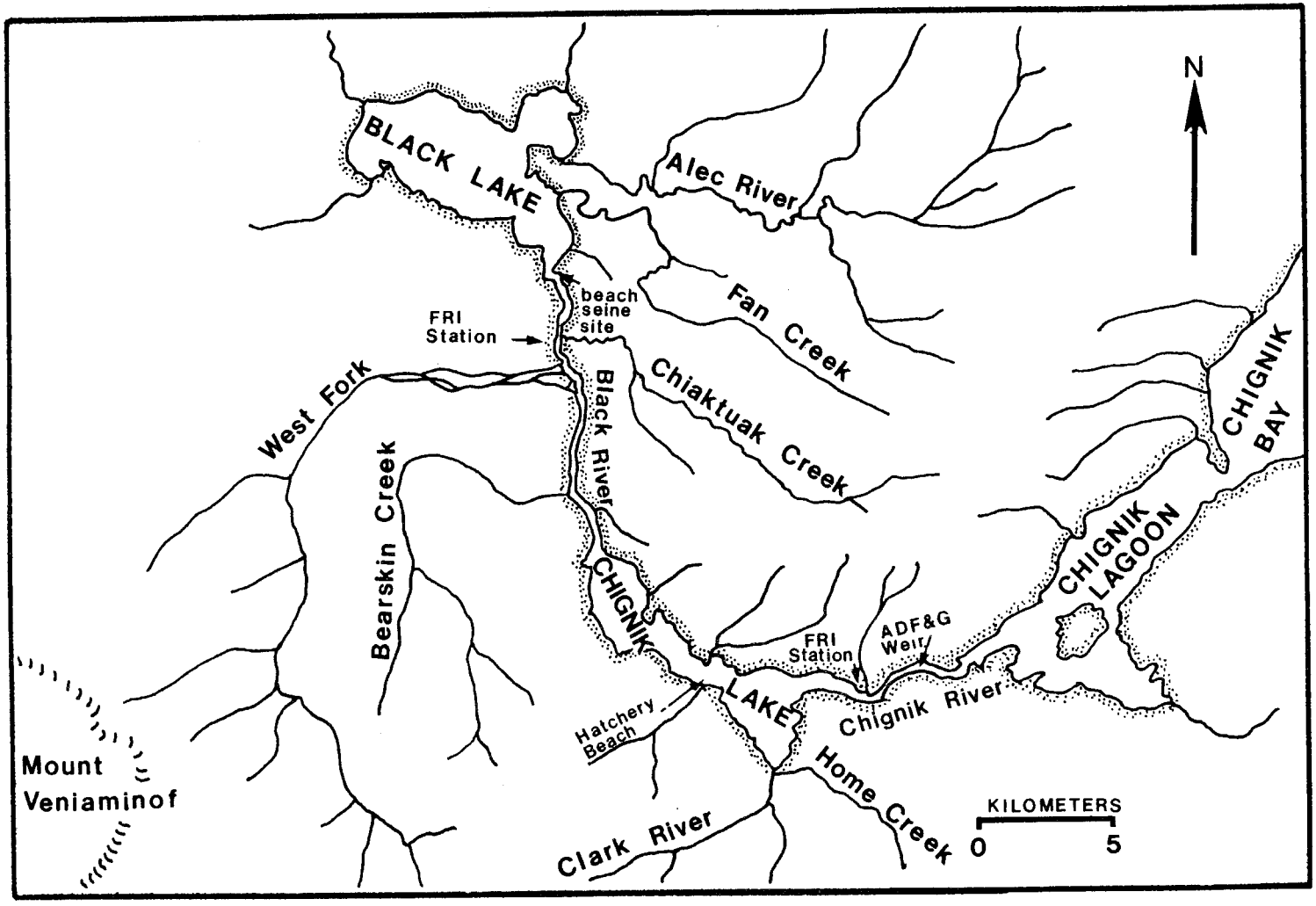

Figure 1. The Chignik lakes watershed.

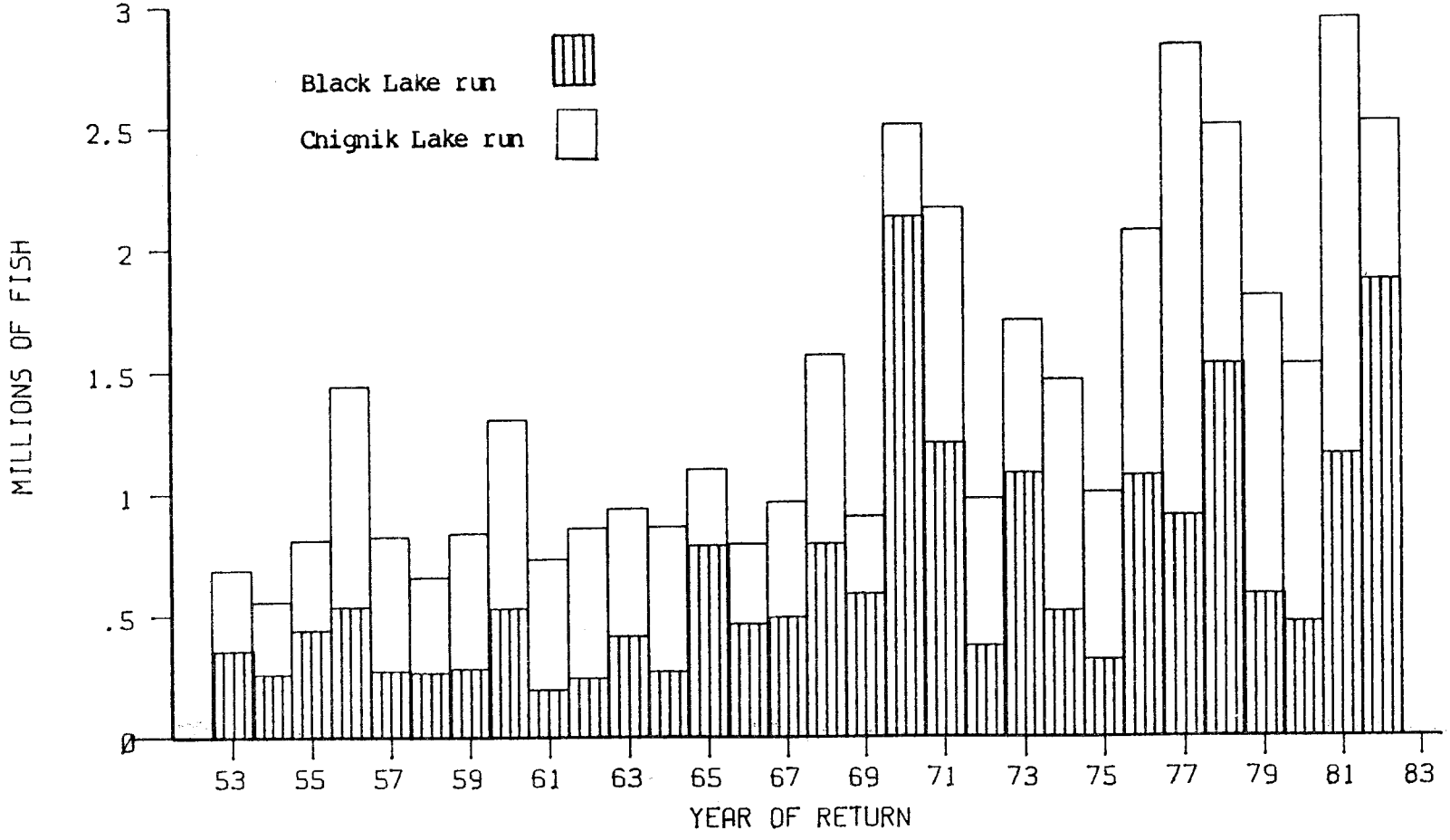

Figure 2. Total annual return of sockeye salmon to the Chignik lakes, 1953-1982.

Conrad (1982; 1984) developed an alternate method for estimating the stock composition of the Chignik sockeye salmon run using scale patterns and linear discriminant function analysis. This method provides year-specific stock composition estimates and is based on information collected throughout the main portion of the run. The 1978-1982 Chignik sockeye salmon runs were analyzed with this procedure, and an in-season application of the technique was evaluated (Conrad 1984).

This report presents the results of a post-season scale pattern analysis of the 1983 sockeye salmon run to Chignik. Basic run statistics and the results of the intermediate steps of the scale pattern analysis method of separating the stocks are given. Estimates of the numbers of fish from each stock in the catch and escapement, and the age composition of each component, are presented.

METHODS

The Chignik management area is divided into four management districts. For this report the Central District is divided into two smaller sub-districts, Hook Bay/Kujulik and Aniakchak (Figure 3). Commercial fishing in the Chignik management area is exclusively by purse seine. The daily sockeye salmon catch in each district or sub-district is summarized from fish ticket information provided by salmon processors. Traditionally, 80% of the sockeye salmon caught by the Cape Igvak purse seine fishery have been allocated to the Chignik run and that procedure is followed for this report. The total escapement of sockeye salmon to the Chignik system is estimated from counts made at the weir located on Chignik River.

The scale samples used to estimate the stock and age composition of the Chignik run were collected in Chignik Lagoon. Because the commercial catch in areas outside of Chignik Lagoon and the escapement to Chignik River must be adjusted to coincide with the daily catch in the Lagoon before these estimates can be applied, the following migration times from the outside areas were assumed and consequently used: Hook Bay/Kujulik, 1 day; Aniakchak, 2 days; Western, 2 days; Eastern, 3 days; Perryville, 3 days; and Cape Igvak, 5 days. A one-day migration time from Chignik Lagoon to the weir was used to adjust the escapement estimates. To determine the total daily run abundance, each escapement estimate and catch from an outside area was adjusted to coincide with a Chignik Lagoon date and then summed for each day of the run.

