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MODELING THE MIGRATION OF SOCKEYE SALMON SMOLTS  
THROUGH BRISTOL BAY, ALASKA

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This report is to describe the status of our work on modeling the migration of sockeye salmon smolts through Bristol Bay. Thus far, we have gathered available information on the timing, abundance, and size and age composition (Table 1) for four major river systems in Bristol Bay--Wood, Kvichak, Naknek, and Ugashik. Raw data and sources of this information are given in Appendix I. Additional summary information\* is also provided in Tables 2 and 3 and Fig. 1.

Introduction

The objective of this modeling effort is to derive (based on some assumptions regarding rate of migration, mortality, and growth) from the information (timing, abundance, size) collected at the smolt indexing sites the spatial and temporal distribution of the major stocks of 0+ ocean age sockeye salmon in Bristol Bay. The model will aid in:

(1) Assessing the potential for intrastock competition by determining area, time, and extent of intrastock mixing of fish.

(2) Assessing the potential predation by birds, marine mammals, and fish by comparison of predator distribution with predicted distribution of salmon.

(3) Determining sensitivity of particular sockeye salmon stocks to annual variation in food availability in Bristol Bay by comparing temporal and spatial availability of food to predicted distribution of salmon.

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\*Rogers, D.E. 1977. Determination and description of knowledge of the distribution, abundance, and timing of salmonids in the Gulf of Alaska and Bering Sea. Report 7736, Fisheries Research Institute, University of Washington, Seattle, 29 pp.

Key to Table 1

Year: Year of seaward migration.

River: Kvi = Kvichak (L. Iliamna), Nak = Naknek, Ugas = Ugashik,  
Wood = Wood (Nushagak District).

% N: Percentage of season's catch during the 5-day period.

% age I: Percentage of catch during 5-day period that were age I smolts.

L I: Mean length of age I smolts during a 5-day period.

L II: Mean length of age II smolts during a 5-day period.

Smolt total: Total of season's index catch or the season's population  
estimate.

Adult return: Age 1. = returns of ages 1.2 and 1.3.

Age 2. = returns of ages 2.2 and 2.3.

Mean length: Reported seasonal average length.

Mean weight: Reported seasonal average weight.

% Age: Reported seasonal age composition.





Table 1, cont'd

Year	River	Five-day period ending:												Smolt total	Adult return		Mean length		% Age								
		5/16	5/21	5/26	5/31	6/5	6/10	6/15	6/20	6/25	6/30	7/5	7/10		7/15	7/20	7/25	7/30	age I	age II	age I	age II					
1964	Kvi	% N	0	0	0	0.1	28.6	52.8	14.4	4.1								2062	23	265	87	108	5.2	9.8	22	78	
		% age I																	723	27	85	97	110	7.7	11.0	31	69
		L I																	999	18	33	92	118	6.9	12.7	80	20
1965	Kvi	% N	0	0	0	0.1	28.6	52.8	14.4	4.1								1812	8	456	90	109	6.8	11.3	4	96	
		% age I																	2471	45	65	99	114	8.4	13.0	60	40
		L I																	364	3	19	94	114	6.9	12.5	29	71
1966	Kvi	% N	0	0	0	0.5	6.2	12.3	7.2	22.5	12.2	27.4	11.3	0.4				3701	113	14	86	106	5.6	9.9	92	8	
		% age I																	276	213	76	94	114	7.4	12.6	92	8
		L I																	921	54	109	106	118	10.6	14.2	34	66
1967	Kvi	% N	0	0	0	0.7	2.3	20.8	22.4	38.0	4.8	9.7	1.3					2500	61	9	77	101	4.3	7.5	94	6	
		% age I																	3089	940	266	86	118	5.9	14.2	93	7
		L I																	941	78	118	113	119	13.1	14.7	44	56
1968	Kvi	% N	0	0	0	0.1	28.6	52.8	14.4	4.1								1812	8	456	90	109	6.8	11.3	4	96	
		% age I																	2471	45	65	99	114	8.4	13.0	60	40
		L I																	364	3	19	94	114	6.9	12.5	29	71





Table 1, cont'd

Year River	Five-day period ending:															Smolt total	Mean length		Mean weight		% Age			
	5/16	5/21	5/26	5/31	6/5	6/10	6/15	6/20	6/25	6/30	7/5	7/10	7/15	7/20	7/25		7/30	age I	age II	age I	age II	I	II	
Ugas	% N	9.9	68.1	22.0														96	116	7.2	13.0	25	74	
	% age I	12.0	19.5	49.5																				
	L I	98	101	93																				
	L II	116	116	113																				
Wood	% N	1.1	2.4	17.0	10.5	6.8	6.6	24.7	7.9	12.4	10.6							83	98	5.1	10.1	83	17	
	% age I	99.0	99.0	94.2	85.0	81.6	76.0	71.2																
	L I	83	81	83	85	84	87	89																
1976 Kvi	% N	0.5	0.7	1.4	45.3	49.7	2.4											88	121	5.8	14.2	98	2	
	% age I	82	100	99	94	100	99																	
	L I																							
Nak	% N	0.2	0	38.6	27.3	24.5	5.3	4.1																
	% age I	72.0		28.5	68.4	48.4	70.4	70.4																
	L I	76		93	90	90	93	93																
	L II	102		114	105	105	102	102																
Wood	% N	1.4	3.5	4.3	9.6	5.1	8.9	10.6	25.2	11.8	7.3	12.3	212.4*					83	95	4.5	6.5	96	4	
	% age I	92.0	89.2	97.1	95.8	97.5	97.3	97.4	97.2	99.3	91.9													
	L I	77	80	83	79	81	82	81	85	83	88													
	L II	104	100	99	95	103	94	92	90	94	92													

\*Population estimates in ten thousands.

Table. 2. Estimates of the number (millions) of sockeye salmon smolts by district and year of migration from Bristol Bay.

Year	Naknek- Kvichak	Egegik	Ugashik	Nushagak	Togiak	Total
1950	167	13	15	45	4	244
51	32	12	20	14	3	81
52	26	10	13	49	5	103
53	60	8	4	113	7	192
54	262	20	16	54	8	360
55	13	3	9	41	4	70
56	18	5	5	59	6	93
57	60	13	4	168	12	257
58	435	50	70	79	13	647
59	64	9	3	14	3	93
60	38	12	6	92	7	155
61	29	9	4	56	8	106
62	68	15	20	107	15	225
63	461	40	26	70	11	608
64	38	8	6	54	6	112
65	54	9	2	62	4	131
66	71	6	1	41	4	123
67	274	11	4	94	11	394
68	266	24	40	99	19	448
69	60	10	3	33	3	109
70	20	7	1	41	7	76
71	16	3	<1	22	6	47
72	57	14	1	121	9	202
73	120	9	9	76	16	230
74	42	12	3	47	10	114

Table 13. Timing of smolt migrations from Bristol Bay river systems. Dates on which 10, 50, and 90 percent of smolts migrated past the lake outlet.

Year	Kvichak			Ugashik			Naknek			Wood River		
	10%	50%	90%	10%	50%	90%	10%	50%	90%	10%	50%	90%
1951										6/7	6/23	7/11
1952										6/12	6/25	7/18
1953										6/3	6/17	6/23
1954										6/2	6/10	6/15
1955	6/5	6/5	6/8	-	-	-	-	-	-	6/26	7/10	7/15
1956	6/1	6/5	6/15	-	-	-	-	-	-	6/16	7/6	7/12
1957	5/31	6/1	6/24	-	-	-	-	-	-	6/11	6/24	6/26
1958	5/22	5/27	6/13	5/23	5/29	6/5	5/28	6/21	7/7	6/9	6/15	7/1
1959	5/26	5/30	6/1	5/29	5/31	6/15	6/3	6/17	7/10	6/6	6/18	6/25
1960	-	-	-	6/2	6/5	6/12	6/4	6/13	6/25	6/2	6/18	7/10
1961	-	-	-	5/16	5/28	6/20	6/6	6/14	7/1	6/5	6/15	7/2
1962	6/2	6/9	6/15	5/16	5/30	6/9	6/2	6/8	6/18	6/13	6/21	7/5
1963	5/25	5/27	6/7	5/16	5/31	6/10	6/1	6/19	7/1	6/9	6/16	7/2
1964	6/4	6/7	6/13	5/25	6/5	6/9	6/9	6/16	7/2	6/21	6/30	7/5
1965	5/24	5/26	5/29	5/27	6/3	6/13	6/3	6/15	6/27	6/18	7/1	7/11
1966	6/5	6/7	6/11	-	-	-	6/6	6/14	6/22	6/17	6/26	7/8
1967	5/26	6/1	6/9	5/23	5/28	6/8	5/31	6/8	6/26	-	-	-
1968	5/21	5/23	5/27	5/23	5/27	6/5	6/3	6/8	6/26	-	-	-
1969	5/28	6/1	6/12	5/25	5/30	6/5	6/4	6/9	6/29	-	-	-
1970	5/22	5/27	6/3	5/19	5/29	6/6	6/5	6/6	6/26	-	-	-
1971	6/10	6/10	6/15	-	-	-	6/9	6/13	6/25	-	-	-
1972	6/8	6/12	6/17	5/28	6/12	6/18	6/9	6/11	6/20	-	-	-
1973	5/23	5/25	5/31	5/27	5/29	6/4	5/28	6/3	6/13	-	-	-
1974	5/23	5/27	6/1	5/27	5/29	6/7	5/31	6/3	6/21	-	-	-
1975	-	-	-	-	-	-	6/6	6/9	6/27	6/14	7/2	7/13
1976	6/9	6/11	6/13	-	-	-	-	-	-	6/20	7/14	7/29
Means	5/30	6/2	6/9	5/24	5/31	6/10	6/4	6/12	6/26	6/12	6/24	7/6

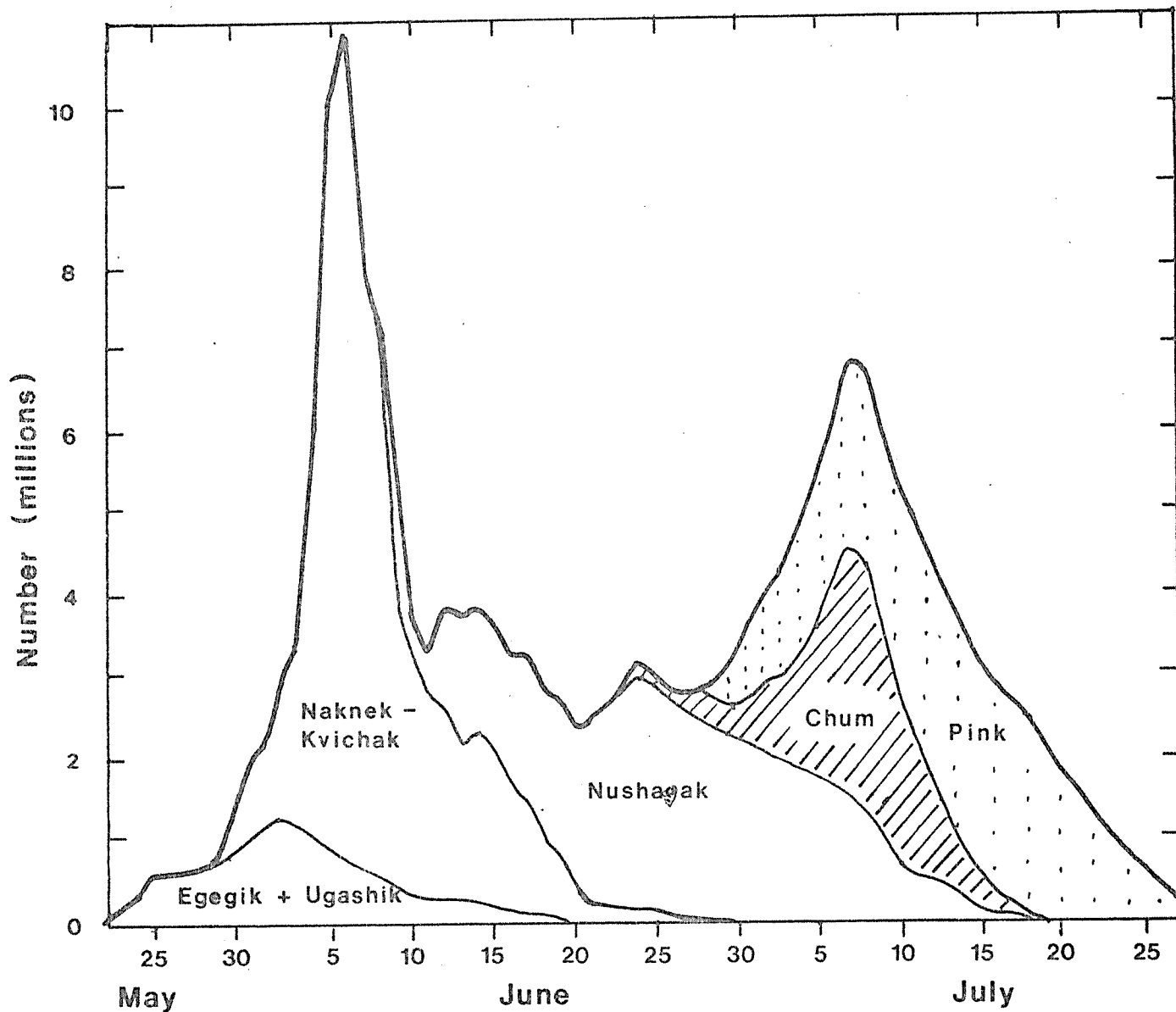


Fig. 1. Daily abundance of salmon smolt entering Bristol Bay in an average odd-numbered year, sockeye salmon for each district and pink and chum salmon from the Nushagak District only. Pink salmon would be nearly absent in an even-numbered year.

