Informational Leaflet 123

BRISTOL BAY RED SALMON FORECAST OF RUN FOR 1968

Edited by:

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June 12, 1968

STATE OF ALASKA
WALTER J. HICKEL - GOVERNOR

DEPARTMENT OF
FISH AND GAME

SUBPORT BUILDING, JUNEAU

Expected Inshore Run of Bristol Bay Red Salmon for 1968, in Millions of Fish. 1/

River System	.2-ocean	.3-ocean	Total
Togiak	0.114	0.108	0.222
Igushik	0.062	0.210	0.272
Snake	0.046	0.004	0.050
Nuyakuk	0.173	0.227	0.400
Wood	2.050	0.486	2.536
Nushagak-Mulchatna	0.003	0.037	0.040
Sub-total	2.334	0.964	3.298
Kvichak	0.305	0.569	0.874
Naknek	0.952	1.343	2.295
Branch (Alagnak)	0.383	0.194	0.577
Sub-total	1.640	2.106	3.746
Egegik	1.482	0.611	2.093
Ugashik	0.975	0.075	1.050
North Side Alaska Peninsula	0.319	0.200	0.519
Total	6.864	4.064	10.928

1/ These figures are compiled from Table 6.

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I. Contributors

The forecast for the 1968 Bristol Bay red salmon run was jointly prepared by the Alaska Department of Fish and Game, the Fisheries Research Institute of the University of Washington, and the U. S. Bureau of Commercial Fisheries.

The yearly field collection of the Bristol Bay red salmon run data is carried out by the Alaska Department of Fish and Game under the direction of Fisheries Biologists Kenneth Middleton, Michael J. Nelson, Steve Pennoyer and Donald M. Stewart.

The following scientists participated in the analysis of the data: Mr. Steve Pennoyer of the Alaska Department of Fish and Game; Dr. Robert L. Burgner and Mr. Donald E. Rogers of the Fisheries Research Institute; Mr. Reynold A. Fredin and Frank J. Ossiander of the U. S. Bureau of Commercial Fisheries.

A previous draft of the 1968 river system forecast was compiled in August, 1967, using incomplete data on the 1967 run. This forecast uses final 1967 run data from all river systems in Bristol Bay.

II. Introduction

The methods used to compile the yearly inshore run to each river and to make the river system forecast are the same as those given in Alaska Department of Fish and Game, Informational Leaflet 105. The procedures use a general escapement-return relationship to estimate the magnitude of the return from each escapement. Subsequently the 1968 run is obtained by mathematically modeling the age structure as a stochastic process by assigning a probably measure to the life history phases.

Alaska Department of Fish and Game, Informational Leaflets 1, 14, 23, 39, 59, 82 and 105 give forecasts for the years 1961 through 1967 respectively. These are presented as forecasts of total return to Western Alaska based on purse seine sampling in the ocean south of Adak and as river system forecasts based on data

from each river in Bristol Bay. The historical record of these forecasts and the actual runs is graphed in Figure 1. This figure also shows the hindcasts for the new method of computing the river system forecasts. The purse seine method and the old method of computing the river system forecasts have each yielded predictions within 25 percent of the actual total runs only one time for the years 1961 through 1966. The hindcasts for the new method of computing the river system forecast have been within 25 percent of the actual run for each year in this period. The new method, which was first used in 1967, was in error 10 percent. For this year the purse seine forecast was in error 67 percent.

The purse seine and the old method of river system forecasting tend to yield predictions which have a small amplitude around an average value and they may be unresponsive to changes in the period or cycle of the runs. Figure 1. shows that these methods were out of cycle in 1965 and 1966. This resulted from nonresponse to the current factors which influence the maturity schedule. The new method of river system forecasting utilizes a stochastic procedure to account for the factors that are the direct contributors to the maturing ages in the yearly run. As shown in Figure 1. this method closely agrees in period and amplitude with the cycle of the actual runs. Clearly a method which is a combination of an estimate of magnitude based on long term data and a stochastic estimate of maturity based on current data from the factors which directly contribute to the yearly run will improve forecast methodology for a cyclic, multiple age fish stock.

III. River System Forecasts

Appendix Tables 1. and 2. give the 1967 inshore run and combined run by age class. Appendix Table 3. gives the escapement-return data through 1961. Table 1. gives the total estimated return and estimated run in 1968 by age class for each contributing brood year. Table 2. gives the Nushagak-Mulchatna data and forecast and Table 3. does likewise for the North Side Alaska Peninsula. Table 4. summarizes the river system forecasts.