Scale samples to monitor the age and stock composition of the run were periodically collected in Chignik Lagoon throughout June, July, and August. During the critical period of transition between the Black Lake stock and the Chignik Lake stock, samples were usually collected every third or fourth day. Scale samples were collected from the catches made by two or three boats as they delivered to tenders in Chignik Lagoon. If the fishery was closed and scale samples were needed, a boat was chartered and two or three areas of the Lagoon were sampled.

Approximately 300 scales were collected during each sampling session. The preferred scale (Clutter and Whitesel 1956), or a scale near it, was removed from the left side of each fish sampled. Each scale was mounted on a gummed card, and the sex and mideye-to-fork-of-tail length of the fish was recorded. A permanent

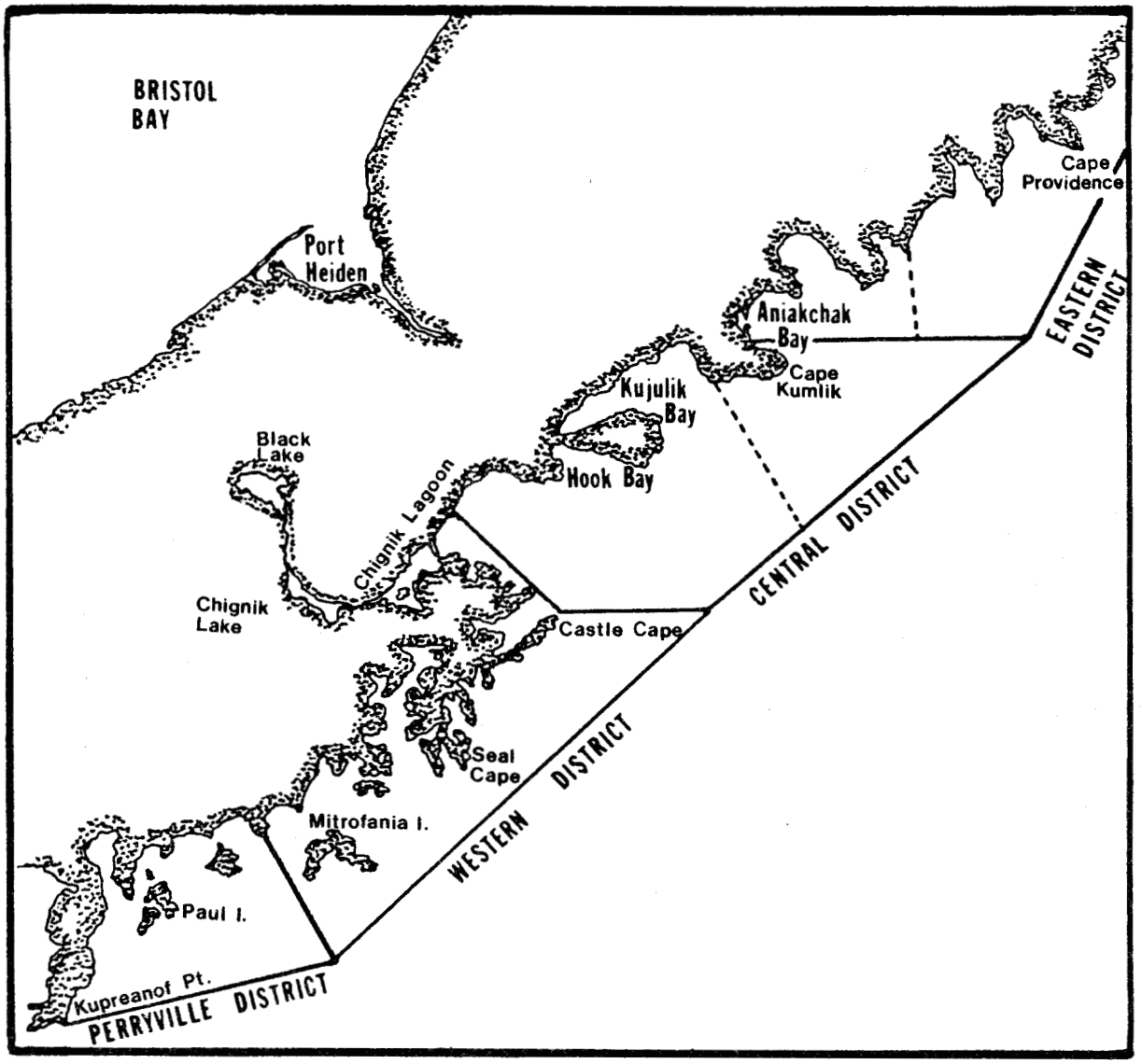

Figure 3. The Chignik area fishing districts and the modifications made for this report.

impression of each gummed card was later made in cellulose acetate. Scale images were projected at 82X on a microfiche reader for aging.

Linear discriminant function (LDF) analysis and measurements made in the lacustrine zone of the scales were used to estimate the stock composition of the Chignik sockeye salmon run. Scale impressions were projected at 210X and detailed measurements of the lacustrine zone were made using a microcomputer controlled digitizing system (Conrad 1984). For each lacustrine annular zone, the total number of circuli in the zone, the total width of the zone, and the distance from the scale focus to each circulus in the annular zone were recorded. The number of circuli of lacustrine plus growth (see Mosher [1969] for definition) and the width of the zone of lacustrine plus growth were recorded. The scale characters examined for the LDF analysis included those measured directly from each scale and combinations of the characters (Conrad 1984).

Scale samples representative of the Black Lake and Chignik Lake stocks (standards) were constructed for the 1.2[1], 1.3, and 2.3 age classes in 1983. Scales for the Chignik Lake standards were randomly selected from the samples collected in Chignik Lagoon after 27 July. The Black Lake standards were scales randomly selected from those collected by beach seining at the outlet of Black Lake. A linear discriminant function was calculated for each age class following the procedure of Fisher (1936). Selection of scale characters to be used in each analysis was through a forward stepping technique with an F-to-enter of 4.0 (Dixon and Brown 1979). A nearly unbiased estimate of the classification accuracy of each age-specific LDF was determined using a leaving-one-out procedure (Lachenbruch 1967).

Scale samples collected in Chignik Lagoon during the period of transition (5 June to 22 July) were used to estimate the proportion of each stock in the catch. A maximum of 100 scales were measured for each age class on a sample date. If less than 15 scales for an age class were available, that age class was omitted for that sample date. For each age class, the appropriate LDF was used to classify the scales of unknown stock composition. The estimates of the proportion of Black Lake and Chignik Lake stocks present on a sample date for an age class were adjusted by the classification matrix correction procedure of Cook and Lord (1978), and the variance of each adjusted stock composition estimate was calculated (Pella and Robertson 1979). The adjusted stock composition estimates for each age class were then smoothed by a moving average of three sample dates (Conrad 1984) to reduce the effects of any bias from unrepresentative sampling in the Lagoon. The stock composition on days between sampling dates was estimated by linear interpolation of the smoothed estimates.

The total catch or escapement on each day of the run (adjusted to Chignik Lagoon date) was allocated by age class using the daily age composition estimates. The age composition of the run for days between sampling dates was estimated by linear interpolation. Catch and escapement by age class for each stock was estimated for

---

[1] European formula: Number of freshwater annuli, decimal point, number of marine annuli. The total age is the sum of these two numbers plus one.

each day of the run by applying the smoothed stock composition estimate to the numbers in the age class. For the age classes which had no stock composition estimates, the average of the available estimates was used. Seasonal estimates of catch and escapement by stock were the sum of the daily estimates.

RESULTS

The sockeye salmon run to Chignik in 1983 was the largest since 1947 totaling 2,977,012 fish (Appendix Table 1). The estimated escapement was 835,635 and the catch was 2,141,377. Usually there are two distinct peaks in the daily abundance of the Chignik sockeye salmon runs, one in June and one in July. In 1983, a distinct peak in June was not apparent, but a series of nearly equal peaks from 15 June to 30 June occurred (Figure 4). The second period of high daily abundances occurred from 10 July to 25 July, with a peak daily migration of nearly 100,000 fish on 12 July.

Age Composition

Scale samples were collected in Chignik Lagoon on 18 separate days between 5 June and 23 August (Appendix Table 2). Sampling was evenly distributed throughout the periods of peak daily abundances in June and July. In early June, the 1.3 age class dominated the catch, but its dominance declined rapidly and by 17 June the 1.2 age class was the most abundant (Figure 5). The 1.2 age class remained the dominant age class for about 10 days from mid to late June. In late June, the 2.3 age class increased rapidly in abundance and was the dominant age class throughout July and August. The 2.2 age class increased in abundance in late July and remained the second most abundant age class for the duration of the sampling.

The decline in abundance of age 1-freshwater adults during the season, paralleled by an increase in abundance of age 2-freshwater adults, is consistent with past observations of the Chignik sockeye salmon run. That is, the majority of the early arriving segment of the run consists of Black Lake stock which produces age 1-freshwater sockeye salmon, and the later arriving segment of the run consists mostly of Chignik Lake stock which produces the majority of the age 2-freshwater fish. Although the 1983 documented change in the freshwater component of the age composition is typical of the Chignik run, the ocean age composition of the age 1-freshwater fish was very unusual. The relative abundance of the 1.2 age class in June was nearly twice that observed during the previous twenty years.