### Conceptual Framework

Straty (1974) found that sockeye smolts originating in the various sockeye-producing lake systems in Bristol Bay migrate through Bristol Bay on their way to the North Pacific, along the eastern shoreline. Sockeye are found along a wide area in inner Bristol Bay (north of Port Heiden). However, sockeye smolts in outer Bristol Bay (south of Port Heiden to Unimak Pass) are found mostly within 40 km of the eastern shoreline of Bristol Bay. No fish were caught farther than 56 km in outer Bristol Bay. The wide distribution of smolts in inner Bristol Bay is presumed due to Nushagak smolts making their way across Bristol Bay to follow the south shoreline to the North Pacific.

Sockeye are mostly within 3 meters of the surface with the nighttime depth distribution somewhat closer to the surface.

Based on Straty's work one may assume that sockeye migrate through a "tube" of width  $DW$  and height  $dV$  (Fig. 2). The major stocks of sockeye salmon enter the tube at various distances from the origin of the tube.

For each smolt-producing system, at any time  $t$  the population is represented, at least conceptually, by a bivariate function of length and distance from the origin (Fig. 3). The population of sockeye is distributed along the tube, and because larger sockeye generally migrate earlier, the length distribution at various points along the tube will be different. As time passes, the sockeye grow and migrate through the tube. The distribution (expressed by the bivariate function) will vary in time. Thus, the model will operate on the initial distribution of sockeye and predict what the distribution will be at some later time. Driving functions will be growth, migration rate, and mortality. These functions are (at least conceptually) derived as follows.

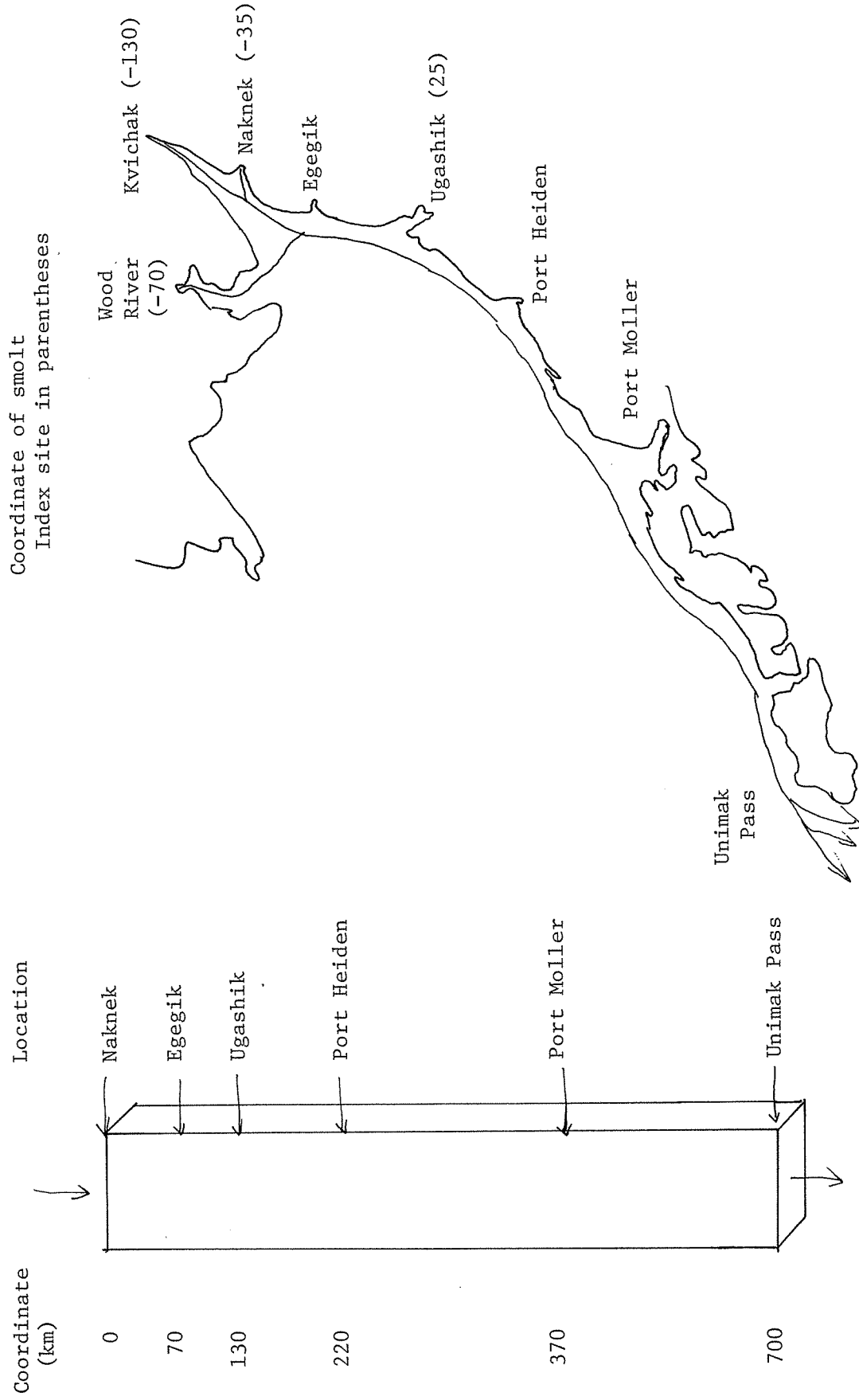


Fig. 2. Conceptual framework.

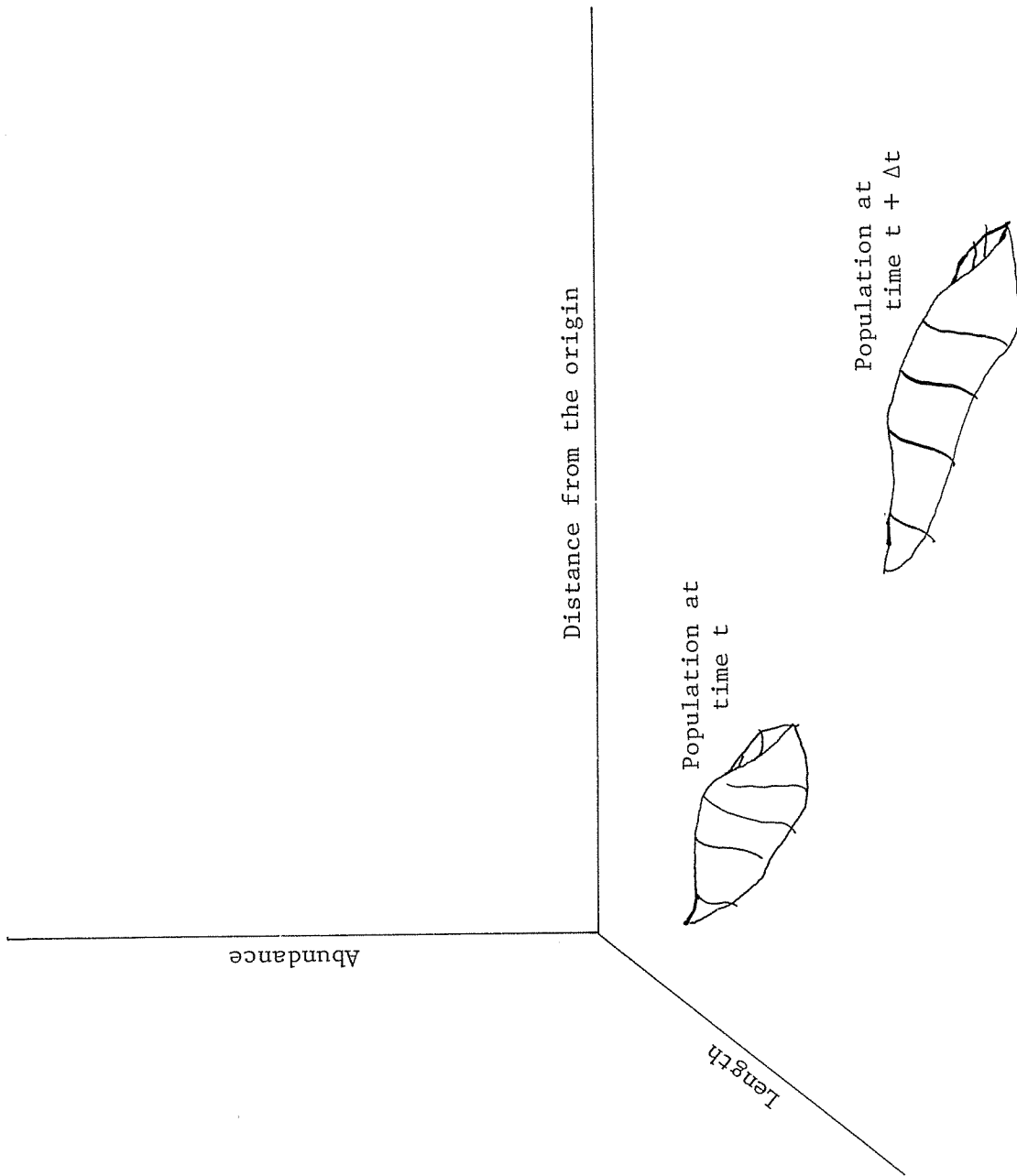


Fig. 3. Bivariate representation of a smolt population.

Growth varies in time; growth increases as more productive areas of Bristol Bay are reached; migration rate is dependent on size of sockeye; mortality is dependent on size and may decrease as sockeye reach more productive feeding areas.

This conceptual framework is certainly an oversimplification, necessary for a tractable model. The observed distribution of smolts (Straty 1974) in inner Bristol Bay is somewhat inconsistent with "the tube concept". If there is a significant east-west component to the smolt direction of travel, then the model's prediction of rate of travel would be in error. The magnitude of this error at present is unknown.

Straty found the wide distribution of smolts in inner Bristol Bay only in 1969, with the distribution during the summers of 1966 and 1967 close to the eastern shoreline as it is in outer Bristol Bay. However, the sampling in 1967 was limited.

The dimensions of the tube (i.e., the width and height) are not relevant to predicting rate of travel. They are very important if one is going to model food consumption or predation experienced by the migrating smolts. This is because the concentration of sockeye on an areal or volumetric basis would depend on the exact dimensions of the tube.

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#### Structure and Simplifications Necessary for Computer Realization

It is not practicable to express the distribution of sockeye as a continuous bivariate function because of the problem of finding a suitable function and fitting such a function to actual smolt data of daily or weekly resolution. Nor is it practicable to express the distribution as a discrete array of abundances (as a two-dimensional histogram) because the dimensions of the array (the size of the length interval of the

population and the length of the tube in which the population occurs) change with time.

To circumvent these problems, we have considered four populations (Wood River, Kvichak, Naknek, and Ugashik) and each population was broken into discrete groups. These groups were chosen in the following manner. The time period of smolt migration (11 May to 30 July) was broken up into 5-day periods. The fish that migrated during one of these 5-day periods were lumped into one group. Each group may be considered to be uniform with respect to size and location in the tube. Hence, the distribution of each sockeye population can be expressed as vectors:

$$P(i), L(i), D(i)$$

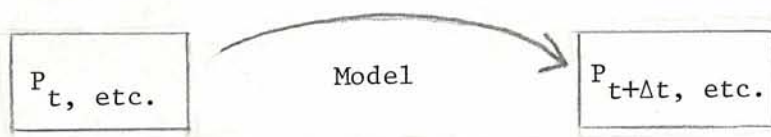
where  $P(i)$  = abundance of the  $i$ th group

$L(i)$  = length of the  $i$ th group

$D(i)$  = location of the  $i$ th group (distance from the origin)

Because of the nature of the available length data, it is suitable to assume that smolts migrating in any period are of uniform length equal to the mean length of the smolts migrating during the particular period. Therefore, the  $P$ ,  $L$ , and  $D$  arrays are singly dimensioned.

The model will then operate on these arrays. The driving functions of mortality, growth, and migration operate on  $P$ ,  $L$ , and  $D$ , respectively, that is:



The primary purpose of the model is to predict the spatial distribution of sockeye smolts in Bristol Bay, in relation to initial condition (i.e., abundance and timing of smolt migration for the major stocks of sockeye--Wood River, Naknek, Kvichak, Egegik, and Ugashik) and a priori rates of migration, growth, and mortality.

### Preliminary Results

As a "first cut", the assumed models of growth, mortality, and migration rates were very simple. Growth was assumed to be linear with growth rate being  $0.2 \text{ mm day}^{-1}$ . The rate of natural mortality was zero, and sockeye smolts were assumed to migrate 24 hrs a day, moving at a speed of  $1 \text{ length sec}^{-1}$ .

