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IN-SEASON DATA MANAGEMENT COMPUTER PROGRAMS FOR BRISTOL BAY

By:
Henry J. Yuen

1980

ALASKA DEPARTMENT OF FISH AND GAME
Subport Building, Juneau, Alaska 99801

Ronald O. Skoog
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 revision will be made via errata sheets. Major revisions will be made in the form of revised reports.

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INTRODUCTION

The Bristol Bay sockeye salmon fishery is large, landing nearly half of all the sockeye salmon harvested in Alaska in 1976 (Alaska Department of Fish and Game 1979). In 1980, catch and escapement totals exceeded 60.8 million sockeye salmon. Management of this fishery is directed toward achieving escapement goals in all river systems. Although fishery closures are frequently necessary to achieve escapement goals, short fishing periods are used early and throughout the season to spread the catch over the duration of the run. Escapement counts, aerial surveys, test fishing forecasts of run size, of timing and of escapement, as well as commercial catch data, are used to determine run status and, therefore, (1) fishery openings and closures by the area management biologists, and (2) scheduling of tender and fly-out operations by commercial operators and fishermen.

There are six fishing districts and eight spawning river systems managed out of two area offices. Daily and revised fishery data must be exchanged between the two offices. While some of these data are used by forecast programs, information on run status and forecasts are also requested by regional and headquarter supervisory staff as well as commercial operators, fishermen, and journalists. Some requests are local while others are by long distance telephone. A computer program was therefore developed to tabulate and summarize current data in table form that could be printed, in unlimited numbers, wherever a computer terminal was available and to update data bases for other computer programs.

METHODS

This program requires input data on daily catch, escapement, and estimated fish in the river below the escapement counting towers (Figure 1). The program will accept data in the above order along with an unlimited number of lines of comments on the fishery. The program also requires test fishing data; accepts this in any river order and uses calendar dates instead of day numbers (Figure 1). This program will insert commas and print the date and time of the report.

(A)

```
"CE"
7,4,1000000,150000,10000,10000,190000,0
7,4,1847400,228558,39990,804,406722,104232,0,2952
4141771,0,282489,60661,0,414408,330000,0
ACCUMULATIVE CATCHES TO DATE BY SPECIES AND DISTRICT
```

	CHUM	PINK	KING
NUSHAGAK	681000	600000	63000
TOGIAK	170000	5000	12000
NAK-KVI	17000	2000	7000
EGEGIK	0	0	5000
UGASHIK	0	0	3000
GENERAL	1000	0	2000

(B)

```
"TF"
"PM",7,9,126,11,100,44,0,0,0,0,4
"PM",7,9,127,9,100,47,3,3.83,2.97,557,3
"PM",7,9,128,7,100,51,4,4.286,2.96,563.7,4
"PM",7,9,129,5,100,67,8,7.164,2.94,553.8,4
"PM",7,9,130,3,100,58,0,0,0,0,4
"PM",7,9,131,1,100,65,0,0,0,0,1
"KV",7,8,69,1,50,9.12,48,631,2.01,510,4
"KV",7,8,70,2,50,14.5,19,157,1.69,511.8,4
"KV",7,9,71,1,50,9,19,253,2.05,511.1,4
"KV",7,9,72,2,50,10.5,54,617,1.99,501.9,4
"EG",7,8,79,1,25,11.25,9,192,2.2,519,4
"EG",7,8,80,2,25,12.75,6,112.94,2.23,518,4
"EG",7,9,81,1,25,3.25,11,812.31,2.6,552,4
"EG",7,9,82,2,25,4.25,22,1242.35,2.75,550,4
"UG",7,9,63,1,25,2.63,40,3650,1.85,505,3
"UG",7,9,64,3,25,6.5,11,406.2,1.81,517,3
"UG",7,9,65,1,25,2.5,37,3552,2.46,511.4,3
"UG",7,9,66,3,25,3,6,480,2.64,526,3
```

Figure 1. (A) Example of input data file INPUT for catch, escapement and estimated river fish data (first record is "CE", followed by three lines of data, and no limit to number of subsequent lines of commentary), and (B) for test fishing data (first record is "TF"; consecutive dates by river, but river order not necessary).

RESULTS

Output includes daily and accumulative catch by commercial fishing district (Figure 2), escapement by river (Figure 3), test fishing catch per unit effort (CPUE) data by river (Figure 4), and a daily run summary with commentary (Figure 5). Storage files, designed to be read by two test fishing forecast programs, are also updated when the reports are written (Figure 6). Data corrections are made by revising the storage files with a text editor. Subsequent reports incorporate the updated data.

One test fishing program was written to forecast accumulative escapements into three river systems from inside test fishing data where it takes several days for the fish to move from the fishing districts to the counting towers in clear water (Figure 7). Another was written to summarize offshore test fishing CPUE data by day and to forecast accumulative inshore run, total inshore run and run timing (Figure 8). The forecasts of accumulative escapement and inshore run are based on passage rates derived from either fish size - catchability curves or lag time (Meacham 1978; Yuen 1978). The forecasts of total run are based on either fish size-density relationships (Huttunen 1979) or entry pattern analysis (Figure 9; Mundy and Mathisen 1978).

DISCUSSION

This fisheries data management program was used in Bristol Bay in 1980 and can be applied wherever there is a large volume exchange of current daily, accumulative and summary data originating from many sources. This program is particularly applicable where large volumes of revised and updated information need to be available both to other computer programs and to many users over a wide geographical area. The savings in time to update and exchange current data were demonstrated in Bristol Bay where the previous day's data files were edited at 0745. At 0755, the current day's data were read by the computer. At this same time all data files were updated, and all reports and forecasts with current information were made available to the public with one telephone call to a computer node in Anchorage. These reports were then immediately available to anyone with a computer terminal via local telephone call to computer nodes in Anchorage, Juneau, and Kodiak. Both the data management and test fishing forecast programs were developed on the University of Alaska's Honeywell 6600 System which supports a timesharing and a dial-up system. The FORTRAN IV source listings are in appendices A, B, and C and instruction manuals are available from the author.

07/11/80 8.83 VERSION

TABLE BRISTOL BAY DAILY AND ACCUMULATIVE SOCKEYE SALMON CATCH DATA BY DISTRICT THRU 7 10 80

EASTSIDE

	NAKNEK-KVICHAK		EGEGIK		UGASHIK		GENERAL		TOTAL	
DATE	DAILY	ACCUM	DAILY	ACCUM	DAILY	ACCUM	DAILY	ACCUM	DAILY	ACCUM
6 18	669	669	1,490	1,490	535	535	0	0	2,694	2,694
6 19	845	1,514	1,569	3,059	15	550	688	688	3,117	5,811
6 20	1,824	3,338	2,811	5,870	0	550	34	722	4,669	10,480
6 21	704	4,042	2,467	8,337	0	550	62	784	3,233	13,713
6 22	105	4,147	4,927	13,264	0	550	96	880	5,128	18,841
6 23	1,071	5,218	10,963	24,227	0	550	0	880	12,034	30,875
6 24	2,979	8,197	6,687	30,914	0	550	2,000	2,880	11,666	42,541
6 25	29,361	37,558	8,807	39,721	2,000	2,550	15,000	17,880	55,168	97,709
6 26	50,684	88,242	21,000	60,721	1,000	3,550	12,000	29,880	84,684	182,393
6 27	35,000	123,242	35,000	95,721	1,000	4,550	9,000	38,880	80,000	262,393
6 28	50,000	173,242	23,000	118,721	2,000	6,550	5,000	43,880	80,000	342,393
6 29	73,000	246,242	9,000	127,721	21,000	27,550	5,000	48,880	108,000	450,393
6 30	109,000	355,242	41,000	168,721	12,000	39,550	66,000	114,880	228,000	678,393
7 1	213,000	568,242	67,000	235,721	7,000	46,550	46,000	160,880	333,000	1,011,393
7 2	206,000	774,242	92,000	327,721	11,000	57,550	17,000	177,880	326,000	1,337,393
7 3	1,048,000	1,822,242	190,000	517,721	17,000	74,550	64,000	241,880	1,319,000	2,656,393
7 4	1,321,000	3,143,242	175,000	692,721	8,000	82,550	96,000	337,880	1,600,000	4,256,393
7 5	1,595,000	4,738,242	55,000	747,721	15,000	97,550	72,000	409,880	1,737,000	5,993,393
7 6	1,680,000	6,418,242	135,000	882,721	32,000	129,550	84,000	493,880	1,931,000	7,924,393
7 7	1,538,000	7,956,242	160,000	1,042,721	15,000	144,550	94,000	587,880	1,807,000	9,731,393
7 8	850,000	8,806,242	75,000	1,117,721	15,000	159,550	95,000	682,880	1,035,000	10,766,393
7 9	800,000	9,606,242	75,000	1,192,721	15,000	174,550	110,000	792,880	1,000,000	11,766,393
7 10	800,000	10,406,242	60,000	1,252,721	15,000	189,550	90,000	882,880	965,000	12,731,393

WESTSIDE

	NUSHAGAK		TOGIAK		TOTAL		BAY-WIDE	
DATE	DAILY	ACCUM	DAILY	ACCUM	DAILY	ACCUM	DAILY	ACCUM
6 18	0	0	1,000	1,000	1,000	1,000	3,694	3,694
6 19	0	0	1,000	2,000	1,000	2,000	4,117	7,811
6 20	0	0	1,000	3,000	1,000	3,000	5,669	13,480
6 21	0	0	1,000	4,000	1,000	4,000	4,233	17,713
6 22	0	0	1,000	5,000	1,000	5,000	6,128	23,841
6 23	0	0	1,000	6,000	1,000	6,000	13,034	36,875
6 24	0	0	1,000	7,000	1,000	7,000	12,666	49,541
6 25	0	0	1,000	8,000	1,000	8,000	56,168	105,709
6 26	0	0	0	8,000	0	8,000	84,684	190,393
6 27	0	0	1,000	9,000	1,000	9,000	81,000	271,393
6 28	1,000	1,000	1,000	10,000	2,000	11,000	82,000	353,393
6 29	0	1,000	0	10,000	0	11,000	108,000	461,393
6 30	0	1,000	0	10,000	0	11,000	228,000	689,393
7 1	0	1,000	0	10,000	0	11,000	333,000	1,022,393
7 2	0	1,000	0	10,000	0	11,000	326,000	1,348,393
7 3	502,000	503,000	10,000	20,000	512,000	523,000	1,831,000	3,179,393
7 4	259,000	762,000	51,000	71,000	310,000	833,000	1,910,000	5,089,393
7 5	476,000	1,238,000	25,000	96,000	501,000	1,334,000	2,238,000	7,327,393
7 6	411,000	1,649,000	7,000	103,000	418,000	1,752,000	2,349,000	9,676,393
7 7	376,000	2,025,000	28,000	131,000	404,000	2,156,000	2,211,000	11,887,393
7 8	328,000	2,353,000	31,000	162,000	359,000	2,515,000	1,394,000	13,281,393
7 9	432,000	2,785,000	31,000	193,000	463,000	2,978,000	1,463,000	14,744,393
7 10	200,000	2,985,000	47,000	240,000	247,000	3,225,000	1,212,000	15,956,393

Figure 2. Example of table of daily and accumulative catch by district for 10 July 1980 in report file BBCATCH.