Scale samples were collected at Black Lake outlet on five separate days between 19 June and 2 July (Appendix Table 3). The 1.3 and 1.2 age classes were the most abundant accounting for 56% and 31% of the scales collected, respectively.

Stock Composition

Mean classification accuracies of the linear discriminant functions for the 1.2, 1.3, and 2.3 age classes were 83.0%, 71.4%, and 82.5%, respectively (Table 1). Scale samples of unknown stock composition collected in Chignik Lagoon between 5 June and 22 July were classified using the appropriate age-specific LDF analysis. The adjusted stock composition estimates, the smoothed estimates, and their standard

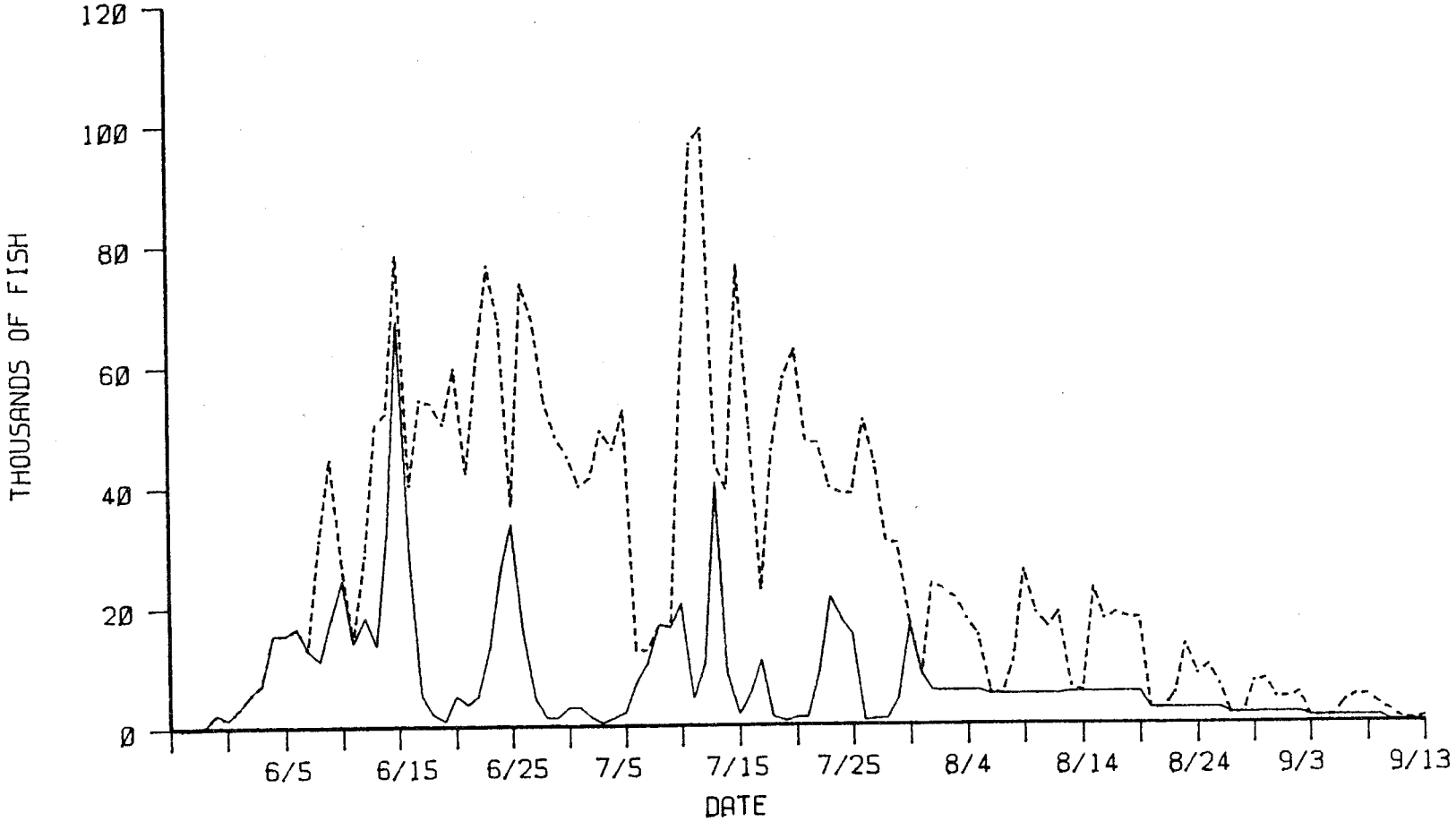

Figure 4. Daily escapement (——) and total daily abundance (- -) of sockeye salmon, adjusted to Chignik Lagoon date.

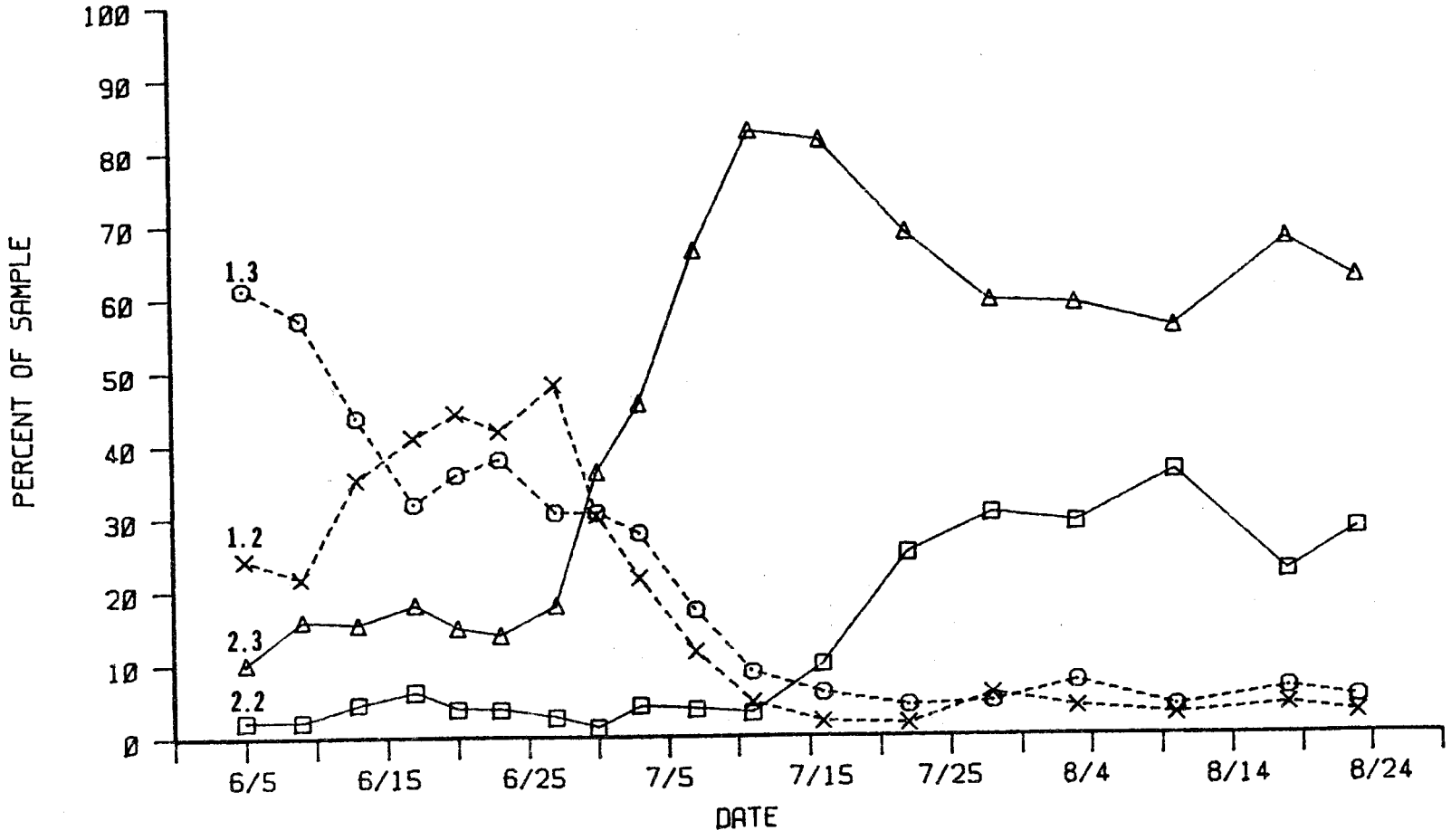

Figure 5. Age composition of scale samples collected in Chignik Lagoon. Minor age groups are not shown.

Table 1. Classification matrices for ages 1.2, 1.3, and 2.3 sockeye salmon.

Age 1.2

Actual Stock of Origin	Sample Size	Classified Stock of Origin	
		Black Lake	Chignik Lake
Black Lake	200	0.845	0.155
Chignik Lake	43	0.186	0.814

Mean classification accuracy = 0.830

Age 1.3

Actual Stock of Origin	Sample Size	Classified Stock of Origin	
		Black Lake	Chignik Lake
Black Lake	200	0.760	0.240
Chignik Lake	60	0.333	0.667

Mean classification accuracy = 0.714

Age 2.3

Actual Stock of Origin	Sample Size	Classified Stock of Origin	
		Black Lake	Chignik Lake
Black Lake	91	0.780	0.220
Chignik Lake	200	0.130	0.870

Mean classification accuracy = 0.825

errors were calculated for each age class. The Black Lake stock represented from 90.6% to 98.4% of the age 1.2 catch samples (Table 2). The Black Lake stock represented from 15.8% to 100% of the age 1.3 catch samples with its stock contribution declining through time (Table 3). A similar trend was observed for fish aged 2.3 with Black Lake contribution to the catch changing from 93.6% early in the season to only 11.8% late in the season (Table 4). Because of insufficient sample sizes, the stock composition for the 1.2 age class could not be estimated after 7 July and the 1.3 age class after 11 July. The temporal change in the stock composition of the 1.3 and 2.3 age classes closely resembled that predicted by a logistic time-of-entry curve (Figure 6). This was not true for the 1.2 age class, however, as at least 90% of each sample classified was estimated to belong to the Black Lake stock.