Input data to the model were those contained in Table 1. Information on the length of salmon in the constituent groups migrating every 5 days is not available for all stocks in all years. The length of each particular group was estimated assuming length decreased linearly over the duration of smolt outmigration. This assumption is consistent with the widely observed tendency of larger' smolts to leave first. Furthermore, the difference between the mean length of the first group to leave and the mean length of the last group to leave was 20% of the mean length of the total population in the particular year. The smolt abundance was taken to be the estimated number of outmigrants for the Naknek and Ugashik population. For the Wood River and Kvichak population only smolt indices are available and the smolt abundance was taken to be ten times the number of adults returning from the particular smolt population.

The assumption that size of smolts decreases as the outmigration progresses is somewhat erroneous. It is true that the larger smolts leave the lakes first, but plus freshwater growth occurs and compensates for this differential migration by size. Therefore, the size of the smolts during the outmigration is fairly constant. One should be aware that the model is at this point an archetype and with application the assumptions can be more realistic.

A list of the FORTRAN version of the model, together with some sample output, is presented in Appendix II. Graphical output\* for the 1962 and 1963 smolt outmigration is presented in Figs. 4 and 5, respectively. During 1962 the magnitudes of the smolt outmigration from the Wood River, Kvichak, Naknek, and Ugashik systems were comparable. During this year there is a great deal of overlap (i.e., co-occurrence in Bristol Bay) in the distribution for Naknek and Ugashik and for Wood

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\*These graphs were generated using GENPLT (Gales, L.E., and N.J. Sands, 1975. GENPLT: A general purpose two-dimensional plotting program. NORFISH Rept. NI41).

DISTR. OF SMOLTS IN BRISTOL BAY DURING 1962

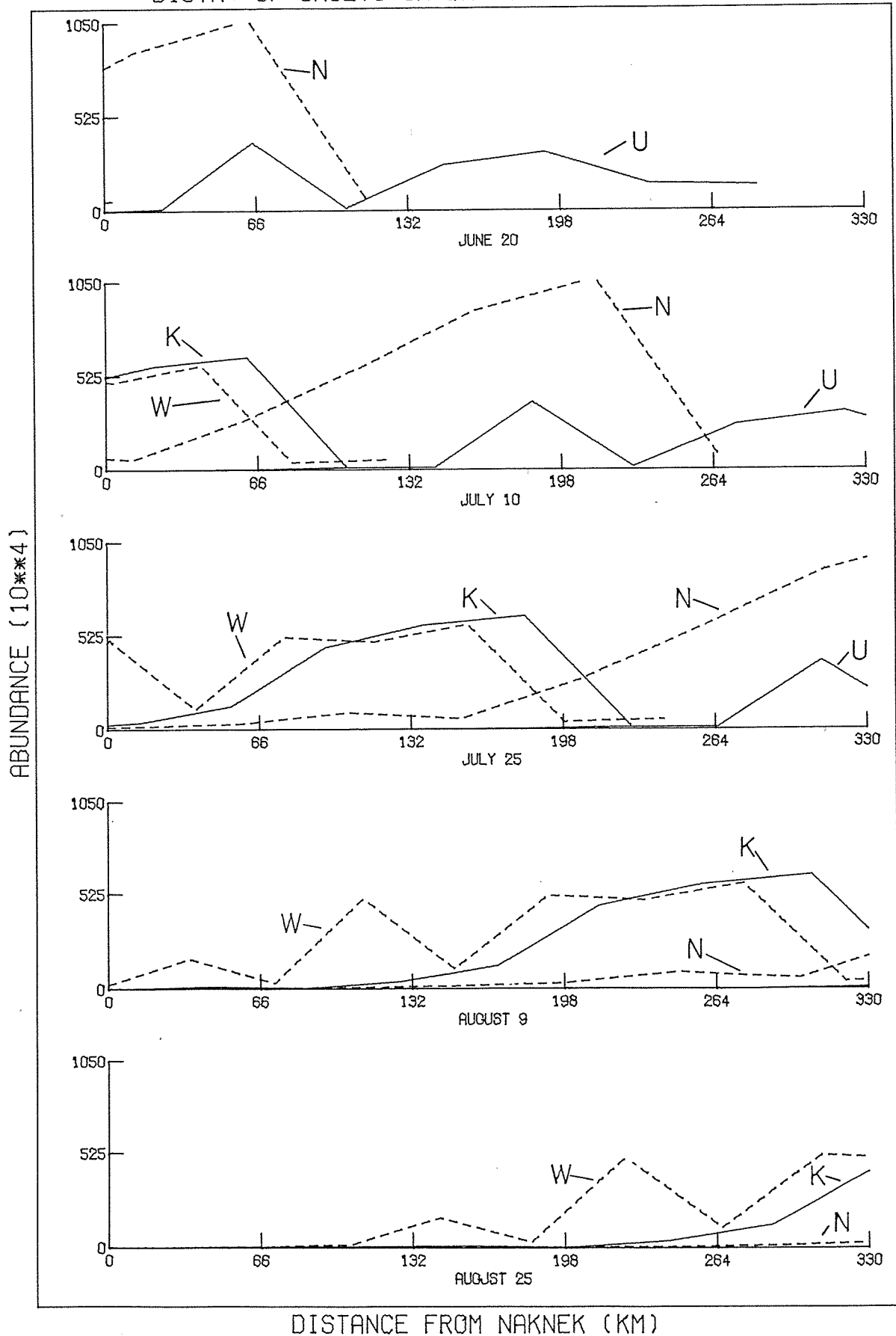


Fig. 4. Distribution of smolts in Bristol Bay, 1962.

DISTR. OF SMOLTS IN BRISTOL BAY DURING 1963

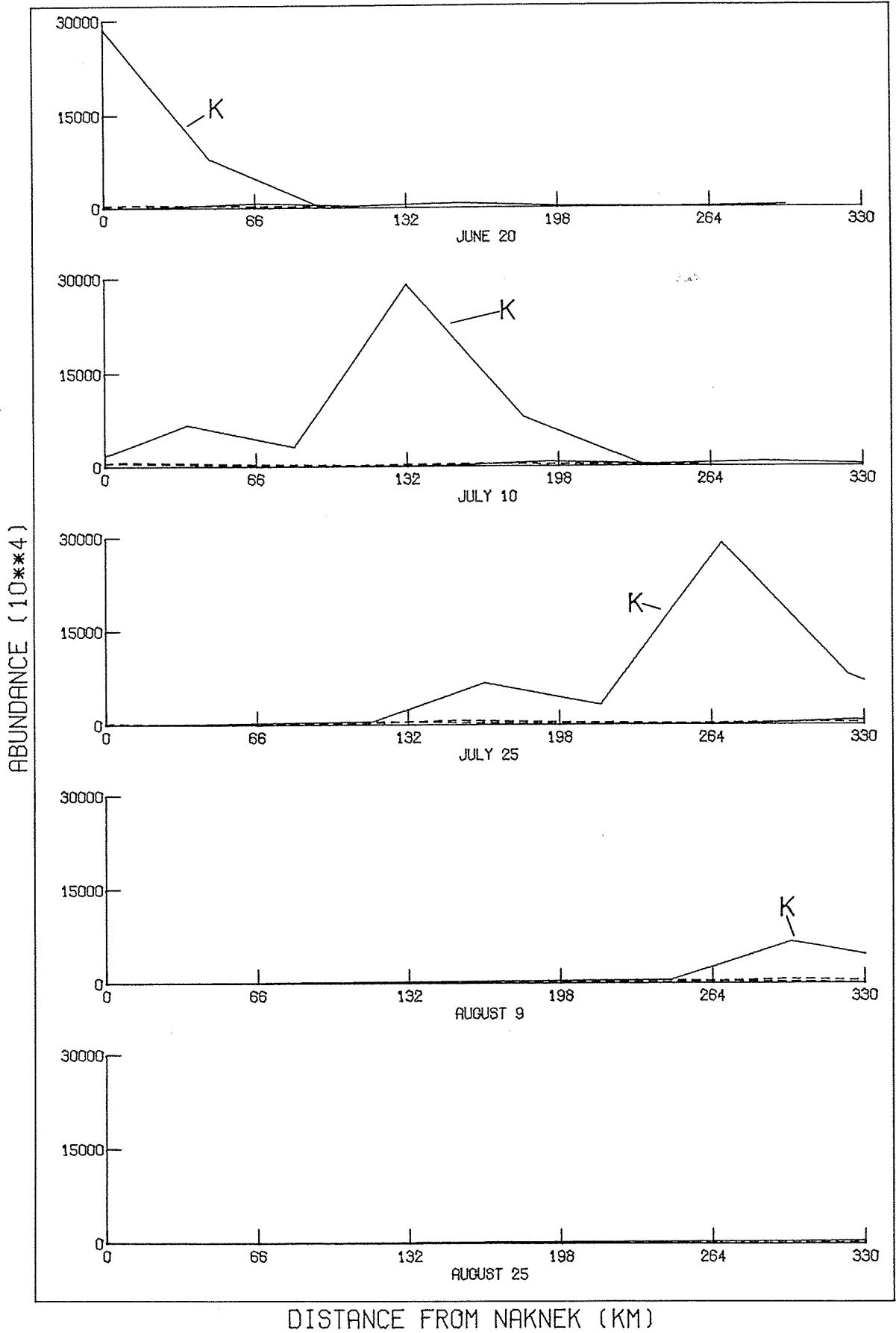


Fig. 5. Distribution of smolts in Bristol Bay, 1963.

River and Kvichak. Smolts are for the most part gone from Bristol Bay by September. This is consistent with that found by Straty (1975). The distribution of sockeye smolts in Bristol Bay during 1963 was dominated by Kvichak smolts.

The model has some potentially useful extensions. The first extension would be to use the model to generate the approximate (N-S) spatial and temporal distribution of smolts in Bristol Bay. This distribution would then be compared with known distribution of potential predators or known food availability to obtain some insight as to whether food limitation or predator limitation is occurring during the period of sockeye smolt residence in Bristol Bay. Secondly, the model may be used to predict magnitude of population interaction among the various stocks of salmon migrating through Bristol Bay. Indices of stock interaction may be formulated based on the degree of overlap in the spatial and temporal distribution of respective stocks. Cross-correlation analyses between population interaction indices and marine survival in various stocks of salmon may indicate whether food limitation or predator limitation is occurring in Bristol Bay. A low survival of stocks in years of high distributional overlap would indicate food limitation, whereas high survival in years of distributional overlap would indicate predator limitation.

Because the number of Kvichak smolts in Bristol Bay is so variable, analysis of marine survival and degree of distributional overlap between other Bristol Bay salmon stocks and Kvichak salmon may provide insight into evaluation of the determinative regulatory mechanisms of food limitation and predator limitation.

Another potentially valuable application of this sort of modeling is to aid in the analysis of both the size and time that sockeye, which were smolts the previous year, appear off Adak. This information exists for years 1955 to the present. Coupling these analyses with oceanographic variables may further aid in identifying early marine mortality processes.

APPENDIX I

## Appendix I

The following accumulation of tables is the result of sockeye salmon (Oncorhynchus nerka) smolt enumerations during outmigrations on four major rivers in Bristol Bay, Alaska--Ugashik, Naknek, Kvichak, and Wood. The accumulation and condensation were performed to facilitate simulation of outmigration for these four rivers.

Data were condensed from hourly counts to an evening index count, a daily index count, and a random site count where available. The index count was generated by placing an "index net" (typically a fyke net with a cod end) in the region of the stream bed where the majority of smolts were believed to pass, and sampling over a 2-6 hour period of peak daily migration. The daily or 24-hour count was performed by counting migrating smolts passing through the index net over a 24-hour period. Random site counts required a set of five or six fyke nets placed uniformly across the stream bed. At the beginning of the period of peak migration, sometime between 2000 and 0200, a net was selected at random and smolts passing through were counted for an hour; then the process was repeated until the end of the peak migration period.

Also recorded were the average snout to fork of tail length of the smolts in millimeters, the number of fish sampled for the length calibrations (denoted n1), and the percentage of fish in a second sample which had spent one year in the lake and river system as well as the sample size for age calibrations (n2).

The Ugashik samples were taken at a point 150 yards below the outlet of the Lower Ugashik Lake. The Naknek sampling was performed 8-3/4 miles below the outlet of Naknek Lake. The Kvichak samples were obtained 4 miles downstream from the Iliamna Lake outlet. The Wood River sampling was done at Mosquito Point.

The data were obtained from four major sources: Alaska Department of Fish and Game information leaflets; Alaska Department of Fish and Game technical reports; Fishery Bulletins; and records compiled by Dr. Donald E. Rogers, Fisheries Research Institute, University of Washington.