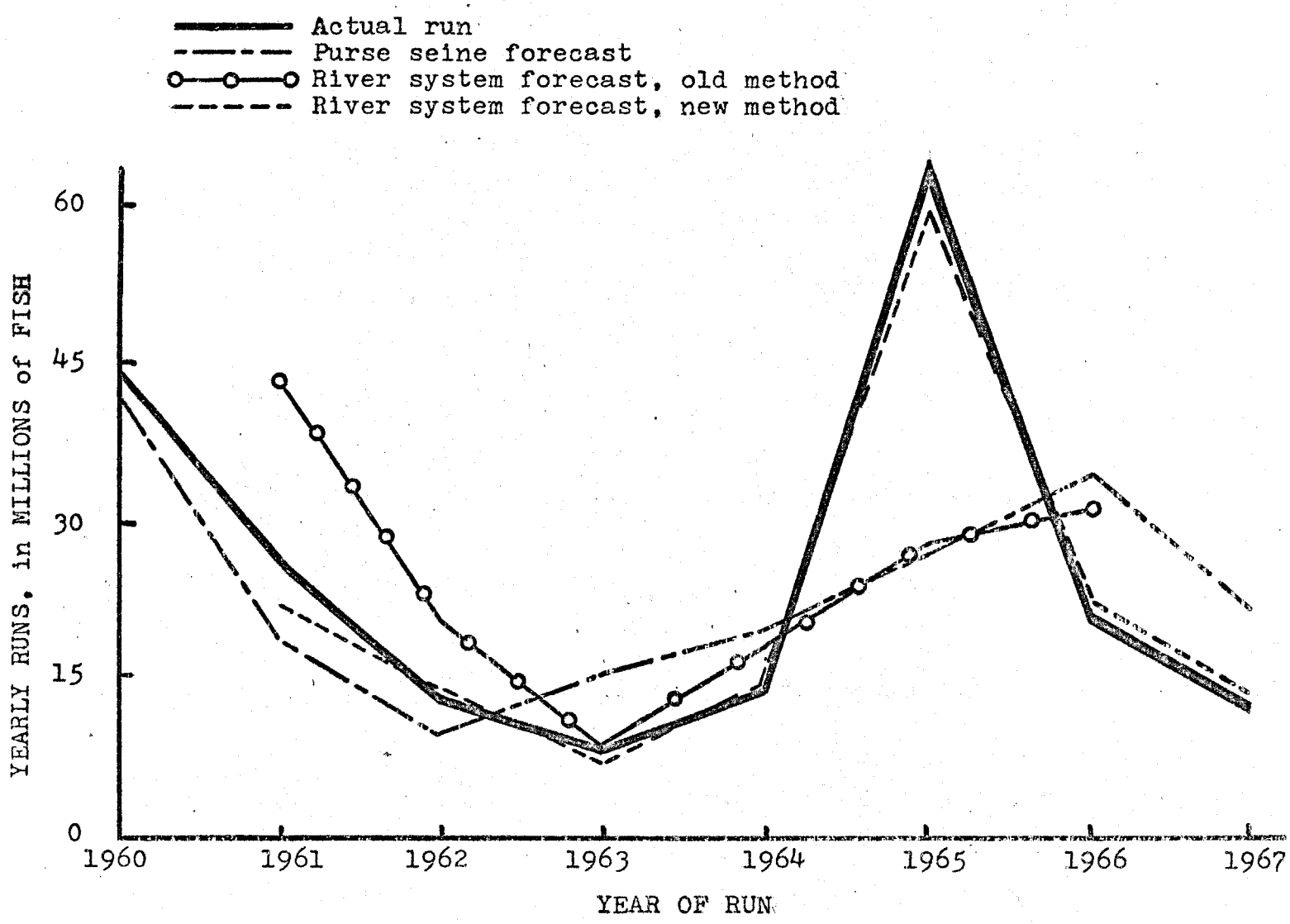

Figure 1. Actual Runs and Forecasts.

TABLE 1.