Catch and Escapement by Stock

The daily sockeye salmon catch and escapement using the age-specific stock composition estimates were calculated by age class and stock. The Black Lake run was 1,282,469 fish with an escapement of 426,177 and catch of 856,292 (Table 5). Approximately 38% of the Black Lake run was assigned to the 1.2 age class. This was the largest contribution of the 1.2 age class to the Black Lake run ever recorded, the previous high being 33% in 1931 (Table 6). The 1.3 and 2.3 age classes were the next most abundant with about 32% and 24% of the Black Lake run, respectively. The daily escapement, catch, and total daily abundance for the Black Lake run was calculated and 50% of that run passed through Chignik Lagoon by 22 June (Table 7).

The Chignik Lake run was 1,694,543. The escapement to Chignik Lake spawning areas was 409,458 fish and there were 1,285,085 fish of Chignik Lake origin in the catch (Table 5). Age 2.3 salmon were the most abundant age group in the Chignik Lake run (63%), followed by the 2.2 (17%) and 1.3 (14%) age classes. The daily escapement, catch, and total daily abundance for the Chignik Lake run was calculated and 50% of that run entered Chignik Lagoon by 19 July (Table 8). The total daily abundance by stock was plotted and as can be seen, abundance of Chignik Lake sockeye salmon surpassed abundance of Black Lake sockeye salmon by early July (Figure 7).

DISCUSSION

The salient feature of the 1983 sockeye salmon run to the Chignik River system was the contribution of the 1.2 age class to the Black Lake run. Both the total number of fish allocated to that age class and its percentage of the total Black Lake run exceeded all historical estimates. The pattern of change in stock composition of the 1.2 age class during the season was significantly different from the entry patterns of the 1.3 and 2.3 age classes. The stock composition estimates from the scale pattern analysis of the 1.2 age class indicated that nearly all age 1.2 fish were of Black Lake origin. This was a significant departure from the entry pattern predicted by the average TOE curve, which assigns the same daily stock composition estimate to all age classes, and consequently this departure stresses the importance of age-specific stock composition estimates. The average TOE curve would have seriously underestimated the contribution of the 1.2 age class

Table 2. Stock composition estimates from the scale pattern analysis of the 1.2 age class.

Sample Date	N	Stock	Adjusted Estimate	Standard Error[1]	Smoothed Estimate	Standard Error
6/ 5	57	Black Lake	.969	.08526	.984[2]	.04950
		Chignik Lake	.031		.016	
6/ 9	24	Black Lake	.982	.12157	.939	.05657
		Chignik Lake	.018		.061	
6/13	78	Black Lake	.866	.08198	.912	.05891
		Chignik Lake	.134		.088	
6/17	48	Black Lake	.887	.09879	.906	.04960
		Chignik Lake	.113		.094	
6/20	79	Black Lake	.966	.07530	.931	.04827
		Chignik Lake	.034		.069	
6/23	87	Black Lake	.939	.07430	.968	.04171
		Chignik Lake	.061		.032	
6/27	100	Black Lake	1.008	.06686	.946	.04550
		Chignik Lake	-.008		.054	
6/30	54	Black Lake	.898	.09311	.966	.04868
		Chignik Lake	.102		.034	
7/ 3	45	Black Lake	.999	.09072	.947	.05967
		Chignik Lake	.001		.053	
7/ 7	26	Black Lake	.943	.12296		
		Chignik Lake	.057			

[1] Standard errors are the same for both proportions.

[2] The first estimate is smoothed with the assumption that the first fish counted at the weir are entirely Black Lake stock (a proportion of 1.00 Black Lake stock and 0.0 variance are assumed).

Table 3. Stock composition estimates from the scale pattern analysis of the 1.3 age class.

Sample Date	N	Stock	Adjusted Estimate	Standard Error[1]	Smoothed Estimate	Standard Error
6/ 5	100	Black Lake	1.023	.12231	1.000[2]	.06050
		Chignik Lake	-.023		0.000	
6/ 9	72	Black Lake	1.204	.13401	.984	.07308
		Chignik Lake	-.204		.016	
6/13	100	Black Lake	.953	.12304	.898	.08718
		Chignik Lake	.047		.102	
6/17	40	Black Lake	.742	.18788	.866	.08752
		Chignik Lake	.258		.134	
6/20	78	Black Lake	.902	.13601	.841	.08803
		Chignik Lake	.098		.159	
6/23	96	Black Lake	.879	.12637	.734	.08179
		Chignik Lake	.121		.266	
6/27	76	Black Lake	.422	.16031	.515	.09105
		Chignik Lake	.578		.485	
6/30	64	Black Lake	.245	.18158	.302	.10134
		Chignik Lake	.755		.698	
7/ 3	62	Black Lake	.240	.18374	.239	.11318
		Chignik Lake	.760		.761	
7/ 7	37	Black Lake	.233	.22045	.158	.13722
		Chignik Lake	.767		.842	
7/11	18	Black Lake	-.129	.29514		
		Chignik Lake	1.129			

[1] Standard errors are the same for both proportions.

[2] The first estimate is smoothed with the assumption that the first fish counted at the weir are entirely Black Lake stock (a proportion of 1.00 Black Lake stock and 0.0 variance are assumed).

Table 4. Stock composition estimates from the scale pattern analysis of the 2.3 age class.

Sample Date	N	Stock	Adjusted Estimate	Standard Error[1]	Smoothed Estimate	Standard Error
6/ 5	25	Black Lake	.908	.15093	.936[2]	.07409
		Chignik Lake	.092		.064	
6/ 9	21	Black Lake	.899	.16316	.890	.08485
		Chignik Lake	.101		.110	
6/13	42	Black Lake	.862	.12406	.849	.08602
		Chignik Lake	.138		.151	
6/17	25	Black Lake	.785	.15691	.787	.08179
		Chignik Lake	.215		.213	
6/20	32	Black Lake	.713	.14220	.760	.08355
		Chignik Lake	.287		.240	
6/23	36	Black Lake	.783	.13405	.688	.07701
		Chignik Lake	.217		.312	
6/27	44	Black Lake	.569	.12304	.608	.06812
		Chignik Lake	.431		.392	
6/30	80	Black Lake	.473	.09301	.450	.05779
		Chignik Lake	.527		.550	
7/ 3	100	Black Lake	.308	.07937	.353	.04837
		Chignik Lake	.692		.647	
7/ 7	100	Black Lake	.277	.07810	.246	.04427
		Chignik Lake	.723		.754	
7/11	100	Black Lake	.154	.07253	.205	.04324
		Chignik Lake	.846		.795	
7/16	100	Black Lake	.185	.07403	.169	.04231
		Chignik Lake	.815		.831	
7/22	100	Black Lake	.169	.07328	.118	.03479
		Chignik Lake	.831		.882	

[1] Standard errors are the same for both proportions.

[2] The first estimate is smoothed with the assumption that the first fish counted at the weir are entirely Black Lake stock (a proportion of 1.00 Black Lake stock and 0.0 variance are assumed).