1963 Ugashik Lakes ADF&G 49, Multiple Fyke Nets, Count or Weighed.

Date	Index		Random	n1	Mean	Mean	% I
	2000-0200	24 hrs.	site		length I	length II	
May 5	1		7				
6	2		30				
7	11	24	--				
8	26		11				
9	1027		494				
10	216		111				
11	280		253				
12	1359	1400	--	20	85	101	45.0
13	51		580				
14	4171		2863				
15	12094		9299				
16	142893		174307	40	88	99	42.5
17	6755	7302	--	30	--	--	63.3
18	1909		1128				
19	3412		3365				
20	2673		1744				
21	8449		15966				
22	111	117	--				
23	2304		1484	40	90	104	65.0
24	84337		48488	39	89	102	30.8
25	6337		3451				
26	10864		3122				
27	157675	180466	--	40	87	102	32.5
28	71066		18016	38	90	103	47.4
29	30185		11804	30	89	109	23.3
30	73112		53419	40	88	103	40.0
31	52813		38403	40	89	113	47.5
June 1	82297	93920	--	40	92	100	52.5
2	16485		7939				
3	9		2016				
4	26		69				
5	38304		77524	40	91	110	37.5
6	64654	77270	--	40	92	106	70.0
7	47621		80307	30	90	107	50.0
8	105182		15698	30	92	106	32.5
9	68740		12633	40	90	110	77.5

63 Ugashik cont.

Date	Index		Random site 2100-0200	nl	Mean length I	Mean length II	% I
	2000-0200	24 hrs.					
June 10	86906		40800	40	90	107	77.5
11	21734	25027	--	40	90	103	82.5
12	736		3067	--			
13	8974		5332	40	91	116	77.5
14	11293		7107	40	89	109	92.5
15	2301		4779	30	92	108	76.7
16	1569	2488	--	30	93	119	53.4
17	13042		5178	40	92	103	87.5
18	2533		4827	29	90	110	89.7
19	805		2621	25	94	117	68.0
20	143		635				
21	106	432	--				
22	233		1656				
23	5		238				
24	1		32				
25	2054		1495	30	89	101	86.7
26	433	444	--				
Total	1250319	388890	921				
Average				90	104	46.33	

1964 Ugashik ADF&G 62, Multiple Fyke Net; Hand Count or Weighed.

Date	Index		n1	Mean length I	Mean length II	n2	% I
	2200-0100	24 hrs					
May 15	0						
16	2						
17	1	4					
18	0						
19	0		219	93.21	113.59	70	46.67
20	1						
21	0						
22	1	31					
23	102						
24	--						
25	1917						
26	759						
27	281						
28	15839	73604					
29	3930		759	94.26	118.20	100	74.57
30	19053						
31	7360						
June 1	1385						
2	3097	30975					
3	19526		825	93.40	118.60	100	75.88
4	11752						
5	26122	62051					
6	24138						
7	34869	58685					
8	10213		949	90.41	117.36	100	86.72
9	7425	11089					
10	4121						
11	4801						
12	1897	4185					
13	2686		923	90.10	123.09	100	90.14
14	2206						
15	191						
16	30						
17	11	22					
18	1283		372	90.91	124.90	40	94.86
19	51						
20	95						
Total	205145	240646	4047			510	
Average				92.21	118.26		80.14

1965 Ugashik Lakes ADF&G 85, Multiple Fyke Nets, Hand Count or Weighed.

Date	Index		n1	Mean length I	Mean length II	n2	% I
	2200-0100	24 hrs					
May 13	0						
14	1						
15	1	1					
16	0		427	94.0	110.4	80	16.0
17	17						
18	700						
19	4515						
20	1215	3564					
21	274						
22	22						
23	1082						
24	245		239	95.1	112.2	40	11.7
25	125	715					
26	6922						
27	12392	24089					
28	(8802)						
29	5210		321	94.8	114.4	60	15.0
30	3234	12964					
31	1064						
June 1	26163						
2	3713	20037					
3	7280		634	93.8	114.1	100	16.3
4	7169						
5	389						
6	1551						
7	11227						
8	10956	19716	655	93.4	115.1	100	32.7
9	7086	15163					
10	9303						
11	560						
12	7558	17952					
13	12282		716	93.3	114.3	100	63.1
14	8047	9197					
15	278						
16	32						
17	1115						
18	2698		304	92.7	112.3	40	83.2
19	3	5					
20	1						
Total	172893	123403	3296			520	
Average				93.7	114.1		28.8

1967 Ugashik ADF&G Inf. Lflt 134 Multiple Fyke Net: Count or Weighed.

Date	Index		Random site	n1	Length I	Length II	n2	% I
	2200-0100	24 hrs	2200-0200					
May 15	21		9					
16	62	87	99					
17	--			121	81.8	113.4	60	14.0
18	475		242					
19	973	1058	1118					
20	--							
21	80		485					
22	7465	12084	4869					
23	--							
24	19871		18946					
25	610	2997	5224	260	85.9	112.6	100	50.4
26	--							
27	513		4736					
28	8828	20388	8683					
29	--							
30	9552		9502					
31	442	533	3664					
June 1	--			234	91.9	115.2	100	94.0
2	2425		695					
3	2338	3066	562					
4	--							
5	3213		3045					
6	1968	12741	1449					
7	--							
8	3075		2747					
9	775	875	1078	351	88.2	110.5	100	92.6
10	--							
11	993		441					
12	508	554	1157					
Total	64185	54383	68751	966			360	
Average					87.5	113.1		52.5

1968 Ugashik Lakes ADF&G Leaflet 138, Multiple Fykenets: Count or Weighed Samples.

Date	Index		Random site	n1	Length I	Length II	n2	% I
	2200-0100	2200-2200	2100-0200					
May 13	119		100					
14	44		47					
15	173		--					
16	2209		2092					
17	608	3309	1136					
18	234		--	999	93.9	110.4	179	90.6
19	987		2400					
20	1218	1248	3451					
21	2084		--					
22	7717		6312					
23	87963	94604	144490					
24	25986		36209					
25	30214		29030	814	93.8	110.0	200	89.1
26	18244	99599	106018					
27	44708		49510					
28	2610		17544					
29	978	1017	6754	640	94.2	113.7	158	90.5
30	60		--					
31	164		1116					
June 1	9874	15667	30017					
2	70496		12868					
3	29724		50608	1010	91.7	113.2	226	97.2
4	24280	29882	34767					
5	15799		--					
6	15223		21277					
7	1616	2238	5325					
8	756		--	567	92.3	118.1	129	90.1
9	114		2022					
10	13	1325	278					
11	14100		--					
12	13599		12434					
13	2059	2412	6269	1094	91.2	117.3	151	98.6
14	1600		--					
15	2206		2623					
16	3573		20695					
17	1476	14753	--					
18	1019		1911					
19	317	453	705					
20	1384		--	1603	97.7	116.9	171	99.1
21	2347		5796					
22	1455	1480	259					
23	6		--					
24	271		656					
Total	439587	267987	614719	6727			1270	
Average					92.8	112.6		93.1

1969 Ugashik Lakes ADF&G Technical Report #3.

Date	Index		n1	Length I	Length II	n2	% I
	2200-0100	2200-2200		mm	mm		
May 23	1025						
24	3400						
25	2332	10839	232	98.7	121.2	120	47.8
26	1530						
27	4204						
28	4907	12239					
29	4143						
30	29105						
31	211	250					
June 1	684						
2	1242		335	96.2	121.2	160	70.2
3	2850	25772					
4	549						
5	5329						
6	2508						
Total	63999	49100	567			280	
Average				97.4	121.2		59.7

1970 Ugashik ADF&G Technical Report #4.

Date	Index 2200-2200	Random		Length I mm	Length II mm	n2	% I
		site 2100-0200	n1				
May 15		32					
16		32					
17	508	101					
18		--	154	100.0	126.8	120	33.1
19		102					
20	181	220					
21		--					
22		220					
23	1350	86					
24		--					
25		553					
26		3094					
27	1422	4306	298	97.0	124.7	160	50.0
28		5871					
29	15704	918					
30		--					
31		3845					
June 1	2122	587					
2		--					
3		1401					
4	2734	1307					
5		--	455	96.6	125.0	180	83.1
6		1311					
7	2651	1037					
8		--					
9		479					
10	1284						
Total	27956	25502	907			460	
Average				97.0	124.8		57.5

1972 Ugashik Lakes ADF&G Technical Report #13.

Date	Index	Random	n1	Length I	Length II	n2	% I
	2200-2200	site		2100-0200	mm		
May 28		117					
29	43	16					
30							
31		139					
June 1	15	2					
2							
3		23	394	80.9	110.3	180	19.3
4	66	29					
5		12					
6		9					
7		237					
8							
9		272					
10	3788	1029					
11		2319					
12		1746					
13	2378	162					
14		594					
15		11					
16	1919	193	221	80.6	112.9	120	7.7
17		2269					
18		733					
19	670	788					
20		3					
Total	8879	10693	615			300	
Average				80.8	111.5		14.1

1973 Ugashik Lakes ADF&G Technical Report #14.

Date	Index 2200-2200	Random		Length I mm	Length II mm	n2	% I
		site 2100-0200	n1				
May 17	431	96					
18		--					
19		1168					
20		158	212	82.2	114.2	60	88.7
21	125	65					
22		--					
23		70					
24		77					
25	1918	698					
26		2980	267	96.5	113.5	120	56.9
27		43233					
28		2289					
29	84546	34160					
30		--	220	91.1	111.8	96	71.4
31		1399					
June 1		17					
2	23437	2049					
3		--					
4		4358					
5		6793					
6	3189	3068	490	89.3	113.7	176	80.8
7		--					
8		100					
9		89					
10	179	212					
11		--					
12		163					
Total	113825	103242	1189			452	
Average				93.1	112.9		66.6

1974 Ugashik Lakes ADF&G Technical Report #20.

Date	Index		n1	Length I	Length II	n2	% I
	2200-0100	2200-2200		mm	mm		
May 17	21						
18	110						
19	262	277					
20	55						
21	1109		253	84.9	119.9	160	16.6
22	3338						
23	2019	2082					
24	298						
25	542						
26	1339						
27	19482	29162					
28	17676		385	95.0	119.7	233	11.9
29	13714						
30	18474						
31	7507	9273					
June 1	515						
2	1066						
3	2830						
4	2140	2588	268	94.1	118.0	140	35.4
5	3162						
6	6680						
7	3598						
8	258	408					
9	624						
10	727						
11	1516		355	94.8	118.2	160	66.2
12	841	1182					
13	529						
14	235						
15	916						
16	3916						
17	889						
Total	116388	44972	1261			693	
Average				94.2	119.3		21.1

1975 Ugashik Lakes ADF&G Technical Report #25.

Date	Index		Length I mm	Length II mm	% I
	2200-0100	2200-2200			
May 22	5				
June 3			94.3	117.8	16
4	447		101.5	112.9	20
5	357			118.3	0
6	4989	6816	95.5	114.1	30
7	8				
8	2				
9	2539		92.7	115.0	35
10	6322	7892	108.0	117.0	5
11	37				
12	147		97.9	115.1	40
13	2903				
14	488		93.2	113.4	50
Total	18235	14708			
Average			95.8	115.7	25

1966 Naknek River ADF&G Information Leaflet 102. Multiple Fyke Nets,  
Samples Counted or Weighed.

Date	Index	Random	Length I mm	Length II mm	% I
	2100-2100	site 2100-0600			
June 2	--	60	111	121	21.9
3	3289	1837	111	122	5.0
5	--	7416	--	127	--
6	12014	7932	113	125	7.5
8	--	9243	112	121	5.0
9	11484	2105	114	119	7.5
11	--	10662	--	121	--
12	84982	7436	113	117	31.6
14	--	9243	112	114	28.2
15	39961	12042	109	112	42.5
17	--	3246	106	110	48.7
18	18234	10146	106	108	62.5
20	--	5669	103	104	78.9
21	9579	4795	103	107	62.5
23	--	1350	98	107	80.0
24	4348	1023	100	104	90.0
26	--	477	100	99	94.1
27	1613	506	101	103	95.0
29	--	1062	100	113	97.5
July 2	1720	347	101	101	87.5
4	--	109	104	103	90.0
5	873	179	105	107	97.5
7	--	89	102	103	90.9
8	--	1777	106	111	95.0
10	--	109	107	111	91.7
11	--	109	108	107	90.9
13	--	308	108	112	88.0
Total	138097	99278			
Average			106	118	33.8

1967 Naknek River Smolt Enumeration ADF&G Information Leaflet 134: Multiple  
Fyke Nets, Samples Counted or Weighed.

Date	Index	Random	Length I	Length II	% I
	2100-2100	site 2100-0600	mm	mm	
May 27		7060			
28	2679	1534			
30		3067			
31	17683	10078			
June 2		4309			
3	12114	8399			
5		9470			
6	15311	10334			
8		12488			
9	2595	1607			
11		8179			
12	10039	8374			
14		7400			
15	5684	2848			
17		2666			
18	2498	3286			
20		4017			
21	4243	1960			
23		316			
24	891	657			
26		1436			
27	1637	1741			
29		1388			
30	3935	1887			
July 2		2094			
3	1474	1424			
5		1996			
6	1254	852			
8		450			
9	415	402			
Total	82452	121718			
Average			113	119	43.55