Estimated Return From Given Brood Years, in Millions of Fish

River System	Brood Year	Escapement	Estimated Return	Estimated run by age class 4_2	5_3	5_2	6_3	Total
Togiak	1962	0.047	0.138				0.014	
	1963	0.102	0.321		0.018	0.132		
	1964	0.096	0.304	0.098				
								0.262
Igushik	1962	0.016	0.008				0.002	
	1963	0.092	0.270		0.014	0.277		
	1964	0.129	0.378	0.048				
								0.341
Snake	1962	0.002	0.005				0	
	1963	0.038	0.104		0.022	0.006		
	1964	0.012	0.033	0.023				
								0.051
Nuyakuk	1962	0.038	0.115				0.003	
	1963	0.167	0.300		0.011	0.298		
	1964	0.103	0.381	0.166				
								0.478
Wood	1962	0.874	2.585				0.043	
	1963	0.721	2.267		0.090	0.609		
	1964	1.076	2.842	2.019				
								2.761
Kvichak	1962	2.581	2.658				0.905	
	1963	0.339	0.300		0.090	0.042		
	1964	0.957	0.300	0.216				
								1.253

TABLE 1. Cont'd.

Estimated Return From Given Brood Years, in Millions of Fish

River System	Brood Year	Escapement	Estimated Return	Estimated run by age class 4_2	5_3	5_2	6_3	Total
Naknek	1962	0.723	2.634				0.967	
	1963	0.905	2.884		0.543	1.020		
	1964	1.350	3.036	0.386				
								2.916
Branch	1962	0.091	0.235				0.036	
	1963	0.203	1.295		0.172	0.228		
	1964	0.249	1.783	0.206				
								0.642
Egegik	1962	1.027	3.316				0.913	
	1963	0.998	3.175		1.042	0.092		
	1964	0.850	2.482	0.384				
								2.431
Ugashik	1962	0.274	1.105				0.044	
	1963	0.397	1.305		0.536	0.065		
	1964	0.483	1.418	0.418				
								1.063

TABLE 2.

Nushagak-Mulchatna River - past runs and estimated run in 1968, in millions of fish.

Year of Run	.2-ocean Run	.3-ocean Run
1956	0	0.021
1957	0	0.022
1958	0	0.008
1959	0	0.063
1960	0	0.061
1961	0	0.084
1962	0.001	0.022
1963	0.005	0.074
1964	0.002	0.032
1965	0.008	0.061
1966	0.006	0.092
1967	0.010	0.127
1968	0.003 1/	0.055 1/

1/ Estimated run obtained from the arithmetic mean of the .2-ocean and .3-ocean runs.

TABLE 3.

North Side Alaska Peninsula - past runs and estimated run in 1968, in millions of fish.

Year of Run	.2-ocean Run	.3-ocean Run
1956	2.182	0.720
1957	0.261	0.857
1958	0.510	0.540
1959	1.088	0.235
1960	1.044	0.198
1961	0.363	0.805
1962	0.399	0.194
1963	0.336	0.293
1964	0.975	0.357
1965	1.986	0.245
1966	0.143	0.444
1967	0.400	0.225
1968	0.318 1/	0.298 1/

1/ Forecast based on arithmetic mean and cycle analysis.

TABLE 4.

Summary of the River System Forecast of the Bristol Bay Red Salmon Run for 1968, in Millions of Fish.

River System	Age Class 4_2	5_3	5_2	6_3	Total
Togiak	0.098	0.018	0.132	0.014	0.262
Igushik	0.048	0.014	0.277	0.002	0.341
Snake	0.023	0.022	0.006	0	0.051
Nuyakuk	0.166	0.011	0.298	0.003	0.478
Wood	2.019	0.090	0.609	0.043	2.761
Nushagak-Mulchatna	0.001	0.002	0.031	0.024	0.058
Nushagak Sub-total	2.257	0.139	1.221	0.072	3.689
Kvichak	0.216	0.090	0.042	0.905	1.253
Naknek	0.386	0.543	1.020	0.967	2.916
Branch (Alagnak)	0.206	0.172	0.228	0.036	0.642
Naknek-Kvichak Sub-total	0.808	0.805	1.290	1.908	4.811
Egegik	0.384	1.042	0.092	0.913	2.431
Ugashik	0.418	0.536	0.065	0.044	1.063
North Side Alaska Peninsula	0.200	0.118	0.140	0.158	0.616
Total	4.165	2.658	2.940	3.109	12.872

IV. Forecast of Total Run Based on High Seas Purse Seine Catches

Mr. Donald E. Rogers prepared the forecast of the total run based on high seas purse seine sampling of immature red salmon. This forecast has been printed as Circular No. 68-6 of the Fisheries Research Institute, College of Fisheries, University of Washington. The methods and data are given in that circular.