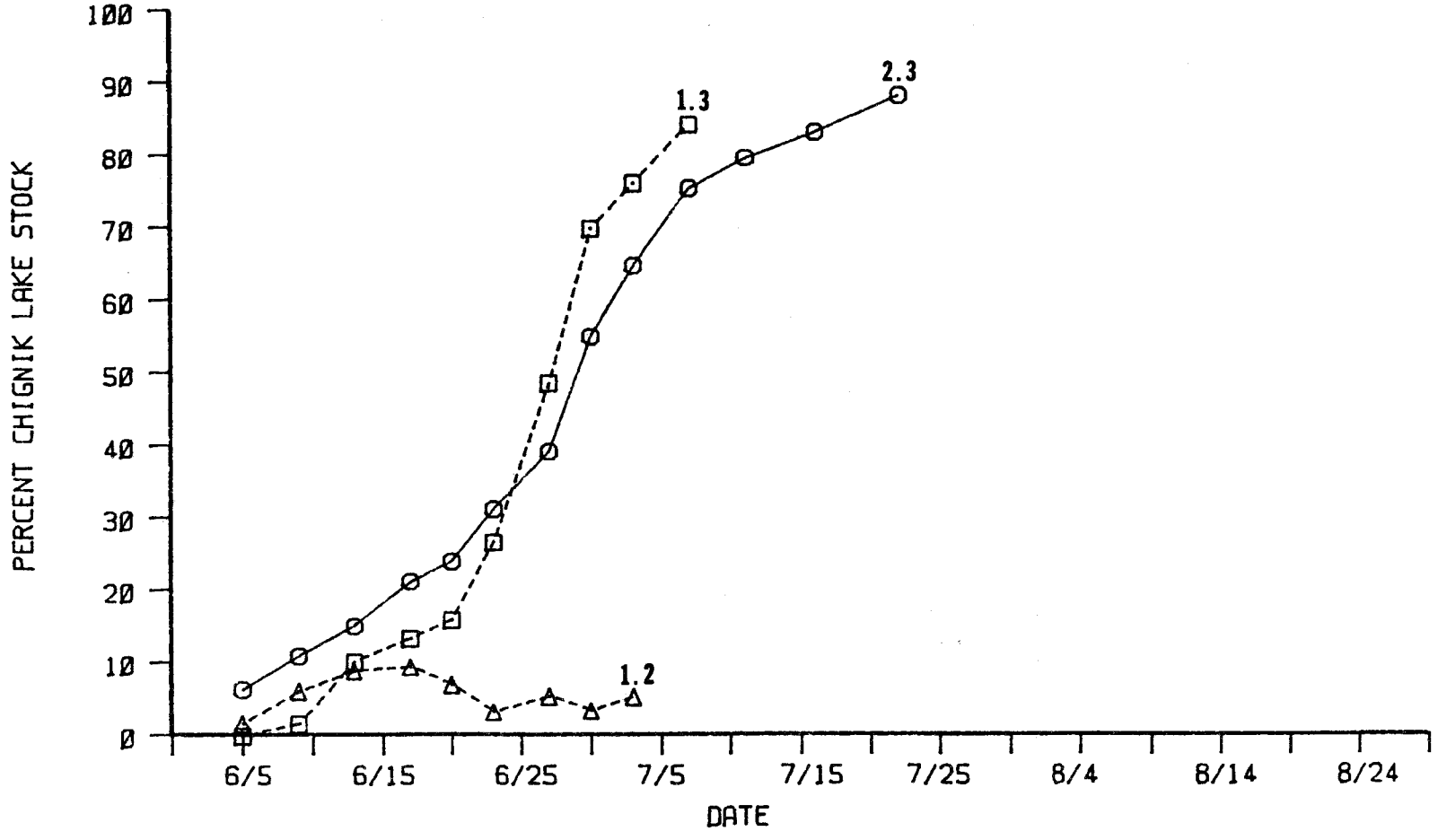

Figure 6. Daily stock composition during the period of transition for the age-specific stock composition estimates smoothed by a moving average of three sample dates.

Table 5. The escapement, catch, and return by age class and stock estimated by analysis of scale patterns.

	Age[1]											
	1.1	2.1	1.2	2.2	3.2	1.3	2.3	3.3	1.4	2.4	Other	Total
Black Lake												
Escapement	36	166	143,871	17,066	0	174,396	82,949	286	2,479	0	4,928	426,177
%	0.01	0.04	33.76	4.00	0.00	40.92	19.46	0.07	0.58	0.00	1.16	100.00
Catch	197	447	343,133	39,335	0	235,155	225,197	19	3,907	0	8,902	856,292
%	0.02	0.05	40.07	4.59	0.00	27.46	26.30	T[2]	0.46	0.00	1.04	99.99
Total	233	613	487,004	56,401	0	409,551	308,146	305	6,386	0	13,830	1,282,469
%	0.02	0.05	37.97	4.40	0.00	31.93	24.03	0.02	0.50	0.00	1.08	100.00
Chignik Lake												
Escapement	336	1,382	24,879	75,022	0	49,418	255,507	8	494	975	1,437	409,458
%	0.08	0.34	6.08	18.32	0.00	12.07	62.40	T	0.12	0.24	0.35	100.00
Catch	1,257	3,108	66,560	207,848	0	181,413	816,661	1	1,244	1,792	5,201	1,285,085
%	0.10	0.24	5.18	16.17	0.00	14.12	63.55	T	0.10	0.14	0.40	100.00
Total	1,593	4,490	91,439	282,870	0	230,831	1,072,168	9	1,738	2,767	6,638	1,694,543
%	0.09	0.27	5.40	16.69	0.00	13.62	63.27	T	0.10	0.16	0.39	99.99

[1] The stock composition of ages other than 1.2, 1.3, and 2.3 estimated by averaging the composition of these ages.

[2] Trace, less than 0.005%.

Table 6. Contribution of the 1.2 age class to the Black Lake sockeye salmon run, 1922-1937, 1939, 1955-1983[1] [2] [3].

Year	Numbers	%	Year	Numbers	%
1922	12,960	3.0	1961	6,559	3.4
1923	15,073	17.7	1962	19,146	8.0
1924	63,251	27.2	1963	31,039	7.5
1925	122,550	18.9	1964	52,866	19.9
1926	40,685	7.7	1965	13,946	1.8
1927	18,213	1.8	1966	8,246	1.8
1928	85,083	16.5	1967	30,139	6.1
1929	1,529	0.1	1968	11,885	1.5
1930	7,544	8.0	1969	95,019	16.3
1931	99,929	33.0	1970	66,122	3.1
1932	23,860	0.8	1971	15,832	1.3
1933	9,910	2.1	1972	12,922	3.5
1934	23,769	1.6	1973	12,477	1.2
1935	33,685	8.3	1974	16,859	3.3
1936	50,602	4.7	1975	22,137	7.1
1937	62,079	15.0	1976	30,727	2.9
.	.	.	1977	19,193	2.1
1939	68,710	3.5	1978	50,713	3.3
.	.	.	1979	19,444	3.4
.	.	.	1980	42,633	9.2
1955	46,798	10.7	1981	56,257	4.9
1956	4,390	0.8	1982	53,026	2.8
1957	1,024	0.4	1983	487,004	38.0
1958	6,468	2.5			
1959	30,302	10.9			
1960	16,499	3.1			

[1] Dahlberg 1968.

[2] Nicholson et al. 1982.

[3] Conrad 1984.

Table 7. Daily and cumulative return of sockeye salmon to Black Lake (adjusted to Chignik Lagoon date).

DATE	NUMBERS OF FISH				
	ESCAPEMENT	CATCH	DAILY RETURN	CUMULATIVE RETURN	CUMULATIVE PROPORTION
PRIOR 5/29	0	0	0	0	0.000
5/29	461	0	461	461	.000
5/30	2,424	0	2,424	2,885	.002
5/31	1,365	0	1,365	4,250	.003
6/ 1	3,400	0	3,400	7,650	.006
6/ 2	5,700	0	5,700	13,350	.010
6/ 3	7,210	0	7,210	20,560	.016
6/ 4	15,313	0	15,313	35,873	.028
6/ 5	15,326	0	15,326	51,199	.040
6/ 6	16,298	0	16,298	67,497	.053
6/ 7	12,634	0	12,634	80,131	.062
6/ 8	10,708	19,473	30,181	110,312	.086
6/ 9	17,445	25,317	42,762	153,074	.119
6/10	23,042	2,299	25,341	178,415	.139
6/11	13,044	397	13,441	191,856	.150
6/12	16,750	9,358	26,108	217,964	.170
6/13	12,218	33,012	45,230	263,194	.205
6/14	28,515	17,900	46,415	309,609	.241
6/15	59,660	9,472	69,132	378,741	.295
6/16	24,868	10,492	35,360	414,101	.323
6/17	4,595	42,709	47,304	461,405	.360
6/18	1,881	44,841	46,722	508,127	.396
6/19	854	42,827	43,681	551,808	.430
6/20	4,615	47,284	51,899	603,707	.471
6/21	3,205	32,943	36,148	639,855	.499
6/22	4,472	46,202	50,674	690,529	.538
6/23	11,171	52,455	63,626	754,155	.588
6/24	21,029	33,184	54,213	808,368	.630
6/25	26,558	2,275	28,833	837,201	.653
6/26	12,268	44,054	56,322	893,523	.697
6/27	3,673	46,634	50,307	943,830	.736
6/28	1,040	36,314	37,354	981,184	.765
6/29	953	29,585	30,538	1,011,722	.789
6/30	1,841	23,509	25,350	1,037,072	.809
7/ 1	1,674	19,622	21,296	1,058,368	.825
7/ 2	734	19,768	20,502	1,078,870	.841
7/ 3	254	22,296	22,550	1,101,420	.859
7/ 4	426	12,770	13,196	1,114,616	.869
7/ 5	651	13,362	14,013	1,128,629	.880
7/ 6	1,791	1,327	3,118	1,131,747	.882
7/ 7	2,338	485	2,823	1,134,570	.885
7/ 8	3,991	0	3,991	1,138,561	.888
7/ 9	3,721	0	3,721	1,142,282	.891
7/10	4,425	7,666	12,091	1,154,373	.900
7/11	971	18,906	19,877	1,174,250	.916
7/12	2,077	17,604	19,681	1,193,931	.931
7/13	7,750	596	8,346	1,202,277	.937
7/14	1,599	5,642	7,241	1,209,518	.943
7/15	340	13,188	13,528	1,223,046	.954
7/16	956	7,433	8,389	1,231,435	.960
7/17	1,749	1,896	3,645	1,235,080	.963
7/18	217	6,782	6,999	1,242,079	.969
7/19	111	8,218	8,329	1,250,408	.975
7/20	193	8,252	8,445	1,258,853	.982
7/21	174	5,819	5,993	1,264,846	.986
7/22	1,074	4,477	5,551	1,270,397	.991
7/23	2,106	1,800	3,906	1,274,303	.994
7/24	1,385	1,649	3,034	1,277,337	.996
7/25	885	1,386	2,271	1,279,608	.998
7/26	28	1,974	2,002	1,281,610	.999
7/27	21	838	859	1,282,469	1.000
AFTER 7/27	0	0	0	1,282,469	1.000
TOTAL	426,177	856,292	1,282,469		

Table 8. Daily and cumulative return of sockeye salmon to Chignik Lake (adjusted to Chignik Lagoon date).