07/11/80 8.84 VERSION

TABLE BRISTOL BAY DAILY AND ACCUMULATIVE SOCKEYE SALMON ESCAPEMENT DATA BY RIVER THRU 7 10 80

EASTSIDE

	KVICHAK		NAKNEK		EGEGIK		UGASHIK	
DATE	DAILY	ACCUM	DAILY	ACCUM	DAILY	ACCUM	DAILY	ACCUM
6 18	0	0	0	0	0	0	0	0
6 19	0	0	0	0	0	0	0	0
6 20	0	0	0	0	0	0	0	0
6 21	0	0	0	0	0	0	0	0
6 22	4,446	4.446	0	0	0	0	0	0
6 23	1,644	6.090	6	6	0	0	0	0
6 24	840	6,930	6	12	0	0	0	0
6 25	480	7.410	276	288	0	0	0	0
6 26	450	7,860	20,940	21,228	0	0	0	0
6 27	148,122	155,982	180,084	201,312	0	0	0	0
6 28	825.480	981.462	243,312	444,624	0	0	0	0
6 29	1.090.650	2,072,112	438,456	883,080	0	0	0	0
6 30	1,006.020	3,078,132	434.958	1,318,038	12	12	0	0
7 1	1,355,130	4,433,262	259,194	1,577,232	0	12	0	0
7 2	1,520,382	5.953,644	120,228	1,697,460	0	12	42	42
7 3	1,360,860	7,314,504	226,668	1,924,128	1,746	1.758	288	330
7 4	1.847,400	9,161,904	228,558	2,152,686	39,990	41,748	804	1,134
7 5	1,567,500	10,729,404	17.064	2,169,750	75,660	117,408	960	2.094
7 6	1,536,300	12,265,704	75,000	2,244,750	25,944	143,352	600	2,694
7 7	1,334,820	13,600,524	110,370	2,355,120	77,832	221,184	126	2.820
7 8	1,413,720	15.014,244	44,784	2,399.904	91,446	312,630	1,062	3.882
7 9	1,310,760	16,325,004	21,846	2,421,750	36,060	348.690	1.878	5,760
7 10	1,105,380	17,430,384	26,532	2,448,282	73,794	422.484	19.290	25.050

WESTSIDE

	WOOD		IGUSHIK		NUYAKUK		TOGIAK	
DATE	DAILY	ACCUM	DAILY	ACCUM	DAILY	ACCUM	DAILY	ACCUM
6 18	108	108	0	0	0	0	0	0
6 19	0	108	0	0	0	0	0	0
6 20	312	420	0	0	0	0	0	0
6 21	432	852	0	0	0	0	0	0
6 22	132	984	0	0	0	0	0	0
6 23	426	1,410	2.352	2.352	0	0	0	0
6 24	54	1,464	1,020	3,372	0	0	0	0
6 25	174	1,638	2,610	5,982	0	0	0	0
6 26	48	1,686	4,650	10,632	0	0	0	0
6 27	522	2,208	7,530	18,162	0	0	0	0
6 28	906	3,114	3,954	22,116	0	0	0	0
6 29	24,810	27,924	2,400	24.516	0	0	0	0
6 30	120,312	148,236	3,666	28,182	0	0	0	0
7 1	175,638	323,874	3,036	31,218	0	0	0	0
7 2	341,214	665.088	21,276	52,494	0	0	0	0
7 3	415,668	1,080,756	53,220	105.714	0	0	546	546
7 4	460,722	1,541,478	104,232	209,946	0	0	2.952	3,498
7 5	198,684	1,740.162	113,652	323,598	12,126	12,126	9.636	13.134
7 6	141,096	1,881,258	120,234	443,832	81,834	93,960	15,294	28,428
7 7	162,906	2,044,164	156,936	600.768	150,840	244,800	25,352	53,780
7 8	230,490	2,274.654	148.842	749.610	153.810	398.610	11.058	64.838
7 9	246,156	2,520,810	192,924	942,534	200,298	598.908	10,998	75,836
7 10	95,850	2,616,660	143,658	1,086,192	253,344	852,252	9.420	85.256

Figure 3. Example of table of daily and accumulative escapement by river for 10 July 1980 in report file BBESC.

07/06/80 7.82 VERSION
TABLE SOCKEYE SALMON INSIDE TEST FISH SUMMARY DATA FOR THE KVICHAK, EGEGIK, AND UGASHIK RIVERS AS OF 7 5 80

DATE	FISHING TIME	CATCH	INDEX	ACCUMULATIVE INDEX	MEAN WEIGHT	MEAN LENGTH
KVICHAK						
6 19	61.00	5.50	1.97	1.97	4.32	488.00
6 20	24.00	34.00	21.78	23.75	5.54	533.50
6 21	67.50	5.00	8.90	32.64	5.54	546.00
6 22	76.50	1.00	1.57	34.21	5.52	536.00
6 23	115.50	0.	0.	34.21	0.	0.
6 24	78.50	3.00	4.60	38.81	5.18	537.70
6 25	111.50	11.00	11.59	50.40	5.27	531.30
6 26	13.00	250.00	3076.92	3127.32	5.24	521.13
6 27	6.00	114.00	4560.00	7687.32	5.32	519.28
6 28	4.00	64.00	3840.00	11527.32	4.81	514.25
6 29	8.00	217.00	6510.19	18037.51	5.14	510.18
6 30	7.00	214.00	7337.14	25374.65	5.38	511.25
7 1	4.50	166.00	8186.67	33561.32	5.37	510.33
7 2	4.50	270.00	12816.00	46377.32	6.80	516.70
7 3	6.00	404.00	16160.00	62537.32	5.10	515.92
7 4	5.50	157.00	8373.33	70910.65	5.01	510.85
7 5	34.00	42.00	5040.00	75950.65	5.18	513.00
EGEGIK						
6 18	53.00	47.00	4.53	4.53	5.18	523.00
6 19	94.00	16.50	10.23	14.75	6.10	552.00
6 20	88.00	41.00	19.09	33.85	6.33	566.50
6 21	106.00	7.00	15.85	49.69	5.18	515.00
6 22	101.50	9.00	21.28	70.97	4.42	506.00
6 23	53.50	4.00	17.94	88.92	4.50	510.00
6 24	51.75	0.	0.	88.92	0.	0.
6 25	79.25	1.00	3.03	91.95	6.44	583.00
6 26	142.50	1.00	1.68	93.63	5.87	542.00
6 27	67.50	4.00	14.22	107.85	4.46	496.00
6 28	76.02	4.00	12.63	120.48	4.76	512.25
6 29	80.15	13.00	38.93	159.41	5.06	527.30
6 30	83.75	5.00	14.33	173.74	5.27	525.75
7 1	40.75	58.00	341.73	515.46	5.57	535.25
7 2	53.50	40.00	179.44	694.90	5.01	524.50
7 3	47.00	29.00	151.30	846.21	5.20	528.50
7 4	16.50	135.00	1831.69	2677.90	4.87	519.00
7 5	41.00	47.00	269.26	2947.16	4.89	515.00
UGASHIK						
6 23	32.50	5.00	36.92	36.92	5.77	539.67
6 24	39.50	5.00	27.45	64.37	5.39	522.00
6 25	46.75	3.00	15.40	79.77	5.15	524.00
6 26	78.90	18.00	54.75	134.53	4.51	519.00
6 27	58.60	17.00	69.63	204.16	5.54	528.33
6 28	52.00	15.00	69.23	273.39	4.90	512.35
6 29	42.05	13.00	74.19	347.58	6.08	557.53
6 30	52.25	7.00	32.15	379.73	5.03	530.27
7 1	48.40	8.00	39.67	419.40	4.58	512.25
7 2	56.20	5.00	21.35	440.76	5.18	523.40
7 3	69.45	34.00	117.49	558.25	5.11	516.40
7 4	16.75	15.00	230.97	789.22	4.55	518.50
7 5	35.10	44.00	263.13	1052.35	5.00	520.10

Figure 4. Example of table of daily and accumulative inside test fishing data by river for 5 July 1980 in the report file BBTFISH

07/13/80 8.89 VERSION

TABLE BRISTOL BAY RED SALMON DAILY RUN SUMMARY THRU 7 12 80

DISTRICT	CATCH DAILY	CATCH ACCUMULATIVE	ESCAPEMENT DAILY	ESCAPEMENT ACCUMULATIVE	RIVER EST FISH	TOTAL RUN
KVICHAK R.			906,780	19,415,304	750,000	
NAKNEK R.			87,978	2,570,856	0	
NAKNEK-KVI...	800,000	12,329,242	994,758	21,986,160	750,000	35,065,402
EGEGIK.....	100,000	1,794,721	10,200	842,166	50,000	2,686,887
UGASHIK.....	20,000	262,550	30,594	71,292	500,000	833,842
GENERAL.....	60,000	1,029,880				1,029,880
WOOD R.			119,424	2,783,076	0	
IGUSHIK R.			122,208	1,329,780	407,220	
NUYAKUK R.			293,694	1,360,548	0	
NUSHAGAK.....	38,000	3,592,000	535,326	5,473,404	407,220	9,472,624
TOGIAK.....	25,000	300,000	26,238	129,236	0	429,236
BRISTOL BAY..	1,043,000	19,308,393	1,597,116	28,502,258	1,707,220	49,517,871

COMMENTS:
TODAY'S ACCUMALTIVE TOTAL REFLECT REVISED AND UPDATED DATA

TABLE DAILY AND ACCUMULATIVE BRISTOL BAY CATCH, ESCAPEMENT AND INSHORE RUN WITH ESTIMATED RIVER FISH THRU 6 25 80

	CATCH		ESCAPEMENT		CATCH+ESCAPEMENT		INSHORE	
DATE	DAILY	ACCUM	DAILY	ACCUM	DAILY	ACCUM	DAILY	ACCUM
6 18	3,694	3,694	108	108	3,802	3,802	4,264	4,264
6 19	4,117	7,811	0	108	4,117	7,919	5,470	9,734
6 20	5,669	13,480	312	420	5,981	13,900	14,772	24,506
6 21	4,233	17,713	432	852	4,665	18,565	7,195	31,701
6 22	6,128	23,841	4,578	5,430	10,706	29,271	9,204	40,905
6 23	13,034	36,875	4,428	9,858	17,462	46,733	19,685	60,590
6 24	12,666	49,541	1,920	11,778	14,586	61,319	18,019	78,609
6 25	56,168	105,709	3,540	15,318	59,708	121,027	63,449	142,058

Figure 5. Example of daily run summary for 12 July 1980 and example of table of daily and accumulative catch, escapement and inshore run for 25 June 1980 in report file BBRUN.