The following is the predicted abundance of freshwater and ocean age groups in 1968.

Age Class	Estimated Run in Millions of Fish	
4_2	4.26	
5_3	3.51	
6_4	0.03	
Sub-total		7.8
5_2	2.38	
6_3	2.44	
7_4	0.08	
Sub-total		4.9
Total		12.7

V. Combined Forecasts

The river system and purse seine forecasts are combined by arithmetically averaging the .2-ocean sub-totals from each forecast and the .3-ocean sub-totals from each forecast. These sub-totals are then prorated to the separate rivers on the basis of the forecasted run to each river as given in Table 4. The combined forecast is given in Table 5.

A portion of this forecasted run will be removed by the Japanese high seas fishery. On the basis of past high seas catches and the relation of these catches to the composition of the inshore run this portion of the forecasted run has been removed and an expected inshore run is given in Table 6.

TABLE 5.

Combined Forecast of the Purse Seine and River System Forecasts of the Bristol Bay Red Salmon Run for 1968, in Millions of Fish.

River System	Age Class 4_2	5_3	5_2	6_3	Total
Togiak	0.099	0.021	0.119	0.013	0.252
Igushik	0.049	0.016	0.251	0.002	0.318
Snake	0.023	0.026	0.005	0	0.054
Nuyakuk	0.168	0.013	0.270	0.003	0.454
Wood	2.041	0.105	0.551	0.039	2.736
Nushagak-Mulchatna	0.001	0.002	0.028	0.021	0.052
Nushagak Sub-total	2.282	0.162	1.105	0.065	3.614
Kvichak	0.218	0.105	0.038	0.819	1.180
Naknek	0.390	0.633	0.923	0.875	2.821
Branch (Alagnak)	0.209	0.201	0.206	0.033	0.649
Naknek-Kvichak Sub-total	0.817	0.939	1.167	1.727	4.650
Egegik	0.389	1.215	0.083	0.826	2.513
Ugashik	0.423	0.625	0.059	0.040	1.147
North Side Alaska Peninsula	0.202	0.138	0.127	0.143	0.610
Total	4.212	3.100	2.660	2.814	12.786

TABLE 6.

Expected Inshore Run of Bristol Bay Red Salmon for 1968, in Millions of Fish. 1/

River System	Age Class 4_2	5_3	5_2	6_3	Total
Togiak	0.095	0.019	0.099	0.009	0.222
Igushik	0.047	0.015	0.209	0.001	0.272
Snake	0.022	0.024	0.004	0	0.050
Nuyakuk	0.161	0.012	0.225	0.002	0.400
Wood	1.955	0.095	0.460	0.026	2.536
Nushagak-Mulchatna	0.001	0.002	0.023	0.014	0.040
Nushagak Sub-total	2.186	0.148	0.921	0.043	3.298
Kvichak	0.209	0.096	0.032	0.537	0.874
Naknek	0.374	0.578	0.769	0.574	2.295
Branch (Alagnak)	0.200	0.183	0.172	0.022	0.577
Naknek-Kvichak Sub-total	0.783	0.857	0.973	1.133	3.746
Egegik	0.373	1.109	0.069	0.542	2.093
Ugashik	0.405	0.570	0.049	0.026	1.050
North Side Alaska Peninsula	0.193	0.126	0.106	0.094	0.519
Total	4.035	2.829	2.217	1.847	10.928

1/ The forecast has been adjusted by subtracting the Japanese high seas catch of immature red salmon in 1967 and the expected high seas catch of mature red salmon in 1968.

APPENDIX TABLE 1.

River	Age Composition of 1967 Inshore Run						
	4_2	5_3	6_4	5_2	6_3	7_4	Total
Togiak	46,203	5,480	0	115,017	22,425	22	189,147
Igushik	159,750	4,480	0	129,488	6,291	0	300,009
Snake	6,526	1,015	0	3,313	146	0	11,000
Wood	547,385	107,780	0	360,866	25,403	0	1,041,434
Nuyakuk	3,869	237	0	39,548	386	0	52,519 1/
Nushagak-Mulchatna	8,888	543	0	91,137	890	0	120,997 2/
Kvichak	43,722	4,213,336	4,609	134,664	603,381	5,581	5,005,293
Branch	179,580	2,408	0	81,173	0	359	263,161
Naknek	122,925	316,405	0	203,915	567,899	1,343	1,212,487
Egegik	14,083	856,330	24,804	61,481	702,327	44,681	1,703,706
Ugashik	11,943	166,856	128	115,459	106,166	286	400,838
North Side Alaska Peninsula							526,635*

* No age data available for North Side Alaska Peninsula runs.