1968 Naknek River Smolt Enumeration ADF&G Information Leaflet #138  
 Multiple Fyke Nets Samples Counted or Weighed.

Date	Random		Length I	Length II	% I
	Index 2100-2100	site 2100-0600			
May 23		359	122	124	24.0
24		404	--	124	0
26		494	105	117	18.4
27	715	449	91	125	2.1
29		4334	113	124	5.3
30	268	764	107	121	7.2
June 1		5143	111	121	2.6
2	4385	3324	98	116	4.6
4		19740	105	110	16.9
5	18556	45971	96	106	32.5
7		26230	94	105	19.4
8	13984	8579	106	105	24.2
10		8803	92	108	19.8
11	9963	9634	97	106	14.5
13		9140	98	106	14.2
14	8512	8579	94	105	36.6
16		7793	97	107	30.5
17	14122	5906	99	106	65.8
19		6580	100	106	92.2
20	1829	8601	100	106	87.0
22		4986	101	105	89.7
23	1585	5772	100	105	74.3
25		3346	100	104	99.6
26	3298	15451	101	106	84.5
28		2695	101	105	84.4
29	4282	1774	101	109	100.0
July 1		202	99	118	100.0
2	2431	1594	103	--	100.0
4		1954	103	109	100.0
5	8192	2672	104	--	100.0
7		1550	104	--	100.0
8	307	876	106	--	100.0
10		449	105	--	100.0
11	829	427	106	--	100.0
Total	93258	224576			
Average			99	108	41.2

1969 Naknek River Smolt Enumeration ADF&G Technical Report #3.

Date	Index	Random	Length I	Length II	% I
	2100-2100	site 2100-0600			
May 29		2063	103.5	123.2	1.7
30	8355	3587	102.0	110.9	45.0
June 1		3407	96.7	112.7	85.0
2	8166	1476	96.4	106.8	67.4
4		14240	96.6	116.3	40.0
5	41426	16855	97.1	109.1	45.0
8		1787	91.5	107.6	75.1
9	39919	26452	94.2	109.8	50.0
11		2267	96.3	122.6	62.5
12	11713	8542	93.8	114.0	58.3
16		10953	91.8	112.2	85.0
17	10258	2735	97.2	110.4	57.5
19		228	98.6	117.0	44.5
20	8163	1620	103.4	109.8	24.9
22		6034	96.2	101.8	82.5
23	2857	1500	93.6	103.6	77.4
25		2291	92.6	98.0	95.0
26	970	336	93.2	93.3	92.9
28		300	99.7	110.0	79.7
29	4159	1428	97.9	110.0	94.9
July 1		1164	102.5	110.5	80.1
2	4147	2423	99.5	109.0	97.4
4		708	98.7	120.5	95.2
5	2357	1044	101.2	112.0	94.9
7		2483	100.9	106.7	92.4
8	2458	1548	99.9	118.0	97.5
10		180	(100.0)	--	100.0
11	597	420	100.3	--	100.0
13		1248	103.5	124.0	95.0
14	417	336	102.0	--	100.0
16		312	(102.0)	--	100.0
Total	146962	119965			
Average			100.1	111.8	59.83

1970 Naknek River Smolt Enumeration. ADF&G Technical Report #4.

Date	Index 2100-2100	Random site 2100-0600	Length I mm	Length II mm	n2	% I
May 29		373			15	26.7
30	7270	1513			28	42.9
June 1		2227			40	42.5
2	361	128			40	62.5
4		492			40	45.0
5	13633	19757			40	50.0
7		974			40	35.0
8	3472	1962			40	30.0
10		1319			30	66.7
11	6174	2288			40	52.5
13		1593			40	40.0
14	9089	2350			40	57.5
16		515			40	57.5
19		2723			40	70.0
20	1303	1839			40	60.0
22		1622			40	77.5
23	2406	416			40	65.0
25		232			40	90.0
26	1393	2321			40	85.0
28		799			20	75.0
29	1942	340			40	77.5
July 1		383			40	85.0
2		586			40	95.0
4		241			40	90.0
5	1194	284			29	94.9
Total	48237	47277			932	
Average			99.65	113.65		55.3

1972 Naknek River Smolt Enumeration. ADF&G Technical Report #13.

Date	Index 2100-2100	Random site 2100-0600	Length I mm	Length II mm	% I
June 8		6812	106	116	10.0
9	44411	21255	--	112	0.0
11		38947	--	110	0.0
12	34427	16445	98	113	10.0
14		7757	101	109	10.0
15	(22000)	7417	--	116	0.0
17		10514	105	107	10.0
18	9119	3639	102	105	17.5
20		541	104	107	12.5
21	4435	2166	101	110	12.5
23		2770	97	102	22.5
24	12850	4004	85	101	35.0
26		1574	96	100	20.0
27	3369	1070	101	103	42.5
29		504	106	104	22.5
30	740	201	104	111	37.1
July 2		101	106	111	20.0
3	148	63	100	110	15.4
5		139	104	106	46.4
Total	134499	125921			
Average			98	110	6.52

1973 Naknek River Smolt Enumeration. ADF&G Technical Report #14.

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Date	Index	Random	Length I	Length II	% I
	2100-2100	site 2100-0600	mm	mm	
May 28		3878	112.6	120.7	22.6
29	4478	245	112.7	118.0	22.5
31		10155	112.0	116.2	17.5
June 1	1043	171	109.6	120.9	22.5
3		1572	107.0	117.5	28.6
4	2097	948	109.0	115.5	2.5
6		2184	105.3	110.2	22.5
7	3675	882	110.9	110.0	22.5
9		2057	105.3	112.0	32.5
10	12688	3166	101.5	109.2	32.5
12		2467	103.2	106.1	42.5
13	9562	1439	105.5	111.2	45.0
15		392	98.8	103.7	55.0
16	1877	370	101.3	116.1	40.0
18		746	101.4	114.5	44.4
19	1671	75	99.9	113.1	60.0
21		34	96.4	101.0	79.0
22	926	162	97.2	101.1	82.5
24		6	93.5	138.0	60.0
25	688	124	100.5	102.3	90.0
Total	38705	31073			
Average			104.2	112.9	26.77

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## 1974 Naknek River Smolt Enumeration. ADF&amp;G Technical Report #20.

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Date	Index 2100-2100	Length I mm	Length II mm	% I
May 21		--	--	--
22	61	111.0	129.3	1.27
24		102.0	128.3	5.00
25	252	--	129.0	0
27		--	125.0	0
28	782	--	122.5	0
30		113.0	119.1	5.41
31	5018	119.0	120.2	5.13
June 2		112.0	116.3	2.50
3	5458	113.3	114.4	7.69
5		103.0	108.6	9.38
6	465	105.5	111.8	10.00
8		104.8	119.6	20.00
9	779	103.6	109.0	25.00
11		97.3	116.6	15.00
12	417	100.0	110.0	21.88
14		101.9	109.6	50.00
15	2011	103.3	117.3	47.50
17		--	--	--
18	511	105.0	115.9	20.00
20		104.1	109.3	46.67
21	1112	103.4	109.4	63.33
23		106.0	121.7	60.00
24	1801	104.9	114.0	85.00
26		105.5	123.8	53.57
Total	18667			
Average		104.3	118.1	18.92

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1975 Naknek River Smolt Enumeration. ADF&G Technical Report #25.

Date	Index 2100-2100	Length I mm	Length II mm	% I
May 28		103.5	122.0	9.5
29	24	99.3	118.1	14.3
31		107.0	130.3	6.3
June 1	2270	108.3	131.0	16.7
3		115.6	121.9	12.5
4	17712	103.7	114.6	60.0
6		105.5	121.8	57.5
7	67063	100.1	100.5	32.5
9		95.3	105.9	55.0
10	12212	97.7	108.8	51.3
12		92.9	103.0	52.5
13	9311	95.8	100.3	47.5
15		99.9	106.0	40.0
16	5655	99.8	101.4	37.5
18		92.6	106.0	77.5
19	1885	92.2	109.4	72.5
21		92.3	104.0	72.5
22	3636	92.5	108.4	82.5
24		96.7	114.7	57.5
25	282	96.5	108.9	75.0
27		104.5	109.3	47.5
28	1828	96.0	99.9	72.5
30		96.5	103.0	50.0
July 1	3553	101.4	102.2	52.5
3		96.0	108.2	77.5
5	990	103.7	105.5	57.5
7		102.2	102.2	50.0
8	257	104.2	101.3	65.0
Total	126678			
Average		97.5	110.7	48.04

1976 Naknek River Smolt Enumeration. ADF&G Tech. Data Report 33.

Date	Index	Random	Length I mm	Length II mm	% I
	2100-2100	site 2100-0600			
May 22		8			
23	17	5			
25		41	76.0	101.7	72.0
26	9	1			
28		3			
29	22	12			
31		7			
June 1	614	37			
3		128			
4	14894	11227	93.2	114.3	28.5
6		3945			
7	9386	3750			
9		2328			
10	816	510			
12		932			
13	10117	5787	90.2	104.7	48.4
15		1186			
16	3835	685			
18		784			
19	266	218			
21		79			
22	2975	560	92.6	101.9	70.4
24		246			
25	1331	737			
Total	44282	33216			
Average			91.3	107.1	38.8

1955 Kvichak River Smolt Enumeration. Fishery Bulletin 189 Volume 61.

Date	Index 2200-0100	n2	% I
May 28	(36)		
29	(18)		
30	(114)		
31	(91)		
June 1	(12)		
2	(8148)	191	4.2
3	(450)		
4	(8106)	377	0.3
5	134079	690	2.9
6	8189	306	10.8
7	24326	644	16.6
8	16740	789	18.0
9	9941	437	35.5
10	45		
11	(10)		
12	31		
13	606		
14	32		
15	40		
16	8		
17	(376)		
18	481		
19	69		
20	(45)		
21	10		
22	101		
23	435		
24	918		
25	201		
26	24		
27	2		
Total	213684	3434	
Average			13.6

Parentheses include periods outside 2100-0100 to estimate index catch.

1956 Kvichak River Smolt Enumeration. Fishery Bulletin 189 Vol. 61. Parentheses  
 Estimate from 4 Days Simultaneous Fishing at Index and Site A.

Date	Index 2200-0100	n2	% I
May 24	(0)		
25	(155)		
26	(1019)	58	12.1
27	(328)		
28	(803)		
29	(1278)	73	5.5
30	(499)		
31	(1261)		
June 1	(11779)	106	13.2
2	(6632)		
3	(6632)		
4	(1485)		
5	(933)	54	72.2
6	(449)		
7	9449	250	34.0
8	4127	240	41.7
9	1851	163	30.7
10	115	115	34.8
11	138	103	50.5
12	17		
13	83		
14	3091	169	36.7
15	6926	341	38.7
16	2718	179	52.5
17	105		
18	65		
19	1007	112	75.0
20	424		
21	3		
22	289	119	94.1
23	33		
24	19		
25	6		
26	78	65	13.9
27	25		
28	3		
Total			
Average			

1957 Kvichak River Smolt Enumeration. Fishery Bulletin 189 Volume 61.  
 Parentheses Estimate Based on Average of Preceding and Following Days.

Date	Index		n2	% I
	2200-0100	2200-2200		
May 28	1084		86	54.7
29	96		87	37.9
30	69	875	235	92.8
31	9274		318	83.0
June 1	61088	7230	164	48.2
2	178		90	56.7
3	599	886	268	74.6
4	2			
5	3426	3478	377	97.6
6	473	534	81	38.3
7	3	3		
8	91			
9	4			
10	2			
11	231			
12	1	6		
13	2	2		
14	0	1		
15	1			
16	(23)			
17	65			
18	73			
19	292			
20	49			
21	186			
22	216	220		
23	(140)			
24	(140)			
25	(140)			
26	(140)			
27	65			
28	22			
29	321	402		
30	144			

1957 Kvichak River Smolt Enumeration, cont'd.

Date	Index 2200-2200	Site C* 2200-0100	n2	% I
July 1		112		
2		56		
3		159		
4		291		
5		66		
6		120		
7		29		
8		15		
9		45		
10		0		
11		30		
12		59		
13		165		
14		31		
15		156		
16		16		
17		26		
18		45		
19		92		
20	28	43		
21		6		
22		12		
23		130		
24		50		
Total	78640	13655	1706	
Average				75.7

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\*Samples from site C only (no random site selection).  
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1958 Kvichak River Smolt Enumeration.

Date	Index		n2	% I
	2100-0100	2100-2100		
May 10	32			
11	169			
12	1721			
13	259	1274		
14	101			
15	306			
16	363			
17	394			
18	917			
19	1358			
20	2673			
21	14864			
22	178634		459	94.1
23	224524		535	97.9
24	13	647		
25	699			
26	478853		546	96.7
27	274449		535	98.3
28	75175	93679	628	99.7
29	404			
30	7032	156380		
31	121563	136880	659	100.0
June 1	132	2546		
2	30358	56397	683	99.4
3	141717	201803	668	99.9
4	5723	13765		
5	255			
6	3234			
7	7314			
8	30066		624	99.5
9	2225			
10	704			

1958 Kvichak River Smolt Enumeration, cont'd.

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Date	Index		n2	% I
	2100-0100	2100-2100		
June 11	5532			
12	69191		622	99.5
13	95441		652	99.9
14	30019		623	99.8
15	44484		630	100.0
16	4981			
17	3251			
18	6615			
19	58			
20	6863			
21	993			
22	3595			
23	3563			
24	2418			
25	3417			
26	1225			
27	4762			
28	404			
29	3416			
30	10880			
July 1	3974			
2	1043			
3	66			
4	134			
5	211			
Total	1912767	663371	2527	
Average				99.8

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1959 Kvichak River Smolt Enumeration.