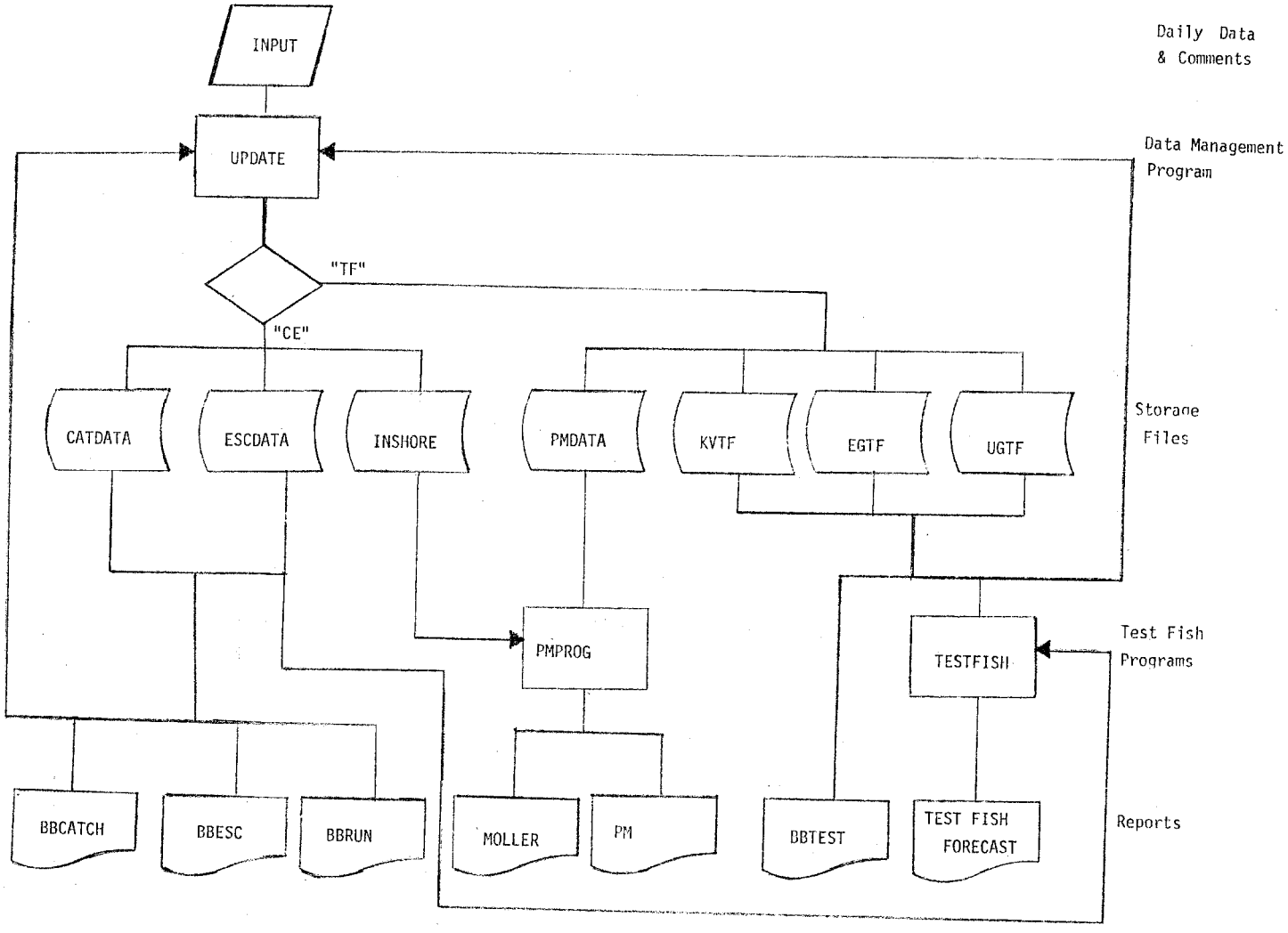


Figure 6. Data flow from file INPUT thru program UPDATE to storage files and report files. Storage files used to calculate accumulative data and by test fishing forecast programs.

```
07/07/80 17:22:56
KVICHAK
JULY  6

ACCUMULATED ESCAPEMENT = 12,265.704
ACCUMULATED INDEX= 83485.89746

MEAN LENGTH = 513.08   FISH/INDEX =      [illegible]   FORECAST = [illegible]


 TIME  MEAN SUM OF SQUARES
 LAG    BETWEEN CURVES
   0       0.0031
   1       0.0005
   2       0.0103
   3       0.0330
   4       0.0671
   5       0.1106
   6       0.1614

LAG TIME?  1
FISH PER INDEX= 159.048
FORECAST 13,278.252

PLOT?  Y


     0.0       0.2       0.4       0.6       0.8       1.0
 TIME Y---------Y---------Y---------Y---------Y---------Y
   0 !2
     !0
     !0
     !=
     !=
   5 !=
     !=2
     !=2
     ! X0
     !   1X0
  10 !      10X
     !          10 X
     !               0 2X
     !                    0 1X2
     !                          0X12
  15 !                                 X0
     !                                      10X
     !                                          0   X
  18 !                                            2 0
 TIME Y---------Y---------Y---------Y---------Y---------Y
     0.0       0.2       0.4       0.6       0.8       1.0

   TIME LAG =  1

              CURVE       DATA POINT    NUMBER OF
   CURVE   PLOT SYMBOL   PLOT SYMBOL    POINTS       A         B
   -----   -----------   -----------    ------     -------    ------
     1         1             0            18       -8.3772    0.6303
     2         2             X            15       -8.5452    0.6091

  THE PLOT SYMBOL "=" USED WHEN 2 DATA POINTS ARE IN SAME PLOT POSITION

ANOTHER LAG TIME?
ANOTHER RIVER?  N
```

Figure 7. Example of forecast of escapement from inside test fishing data from program TESTFISH.

06/27/80 10.24 VERSION

TABLE PORT MOLLER OFFSHORE TESTFISH SOCKEYE SALMON DATA AND ANALYSIS AS OF 6/26/80

DATE	SETS	CATCH	INDEX	RUNNING MEAN WEIGHT(LBS)	RUNNING MEAN LENGTH(MM)	ESTIMATED DAILY PASSAGE METHOD I	ESTIMATED DAILY PASSAGE METHOD II	ESTIMATED ACCUM PASSAGE METHOD I	ESTIMATED ACCUM PASSAGE METHOD II	
6/12	5	17	7.92	6.11	554	205,538	128,596	205,538	128,596	
6/13	4	19	8.82	6.08	554	228,736	143,110	434,274	271,706	
6/14	5	7	3.44	6.34	561	89,350	55.902	523,625	327,609	
6/15	6	41	19.49	6.36	560	505,744	316,421	1,029,370	644,030	
6/16	5	40	18.50	6.30	557	480,047	300,344	1,509,417	944,375	
6/17	6	36	18.70	6.23	553	485,199	303,567	1,994,616	1,247,942	
6/18	5	50	25.59	6.12	551	663,911	415,379	2,658,528	1,663,322	
6/19	3	45	24.45	6.12	550	634,281	396,841	3,292,810	2,060,164	*
6/20	0	0	21.17	6.12	550	549,288	343,665	3,842,099	2,403,830	*
6/21	4	28	24.08	6.07	548	624,876	390,957	4,466,975	2,794,787	*
6/22	0	0	15.95	6.07	548	413,847	258,926	4,880,822	3,053,713	*
6/23	0	0	22.30	6.07	548	578,608	362,009	5,459,431	3,415,722	*
6/24	4	20	10.74	6.05	548	278,572	174,290	5,738,003	3,590,012	
6/25	6	46	20.87	5.98	546	541,493	338,788	6,279,496	3,928,801	
6/26	5	44	22.14	5.92	544	574,421	359,390	6,853,918	4,288,191	

* INCLUDES INTERPOLATED VALUES FOR MISSED FISHING TIME

METHOD I: BASED ON 25,946 INSHORE RETURNS PER PORT MOLLER INDEX
CALCULATED FROM SIZE-CATCHABILITY RELATIONSHIP

METHOD II: BASED ON 16,233 INSHORE RETURNS PER INDEX
CALCULATED FROM ACCUMULATIVE INSHORE RETURN OF 944,375 SOCKEYE THROUGH 6/26
AND 58 ACCUMULATIVE PORT MOLLER INDEX POINTS THROUGH 6/16 WITH LAG TIME OF 10 DAYS

TOTAL RUN SIZE ESTIMATED FROM:
PORT MOLLER RUNNING MEAN LENGTH OF 544.62= 24 MILLION

PORT MOLLER RUNNING MEAN WEIGHT OF 5.92= 18 MILLION

ENTRY PATTERN ANALYSIS :
RUN TIMING 0 DAYS COMPARED TO AVERAGE

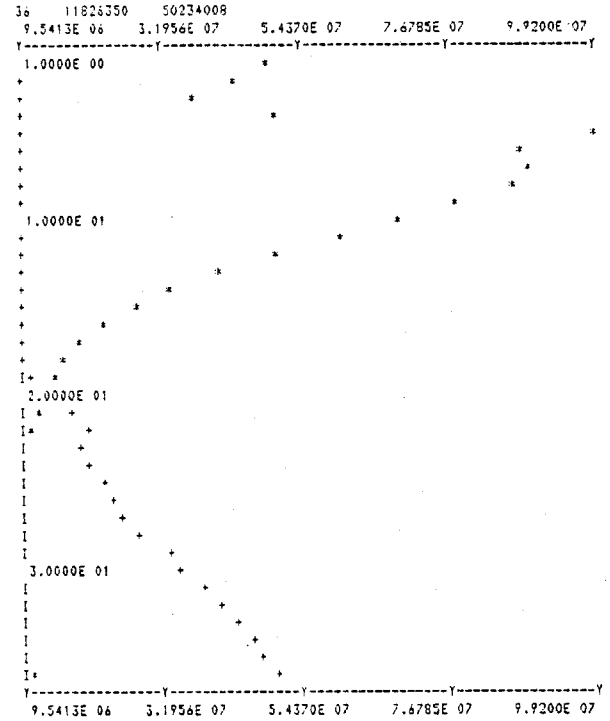
FORECAST 33,621,319 USING MEAN LENGTH PASSAGE RATE

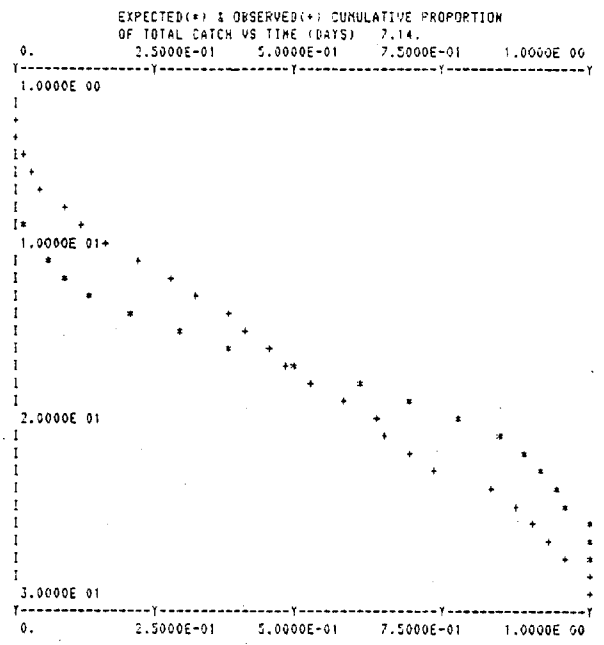
*

Figure 8. Example of table of daily and accumulative offshore test fishing data and forecast of passage with forecast of total inshore return for 26 June 1980 in report file MOLLER.