DATE	NUMBERS OF FISH				
	ESCAPEMENT	CATCH	DAILY RETURN	CUMULATIVE RETURN	CUMULATIVE PROPORTION
PRIOR 6/13	6,522	2,959	9,481	9,481	.006
6/13	1,438	3,884	5,322	14,803	.009
6/14	3,611	2,266	5,877	20,680	.012
6/15	8,088	1,283	9,371	30,051	.018
6/16	3,594	1,516	5,110	35,161	.021
6/17	705	6,557	7,262	42,423	.025
6/18	288	6,858	7,146	49,569	.029
6/19	130	6,512	6,642	56,211	.033
6/20	696	7,132	7,828	64,039	.038
6/21	537	5,516	6,053	70,092	.041
6/22	828	8,570	9,398	79,490	.047
6/23	2,291	10,759	13,050	92,540	.055
6/24	5,067	7,997	13,064	105,604	.062
6/25	7,332	628	7,960	113,564	.067
6/26	3,803	13,655	17,458	131,022	.077
6/27	1,258	15,971	17,229	148,251	.087
6/28	464	16,176	16,640	164,891	.097
6/29	555	17,259	17,814	182,705	.108
6/30	1,424	18,157	19,581	202,286	.119
7/ 1	1,483	17,383	18,866	221,152	.131
7/ 2	751	20,190	20,941	242,093	.143
7/ 3	301	26,422	26,723	268,816	.159
7/ 4	1,065	31,852	32,917	301,733	.178
7/ 5	1,799	36,902	38,701	340,434	.201
7/ 6	5,522	4,090	9,612	350,046	.207
7/ 7	8,117	1,691	9,808	359,854	.212
7/ 8	12,910	0	12,910	372,764	.220
7/ 9	12,757	0	12,757	385,521	.228
7/10	16,101	27,888	43,989	429,510	.253
7/11	3,758	73,166	76,924	506,434	.299
7/12	8,406	71,237	79,643	586,077	.346
7/13	32,840	2,529	35,369	621,446	.367
7/14	7,104	25,066	32,170	653,616	.386
7/15	1,589	61,515	63,104	716,720	.423
7/16	4,686	36,463	41,149	757,869	.447
7/17	9,129	9,899	19,028	776,897	.458
7/18	1,203	37,765	38,968	815,865	.481
7/19	657	48,975	49,632	865,497	.511
7/20	1,241	52,831	54,072	919,569	.543
7/21	1,202	40,157	41,359	960,928	.567
7/22	8,029	33,469	41,498	1,002,426	.592
7/23	19,302	16,502	35,804	1,038,230	.613
7/24	16,208	19,315	35,523	1,073,753	.634
7/25	14,126	22,104	36,230	1,109,983	.655
7/26	691	48,236	48,927	1,158,910	.684
7/27	1,023	41,788	42,811	1,201,721	.709
7/28	1,123	29,459	30,582	1,232,303	.727

-continued-

Table 8. Daily and cumulative return of sockeye salmon to Chignik Lake (adjusted to Chignik Lagoon date) - continued.

DATE	NUMBERS OF FISH				
	ESCAPEMENT	CATCH	DAILY RETURN	CUMULATIVE RETURN	CUMULATIVE PROPORTION
7/29	4,437	25,745	30,182	1,262,485	.745
7/30	16,808	0	16,808	1,279,293	.755
7/31	8,459	0	8,459	1,287,752	.760
8/ 1	5,658	17,909	23,567	1,311,319	.774
8/ 2	5,658	16,680	22,338	1,333,657	.787
8/ 3	5,658	15,259	20,917	1,354,574	.799
8/ 4	5,658	11,828	17,486	1,372,060	.810
8/ 5	5,658	9,075	14,733	1,386,793	.818
8/ 6	5,047	451	5,498	1,392,291	.822
8/ 7	5,047	0	5,047	1,397,338	.825
8/ 8	5,047	5,880	10,927	1,408,265	.831
8/ 9	5,047	20,709	25,756	1,434,021	.846
8/10	5,047	13,374	18,421	1,452,442	.857
8/11	5,047	11,137	16,184	1,468,626	.867
8/12	5,046	13,663	18,709	1,487,335	.878
8/13	5,382	776	6,158	1,493,493	.881
8/14	5,382	36	5,418	1,498,911	.885
8/15	5,382	17,278	22,660	1,521,571	.898
8/16	5,382	12,020	17,402	1,538,973	.908
8/17	5,382	13,125	18,507	1,557,480	.919
8/18	5,382	12,136	17,518	1,574,998	.929
8/19	5,382	12,188	17,570	1,592,568	.940
8/20	2,465	0	2,465	1,595,033	.941
8/21	2,465	0	2,465	1,597,498	.943
8/22	2,464	2,806	5,270	1,602,768	.946
8/23	2,464	10,885	13,349	1,616,117	.954
8/24	2,464	5,807	8,271	1,624,388	.959
8/25	2,464	7,246	9,710	1,634,098	.964
8/26	2,464	3,888	6,352	1,640,450	.968
8/27	1,597	0	1,597	1,642,047	.969
8/28	1,597	0	1,597	1,643,644	.970
8/29	1,597	5,357	6,954	1,650,598	.974
8/30	1,597	5,674	7,271	1,657,869	.978
8/31	1,597	2,710	4,307	1,662,176	.981
9/ 1	1,597	2,558	4,155	1,666,331	.983
9/ 2	1,596	3,406	5,002	1,671,333	.986
9/ 3	1,026	0	1,026	1,672,359	.987
9/ 4	1,025	0	1,025	1,673,384	.988
9/ 5	1,025	200	1,225	1,674,609	.988
9/ 6	1,025	2,583	3,608	1,678,217	.990
9/ 7	1,025	3,419	4,444	1,682,661	.993
9/ 8	1,025	3,374	4,399	1,687,060	.996
9/ 9	1,025	1,792	2,817	1,689,877	.997
9/10	158	1,601	1,759	1,691,636	.998
9/11	158	440	598	1,692,234	.999
9/12	158	213	371	1,692,605	.999
9/13	158	682	840	1,693,445	.999
AFTER 9/13	472	626	1,098	1,694,543	1.000
TOTAL	409,458	1,285,085	1,694,543		

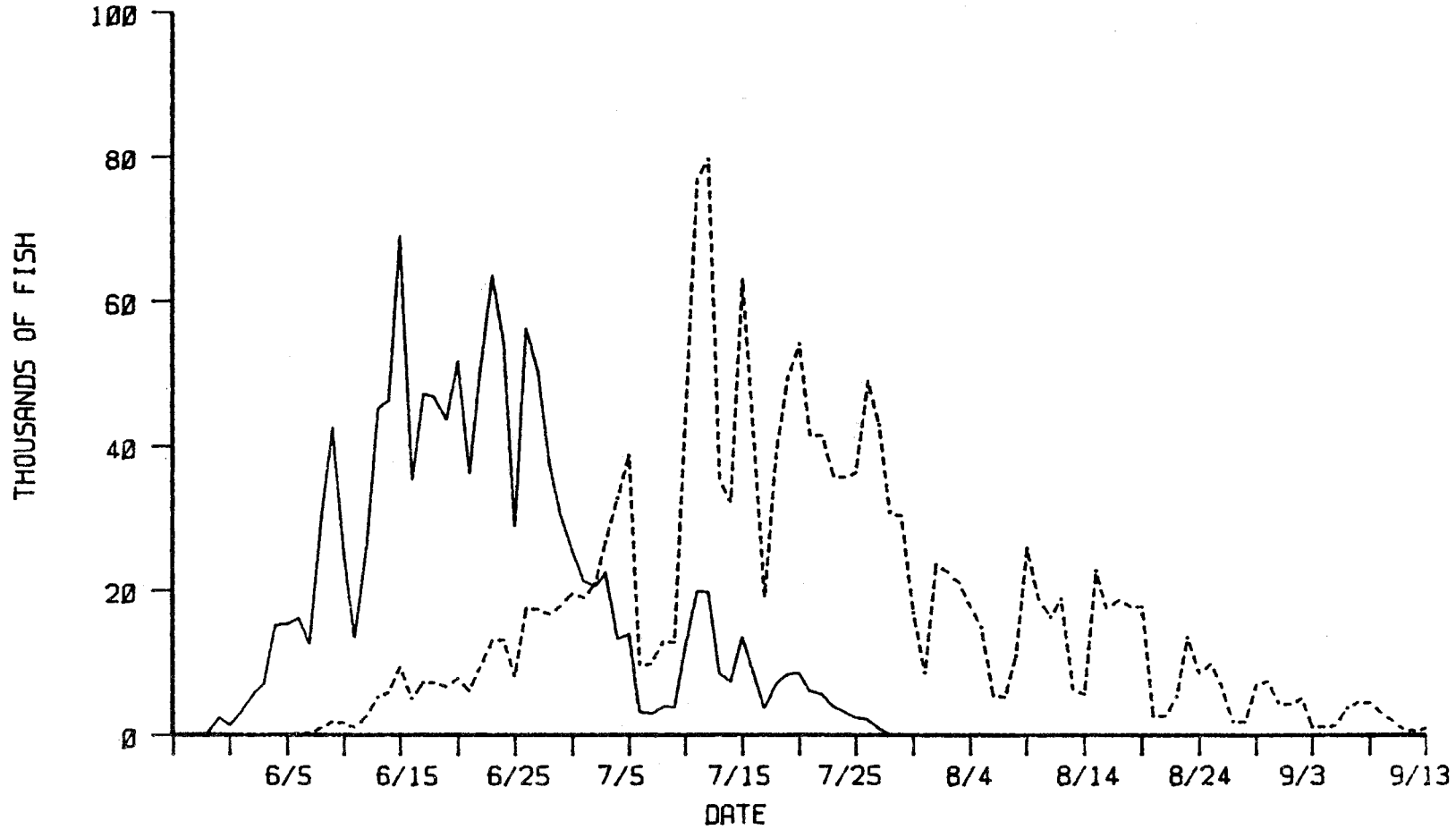

Figure 7. Daily abundance of the Black Lake (—) and Chignik Lake (- -) stocks.

to the Black Lake run and assigned a much larger portion of these 1.2 age class sockeye salmon to the Chignik Lake run.