1/ The total includes 8,479 age 4_1 fish.

2/ The total includes 19,539 age 4_1 fish.

APPENDIX TABLE 2.

River	Age Composition of 1967 Combined Run						
	4_2	5_3	6_4	5_2	6_3	7_4	Total
Togiak	50,967	6,038	0	134,228	29,376	38	220,647
Igushik	176,222	4,936	0	151,116	8,241	0	340,515
Snake	7,199	1,118	0	3,866	191	0	12,374
Wood	603,827	118,760	0	421,141	33,277	0	1,177,005
Nuyakuk	4,268	261	0	46,154	506	0	59,668 1/
Nushagak-Mulchatna	9,804	598	0	106,359	1,166	0	137,466 2/
Kvichak	48,230	4,642,536	6,216	157,157	790,415	9,766	5,654,320
Branch	198,097	2,653	0	94,731	0	628	296,109
Naknek	135,600	348,637	0	237,974	743,934	2,350	1,468,495
Egegik	15,535	943,562	33,453	71,750	920,031	78,183	2,062,514
Ugashik	13,175	183,853	173	134,744	139,075	500	471,520
North Side Alaska Peninsula	67,216	332,800	0	82,986	141,903	0	624,905 3/

1/ The total includes 8,479 age 4_1 fish.

2/ The total includes 19,539 age 4_1 fish.

3/ Age composition estimated.

Appendix Table 3. Escapement-Return Data for Bristol Bay Rivers (in millions of fish).

BROOD YEAR	RIVER																			
	Togiak		Igushik		Snake		Wood		Nuyakuk		Kvichak		Naknek		Branch		Egegik		Ugashik	
	E	R	E	R	E	R	E	R	E	R	E	R	E	R	E	R	E	R	E	R
1944																	.310	.630		
1945																	.530	.561		
1946									.432	.085							.660	1.296		
1947									.325	.060							.910	2.075		
1948									.303	.324							.890	2.425		
1949									.014	.043							.920	.961		
1950					.004	.016	.452	1.282	.042	.032							.630	1.367		
1951					.003	.038	.458	2.460	.039	.095							.950	2.953		
1952	.102	.225	.150	.461	.004	.009	.227	1.283	.038	.200	5.970	21.314	.103	1.533			.757	1.722	.651	1.187
1953	.102	.146	.100	.394	.004	.009	.516	.764	.189	.492	.321	.591	.285	.667			.519	1.420	1.056	1.143
1954	.057	.242	.080	.734	.004	.093	.571	2.519	.029	.078	.241	.829	.799	3.553			.507	2.507	.459	.556
1955	.104	.412	.500	1.633	.030	.174	1.383	4.011	.016	.073	.250	2.127	.279	2.055	.166	1.152	.271	1.791	.077	.200
1956	.225	.495	.400	.714	.004	.018	.773	1.378	.030	.366	9.443	37.798	1.773	2.420	.785	2.385	1.104	6.752	.425	3.990
1957	.025	.151	.130	.069	.003	.002	.289	.458	.067	.018	2.964	4.027	.635	1.613	.125	.086	.391	2.321	.215	.604
1958	.072	.300	.107	.141	.009	.006	.960	2.495	.196	.453	.535	.319	.278	1.125	.091	.168	.246	1.425	.298	.696
1959	.179	.299	.644	.400	.140	.081	2.206	1.818	.049	.094	.680	.552	2.232	2.525	.825	.830	1.072	2.122	.219	.564
1960	.163	.572	.495	.491	.017	.034	1.016	2.722	.146	.573	14.630	54.160	.828	4.005	1.241	.460	1.799	7.850	2.341	2.992
1961	.095	.371	.294	.446	.005	.009	.461	1.418	.080	.370	3.706	3.579	.351	2.019	.090	.285	.702	1.670	.366	1.109

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