EST. TOTAL RUN SIZE. MP=F(W)*. MP=F(INSHORE)+.
VS TIME (DAYS) 7.14.

DAY	F(W)	F(INSHORE)
1	48667415	0
2	44288017	0
3	37380331	0
4	50952778	0
5	99189694	0
6	88673805	0
7	90868973	0
8	87542817	0
9	79218894	0
10	70251054	553914
11	60401244	6010039
12	50513883	10849233
13	41776667	4190586
14	34235434	2589551
15	28209754	2719196
16	23448076	1637714
17	19867342	1767093
18	17253316	8379310
19	15407194	12604357
20	14042237	14416341
21	13094646	18211790
22	12436377	21543781
23	10857899	20357909
24	10027328	21562236
25	9551294	23314642
26	9747815	25529419
27	9935939	26699194
28	10096821	29161480
29	10253258	33549216
30	10393281	35346384
31	10904091	39041755
32	11029745	41356124
33	11157919	44216650
34	11287701	47027078
35	11409571	47763542
36	11826350	50234008





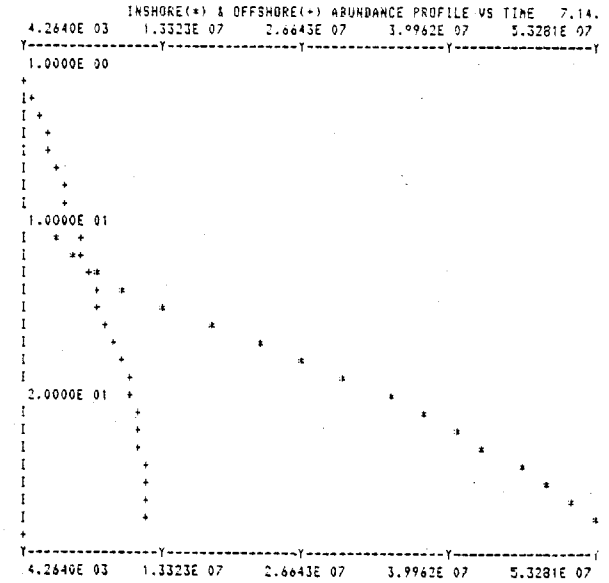


Figure 9. Example of forecast and plot of total return by entry pattern analysis using 2 passage rates by day, expected and observed cummulative proportion of total offshore test fishing indices by day, and forecasted and observed accumulative inshore return by day for 14 July 1980 in report file PMPLOT.

ACKNOWLEDGMENTS

Fred Jamsen prepared the lag time (cumulative curve fit and least sums of squares) subroutines in both test fishing programs. Phil Mundy wrote the entry pattern analysis subroutines used in the offshore test fishing program. Nancy Graves wrote the commas subroutine. Chuck Meacham, Jr. provided overall guidance and support.