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Date	Index 2100-0100	n2	% I
May 23	1297		
24	110		
25	3988		
26	233171	156	1.3
27	315768	166	3.0
28	24087	47	2.1
29	157881	167	4.8
30	232697	182	3.3
31	424486	201	1.0
June 1	171807	164	5.5
2	48565	121	8.3
3	165		
4	459		
5	1667		
6	1025		
7	13699		
8	553		
9	400		
10	142		
11	(74)		
12	5		
13	(83)		
14	161		
15	(952)		
16	1743		
17	(1027)		
18	311		
19	(1444)		
20	2576		
21	(1325)		
22	73		
23	(94)		
24	115		
25	(70)		
26	24		
27	(351)		
28	678		
Total	1643073	1204	
Average			3.6

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1960 Kvichak River Smolt Enumeration. FRI files.

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Date	Index 2200-0100	% I
May 18	198	
19	253	
20	1038	
21	67	
22	1191	
23	74	
24	7	
25	1743	
26	2282	
27	7537	3.9
28	88413	0.9
29	128059	2.7
30	21276	4.1
31	700	
June 1	4812	7.1
2	102426	14.0
3	4444	25.7
4	12596	15.9
5	6164	19.6
6	4841	13.2
7	9775	25.3
8	17184	39.2
9	15772	15.0
10	9690	46.9
11	4108	
12	3901	
13	406	
14	5283	
15	1	
16	96	
17	191	
18	149	
19	106	
Total	454783	
Average		10

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1961 Kvichak River Smolt Enumeration ADF&G #31 Single Fyke Net  
Count or Weighed.

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Date	Index
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May 23	3206
24	4269

Ice flow prevented fishing

June 1	1100
2	15500
3	22
4	178
5	78
6	176
7	679
8	2619
9	61
10	118
11	749
12	26
13	50
14	99
15	47
16	214
17	62
18	136
19	33
20	296

Total	29718
Average	

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1962 Kvichak River Smolt Enumeration, ADF #25, Single Fyke Net,  
Photoelectric Count.

Date	Index 2200-0100	Length I mm	Length II mm	n2	% I
May 27	2878			69	87.0
28	120				
29	162				
30	204			111	80.2
31	111			42	57.1
June 1	3830			103	67.0
2	28790			145	85.5
3	5166			158	93.0
4	46900			165	92.7
5	17014			168	91.7
6	27197			85	97.6
7	7736				
8	4936				
9	31548			174	97.1
10	21863			94	95.7
11	3309			84	97.6
12	6735			195	98.5
13	15708			199	98.0
14	3872				
15	43869				
16	4651				
17	796				
18	1402				
19	219			100	99.0
20	13442			191	99.0
21	2230			88	97.7
22	1091				
23	3016			90	96.7
24	107				
25	18				
26	215				
27	4				
28	288				
29	51				
30	1				
July 1	334				
2	204				
3	1396			83	94.0
4	4				
Total	301413			2344	
Average		82	110		94.0

1963 Kvichak River Smolt Enumeration, ADF&G #48, Photoelectric Count.

Date	Index		Length I	Length II	% I
	2200-0100	2200-2200	mm	mm	
May 16	9				
17	Ice				
18	42				
19	3				
20	Ice				
21	"				
22	"				
23	"				
24	109797	381364			
25	Ice	(236034)			
26	38507	90703			
27	788925	1607614			
28	146053	803540			
29	36243	99077			
30	(38818)	82278			
31	0	136			
June 1	764	2157			
2	30909	83767			
3	116	26227			
4	3799	9841			
5	14070	160921			
6	16939	52317			
7	124448	327655			
8	19590	170761			
9	743	35205			
10	497	12361			
11	2197	23521			
12	1017	3950			
13	144	479			
14	6355	(17275)			
15	818	1927			
Total	1341985	4229431			
Average			83.32	98.34	2.68

1964 Kvichak River Smolt Enumeration, ADF&G #58 Photoelectric Counter.

Date	Index		n1	Mean	Mean	n2	% I
	2200-0100	2200-2200		length I	length II		
May 19	0	0					
20	(6)	(28)					
21	2	(2)					
22	2	(2)					
23	5	(5)					
24	7	(7)					
25	13	79					
26	11	22					
27	31	(31)					
28	3	(8)					
29	148	(150)					
30	40	(40)					
31	335	401					
June 1	314	(2079)					
2	15042	19274					
3	(9952)	(35904)					
4	120637	178273					
5	(234510)	(354620)					
6	121621	320030					
7	97003	364953					
8	(51263)	(221953)					
9	5523	78952					
10	(16565)	(101684)					
11	(27607)	115233					
12	(14108)	(60064)					
13	(611)	(4895)					
14	15245	55924					
15	(31215)	(61486)					
16	(22289)	42151					
17	(5655)	(24969)					
18	584	(18172)					
19	139	(139)					
20	35	(35)					
21	(21)	(21)					
Total	790542	2061586					
Average				86.65	107.81		

1965 Kvichak River Smolt Enumeration, ADF&G 83, Photoelectric Count.

Date	Index		Length I	Length II	n2	% I
	2200-0100	2200-2200	mm	mm		
May 17	1	3				
18	5	5				
19	Ice					
20	"					
21	35	35				
22	233	233				
23	1439	9436				
24	131311	531612				
25	17179	97289				
26	345021	421591				
27	294540	326550				
28	2202	77595				
29	898	187550				
30	0	24401				
31	7038	39786				
June 1	1143	12075				
2	392	1998				
3	448	448				
4	20028	28667				
5	11254	25209				
6	7180	18198				
7	1683	1683				
8	2357	2357				
9	5666	5666				
10	112	112				
11	0	0				
12	56	56				
13	0	0				
Total	850221	1812555				
Average			90.1	108.9		3.6

1966 Kvichak River Smolt Enumeration. ADF&G Information Leaflet 102 Single  
Fyke Net.

Date	Index		Length I	Length II	% I
	2200-0100	1200-1200	mm	mm	
June 2	0	0			
3	Ice	Ice			
4	"	"			
5	"	113025			
6	35190	11136			
7	54	54544			
8	30885	5182			
9	8657	36820			
10	31975	13907			
11	Ice	33669			
12	372	2			
13	Ice	522			
14	"	Ice			
15	"	"			
16	1779	6954			
Total	108912	275761			
Average			94.5	113.7	91.5

1967 Kvichak River Smolt Enumeration. ADF&G Information Leaflet #134.  
Single Fyke Net.

Date	Index 1200-1200	Mean length I	Mean length II	% I
May 17	100			
18	438			
19	62			
20	19			
21	37			
22	96			
23	60			
24	442			
25	24130			
26	444808			
27	464381			
28	48920			
29	99965			
30	114405			
31	35549			
June 1	494953			
2	98356			
3	1800			
4	360			
5	67265			
6	596428			
7	79037			
8	198346			
9	13089			
10	200805			
11	68032			
12	23088			
13	4931			
14	4334			
15	1628			
16	2878			
Total	3088742			
Average		86.4	118.3	92.8

1968 Kvichak River Smolt Enumeration, ADF&G Information Leaflet 138  
Single Fyke Net.

Date	Index 1200-1200	Length I mm	Length II mm	% I
May 17	0			
18	0			
19	107640			
20	326028			
21	416467			
22	295368			
23	1195067			
24	321593			
25	1862406			
26	817424			
27	221938			
28	(23639)			
29	(4263)			
30	(9571)			
31	(25383)			
June 1	290440			
2	(11613)			
3	4290			
4	150374			
5	(7968)			
6	(4035)			
7	2743			
8	13171			
9	3238			
10	178			
11	4049			
12	2906			
13	1941			
Total	6123683			
Average		87.9	104.5	10.59

1969 Kvichak River Smolt Enumeration, ADF&G Technical Report #3.

Date	Index		Length I	Length II	% I
	2200-0100	2200-2200	mm	mm	
May 23	3	3			
24	3	3			
25	22	1144			
26	1093	2978			
27	533	107368			
28	37080	58909			
29	39171	51002			
30	41264	179686			
31	4832	27653			
June 1	143836	165010			
2	147509	163757			
3	3406	4317			
4	57260	106550			
5	588	2971			
6	117	962			
7	138	4989			
8	21	3824			
9	48	551			
10	8553	49476			
11	1887	43427			
12	1148	55298			
13	1364	15776			
14	51887	77452			
15	1575	9954			
16	12	1971			
17	1	313			
Total	543351	1135344			
Average			92.5	109.3	52.3

1970 Kvichak River Smolt Enumeration, ADF&G Data Report #4.

Date	Index		Length I	Length II	% I
	2200-0100	2200-2200	mm	mm	
May 2	0				
3	0				
4	0				
5	3				
6	2				
7	1				
8	0				
9	0				
10	1				
11	9				
12	12				
13	39				
14	0				
15	12				
16	40				
17	25				
18	6	12			
19	56	57			
20	438	953			
21	4685	19123			
22	15834	31319			
23	22144	35094			
24	502	4492			
25	10777	25803			
26	61549	97578			
27	20085	69477			
28	31421	92385			
29	5790	9049			
30	9474	12769			
31	5194	11158			
June 1	557	2027			
2	2230	19489			
3	7666	11068			
4	3156	4232			
5	12539	16142			
6	648	1393			
7	293	989			
8	134	3693			
9	1289	6439			
10	41	1770			
11	96	143			
12	1116	4272			
13	740	2200			
14	367	368			
Total	218951	483638			
Average			88	110	44

1971 Kvichak River Smolt Enumeration, ADF&G Technical Report #2.

Date	Index		Length I	Length II	% I
	2200-0100	2200-2200	mm	mm	
May 29		36			
30		40			
31		38			
June 1		41			
2		43			
3		25			
4		48			
5		28			
6		40			
7	6	441			
8	10	150			
9	353	1207			
10	205686	955803			
11	54771	318029			
12	25446	285481			
13	3236	121448			
14	2159	25777			
15	16307	171300			
16	3335	46450			
17	--	--			
18	961	1251			
19	8	(141)			
Total	212328	1927984			
Average			89.9	111.0	93.5

1972 Kvichak River Smolt Enumeration, ADF&G Technical Report #13 .

Date	Outmigration count	Length I mm	Length II mm	% I
May 29	2097			1.53
30	3329			"
31	54654			"
June 1	9600			"
2	4010			"
3	11678			"
4	21416			"
5	26323			0.53
6	127333			0.28
7	343926			0.32
8	369051			1.04
9	227108			0.30
10	1151046			0.44
11	258979			0.0
12	890194			1.92
13	686647			0.0
14	767982			1.06
15	545590			0.0
16	294337			0.0
17	611767			2.32
18	67954			1.54
19	14367			"
20	21739			"
21	24356			"
22	942			"
23	13178			"
24	48138			"
25	17874			"
26	10499			0.76
27	12850			2.68
28	10796			"
Total	6649760			
Average		80	106	0.84

1973 Kvichak River Smolt Enumeration. ADF&G Tech. Data Report #14.

Date	Index 1200-1200	Sonar outmigration count	Length I mm	Length II mm	% I
May 17	6	--			0
18	321	--			0
19	1437	--			0
20	2552	--			0
21	4782	1357885			0
22	36337	9832802			0
23	44803	22184005			0.5
24	78370	47978439			1.6
25	96116	17417378			0
26	61050	5209076			0.9
27	519078	41922853			2.7
28	229915	14290752			9.6
29	11220	1747982			1.3
30	18328	2503818			1.5
31	30093	12398864			5.7
June 1	3929	873517			5.6
2	13296	737154			0
3	28676	3159104			0
4	6400	2251554			3.7
5	16645	2751638			11.0
6	17089	1653230			3.6
7	7485	2534759			0
8	8650	1520628			7.0
9	2329	601750			7.2
10	1276	549553			12.3
11	1337	404425			12.3
12	127	244953			12.3
13	68	--			12.3
Total	1241715	194126119			
Average			85.6	97.1	2.6

1974 Kvichak River Smolt Enumeration. ADF&G Tech. Data Report #20.

Date	Index 1200-1200	Sonar		% I	
		Outmigration count	Length I mm		Length II mm
May 18	205	--		0	
19	4956	226946		0	
20	3519	690932		1.8	
21	4891	819220		0	
22	22179	2360369		0.8	
23	15107	1698477		0	
24	3247	1422060		5.8	
25	22157	5415236		1.5	
26	84546	5610640		10.2	
27	15124	4302491		0	
28	27652	2702788		6.2	
29	183031	5077988		15.9	
30	125098	2656817		16.3	
31	17427	577954		33.3	
June 1	50170	5290779		8.5	
2	1782	274843		19.8	
3	14619	1303076		25.3	
4	20065	1662492		24.6	
5	3017	421459		79.0	
6	69	51448		56.8	
7	1	51350		56.8	
8	151	57558		34.6	
Total	619013	42714923			
Average			95.5	111.0	9.4*

\*79.1% age II and 11.5% age III (length = 123.5 mm).