An accurate estimate of the number of age 1.2 fish in the Black Lake run is important because it is typically the major component of the forecast for the next year's Black Lake run (Parker 1983). There is a positive correlation between the number of 1.2s in the Black Lake run and the next year's return of 1.3s. Because the number of age 1.2 fish is the best indicator of the next year's Black Lake run strength, it is important that this component of the run be accurately assessed.

An obvious question is whether the estimate of the number of 1.2s in the Black Lake run is representative of the run or an artifact of the method of allocation. The age compositions of the scale samples collected at the outlet of Black Lake indicate that the estimated percentage of 1.2s is reasonable. The estimated percentage of 1.2s in the Black Lake run (33%) is within the range of the percentages in the Black Lake scale samples (22%-37%). Although the age composition of the Black Lake samples cannot be compared directly to the age composition estimated by the scale pattern analysis method (Conrad 1984), it does provide supporting evidence. It can be reasonably stated with certainty that the record number of 1.2s in the Black Lake run was not an artifact of the method of allocation.

LITERATURE CITED

Clutter, R.I. and L.E. Whitesel. 1956. Collection and interpretation of sockeye salmon scales. Int. Pac. Salmon Fish. Comm., Bull. 9. 159 pp.

Conrad, R.H. 1982. Separation of the 1981 Chignik sockeye salmon stocks by scale patterns and a linear discriminant function. Alaska Dept. Fish and Game, Tech. Data Rpt. No. 76. 34 pp.

Conrad, R.H. 1984. Management applications of scale pattern analysis methods for the sockeye salmon runs to Chignik, Alaska. Alaska Dept. Fish and Game, Inf. Leafl. No. 233. 185 pp.

Cook, R.C. and G.E. Lord. 1978. Identification of stocks of Bristol Bay sockeye salmon, *(Oncorhynchus nerka)*, by evaluating scale patterns with a polynomial discriminant method. U.S. Fish and Wildl. Serv., Fish. Bull. 76(2):415-423.

Dahlberg, M.L. 1968. Analysis of the dynamics of sockeye salmon returns to the Chignik lakes, Alaska. Ph.D. Dissertation, Univ. of Washington, Seattle. 337 pp.

Dixon, W.J. and M.B. Brown, eds. 1979. Biomedical computer programs p-series. Health Sci. Computing Facility, Univ. Cal., Los Angeles. 880 pp.

Fisher, R.A. 1936. The use of multiple measurements in taxonomic problems. Ann. Eugen. 7:179-188.

Higgins, E. 1934. Progress in biological inquiries, 1932. Page 106 in Report of the Commissioner of fisheries to the Secretary of Commerce for the fiscal year ended June 30, 1933. U.S. Bureau of Fisheries.

Lachenbruch, P.A. 1967. An almost unbiased method of obtaining confidence intervals for the probability of misclassification in discriminant analysis. Biometrics 23(4):639-645.

Mosher, K.H. 1969. Photographic atlas of sockeye salmon scales. U.S. Fish and Wildl. Serv., Fish. Bull. 67(2): 243-280.

Narver, D.W. 1963. Identification of adult red salmon groups by lacustrine scale measurement, time of entry, and spawning characteristics. M.S. Thesis, Univ. Washington, Seattle. 96 pp.

Narver, D.W. 1966. Pelagial ecology and carrying capacity of sockeye salmon in the Chignik lakes, Alaska. Ph.D. Dissertation, Univ. Washington, Seattle. 348 pp.

Nicholson, L., H. O'Neill, and L. Wright. 1982. Chignik management area finfish annual report, 1981. Alaska Dept. Fish and Game (processed report). 118 pp.

Parker, S.S. 1983. Preliminary forecast of the 1984 Chignik sockeye salmon run. Fish. Res. Inst., Univ. Wash., Seattle (unprocessed report). 3 pp.

LITERATURE CITED (Continued)

Pella, J.J. and T.L. Robertson. 1979. Assessment of composition of stock mixtures. U.S. Fish and Wildl. Serv., Fish. Bull. 77(2):387-398.

APPENDICES

Appendix Table 1. Daily sockeye salmon escapement, catch by area, and total run adjusted to Chignik Lagoon date.

Date	Escapement	Chignik Lagoon	Hook Bay/ Kujulik	Aniakchak	Eastern District	Cape Igvak	Western District	Perryville District	Stepovak	Daily Total
5/27	0	0	0	0	0	0	0	0	0	0
5/28	0	0	0	0	0	0	0	0	0	0
5/29	461	0	0	0	0	0	0	0	0	461
5/30	2,427	0	0	0	0	0	0	0	0	2,427
5/31	1,370	0	0	0	0	0	0	0	0	1,370
6/ 1	3,417	0	0	0	0	0	0	0	0	3,417
6/ 2	5,737	0	0	0	0	0	0	0	0	5,737
6/ 3	7,272	0	0	0	0	0	0	0	0	7,272
6/ 4	15,466	0	0	0	0	0	0	0	0	15,466
6/ 5	15,507	0	0	0	0	0	0	0	0	15,507
6/ 6	16,618	0	0	0	0	0	0	0	0	16,618
6/ 7	12,983	0	0	0	0	0	0	0	0	12,983
6/ 8	11,096	20,177	0	0	0	0	0	0	0	31,273
6/ 9	18,228	23,978	2,474	0	0	0	0	0	0	44,680
6/10	24,511	0	579	1,867	0	0	0	0	0	26,957
6/11	14,119	0	0	207	222	0	0	0	0	14,548
6/12	18,430	9,686	0	0	613	0	0	0	0	28,729
6/13	13,656	34,784	2,112	0	0	0	0	0	0	50,552
6/14	32,126	0	12,402	3,511	0	4,253	0	0	0	52,292
6/15	67,748	0	0	2,657	0	8,098	0	0	0	78,503
6/16	28,462	2,859	0	0	9,149	0	0	0	0	40,470
6/17	5,300	49,266	0	0	0	0	0	0	0	54,566
6/18	2,169	47,498	3,813	388	0	0	0	0	0	53,868
6/19	984	29,858	280	6,926	839	11,436	0	0	0	50,323
6/20	5,311	23,350	13,243	4,350	5,692	7,781	0	0	0	59,727
6/21	3,742	28,035	1,886	3,628	4,910	0	0	0	0	42,201
6/22	5,300	34,683	15,606	2,044	2,439	0	0	0	0	60,072
6/23	13,462	29,137	9,356	3,563	0	21,158	0	0	0	76,676
6/24	26,096	0	143	3,268	0	37,770	0	0	0	67,277
6/25	33,890	0	0	856	0	2,047	0	0	0	36,793
6/26	16,071	50,811	0	0	0	6,898	0	0	0	73,780
6/27	4,931	61,116	0	0	0	1,489	0	0	0	67,536
6/28	1,504	47,384	5,106	0	0	0	0	0	0	53,994
6/29	1,508	39,879	4,008	2,957	0	0	0	0	0	48,352
6/30	3,265	37,994	2,361	1,311	0	0	0	0	0	44,931
7/ 1	3,157	32,140	4,059	806	0	0	0	0	0	40,162

-Continued-

Appendix Table 1. Daily sockeye salmon escapement, catch by area, and total run adjusted to Chignik Lagoon date (continued).

Date	Escapement	Chignik Lagoon	Hook Bay/ Kujulik	Aniakchak	Eastern District	Cape Igvak	Western District	Perryville District	Stepovak	Daily Total
7/ 2	1,485	34,615	3,893	1,283	0	167	0	0	0	41,443
7/ 3	555	42,887	2,246	966	0	0	2,619	0	0	49,273
7/ 4	1,491	41,404	435	48	0	0	2,660	75	0	46,113
7/ 5	2,450	48,232	714	428	0	0	866	24	0	52,714
7/ 6	7,313	0	3,687	764	0	0	966	0	0	12,730
7/ 7	10,455	304	0	1,872	0	0	0	0	0	12,631
7/ 8	16,901	0	0	0	0	0	0	0	0	16,901
7/ 9	16,478	0	0	0	0	0	0	0	0	16,478
7/10	20,526	35,554	0	0	0	0	0	0	0	56,080
7/11	4,729	82,025	10,047	0	0	0	0	0	0	96,801
7/12	10,483	77,974	5,909	2,416	0	0	2,542	0	0	99,324
7/13	40,590	0	0	609	268	0	2,248	0	0	43,715
7/14	8,703	29,034	0	21	0	460	1,193	0	0	39,411
7/15	1,929	58,950	252	0	0	15,501	0	0	0	76,632
7/16	5,642	26,119	1,271	736	0	15,056	714	0	0	49,538
7/17	10,878	0	1,246	1,490	0	8,448	611	0	0	22,673
7/18	1,420	36,790	0	693	0	5,894	1,170	0	0	45,967
7/19	768	34,649	406	0	0	22,138	0	0	0	57,961
7/20	1,434	33,778	3,942	568	0	21,554	1,241	0	0	62,517
7/21	1,376	24,505	2,678	1,398	0	16,305	1,014	76	0	47,352
7/22	9,103	20,002	1,746	2,121	0	11,960	1,920	197	0	47,049
7/23	21,408	0	1,020	1,424	0	13,885	1,440	533	0	39,710
7/24	17,593	0	0	754	0	18,532	778	900	0	38,557
7/25	15,011	0	0	0	0	23,463	0	27	0	38,501
7/26	719	31,117	0	0	0	19,093	0	0	0	50,929
7/27	1,044	22,465	0	0	0	20,161	0	0	0	43,670
7/28	1,123	24,957	0	0	0	4,502	0	0	0	30,582
7/29	4,437	25,745	0	0	0	0	0	0	0	30,182
7/30	16,808	0	0	0	0	0	0	0	0	16,808
7/31	8,459[1]	0	0	0	0	0	0	0	0	8,459
8/ 1	5,658	17,909	0	0	0	0	0	0	0	23,567
8/ 2	5,658	16,680	0	0	0	0	0	0	0	22,338
8/ 3	5,658	14,705	0	0	0	0	554	0	0	20,917
8/ 4	5,658	11,040	0	0	0	0	675	113	0	17,486
8/ 5	5,658	7,797	0	0	0	0	615	663	0	14,733
8/ 6	5,047	0	0	0	0	0	0	451	0	5,498