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APPENDIX A

```
10C.....READ, WRITE AND STORE TEST FISH, CATCH, AND ESCAPEMENT DATA
20C.....FIRST RECORD IS "CE" FOR CATCH, ESCAPEMENT AND RIVER FISH
30C.....FIRST RECORD IS "TF" FOR TESTFISH DATA
40C.....IF "CE" SECOND RECORD IS CATCH BY DISTRICT
50C.....THIRD RECORD IS ESCAPEMENT BY RIVER
60C.....FOURTH RECORD IS ESTIMATED FISH IN RIVER BELOW COUNTING TOWER
70C.....ALL OTHER RECORDS IS COMMENTS, NO LIMIT TO NUMBER OF LINES
80C.....SAVE AS FILE NAMED INPUT
90      CHARACTER A*2
100      CALL ATTACH(12,"AGFCST1/INPUT,R;",3,0,IS,)
110      CALL CALLSS ("LINE 130\")
120      READ(12,1000) A
130 1000 FORMAT (V)
140      IF(A.EQ."TF") CALL TESTFISH
150      CALL CANDE
160      STOP
170      END
180      SUBROUTINE TESTFISH
190C.....READ, WRITE AND STORE TESTFISH DATA
200C.....SUMMARIZE ONLY INSIDE TEST FISH DATA IN REPORT FILE
210      CHARACTER A*2(4,200),RNAME*10(3),MDY*8
220      DATA RNAME/"KVICHAK   ","EGEGIK    ","UGASHIK   "/
230      DIMENSION W(11),X(4,11,200)
240      DIMENSION ACCUM(3,200), FI(3,200), FWT(3,200), SCAT(3,200), STIME(3,150)
250      DIMENSION FLN(3,45)
260      DIMENSION DSAVE(45),MSAV(45)
270      INTEGER IRN(4)
280      CHARACTER B*2
290      CALL ATTACH(01,"AGFCST1/KVTF,R;",3,0,IS,)
300      CALL ATTACH(02,"AGFCST1/EGTF,R;",3,0,IS,)
310      CALL ATTACH(03,"AGFCST1/UGTF,R;",3,0,IS,)
320      CALL ATTACH(04,"AGFCST1/FMDATA,R;",3,0,IS,)
330      CALL ATTACH(11,"AGFCST1/BBTFISH,R;",3,0,IS,)
340      DO 70 I=1,4
350      IRN(I)=1
360   60 READ(I,1100,END=70) A(I,IRN(I)),(X(I,J,IRN(I)),J=1,11)
370 1100 FORMAT(A2,11F9.2)
380      IRN(I)=IRN(I)+1
390      GO TO 60
400   70 IF(X(I,1,IRN(I)).GT.0.) IRN(I)=IRN(I)-1
410   20 READ(12,1000,END=25) B,IDUMMY,(W(J),J=1,11)
420 1000 FORMAT (V)
430      IF(B.EQ."KV") K=1
440      IF(B.EQ."EG") K=2
450      IF(B.EQ."UG") K=3
```

```
460       IF(B.EQ."PM") K=4
470       DO 30 J=1,11
480    30 X(K,J,IRN(K))=W(J)
490       A(K,IRN(K))=B
500       IRN(K)=IRN(K)+1
510       GO TO 20
520    25 CALL DATIM(MDY,HM)
530       WRITE(11,1905) MDY,HM
540 1905 FORMAT(A10,F6.2," VERSION")
550       WRITE (11,2000) IFIX(W(1)),IFIX(W(2))
560 2000 FORMAT("TABLE    SOCKEYE SALMON INSIDE TEST FISH SUMMARY DATA FOR THE"
570       &,/,"KVICHAK, EGEGIK, AND UGASHIK RIVERS AS OF", 2I3," 80")
580       WRITE(11,2100)
590 2100 FORMAT(/,/,8X,"FISHING",18X,"ACCUMULATIVE  MEAN",4X,"MEAN"
600       &,/,"  DATE   TIME      CATCH     INDEX    INDEX    WEIGHT  LENGTH")
610       DO 100 I=1,4
620       REWIND I
630       IF(I.EQ.4) GO TO 35
640       IPASS = 0
650       DO 65 L=1,150
660       ACCUM(I,L)=0.
670       SCAT(I,L)=0.0
680       STIME(I,L)=0.0
690    65 CONTINUE
700    35 J=1
710       DO 200 JJ=1,IRN(I)
720    15 IF(IPASS.EQ.1) GO TO 75
730       IPASS=1
740       DSAVE(J)=X(I,2,JJ)
750       MSAV(J)=X(I,1,JJ)
760       SL=0.
770       SLN=0.0
780       SI=0.
790       SWT=0.
800       SWN=0.
810       SFH=0.
820       GO TO 80
830    75 IF(DSAVE(J).NE.X(I,2,JJ)) GO TO 40
840C.....COMPUTE DAILY MEANS
850C.....WEIGHT INDEX BY FATHOM HOURS FOR DAILY MEANS
860C.....WEIGHT LENGTH AND WEIGHT BY INDEX FOR DAILY MEAN SIZES
870    80 FH=X(I,5,JJ)*X(I,6,JJ)
880       DI=X(I,8,JJ)*FH
890       SFH=SFH+FH
900       SI=SI+DI
```

```
      SCAT(I,J)=SCAT(I,J)+X(I,7,JJ)
      STIME(I,J)=STIME(I,J)+X(I,6,JJ)
      IF(X(I,9,JJ).EQ.0.) GO TO 205
      SWT=SWT+X(I,9,JJ)
      SWN=SWN+1.
  205 IF(X(I,10,JJ).EQ.0.0) GOTO 200
      SL=SL+X(I,10,JJ)
      SLN=SLN+1.0
      GO TO 200
   40 IF(SI.GT.0) FI(I,J)=SI/SFH
      IF(J.EQ.1) ACCUM(I,J)=FI(I,J)
      IF(J.EQ.1) GO TO 41
      ACCUM(I,J)=ACCUM(I,J-1)+FI(I,J)
   41 IF(SWT.GT.0.) FWT(I,J)=SWT/SWN
      IF(SL.GT.0.) FLN(I,J)=SL/SLN
      IPASS=0
      J=J+1
      DSAVE(J)=X(I,2,JJ)
      MSAV(J)=X(I,1,JJ)
      GO TO 15
  200 CONTINUE
C.....ASSIGN MOST RECENT DATA TO ARRAY
      IF(SI.GT.0.) FI(I,J)=SI/SFH
      IF(J.EQ.1) ACCUM(I,J)=FI(I,J)
      IF(J.EQ.1) GO TO 42
      ACCUM(I,J)=ACCUM(I,J-1)+FI(I,J)
   42 IF(SWT.GT.0.) FWT(I,J)=SWT/SWN
      IF(SL.GT.0.) FLN(I,J)=SL/SLN
  210 CONTINUE
      IF(X(I,1,1).EQ.0.) GO TO 100
      IF(I.EQ.4) GO TO 82
      WRITE(11,3000) RNAME(I)
 3000 FORMAT(/,/,A10)
      DO 90K=1,J-1
      WRITE(11,4000) IFIX(MSAV(K)),IFIX(DSAVE(K)),STIME(I,K),SCAT(I,K),FI(I,K),
      &ACCUM(I,K),FWT(I,K)*2.3,FLN(I,K)
 4000 FORMAT(2I3,F8.2,F10.2,F10.2,F12.2,2F8.2)
   90 CONTINUE
   82 DO 85 K=1,IRN(I)-1
   85 WRITE (I,5000) A(I,K),(X(I,J,K),J=1,11)
 5000 FORMAT (A2,11F9.2)
  100 CONTINUE
      STOP
      END
      SUBROUTINE CANDE
```

```
1360C.....READ, WRITE AND STORE CATCH DATA
1370      CHARACTER SYS*14(8),SIDE*8(3),MDY*8
1380      CHARACTER RIV*11(8)
1390      DATA SYS/"NAKNEK-KVICHAK","    EGEGIK    ","   UGASHIK    ",
1400      &"   GENERAL    ","     TOTAL    ","   NUSHAGAK   ","    TOGIAK    ","     TOTAL    "/
1410      DATA RIV/"KVICHAK","NAKNEK ","EGEGIK ","UGASHIK",
1420      &" WOOD  ","IGUSHIK","NUYAKUK"," TOGIAK "/
1430      DATA SIDE/"EASTSIDE","WESTSIDE","BAY-WIDE"/
1440      INTEGER ISUM(9),IACAT(9,120),IAESC(8,120),ICAT(9,120),INUM(9)
1450      INTEGER IESC(8,120)
1460      INTEGER IERF(8),ITF(40),ISCAT(40),ISESC(40)
1470      INTEGER KMO(120),KDA(120)
1480      CHARACTER RNM*19(12),DTIN*1(85)
1490      INTEGER M(45),IDATE(45),ICPT(45)
1500      CHARACTER BLOCK*10(60)
1510      DATA RNM/"     KVICHAK R.     ",
1520      & "     NAKNEK R.     ",
1530      & "NAKNEK-KVI...      ",
1540      & "EGEGIK.......      ",
1550      & "UGASHIK......      ","GENERAL......      ","     WOOD R.       ",
1560      & "     IGUSHIK R.    ",
1570      & "     NUYAKUK R.    ","NUSHAGAK.....      ",
1580      & "TOGIAK.......      ","BRISTOL BAY..      "/
1590      READ(12,1000) MO,IDA,(INUM(I),I=1,6)
1600 1000 FORMAT (V)
1610      CALL ATTACH(07,"AGFCST1/CATDATA,R;",3,0,IS,)
1620      CALL ATTACH(9,"AGFCST1/BBCATCH,R;",3,0,IS,)
1630      N=1
1640      DO 30 K=1,7
1650   30 ISUM(K)=0
1660      ICAT(7,N)=0
1670   40 READ(7,1000,END=90) KMO(N),KDA(N),(ICAT(I,N),I=1,6)
1680C.....ADD UP EAST SIDE
1690      DO 500 K=1,4
1700  500 ICAT(7,N)=ICAT(7,N)+ICAT(K,N)
1710      ICAT(8,N)=ICAT(5,N)+ICAT(6,N)
1720      ICAT(9,N)=ICAT(7,N)+ICAT(8,N)
1730C.... ACCUMULATE TOTALS FOR ALL DISTRICTS
1740      DO 50 K=1,9
1750      ISUM(K)=ISUM(K)+ICAT(K,N)
1760   50 IACAT(K,N)=ISUM(K)
1770      N=N+1
1780      GO TO 40
1790   90 REWIND 07
1800C.....ASSIGN MOST RECENT DATA TO ARRAY
```

```
1810        KMO(N)=MO
1820        KDA(N)=IDA
1830        INUM(7)=0
1840        INUM(8)=0
1850        INUM(9)=0
1860        DO 510 K=1,4
1870  510 INUM(7)=INUM(7)+INUM(K)
1880        INUM(8)=INUM(5)+INUM(6)
1890        INUM(9)=INUM(7)+INUM(8)
1900        DO 95 K=1,9
1910        ICAT(K,N)=INUM(K)
1920        ISUM(K)=ISUM(K)+ICAT(K,N)
1930        IACAT(K,N)=ISUM(K)
1940   95 CONTINUE
1950        CALL DATIM (MDY,HM)
1960        WRITE(9,1905) MDY,HM
1970 1905 FORMAT(A8,F6.2," VERSION")
1980        WRITE(9,2000)  MO,IDA
1990 2000 FORMAT( "TABLE    BRISTOL BAY DAILY AND ACCUMULATIVE SOCKEYE SALMON
2000        &CATCH DATA BY DISTRICT THRU  ", 2I3, " 80")
2010        WRITE(9,2010)
2020 2010 FORMAT(116("-"))
2030        WRITE(9,3000) SIDE(1)
2040 3000 FORMAT (/,/,A8)
2050        WRITE(9,3100) (SYS(I),I=1,5)
2060 3100 FORMAT (6X,3X,5(4X,A14,4X))
2070        WRITE(9,3150)
2080 3150 FORMAT("  DATE",3X, 5(3X,"DAILY",6X,"ACCUM",3X))
2090        DO 100 I=1,N
2100        CALL DISPLA(ICAT(1,I),BLOCK(1))
2110        CALL DISPLA(IACAT(1,I),BLOCK(2))
2120        CALL DISPLA(ICAT(2,I),BLOCK(3))
2130        CALL DISPLA(IACAT(2,I),BLOCK(4))
2140        CALL DISPLA(ICAT(3,I),BLOCK(5))
2150        CALL DISPLA(IACAT(3,I),BLOCK(6))
2160        CALL DISPLA(ICAT(4,I),BLOCK(7))
2170        CALL DISPLA(IACAT(4,I),BLOCK(8))
2180        CALL DISPLA(ICAT(7,I),BLOCK(9))
2190        CALL DISPLA(IACAT(7,I),BLOCK(10))
2200        WRITE(9,3200) KMO(I),KDA(I),(BLOCK(IJ),IJ=1,10)
2210 3200 FORMAT(2I3,10(1X,A10))
2220        WRITE(7,3210) KMO(I),KDA(I),(ICAT(J,I),J=1,6)
2230 3210 FORMAT(2I3,6I10)
2240  100 CONTINUE
2250        WRITE(9,3005) SIDE(2),SIDE(3)
```

```
2260 3005 FORMAT(/,/,A8,93X,A8)
2270      WRITE(9,3300) (SYS(I),I=6,8)
2280 3300 FORMAT( 6X,3X,3(4X,A14,4X))
2290      WRITE(9,3400)
2300 3400 FORMAT("  DATE",3X,3(3X,"DAILY",6X,"ACCUM",3X),22X,3X,"DAILY",6X,"ACCUM")
2310      DO 110 I=1,N
2320      CALL DISPLA(ICAT(5,I),BLOCK(11))
2330      CALL DISPLA(IACAT(5,I),BLOCK(12))
2340      CALL DISPLA(ICAT(6,I),BLOCK(13))
2350      CALL DISPLA(IACAT(6,I),BLOCK(14))
2360      CALL DISPLA(ICAT(8,I),BLOCK(15))
2370      CALL DISPLA(IACAT(8,I),BLOCK(16))
2380      CALL DISPLA(ICAT(9,I),BLOCK(17))
2390      CALL DISPLA(IACAT(9,I),BLOCK(18))
2400      WRITE(9,3500) KMO(I),KDA(I),(BLOCK(IJ),IJ=11,18)
2410 3500 FORMAT(2I3,6(1X,A10),22X,2(1X,A10))