1975 Kvichak River Smolt Enumeration. ADF&G Tech. Data Report #25.

Data	Index		Length I	Length II	% I
	2200-0100	1200-1200	mm	mm	
May 20	0	--			--
21	0	--			--
22	0	--			--
23	0	--			--
24	--	--			--
25	--	--			--
26	0	--			--
27	0	--			--
28	0	0			--
29	4	24			0
30	3	16			0
31	--	44			50
June 1	214	1157			11
2	--	0			--
3	--	--			--
4	17520	24012			39
5	40999	205020			57
6	29658	122237			76
7	--	800			--
8	--	--			--
9	--	--			--
10	--	--			--
11	--	--			--
12	962	7659			83
13	1416	8567			88
14	449	3120			53
Total Average			97.7	121.9	63

1976 Kvichak River Smolt Enumeration. ADF&G Tech. Data Report #33.

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Date	Index 1200-1200	Sonar outmigration count	Length I mm	Length II mm	% I
May 21	69	--			82
22	0	43057			
23	24	41993			82
24	0	253910			
25	0	87216			
26	--	91925			
27	0	191151			
28	0	92219			
29	7	93793			100
30	0	138477			
31	0	254616			
June 1	96	185909			99
2	204	204263			99
3	41	247516			99
4	--	464927			
5	--	332554			
6	--	200180			
7	--	598263			
8	--	3155583			
9	38691	14718902			94
10	210701	27923746			94
11	53216	14179855			100
12	97944	18738475			100
13	318151	14939296			100
14	34670	2244565			100
15	13645	956262			100
16	11583	1532695			99
17	--	906579			
Total	785877*	102817927			
Average			88.2	120.8	98

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\*Includes estimate for unfished days.

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1956 Wood River Smolt Enumeration Rogers' Records (all index data recorded in 100s of fish).

Date	Index 2100-2300	Date	Index 2100-2300
June 7	0	July 9	33
8	5	10	61
9	17	11	141
10	72	12	1299
11	19	13	54
12	6	14	30
13	0	15	3
14	3	16	18
15	303	17	5
16	210	18	1
17	25	19	0
18	0	20	7
19	7	21	9
20	13	22	69
21	276	23	7
22	10	24	6
23	72	25	9
24	212	26	1
25	100	27	5
26	6	28	124
27	5	29	19
28	24	30	0
29	71		
30	51	Total	
July 1	312		
2	1		
3	0		
4	0		
5	160		
6	1556		
4	14		
8	100		

1957 Wood River Smolt Enumeration, Rogers' Records (index count in 100s).

Date	Index 2100-2300	Date	Index 2100-2300
May 29	43	July 1	0
30	3	2	60
31	30	3	4
June 1	8	4	0
2	26	5	0
3	14	6	7
4	14	7	6
5	3	8	1
6	2	9	2
7	37	10	1
8	17	11	0
9	8	12	33
10	21	13	0
11	36	14	0
12	31	15	0
13	1	16	2
14	19	17	3
15	43	18	1
16	103	19	3
17	97	20	15
18	1	21	7
19	8	22	0
20	0	23	0
21	3	24	0
22	285	25	0
23	289		
24	397	Total	1784
25	78		
26	6		
27	5		
28	1		
29	6		
30	4		

1958 Wood River Smolt Enumeration Rogers' Records (index count in 100s).

Date	Index	Date	Index
May 28	0	July 1	64
29	1	2	162
30	14	3	1
31	5	4	5
June 1	0	5	0
2	1	6	0
3	9	7	4
4	0	8	0
5	0	9	23
6	5	10	95
7	143	11	1
8	24	12	0
9	542	13	1
10	0	14	0
11	60	15	35
12	4	16	12
13	52	17	6
14	422	18	0
15	933	19	3
16	591	20	2
17	213	21	4
18	1	22	3
19	1	23	1
20	1	24	2
21	5	25	2
22	12	26	3
23	2	27	2
24	9	28	0
25	372		
26	372	Total	4236
27	4		
28	5		
29	2		
30	0		

1959 Wood River Smolt Enumeration, Rogers' Records (Index count in 100's).

Date	Index 2100-2300	Length I mm	Length II mm	% I
June 3	29			
4	20			
5	27	83.5	97.8	86.0
6	29			
7	98			
8	2			
9	19			
10	27	85.5	99.9	82.8
11	24			
12	0			
13	0			
14	2			
15	0	89.3	113.4	96.1
16	40			
17	14			
18	255			
19	63			
20	31	87.1	114.8	97.1
21	34			
22	91			
23	20			
24	38			
25	61	88.5	117.2	98.2
26	19			
27	15			
28	0			
29	18			
30	5	96.6	119.7	85.3
July 1	0			
2	1			
3	2			
4	0			
5	0			
6	4			
7	0			
8	1	99.5	121.0	95.9
9	1			
10	0			
11	0			
12	0			
13	1			
14	1			
15	1			
16	0			
Total	993			
Average		87.9	105.0	93.5

1960 Wood River Smolt Enumeration Rogers' Records (index in 100s).

Date	Index 2100-2300	Length I mm	Length II mm	% I
June 1	31			
2	342			
3	179	89.1		99.2
4	5			
5	47			
6	120			
7	40			
8	31	89.7		99.2
9	213			
10	99			
11	80			
12	200			
13	65	88.5		99.1
14	28			
15	1			
16	90			
17	66			
18	371	87.3		98.9
19	92			
20	124			
21	95			
22	16			
23	1	87.9		100.0
24	1			
25	18			
26	19			
27	6			
23	126	86.3		99.8
29	225			
30	18			
July 1	2			
2	85			
3	2	86.7		100.0
4	0			
5	2			

1960 Wood River Smolt Enumeration, continued (index in 100's).

Date	Index 2100-2300	Length I mm	Length II mm	% I
July 6	27			
7	415			
8	31	87.8		99.8
9	17			
10	14			
11	1			
12	9			
13	15	86.1		100.0
14	62			
15	85			
16	128			
17	11			
18	15	88.6		100.0
19	33			
20	4			
21	6			
22	2			
23	0	95.4		100.0
24	0			
25	7			
26	6			
Total	3728			
Average		88.0	114.3	99.64*

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\*Weighted by number of entries since sample size was unavailable.

1961 Wood River Smolt Enumeration ADF&G Information Leaflet 32  
 Single Fyke Net, Count or Weighed.

Date	Index 2100-2300	n1	Length I mm	Length II mm	n2	% I
May 31	396					
June 1	8492					
2	19164	1222	79.3	97.5	11	97.5
3	4430					
4	8035					
5	57209					
6	24568					
7	9877					
8	69521	989	81.0	103.2	21	94.2
9	63194					
10	1975					
11	4888					
12	4805					
13	81893	1003	80.9	100.2	26	94.2
14	31253					
15	64473					
16	3683					
17	992					
18	87739	1010	79.6	102.4	19	87.5
19	48056					
20	40503					
21	4191					
22	943					
23	4335	942	80.4	102.2	8	92.8
24	6664					
25	10356					
26	42358					
27	54313					
28	10526	644	85.4	102.5	43	92.2
29	18153					
30	26					

1961 Wood River Smolt Enumeration, continued .

Date	Index	n1	Length I mm	Length II mm	n2	% I
July 1	7					
2	46437					
3	10087	499	85.3	105.8	22	96.2
4	148					
5	4973					
6	3672					
7	16827					
8	7184					
9	69					
10	0					
11	2735					
12	2008					
13	277	792	88.3	104.0	50	93.2
14	51					
15	10					
16	0					
17	168					
18	232					
19	1					
20	14					
Total	881911	7101			200	
Average			81.7	102.1		93.0

1962 Wood River Smolt Enumeration, ADF&G Information Leaflet 33  
 Single Fyke Net Weighed or Counted.

Date	Index 2100-2300	n1	Length I mm	Length II mm	n2	% I
June 3	0					
4	141					
5	6510	519	76.3	95.8	37	82.17
6	3719					
7	4					
8	3					
9	549					
10	512					
11	122					
12	326	618	79.7	93.2	40	78.69
13	21469					
14	3964					
15	44265					
16	4202					
17	8040	806	79.0	93.1	10	85.43
18	3532					
19	15662					
20	27477					
21	26808					
22	8187	1002	79.0	96.0	9	93.58
23	15176					
24	11461					
25	109					
26	84					
27	3030	460	80.2	95.4	27	91.80
28	482					
29	4690					
30	5052					
July 1	30323					
2	11778	745	80.4	102.8	17	83.03
3	969					
4	5388					

1962 Wood River Smolt Enumeration, continued.

Date	Index 2100-2300	n1	Length I mm	Length II mm	n2	% I
July 5	11670					
6	37					
7	6	230	83.4	99.7	11	80.40
8	365					
9	82					
10	3242					
11	4424					
12	14000	657	87.7	103.6	17	75.34
13	647					
14	641					
15	136					
16	677					
17	1013	337	88.5	105.8	14	91.96
18	233					
19	7					
20	61					
21	61					
22	280	111	93.1	113.1	12	92.08
23	239					
24	34					
25	3					
Total	301892	5485			194	
Average			80.1	97.6		85.97

1963 Wood River Smolt Enumeration, ADF&G Information Leaflet #37  
 Single Fyke Net Hand Count or Weighed.

Date	Index 2100-2300	n1	Length I mm	Length II mm	n2	% I
May 30	74					
31	189					
June 1	3130	295	79.6	102.4	21	30.51
2	689					
3						
4	4457					
5	1170					
6	1					
7	1795	464	81.4	98.0	28	69.18
8	1013					
9	1001					
10	358					
11	18186					
12	12256	388	81.6	100.3	30	76.29
13	5					
14	34					
15	26512					
16	7735					
17	18909	827	82.2	101.6	35	90.81
18	2296					
19	3561					
20	15725					
21	1487					
22	409	477	83.4	102.5	28	90.78
23	387					
24	319					
25	684					
26	1					
27	358	330	84.3	102.4	27	94.85
23	412					
29	6					
30	6252					
July 1	4776					
2	6284	721	83.2	104.7	16	96.26
3	1692					
4	1531					

1963 Wood River smolt Enumeration, continued.

Date	Index 2100-2300	n1	Length I mm	Length II mm	n2	% I
July 5	27					
6	84					
7	722	137	85.2	102.8	27	89.05
8	53					
9	125					
10	659					
11	2965					
12	1606	392	91.9	108.9	28	85.46
13	890					
14	4					
15	5					
16	336					
17						
18	3	60	91.7	105.4	0	
19	1					
20	2					
21	21					
Total	151206	4091			240	
Average			84.5	102.9		84.27

1964 Wood River Smolt Enumeration ADF&G Information Leaflet #54  
 Single Fyke Net: Hand Count or Weighed.

Date	Index		n1	Length I	Length II	n2	% I
	2100-2300	2100-2100		mm	mm		
June 6	4502						
7	18						
8	1602		525	88.1	101.3	80	89.71
9	390						
10	3744						
11	288						
12	7290						
13	9294		716	86.7	103.2	100	96.23
14	17649						
15	3359						
16	12117						
17	20	3336					
18	7416	30699	553	85.9	101.7	80	96.56
19	1069						
20	1088						
21	75975						
22	0						
23	121802	172941	671	85.9	104.8	80	98.51
24	3688						
25	11591						
26	6078						
27	1423						
28	56340		835	83.6	107.1	100	99.16
29	105214	127355					
30	50027						
July 1	197237						
2	12						
3	143025		697	82.5	103.3	80	99.12
4	1720	15787					
5	85446						
6	2685						
7	8281						
8	9058		1028	80.8	117.0	100	99.81
9	8430						
10	2960						
11	38						
12	573						
13	1123		466	82.6	108.0	60	99.79
14	9						
15	1113						
16	343						
17	2044						
18	406	556	511	85.0	105.0	100	99.80
19	130	351					
20	190						
Total	966807	351035	5984			780	
Average				83.7	104.2		98.75

1965 Wood River Smolt Enumeration. ADF&G Information Leaflet #76  
 Single Fyke Net Hand Count or Weighed.

Date	Index		n1	Length I	Length II	n2	% I
	2100-2300	2100-2100					
May 29	0						
30	1						
31	4						
June 1	13						
2	1						
3	2						
4	1		293	87.5	109.5	60	89.8
5	--						
6	0						
7	0						
8	254						
9	1231						
10	250						
11	5791	33171					
12	2678						
13	3670		608	85.6	110.2	100	90.0
14	10748	118752					
15	298						
16	5133						
17	2795	20368					
18	13731		894	84.3	106.1	100	96.3
19	14501	119601					
20	9210						
21	22140	50411					
22	2987						
23	997		591	84.4	107.1	80	94.1
24	395	2756					
25	23						
26	1038	27808					
27	20629						
28	5762	106892	647	86.5	107.4	100	88.3
29	15575						
30	40189						

1965 Wood River Smolt Enumeration, continued.

Date	Index		n1	Length I	Length II	n2	% I
	2100-2300	2100-2100					
July 1	31071	48709					
2	8730						
3	2208		869	83.7	105.0	100	95.2
4	2523						
5	769						
6	9						
7	--						
8	1642		335	86.7	104.4	60	89.0
9	7240						
10	92689	301925					
11	39180						
12	2496						
13	24		339	83.9	105.4	40	97.9
14	54						
15	55						
16	7						
17	228						
18	280		233	87.8	107.1	60	94.9
19	223						
20	687						
Total	370112	830393	4809			700	
Average				85.5	106.1		92.0

1966 Wood River Smolt Enumeration ADF&G Information Leaflet #102

Date	Index		n1	Length I	Length II	n2	% I
	2100-2300	2100-0200					
June 6	34						
7	149						
8	371		381	74.2	100.2	80	65.1
9	189	1003					
10	978						
11	864						
12	1934	3638					
13	2522		844	75.5	100.9	100	90.6
14	336						
15	103	3354					
16	14763						
17	17625	50458					
18	331	13813	1089	77.3	102.4	100	89.4
19	4437	29739					
20	14962	19037					
21	325	8477					
22	2322	20114					
23	8291	8929	912	77.2	99.9	100	94.9
24	12835	21120					
25	32226	69365					
26	19250	23183					
27	72369	95806					
28	1004	1779	803	75.8	100.5	100	97.9
29	2260	14048					
30	122	263					
July 1	13	80					
2	81	--					
3	1403	--	310	79.7	104.2	90	82.6
4	2728	16668					
5	7875	23260					
6	3547	9788					
7	1598	4506					
8	3007	6809					
9	5716	11370	1177	80.3	102.5	160	97.4
10	11083	19155					
11	--	--					
12	86	474					
13	1365	4284					
14	945	--					
Total	250049	480520	5516			730	
Average				77.1	101.2		94.3

1967 Wood River Smolt Enumeration ADF&G Information Leaflet #134  
Single Fyke Net.

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Date	Index 2100-2300	n1	Length I	Length II	n2	% I
June 16	10359					
17	0					
18	20266	615	78.6	90.0	80	47.7
19	57247					
20	1767					
21	24328					
22	504					
23	19	422	76.5	88.6	60	77.3
24	16					
25	3806					
26	3771	706	75.5	90.9	48	92.4
27	14700					
Total	136783	1743			188	
Average			77.7	89.9		60.4

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1969 Wood River Smolt Enumeration ADF&G Technical Report #3.