-Continued-

Appendix Table 1. Daily sockeye salmon escapement, catch by area, and total run adjusted to Chignik Lagoon date (continued).

Date	Escapement	Chignik Lagoon	Hook Bay/ Kujulik	Aniakchak	Eastern District	Cape Igvak	Western District	Perryville District	Stepovak	Daily Total
8/ 7	5,047	0	0	0	0	0	0	0	0	5,047
8/ 8	5,047	5,880	0	0	0	0	0	0	0	10,927
8/ 9	5,047	20,709	0	0	0	0	0	0	0	25,756
8/10	5,047	13,102	0	0	0	0	272	0	0	18,421
8/11	5,047	10,363	0	0	0	0	415	359	0	16,184
8/12	5,046	12,704	0	0	0	0	421	538	0	18,709
8/13	5,382	0	0	0	0	0	291	485	0	6,158
8/14	5,382	0	0	0	0	0	21	15	0	5,418
8/15	5,382	17,259	0	11	8	0	0	0	0	22,660
8/16	5,382	12,020	0	0	0	0	0	0	0	17,402
8/17	5,382	13,125	0	0	0	0	0	0	0	18,507
8/18	5,382	12,136	0	0	0	0	0	0	0	17,518
8/19	5,382	12,188	0	0	0	0	0	0	0	17,570
8/20	2,465	0	0	0	0	0	0	0	0	2,465
8/21	2,465	0	0	0	0	0	0	0	0	2,465
8/22	2,464	2,806	0	0	0	0	0	0	0	5,270
8/23	2,464	10,885	0	0	0	0	0	0	0	13,349
8/24	2,464	5,807	0	0	0	0	0	0	0	8,271
8/25	2,464	7,246	0	0	0	0	0	0	0	9,710
8/26	2,464	3,888	0	0	0	0	0	0	0	6,352
8/27	1,597	0	0	0	0	0	0	0	0	1,597
8/28	1,597	0	0	0	0	0	0	0	0	1,597
8/29	1,597	5,357	0	0	0	0	0	0	0	6,954
8/30	1,597	5,674	0	0	0	0	0	0	0	7,271
8/31	1,597	2,710	0	0	0	0	0	0	0	4,307
9/ 1	1,597	2,558	0	0	0	0	0	0	0	4,155
9/ 2	1,596	3,406	0	0	0	0	0	0	0	5,002
9/ 3	1,026	0	0	0	0	0	0	0	0	1,026
9/ 4	1,025	0	0	0	0	0	0	0	0	1,025
9/ 5	1,025	200	0	0	0	0	0	0	0	1,225
9/ 6	1,025	2,583	0	0	0	0	0	0	0	3,608
9/ 7	1,025	3,347	0	72	0	0	0	0	0	4,444
9/ 8	1,025	3,236	0	138	0	0	0	0	0	4,399
9/ 9	1,025	1,768	0	24	0	0	0	0	0	2,817
9/10	158	1,601	0	0	0	0	0	0	0	1,759
9/11	158	440	0	0	0	0	0	0	0	598

-Continued-

Appendix Table 1. Daily sockeye salmon escapement, catch by area, and total run adjusted to Chignik Lagoon date (continued).

Date	Escapement	Chignik Lagoon	Hook Bay/ Kujulik	Aniakchak	Eastern District	Cape Igvak	Western District	Perryville District	Stepovak	Daily Total
9/12	158	213	0	0	0	0	0	0	0	371
9/13	158	682	0	0	0	0	0	0	0	840
9/14	158	626	0	0	0	0	0	0	0	784
9/15	157	0	0	0	0	0	0	0	0	157
9/16	157	0	0	0	0	0	0	0	0	157
9/17	0	0	0	0	0	0	0	0	0	0
9/18	0	0	0	0	0	0	0	0	0	0
9/19	0	0	0	0	0	0	0	0	0	0
9/20	0	0	0	0	0	0	0	0	0	0
9/21	0	0	0	0	0	0	0	0	0	0
9/22	0	0	0	0	0	0	0	0	0	0
9/23	0	0	0	0	0	0	0	0	0	0
9/24	0	0	0	0	0	0	0	0	0	0
9/25	0	0	0	0	0	0	0	0	0	0
9/26	0	0	0	0	0	0	0	0	0	0
9/27	0	0	0	0	0	0	0	0	0	0
9/28	0	0	0	0	0	0	0	0	0	0
9/29	0	0	0	0	0	0	0	0	0	0
9/30	0	0	0	0	0	0	0	0	0	0
Total	835,635	1,596,391	116,920	56,175	24,140	318,049	25,246	4,456	0	2,977,012

[1] Escapements after 7/31 estimated (Peter Probasco, personal communication).

Appendix Table 2. Age composition of sockeye salmon scale samples collected in Chignik Lagoon, by percent of sample.

Sample Date	Sample Size	Age Class										
		1.1	2.1	1.2	2.2	3.2	1.3	2.3	3.3	1.4	2.4	Other
6/ 5	267	0.0	0.0	24.3	2.2	0.0	61.4	10.1	.4	.4	0.0	1.2
6/ 9	138	0.0	0.0	21.7	2.2	0.0	57.3	15.9	0.0	.7	0.0	2.2
6/13	292	0.0	0.0	35.3	4.5	0.0	43.8	15.4	0.0	1.0	0.0	0.0
6/17	144	0.0	0.0	41.0	6.2	0.0	31.9	18.1	0.0	.7	0.0	2.1
6/20	237	0.0	0.0	44.3	3.8	0.0	35.9	14.8	0.0	.8	0.0	.4
6/23	268	0.0	0.0	41.8	3.7	0.0	38.0	13.8	0.0	.4	0.0	2.3
6/27	268	0.0	0.0	48.1	2.6	0.0	30.6	17.9	0.0	.4	0.0	.4
6/30	232	0.0	0.0	30.2	1.3	0.0	30.6	36.2	0.0	.4	0.0	1.3
7/ 3	255	0.0	0.0	21.6	4.3	0.0	27.8	45.5	0.0	0.0	0.0	.8
7/ 7	243	0.0	.4	11.5	3.7	0.0	17.3	66.3	0.0	0.0	0.0	.8
7/11	218	0.0	.9	4.6	3.2	0.0	8.7	82.6	0.0	0.0	0.0	0.0
7/16	204	.5	0.0	1.9	9.8	0.0	5.9	81.4	0.0	0.0	0.0	.5
7/22	192	0.0	0.0	1.6	25.0	0.0	4.2	68.7	0.0	0.0	0.0	.5
7/28	197	0.0	0.0	5.6	30.4	0.0	4.6	59.4	0.0	0.0	0.0	0.0
8/ 3	245	.4	.4	3.7	29.0	0.0	7.3	58.8	0.0	0.0	.4	0.0
8/10	261	0.0	.8	2.7	36.0	0.0	3.8	55.6	0.0	0.0	1.1	0.0
8/18	252	0.0	0.0	4.0	22.2	0.0	6.3	67.5	0.0	0.0	0.0	0.0
8/23	262	0.0	.8	2.7	27.9	0.0	4.9	62.2	0.0	.4	1.1	0.0

Appendix Table 3. Age composition of sockeye salmon scale samples collected at the outlet of Black Lake, by percent of sample.

Sample Date	Sample Size	Age Class										
		1.1	2.1	1.2	2.2	3.2	1.3	2.3	3.3	1.4	2.4	Other
6/19	257	0.0	0.0	25.7	2.7	0.0	61.1	10.1	0.0	0.0	0.0	.4
6/21	205	.5	0.0	22.9	2.4	0.0	65.4	7.8	0.0	.5	0.0	.5
6/25	335	0.0	0.0	36.7	4.5	.3	53.1	3.9	0.0	.3	0.0	1.2
6/28	233	0.0	0.0	28.8	3.4	0.0	55.4	10.7	0.0	.4	0.0	1.3
7/ 2	204	0.0	0.0	37.3	2.4	0.0	48.0	10.8	0.0	0.0	0.0	1.5
Mean		0.10	0.00	30.28	3.08	0.06	56.60	8.66	0.00	0.24	0.00	0.98