2420      ISCAT(I)=0
2430      DO 115 K=1,6
2440      ISCAT(I)=ISCAT(I)+ICAT(K,I)
2450  115 CONTINUE
2460  110 CONTINUE
2470      WRITE(9,2010)
2480C.....
2490C.....READ, WRITE, AND STORE ESCAPEMENT
2500C.....
2510      READ(12,1000) MO,IDA,(INUM(I),I=1,8)
2520      CALL ATTACH(08,"AGFCST1/ESCDATA,R;",3,0,IS,)
2530      CALL ATTACH(10,"AGFCST1/BBESC,R;",3,0,IS,)
2540      N=1
2550      DO 35 K=1,8
2560   35 ISUM(K)=0
2570   45 READ(8,1000,END=195) KMO(N),KDA(N),(IESC(I,N),I=1,8)
2580      DO 55 K=1,8
2590      ISUM(K)=ISUM(K)+IESC(K,N)
2600   55 IAESC(K,N)=ISUM(K)
2610      N=N+1
2620      GO TO 45
2630  195 REWIND 08
2640C.....ASSIGN MOST RECENT DATA TO ARRAY
2650      KMO(N)=MO
2660      KDA(N)=IDA
2670      DO 300 K=1,8
2680  300 IESC(K,N)=INUM(K)
2690      DO 310 K=1,8
2700      ISUM(K)=ISUM(K)+INUM(K)
```

```
      IAESC(K,N)=ISUM(K)
  310 CONTINUE
      CALL DATIM (MDY,HM)
      WRITE(10,1905) MDY,HM
      WRITE(10,4000)  MO,IDA
 4000 FORMAT(/,/, "TABLE    BRISTOL BAY DAILY AND ACCUMULATIVE SOCKEYE SALMON
      &ESCAPEMENT DATA BY RIVER THRU  ", 2I3, " 80")
      WRITE(10,2020)
 2020 FORMAT(100("-"))
      WRITE(10,3550) SIDE(1)
 3550 FORMAT (/,/,A8)
      WRITE(10,4100) (RIV(L),L=1,4)
 4100 FORMAT(6X,4(7X,A11,6X))
      WRITE(10,3155)
 3155 FORMAT("  DATE",4(5X,"DAILY",7X,"ACCUM",2X))
      DO 200 I=1,N
      CALL DISPLA(IESC(1,I),BLOCK(15))
      CALL DISPLA(IAESC(1,I),BLOCK(16))
      CALL DISPLA(IESC(2,I),BLOCK(17))
      CALL DISPLA(IAESC(2,I),BLOCK(18))
      CALL DISPLA(IESC(3,I),BLOCK(19))
      CALL DISPLA(IAESC(3,I),BLOCK(20))
      CALL DISPLA(IESC(4,I),BLOCK(21))
      CALL DISPLA(IAESC(4,I),BLOCK(22))
      WRITE(10,4200) KMO(I),KDA(I),(BLOCK(IJ),IJ=15,22)
 4200 FORMAT(2I3,A10,7(2X,A10))
      WRITE(8,4210) KMO(I),KDA(I),(IESC(J,I),J=1,8)
 4210 FORMAT(2I3,8I10)
  200 CONTINUE
      WRITE(10,3550) SIDE(2)
      WRITE(10,4100) (RIV(I),I=5,8)
      WRITE(10,3155)
      DO 210 I=1,N
      CALL DISPLA(IESC(5,I),BLOCK(23))
      CALL DISPLA(IAESC(5,I),BLOCK(24))
      CALL DISPLA(IESC(6,I),BLOCK(25))
      CALL DISPLA(IAESC(6,I),BLOCK(26))
      CALL DISPLA(IESC(7,I),BLOCK(27))
      CALL DISPLA(IAESC(7,I),BLOCK(28))
      CALL DISPLA(IESC(8,I),BLOCK(29))
      CALL DISPLA(IAESC(8,I),BLOCK(30))
      WRITE(10,4200) KMO(I),KDA(I),(BLOCK(IJ),IJ=23,30)
      ISESC(I)=0
      DO 215 K=1,8
      ISESC(I)=ISESC(I)+IESC(K,I)
```

```
  215 CONTINUE
  210 CONTINUE
      WRITE(10,2020)
C.....READ ESTIMATED RIVER FISH
      CALL ATTACH(13,"AGFCST1/BBRUN,R;",3,0,IS,)
      READ(12,1000) (IERF(I),I=1,8)
C.....
C.....PRINT DAILY RUN SUMMARY
C.....
      CALL DATIM (MDY,HM)
      WRITE(13,1905) MDY,HM
      WRITE(13,360)
      WRITE(13,360)
      WRITE (13,4300) MO,IDA
 4300 FORMAT ("TABLE     BRISTOL BAY RED SALMON DAILY RUN SUMMARY THRU ",2I3," 80"//
      & 23X,"-------C A T C H------",4X,"--E S C A P ",
      & "E M E N T-",6X,"R I V E R",5X,"T O T A L"
      &,/,
      & "DISTRICT",18X,"DAILY",2X,
      & "ACCUMULATIVE",7X,"DAILY  ACCUMULATIVE",5X,"EST FISH",9X,"RUN",
      & /99("-")/)
      CALL DISPLA(IERF(1),BLOCK(31))
      WRITE(13,5000) RNM(1),(BLOCK(IJ),IJ=15,16),BLOCK(31)
 5000 FORMAT(A19,30X,A10,2X,A10,4X,A10,4X,A10)
      WRITE(13,360)
      CALL DISPLA(IERF(2),BLOCK(32))
      WRITE(13,5000) RNM(2),(BLOCK(IJ),IJ=17,18),BLOCK(32)
      WRITE(13,360)
      DO 205 J=1,3
  205 ISUM(J)=0
      DO 610 I=1,2
      ISUM(1)=ISUM(1)+IESC(I,N)
      ISUM(2)=ISUM(2)+IAESC(I,N)
      ISUM(3)=ISUM(3)+IERF(I)
  610 CONTINUE
      ISUM(4)=ISUM(2)+ISUM(3)+IACAT(1,N)
      CALL DISPLA(ISUM(1),BLOCK(33))
      CALL DISPLA(ISUM(2),BLOCK(34))
      CALL DISPLA(ISUM(3),BLOCK(35))
      CALL DISPLA(ISUM(4),BLOCK(36))
      WRITE(13,5100) RNM(3),(BLOCK(IJ),IJ=1,2),(BLOCK(JK),JK=33,36)
 5100 FORMAT(A19,2(4X,A10,2X,A10),2(4X,A10))
      WRITE(13,360)
      JTOTAL=IACAT(2,N)+IAESC(3,N)+IERF(3)
      CALL DISPLA(IERF(3),BLOCK(37))
```

```
      CALL DISPLA(JTOTAL,BLOCK(38))
      WRITE(13,5100) RNM(4),BLOCK(3),BLOCK(4),BLOCK(19),BLOCK(20),BLOCK(37),
      & BLOCK(38)
      WRITE(13,360)
      JTOTAL=IACAT(3,N)+IAESC(4,N)+IERF(4)
      CALL DISPLA(IERF(4),BLOCK(39))
      CALL DISPLA(JTOTAL,BLOCK(40))
      WRITE(13,5100) RNM(5),BLOCK(5),BLOCK(6),BLOCK(21),BLOCK(22),
      & BLOCK(39),BLOCK(40)
      WRITE(13,360)
      WRITE(13,5200) RNM(6),BLOCK(7),BLOCK(9),BLOCK(8)
 5200 FORMAT (A19,4X,A10,2X,A10,44X,A10)
      WRITE(13,360)
      CALL DISPLA(IERF(5),BLOCK(41))
      CALL DISPLA(IERF(6),BLOCK(42))
      CALL DISPLA(IERF(7),BLOCK(43))
      WRITE(13,5000) RNM(7),BLOCK(23),BLOCK(24),BLOCK(41)
      WRITE(13,360)
      WRITE(13,5000) RNM(8),BLOCK(25),BLOCK(26),BLOCK(42)
      WRITE(13,360)
      WRITE(13,5000) RNM(9),BLOCK(27),BLOCK(28),BLOCK(43)
      WRITE(13,360)
      DO 239 I=1,3
  239 ISUM(I)=0
      DO 240 I=5,7
      ISUM(1)=ISUM(1)+IESC(I,N)
      ISUM(2)=ISUM(2)+IAESC(I,N)
      ISUM(3)=ISUM(3)+IERF(I)
  240 CONTINUE
      ISUM(4)=ISUM(2)+ISUM(3)+IACAT(5,N)
      CALL DISPLA(ISUM(1),BLOCK(44))
      CALL DISPLA(ISUM(2),BLOCK(45))
      CALL DISPLA(ISUM(3),BLOCK(46))
      CALL DISPLA (ISUM(4),BLOCK(47))
      WRITE(13,5100) RNM(10), BLOCK(11),BLOCK(12), (BLOCK(IJ),IJ=44,47)
      WRITE(13,360)
      CALL DISPLA(IERF(8),BLOCK(48))
      JTOTAL=IACAT(6,N)+IAESC(8,N)+IERF(8)
      CALL DISPLA(JTOTAL,BLOCK(49))
      WRITE(13,5100) RNM(11),BLOCK(13),BLOCK(14),BLOCK(29),BLOCK(30),
      & BLOCK(48),BLOCK(49)
      WRITE(13,360)
      DO 405 J=1,5
  405 ISUM(J)=0
      ITOTAL=0
```

```
      DO 410 I=1,8
      IF(I.GT.6) GO TO 415
      ISUM(1)=ISUM(1)+ICAT(I,N)
      ISUM(2)=ISUM(2)+IACAT(I,N)
  415 ISUM(3)=ISUM(3)+IESC(I,N)
      ISUM(4)=ISUM(4)+IAESC(I,N)
      ISUM(5)=ISUM(5)+IERF(I)
  410 CONTINUE
      ITOTAL=ISUM(2)+ISUM(4)+ISUM(5)
      CALL DISPLA(ISUM(1),BLOCK(50))
      CALL DISPLA(ISUM(2),BLOCK(51))
      CALL DISPLA(ISUM(3),BLOCK(52))
      CALL DISPLA(ISUM(4),BLOCK(53))
      CALL DISPLA(ISUM(5),BLOCK(54))
      CALL DISPLA(ITOTAL,BLOCK(55))
      WRITE(13,5100) RNM(12),(BLOCK(IJ),IJ=50,55)
      WRITE(13,360)
  360 FORMAT (/)
      WRITE(13,2020)
C.....ENTER COMMENTS
      WRITE(13,700)
  700 FORMAT(//"COMMENTS:")
  725 READ(12,70,END=795) (DTIN(I),I=2,85)
   70 FORMAT (84A1)
      WRITE(13,740) (DTIN(I),I=2,85)
  740 FORMAT (5X,85A1)
      GO TO 725
  795 CALL ATTACH(14,"AGFCST1/INACCUM,R;",3,0,IS,)
      J=1
  580 READ(14,6000,END=590) M(J),IDATE(J),ICPT(J),ITF(J)
 6000 FORMAT (2I3,2I12)
      J=J+1
      GO TO 580
  590 REWIND 14
      M(J)=MO
      IDATE(J)=IDA
      ITF(J)=ISUM(5)
      DO 600 K=1,N
  600 WRITE(14,6000) KMO(K),KDA(K),ISCAT(K)+ISESC(K),ITF(K)
      CALL ATTACH(15,"AGFCST1/INSHORE,R;",3,0,IS,)
      WRITE(15,6000) KMO(1),KDA(1),ISCAT(1)+ISESC(1)+ITF(1)
      DO 620 K=2,N
      WRITE(15,6005) KMO(K),KDA(K),ISCAT(K)+ISESC(K)+ITF(K)-ITF(K-1)
 6005 FORMAT(2I3,I12)
  620 CONTINUE
```

```
      WRITE(13,7000) MO,IDA
 7000 FORMAT(/,/,/,"TABLE  DAILY AND ACCUMULATIVE BRISTOL BAY CATCH, ESCAPEMENT
     & AND INSHORE RUN WITH ESTIMATED RIVER FISH THRU",2I3," 80",/)
      WRITE(13,7010)
 7010 FORMAT(16X,"CATCH",17X,"ESCAPEMENT",11X,"CATCH+ESCAPEMENT",
     & 12X,"INSHORE",/)
      WRITE(13,3155)
      ITC=0
      ITE=0
      ITCE=0
      ITI=0
      DO 800 I=1,N
      ITC=ITC+ISCAT(I)
      ITE=ITE+ISESC(I)
      ITCE=ITCE+ISCAT(I)+ISESC(I)
      IF(I.EQ.1) IDI=ITF(1)
      IF(I.GT.1) IDI=ITF(I)-ITF(I-1)
      CALL DISPLA(ISCAT(I),BLOCK(1))
      CALL DISPLA(ITC,BLOCK(2))
      CALL DISPLA(ISESC(I),BLOCK(3))
      CALL DISPLA(ITE,BLOCK(4))
      CALL DISPLA(ISCAT(I)+ISESC(I),BLOCK(5))
      CALL DISPLA (ITCE,BLOCK(6))
      CALL DISPLA (IDI+ISCAT(I)+ISESC(I),BLOCK(7))
      CALL DISPLA(ITF(I)+ITCE,BLOCK(8))
      WRITE (13,4200) KMO(I),KDA(I), (BLOCK(J),J=1,8)
  800 CONTINUE
      STOP
      END
      SUBROUTINE DISPLA(NUM,INBLOCK)
C.....ENTERS COMMAS INTO NUMBERS FOR EASY READABILITY
C.....HANDLES NUMBERS UP TO 99 MILLION - RETURNS A10
C.....HANDLES NEGATIVE NUMBERS UP TO -9 MILLION
C.....LARGER, OR LESS THAN 1000 RETURNED UNPROCESSED
      CHARACTER*1 COMMA/","/,MINUS/"-"/,BLANK/" "/,HOLD/" "/
      CHARACTER*10 INBLOCK,OUTBLOCK
      OUTBLOCK = BLANK
      ENCODE(INBLOCK,10) NUM
   10 FORMAT(I10)
      IF(NUM.LT.1000 .AND. NUM.GT.-1000) GO TO 200
      IF(NUM.GE.1E+8 .OR. NUM.LE.-1E+7) GO TO 200
      L = 10
      DO 100 I=1,8
      LL = 10-I+1
      CALL CONCAT(OUTBLOCK,L,INBLOCK,LL,1)
```

```
      L = L-1
      IPTR = MOD(I,3)
      IF(IPTR.GT.0) GO TO 100
      CALL CONCAT(HOLD,1,INBLOCK,LL-1,1)
      IF(HOLD.EQ.BLANK) GO TO 150
      IF(HOLD.EQ.MINUS) GO TO 50
      CALL CONCAT(OUTBLOCK,L,COMMA,1,1)
      L = L-1
      GO TO 100
   50 CALL CONCAT(OUTBLOCK,L-1,INBLOCK,LL-1,1)
      GO TO 150
  100 CONTINUE
  150 INBLOCK = OUTBLOCK
  200 RETURN
      END
```