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Date	Index 2100-2300
June 14	9764
15	10584
16	646
17	720
18	1018
19	13
20	4576
21	9855
22	9888
23	1190
24	1353
25	2537
26	2760
27	13301
28	1496
29	4500
30	6956
July 1	11656
Total	92813

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1970 Wood River Smolt Enumeration ADF&G Technical Report #4.

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Date	Index 2100-2300	n1	Length I	Length II	n2	% I
June 6	2063					
7	17207					
8	16285	364	81.3	90.9	70	83.0
9	1244					
10	4385					
11	50					
12	1235					
13	3503	302	82.7	94.0	60	83.8
14	4952					
15	14352					
16	12					
17	150					
18	50					
19	135	182	84.7	95.1	40	67.6
20	200					
21	2274					
22	23753					
Total	91851	848			170	
Average			82.7	92.9		78.8

---

APPENDIX II

FORTRAN Program Deck of the  
Model Together with Sample Output

```
PROGRAM BBSMOLT(INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,
1TAPE7,TAPE8)
DIMENSION DDO(4,16),INDX0(4)
LOGICAL FIRST
DIMENSION IR(4)
DIMENSION DUM(16),FLDUM(16),FLOC(16)
REAL NPOP,N(4,16),L(4,16),LO(4,16),NO(4,16),NDUM(16)
DIMENSION A1(4,16),A2(4,16),A3(4,16)
DIMENSION D(4,16),DS(4),INDX(4)
INTEGER TIM,DT
DATA (DS(I),I=1,4)/-130.,-35.,25.,-70./
DATA (IR(I),I=1,4)/4H KVI,4H NAK,4HUGAS,4HWOOD/
READ(5,4) DT,IOUT,IEND
4 FORMAT(3I5)
GR=.2
PLG=.2
INDXY=0
C... READ DATA
1 READ(5,5)YR,(INDX(I),I=1,4)
10 READ(5,15,END=2000) YR,IRIV,(DUM(I),I=1,16),ST,R1,R2,FL1,FL2,
1PA1,PA2
15 FORMAT(F5.0,1X,A4,14F5.0/10X,2F5.0,5F5.0,10X,2F5.0)
5 FORMAT(F5.0,4I2)
IF(YR.EQ.99999.) GO TO 110
YRR=YR
IN=0
IF(IRIV.EQ.4H KVI) IN=1
IF(IRIV.EQ.4H NAK) IN=2
IF(IRIV.EQ.4HUGAS) IN=3
IF(IRIV.EQ.4HWOOD) IN=4
IF(IN.EQ.0) GO TO 25
GO TO 27
25 WRITE(6,26)IRIV,YR
26 FORMAT(1X,A4,F5.0)
CALL EXIT
27 CONTINUE
FIRST=.F.
DO 35 I=1,16
IF(FIRST) GO TO 32
IF(DUM(I).EQ.0.) GO TO 35
FIRST=.T.
I1=I
GO TO 35
32 IF(DUM(I).EQ.0.) GO TO 36
35 CONTINUE
GO TO 37
36 I2=I-1
GO TO 38
37 I2=I
38 CONTINUE
C... SET UP INITIAL ARRAYS N,L,D
FLENGTH=((PA1*FL1)+(PA2*FL2))/100.
ITL=I2-I1+1
XX=FLOAT(ITL-1)
```

```
DTL=FLOAT(ITL)
DO 40 I=1,16
NDUM(I)=0.
FLOC(I)=0.
40 FLDUM(I)=0.
J=0
DO 42 I=I1,I2
J=J+1
X=(DTL/2.)-FLOAT(J)+.5
FLOC(I)=DS(IN)
42 FLDUM(I)=FLENGTH*(1.+((PLG/2.)*(X/XX)))
IF(IN.EQ.2.OR.IN.EQ.3) GO TO 65
NPOP=(R1+R2)/.10
GO TO 72
65 X=R1+R2
IF(ST.GE.X) GO TO 70
NPOP=ST
GO TO 72
70 NPOP=X/.10
72 CONTINUE
DO 67 I=I1,I2
67 NDUM(I)=DUM(I)*NPOP*.01
DO 100 J=1,16
A1(IN,J)=FLOC(J)
A2(IN,J)=NDUM(J)
100 A3(IN,J)=FLDUM(J)
GO TO 10
110 DAYS=136.
DO 132 I=1,4
DO 129 J=1,16
D(I,J)=0.
N(I,J)=0.
129 L(I,J)=0.
132 CONTINUE
C... BEGIN SIMULATION
INPT=0
DO 600 TIM=1,IEND,DT
INPT=INPT+1
DO 220 I=1,4
IF(INDX(I).EQ.0) GO TO 220
IF(INPT.LE.16) GO TO 210
GO TO 215
210 D(I,INPT)=A1(I,INPT)
N(I,INPT)=A2(I,INPT)
L(I,INPT)=A3(I,INPT)
INP=INPT-1
IF(INP.EQ.0) GO TO 220
DO 213 JJ=1,INP
IF(N(I,JJ).EQ.0.) GO TO 213
FMGR=.0864*L(I,JJ)*FLOAT(DT)
L(I,JJ)=L(I,JJ)+(GR*FLOAT(DT))
D(I,JJ)=D(I,JJ)+FMGR
213 CONTINUE
GO TO 220
```

```
215 DO 200 J=1,16
    IF(N(I,J).EQ.0.) GO TO 200
C... COMPUTE DERIVATIVES
    FMGR=.0864*L(I,J)*FLOAT(DT)
C... INTEGRATE D,L
    D(I,J)=D(I,J)+FMGR
    L(I,J)=L(I,J)+(GR*FLOAT(DT))
200 CONTINUE
220 CONTINUE
    IT=TIM-1
    IO=MOD(IT,IOUT)
    IF(IO.EQ.0) GO TO 250
    GO TO 600
250 KK=0
    DO 260 K=1,4
    IF(INDX(K).EQ.1) GO TO 255
    GO TO 260
255 KK=KK+1
    DO 258 I=1,16
    LO(KK,I)=L(K,I)
    NO(KK,I)=N(K,I)
258 DDO(KK,I)=D(K,I)
    INDX0(KK)=IR(K)
260 CONTINUE
    WRITE(6,262)YRP,DAYS
262 FORMAT(1H1,*YEAR= *,F5.0,*TIME= *,F6.0)
    IFORM=0
    DO 265 I=1,4
265 IFORM=IFORM+INDX(I)
    GO TO (270,280,290,300),IFORM
270 WRITE(6,272) (INDX0(I),I=1,IFORM)
272 FORMAT(6X,11X,A4,12X)
    WRITE(6,274)
274 FORMAT(1X,*GROUP*,2X,*LOCAT*,4X,*ABUND*,3X,*LENGTH*,2X/
16X,* (KM FROM*,1X,7H(10**4),3X,* (MM)*,3X/
26X,1X,*NAKNEK)*,19X)
    GO TO 350
280 WRITE(6,282) (INDX0(I),I=1,IFORM)
282 FORMAT(6X,2(11X,A4,12X))
    WRITE(6,284)
284 FORMAT(1X,*GROUP*,2(2X,*LOCAT*,4X,*ABUND*,3X,*LENGTH*,2X)/
16X,2(* (KM FROM)*,1X,7H(10**4),3X,* (MM)*,3X)/
26X,2(1X,*NAKNEK)*,19X))
    GO TO 350
290 WRITE(6,292) (INDX0(I),I=1,IFORM)
292 FORMAT(6X,3(11X,A4,12X))
    WRITE(6,294)
294 FORMAT(1X,*GROUP*,3(2X,*LOCAT*,4X,*ABUND*,3X,*LENGTH*,2X)/
16X,3(* (KM FROM*,1X,7H(10**4),3X,* (MM)*,3X)/
26X,3(1X,*NAKNEK)*,19X))
    GO TO 350
300 WRITE(6,302) (INDX0(I),I=1,IFORM)
302 FORMAT(6X,4(11X,A4,12X))
    WRITE(6,304)
```

```
304 FORMAT(1X,*GROUP*,4(2X,*LOCAT*,4X,*ABUND*,3X,*LENGTH*,2X)/
16X,4(*(KM FROM*,1X,7H(10**4),3X,* (MM)*,3X)/
26X,3(1X,*NAKNEK)*,19X))
350 DO 360 I=1,16
360 WRITE(6,355) I,(DDO(K,I),NO(K,I),LO(K,I),K=1,IFORM)
355 FORMAT(1X,I3,2X,4(2X,F6.1,3X,F6.1,3X,F6.2,1X))
C.....WRITE GOODIES ON THE XYFILE
DO 1000 JJ=1,IFORM
INDXY=INDXY+1
WRITE(7,1005) INDXY,YRR,DAYS,INDX0(JJ)
DO 1010 JJJ=1,16
J=17-JJJ
IF(DDO(JJ,J).EQ.0.) GO TO 1010
WRITE(8) DDO(JJ,J),NO(JJ,J)
1010 CONTINUE
1005 FORMAT(1X,*FILE= *,I3,4X,F5.0,*TIME=*,F6.0,5X,A4)
ENDFILE 8
1000 CONTINUE
ENDFILE 8
DAYS=DAYS+FLOAT(DT)
600 CONTINUE
GO TO 1
2000 STOP
END
```

YEAR=		1962 TIME=		196		KVI		NAK		UGAS		WOOD	
GROUP	LOCAT	ABUND	LENGTH	LOCAT	ABUND	LENGTH	LOCAT	ABUND	LENGTH	LOCAT	ABUND	LENGTH	LENGTH
	(KM FROM	(10**4)	(MM)	(KM FROM	(10**4)	(MM)	(KM FROM	(10**4)	(MM)	(KM FROM	(10**4)	(MM)	(MM)
	NAKNEK)			NAKNEK)			NAKNEK)			NAKNEK)			
1	.0	.0	.00	.0	.0	.00	557.3	133.3	109.19	.0	.0	.00	.00
2	.0	.0	.00	.0	.0	.00	505.1	144.8	107.03	.0	.0	.00	.00
3	.0	.0	.00	.0	.0	.00	454.3	321.3	104.87	.0	.0	.00	.00
4	227.2	22.6	96.86	423.2	61.2	123.00	404.9	251.5	102.72	.0	.0	.00	.00
5	181.5	633.6	94.67	366.9	1067.9	120.79	357.0	15.2	100.56	241.5	55.2	94.65	94.65
6	137.5	580.9	92.47	311.5	887.4	118.59	310.5	379.7	98.40	198.6	40.2	92.82	92.82
7	94.9	458.7	90.28	257.6	566.1	116.38	265.4	11.4	96.25	156.8	584.8	91.00	91.00
8	53.8	127.4	88.08	205.1	275.4	114.17	221.8	11.4	94.09	116.1	489.4	89.17	89.17
9	14.1	39.5	85.39	154.2	58.1	111.97	179.5	1.3	91.93	76.6	514.5	87.35	87.35
10	-24.1	3.8	83.60	104.7	91.8	109.76	.0	.0	.00	38.2	110.4	85.52	85.52
11	-60.9	11.3	81.50	54.6	30.6	107.55	.0	.0	.00	1.0	499.5	83.69	83.69
12	.0	.0	.00	10.1	15.3	105.35	.0	.0	.00	-35.1	30.1	81.87	81.87
13	.0	.0	.00	-35.0	6.1	103.14	.0	.0	.00	-70.0	163.1	80.04	80.04
14	.0	.0	.00	.0	.0	.00	.0	.0	.00	.0	.0	.00	.00
15	.0	.0	.00	.0	.0	.00	.0	.0	.00	.0	.0	.00	.00
16	.0	.0	.00	.0	.0	.00	.0	.0	.00	.0	.0	.00	.00