APPENDIX B

```
10*#RUN=(ULIB,NWARN)SX/IMSL/LIB,R
20C.....FORECAST ESCAPEMENT FROM INSIDE TEST FISH DATA AND LAG TIME
30C.....WEIGHT FISH WEIGHTS & LENGTHS BY INDEX
40C.....WITH PLOT OPTION
50      EXTERNAL FUNC1
60      COMMON /SSQ/T(100),Y(100)
70      DIMENSION CNT(100,2),CPT(100,2),DAY(100,2)
80      DIMENSION DSAVE(100,2),AVGWT(100),AVGLN(100)
90      INTEGER OK1/0400000000000/,OK2/0403700000000/
100      INTEGER KODE/0007007040040/
110      INTEGER LAGSAVE(30)
120      CHARACTER ANUM*1(20)
130      CHARACTER ANSW*1
140      CHARACTER NAME*12
150      CHARACTER FNAM*30, WHICH*1,FNAME*30,P*1(51)
160      CHARACTER MARKS*1(5)/"1","2","O","X","="/
170      DIMENSION NPTS(2),A(2),B(2)
180      DIMENSION F(100),XX(3),X(3),XJAC(300),XJTJ(6),WORK(221)
190      DIMENSION ESC(3)
200      REAL LN
210      CALL CALLSS('LINE 140\')
220      CALL FPARAM(3,KODE)
230   40 IPASS=0
240      SWT=0.0
250      SLN=0.0
260      SWN=0.0
270      SLNO=0.0
280      IZERO=0
290      ISW=0
300      PRINT,"WHICH RIVER?   1=KVICHAK"
310      PRINT,"               2=EGEGIK"
320      PRINT,"               3=UGASHIK"
330      READ(05,4400) ISELECT
340      IF(ISELECT.EQ.1) CALL ATTACH(01,"AGFCST1/KVTF,R;",3,0,IS,)
350      IF(ISELECT.EQ.2) CALL ATTACH(01,"AGFCST1/EGTF,R;",3,0,IS,)
360      IF(ISELECT.EQ.3) CALL ATTACH(01,"AGFCST1/UGTF,R;",3,0,IS,)
370      CALL ATTACH(02,"AGFCST1/ESCDATA,R;",3,0,IS,)
375C.....IF IPART = 1, TESTFISH INDICES, IPART = 2, ESCAPEMENT
380      DO 230 IPART=1,2
390      IF(IPART.EQ.1) J=1
400      IF(IPART.EQ.2) J=0
410      I=1
420      TEMP=0.0
430   50 IF(IPART.EQ.2) GO TO 60
440      READ(01,2000,END=150) FMO,DATE,SET,STATION,FATH,TIME,CATCH,XINDEX,WT,LN
450 2000 FORMAT(2X,11F9.2)
```

```
      MO=IFIX(FMO)
      TM=MO
      TD=DATE
      GO TO 70
   60 READ (02,3000,END=180) MO,DATE,(ESC(II),II=1,3)
 3000 FORMAT(I3,F3.0,F10.0,10X,2F10.0)
      IF(ISELECT.EQ.1) CPT(I,2)=ESC(1)
      IF(ISELECT.EQ.2) CPT(I,2)=ESC(2)
      IF(ISELECT.EQ.3) CPT(I,2)=ESC(3)
      IF(IZERO.EQ.0.AND.CPT(I,2).EQ.0.0) GO TO 60
      IZERO=1
      GO TO 90
C.....CONVERT CALENDER DATE TO DAY, VALID FOR JUNE AND JULY ONLY
C.....IF FIRST DATE, ASSIGN AS DAY 1
   70 IF(IPASS.GT.0) GO TO 90
      IPASS=1
      IF(MO.EQ.7) GO TO 80
      DCONV=DATE-1.0
      FIRST=DATE
      GO TO 90
   80 DCON=DATE-1.0
      IPASS=2
   90 IF(IPASS.EQ.2) GO TO 100
C.....IF CHANGE FROM JUNE TO JULY...
      IF(MO.EQ.6) GO TO 100
      DCON=FIRST-31.0
      IPASS=2
  100 K=I
      IF(MO.EQ.6) DAY(I,IPART)=DATE-DCONV
      IF(MO.EQ.7) DAY(I,IPART)=DATE-DCON
      I=I+1
      IF(IPART.EQ.2) GO TO 170
C.....CALCULATE DAILY MEANS
      IF(ISW.EQ.1) GO TO 120
      ISW=1
      DSAVE(J,1)=DAY(K,1)
  110 SI=0.
      SFH=0.
      GO TO 130
  120 IF(DSAVE(J,1).NE.DAY(K,1)) GO TO 160
  130 FH=FATH*TIME
      SFH=SFH+FH
      DIN=6000.*CATCH
      SI=SI+DIN
      XINDEX=DIN/FH
```

```
      IF(WT.EQ.0.) GO TO 140
      SWT=SWT+WT*XINDEX
      SWN=SWN+XINDEX
  140 IF(LN.EQ.0) GO TO50
      SLN=SLN+LN*XINDEX
      SLNO=SLNO+XINDEX
      GO TO50
  150 ISW=2
C.....CALCULATE DAILY MEANS
  160 CPT(J,1)=SI/SFH
       IF(SWN.GT.0.) AVGWT(J)=SWT/SWN
       IF(SLNO.GT.0.) AVGLN(J)=SLN/SLNO
       AWT=AVGWT(J)
       ALN=AVGLN(J)
  170 J=J+1
       DSAVE(J,IPART)=DAY(K,IPART)
       IF(IPART.EQ.2) GO TO 60
       IF(ISW.EQ.2) GO TO 180
       GO TO 110
  180 IF(IPART.EQ.1)J=J-1
C.....CALCULATE ACCUMULATIVE TABLES
       DO 190 I=1,J
       TEMP=TEMP+CPT(I,IPART)
       CNT(I,IPART)=TEMP
  190 CONTINUE
       DO 200 I=1,J
       CPT(I,IPART)=CNT(I,IPART)/CNT(J,IPART)
  200 CONTINUE
C.....CUMMULATIVE CURVE FIT (CALL /IMSL/ZXSSQ)
C.....NPTS IS NUMBER OF DATA POINTS
  210 NPTS(IPART)=J
       IXJAC=NPTS(IPART)
       DO 220 I=1,IXJAC
       T(I)=DSAVE(I,IPART)
  220 Y(I)=CPT(I,IPART)
       IF(NPTS(IPART).LT.5) GO TO 230
       N=2
       NSIG=3
       EPS=0.0
       DELTA=0.0
       MAXFN=500
       IOPT=1
       X(1)=-5.0
       X(2)=.5
       IF(ISELECT.EQ.2) X(2)=1.8
       IF(IPART.EQ.2) X(1)=-10.
```

```
      XX(1)=X(1)
      XX(2)=X(2)
      CALL ZXSSQ(FUNC1,NPTS(IPART),N,NSIG,EPS,DELTA,
     & MAXFN,IOPT,PARM,X,SSQ,F,XJAC,IXJAC,XJTJ,WORK,INFER,IER)
      A(IPART)=X(1)
      B(IPART)=X(2)
  230 CONTINUE
C.....BEGIN PRINTING REPORT
      PRINT,
      CALL CALLSS("TIME\")
      IF(ISELECT.EQ.2) PRINT, "EGEGIK"
      IF(ISELECT.EQ.3) PRINT, "UGASHIK"
      IF(ISELECT.EQ.1) PRINT, "KVICHAK"
      IF(TM.EQ.6.0) PRINT 3200, IFIX(TD)
 3200 FORMAT("JUNE",1X,I2)
      IF(TM.EQ.7.0) PRINT 3400, IFIX(TD)
 3400 FORMAT("JULY",1X,I2)
C.....F O R E C A S T  BY SIZE-CATCHABILITY RELATIONSHIPS
      CALL COMMAS(IFIX(CNT(NPTS(2),2)),ANUM(1))
      PRINT 3800,(ANUM(JJ),JJ=1,10)
 3800 FORMAT(1X/' ACCUMULATED ESCAPEMENT = ',10A1)
      PRINT 3900, CNT(NPTS(1),1)
 3900 FORMAT("ACCUMULATED INDEX=",F12.5)
      PRINT,
      IF(ISELECT.EQ.3) GO TO 270
      IF(ISELECT.EQ.2) GO TO 240
      FCSTL=EXP(ALOG(3.05945)+(63*ALOG(10.0))-(22.46593*(ALOG(ALN))))
      FCSTW=152602.2283*(AWT^(-6.7256))
      GO TO 260
  240 FCSTW=6207.40091*(AWT^(-3.8023))
      FCSTL=EXP(ALOG(1.07099)+(49*ALOG(10.0))-(17.25878*ALOG(ALN)))
      GO TO 260
  270 FCSTL=EXP(ALOG(1.86219)+(74*ALOG(10.0))-(26.58751*ALOG(ALN)))
  260 CALL COMMAS(IFIX(CNT(NPTS(1),1)*FCSTL),ANUM(1))
      CALL COMMAS(IFIX(CNT(NPTS(1),1)*FCSTW),ANUM(11))
      PRINT 4000,ALN,IFIX(FCSTL),(ANUM(JJ),JJ=1,10),
     & AWT,IFIX(FCSTW),(ANUM(JJ),JJ=11,20)
 4000 FORMAT(' MEAN LENGTH =',F7.2,'   FISH/INDEX =',I8,
     & '   FORECAST = ',10A1/
     & ' MEAN WEIGHT =',F7.2,'   FISH/INDEX =',I8,
     & '   FORECAST = ',10A1)
      IF(NPTS(2).LT.5) GO TO 400
      PRINT,
      IF(NPTS(2).LT.5) GO TO 400
C.....F I N D   L A G   T I M E
      PRINT,
```

```
1810        PRINT,
1820        PRINT 4200
1830 4200 FORMAT("  TIME  MEAN SUM OF SQUARES"/"  LAG    BETWEEN CURVES")
1840        SUMSAV=999999.
1850        ICNT=0
1860        DO 290 I=1,NPTS(2)
1870        TLAG=I-1
1875C.....COMPUTE AND COMPARE SUMS OF SQUARES
1880        SUM=0.
1890        DO 280 J=1,NPTS(2)
1900        E=J
1910        EE=J+TLAG
1920        Y(1)=1./(1.+EXP(-(A(1)+B(1)*E)))
1930        Y(2)=1./(1.+EXP(-(A(2)+B(2)*EE)))
1940  280 SUM=SUM+(Y(1)-Y(2))^2
1950        SUM=SUM/FLOAT(NPTS(2))
1955C.....COMPUTE 5 DAYS BEYOND DAY WITH LEAST SUMS OF SQUARES
1960        IF(SUM.GE.SUMSAV) ICNT=ICNT+1
1970        IF(ICNT.GT.5) GO TO 300
1980        SUMSAV=SUM
1990        J=TLAG
2000        PRINT 4300, J, SUM
2010 4300 FORMAT (I5,F12.4)
2020  290 CONTINUE
2030C.....F O R E C A S T  BY LAG TIME
2040  300 PRINT,
2050        PRINT,"LAG TIME?"
2060        READ(05,4400) LAG
2070 4400 FORMAT(V)
2080        DO 305 II=1,NPTS(2)
2090  305 IF(DSAVE(II,2).EQ.NPTS(1)) GO TO 307
2100  307 FPT=CNT(II,2)/CNT(NPTS(1)-LAG,1)
2110        PRINT 4600, FPT
2120 4600 FORMAT("FISH PER INDEX=",F8.3)
2130        CALL COMMAS(IFIX(FPT*CNT(NPTS(1),1)),ANUM(1))
2140        PRINT 4800,(ANUM(JJ),JJ=1,10)
2150 4800 FORMAT(' FORECAST ',10A1)
2160        PRINT,
2170C.....PLOT OPTION
2180        PRINT,"PLOT?"
2190        READ(05,4400) ANSW
2200        IF(ANSW.EQ."N") GO TO 400
2210        TLAG=LAG
2220        IF(NPTS(1).GT.NPTS(2)) ITIME=NPTS(1)
2230        IF(NPTS(2).GT.NPTS(1)) ITIME=NPTS(2)
```

```
  310 PRINT,
      IUNIT=1
      NTIME=IUNIT*ITIME+1
      DELT=1./FLOAT(IUNIT)
      E=-DELT
      PRINT,
      PRINT 5000
 5000 FORMAT(6X,'0.0',7X,'0.2',7X,'0.4',7X,'0.6',7X,'0.8',7X,'1.0')
      PRINT 5200
 5200 FORMAT('  TIME Y',5(9('-'),'Y'))
      DO 390 J=1,NTIME
      E=E+DELT
      EE=E+TLAG
      ITIME=E
      Y(1)=1./(1.+EXP(-(A(1)+B(1)*E)))
      Y(2)=1./(1.+EXP(-(A(2)+B(2)*EE)))
      Y(3)=99999.
      Y(4)=99999.
      NPT=NPTS(1)
      IF(NPT.EQ.0) GO TO 330
      DO 320 I=1,NPT
      IF(E.NE.DSAVE(I,1)) GO TO 320
      Y(3)=CPT(I,1)
      GO TO 330
  320 CONTINUE
  330 NPT=NPTS(2)
      IF(NPT.EQ.0) GO TO 350
      DO 340 I=1,NPT
      IF(EE.NE.DSAVE(I,2)) GO TO 340
      Y(4)=CPT(I,2)
      GO TO 350
  340 CONTINUE
  350 DO  360 K=1,51
  360 P(K)=' '
      ISAME=0
      DO 370 K=1,4
      IF(Y(K).GT.1.) GO TO 370
      NPOS=50.*Y(K)+1.4999999
      P(NPOS)=MARKS(K)
      IF(K.EQ.3) ISAME=1
      IF(.NOT.(ISAME.EQ.1 .AND.K.EQ.4)) GO TO 370
      IF(NPOS.NE.NPOSAV) GO TO 370
      P(NPOS)=MARKS(5)
      IBYPAS=1
  370 NPOSAV=NPOS
      REM=AMOD(E.5.)
```

```
      L=E
      IF(REM.EQ.0. .OR. J.EQ.NTIME) GO TO 380
      PRINT 5600,(P(K),K=1,51)
 5600 FORMAT(6X,'!'.51A1)
      GO TO 390
  380 PRINT 5400,L,(P(K),K=1.51)
 5400 FORMAT(I5,' !',51A1)
  390 CONTINUE
      PRINT 5200
      PRINT 5000
      PRINT 5800,LAG
 5800 FORMAT(2X/'    TIME LAG =',I3)
      PRINT 6000,MARKS(1),MARKS(3).NPTS(1),A(1),B(1)
 6000 FORMAT(2X/14X,'CURVE'.7X,'DATA POINT    NUMBER OF'/
     & '    CURVE   PLOT SYMBOL   PLOT SYMBOL    POINTS'.
     & 7X.'A',9X,'B'/
     & '    -----   -----------   -----------    ------',
     & 5X,'-------    ------'/
     & '       1    ',5X,A1.13X,A1,I14,F14.4,F10.4)
      PRINT 6200,MARKS(2),MARKS(4),NPTS(2),A(2),B(2)
 6200 FORMAT(
     & '       2    ',5X,A1,13X,A1.I14,F14.4.F10.4)
      IF(IBYPAS.EQ.1) PRINT 740,MARKS(5)
  740 FORMAT(2X/'   THE PLOT SYMBOL "',A1,'" USED WHEN 2 DATA',
     & ' POINTS ARE IN SAME PLOT POSITION')
  400 PRINT,
      PRINT,"ANOTHER LAG TIME?"
      READ (05,4400) ANSW
      IF(ANSW.EQ."Y") GO TO 300
      CALL DETACH (02,IS,)
      CALL DETACH(01,IS,)
      PRINT,"ANOTHER RIVER?"
      READ(5,4400) ANSW
      IF(ANSW.EQ."Y") GO TO 40
      STOP
      END
C.....SUBROUTINE FOR ZXSSQ
      SUBROUTINE FUNC1(X,M,N,F)
      DIMENSION X(N),F(M)
      COMMON /SSQ/T(100),Y(100)
      DO 5 I=1,M
    5 F(I)=Y(I)-1.0/(1.0+EXP(-(X(1)+X(2)*T(I))))
      RETURN
      END
      SUBROUTINE COMMAS(NUM,ANUM)
```

```
C.....I N S E R T   C O M M A S   I N T O   A   N U M B E R
      CHARACTER D*1(10)/'0','1','2','3','4','5','6','7','8','9'/
      CHARACTER ANUM*1(10)
      LOGICAL POSIT
      POSIT=.TRUE.
      N=NUM
      IF(N.GE.0) GO TO 10
      POSIT=.FALSE.
      N=-N
   10 L=11
      DO 30 I=1,10
      NN=N/10
      JJ=N-10*NN
      L=L-1
      IF(.NOT.(L.EQ.3 .OR. L.EQ.7)) GO TO 20
      ANUM(L)=','
      L=L-1
   20 ANUM(L)=D(JJ+1)
      IF(NN.EQ.0) GO TO 40
      N=NN
   30 CONTINUE
   40 IF(L.EQ.1) RETURN
      L=L-1
      IF(POSIT) GO TO 50
      ANUM(L)='-'
      L=L-1
      IF(L.LE.0) RETURN
   50 DO 60 I=1,L
   60 ANUM(I)=' '
      RETURN
      END
```

APPENDIX C

```
10*#RUN=(ULIB,NWARN)SX/IMSL/LIB,R
20C.....SUMMARIZE OFFSHORE TESTFISHING CPUE DATA AND FORECAST INSHORE RUN
30C.....SEE MUNDY, PHILLIP R. AND OLE A. MATHISEN. 1978. HANDBOOK OF
40C.....BRISTOL-BAY SOCKEYE SALMON MANAGEMENT.  FINAL REPORT FOR THE
50C.....PERIOD MAY 1, 1978 TO OCTOBER 31, 1978.  FRI-UW-7720
60C.....(FISHERIES RESEARCH INSTITUE, SEATTLE, WASHINGTON).  76 PP.
70C.....FOR DETAILS ON ENTRY PATTERN ANALYSIS
80C.....NOTE THAT THE FOLLOWING MUST BE CHANGED EACH YEAR
90C.....FLR,FC3,FCSTW,FCSTL, AND
100C.....TOTAL RUN SIZE ESTIMATED FROM MEAN LENGTH AND WEIGHT COEFFICIENTS
110       COMMON/ /H(40,20),F(40,3),KBIG,S(40,8)
120       CALL ATTACH(07,"AGFCST1/MOLLER,R;",3,0,ISTAT,)
130       DIMENSION Y(2)
140       DO 2 I = 1,40
150       DO 3 J = 1,20
160     3 H(I,J)= 0.0
170       DO 5 J=1,3
180     5 F(I,J)=  0.0
190       DO 7 L = 1,8
200     7 S(I,L)=  0.0
210     2 CONTINUE
220       CALL MAIN
230       CALL CONTROL
240       CALL REPORT
250C.....PLOT ENTRY PATTERN EXPECTED VS OBSERVED
260       IF(KBIG.LT.5) GO TO 11
270       WRITE(1,100) H(KBIG,2),H(KBIG,3),H(KBIG,20)
280   100 FORMAT(13X,47HEXPECTED(*) & OBSERVED(+) CUMULATIVE PROPORTION/
290      &14X,29HOF TOTAL CATCH VS TIME (DAYS),2X,3F3.0)
300       N=2
310       YMAX = 1.
320       YMIN = 0.
330       CALL PLOT(X,Y,YMAX,YMIN,N,1,30)
340       DO 8I=1,30
350       X = FLOAT(I)
360       Y(1) = F(I,2)
370       Y(2) = F(I,3)
380       CALL PLOT(X,Y,YMAX,YMIN,N,0,30)
390     8 CONTINUE
400C.....PLOT NHAT AND IHAT VS TIME
410       IF(KBIG.LT.10) GO TO 11
420       WRITE(1,101) H(KBIG,2),H(KBIG,3),H(KBIG,20)
430   101 FORMAT(13X,47HEST. TOTAL RUN SIZE, MP=F(W)*. MP=F(INSHORE)+, /
440      &14X,14HVS TIME (DAYS),2X,3F3.0)
450       WRITE(1,190)
```

```
  190 FORMAT(/,"DAY    F(W)     F(INSHORE)",/)
      DO 20 I=1,KBIG
      WRITE(1,200) I,IFIX(H(I,6)),IFIX(H(I,7))
  200 FORMAT(I3,2I2)
   20 CONTINUE
      YMAX = H(1,6)
      YMIN = H(1,6)
      DO 12 I = 2, KBIG
      IF(YMAX.LT.H(I,6)) GO TO 13
      IF(YMIN.GT.H(I,6)) GO TO 14
      GO TO 12
   13 YMAX = H(I,6) + 10000.
      GO TO 12
   14 YMIN = H(I,6) - 10000.
   12 CONTINUE
      LZ = KBIG
      CALL PLOT(X,Y,YMAX,YMIN,N,1,LZ)
      DO 9 I = 1,KBIG
      X = FLOAT(I)
      Y(1) = H(I,6)
      Y(2) = H(I,7)
      CALL PLOT(X,Y,YMAX,YMIN,N,0,LZ)
    9 CONTINUE
C.....PLOT OFFSHORE/INSHORE PROFILE
      IF(KBIG.LT.12) GO TO 11
      IF(S(1,1).LT.1.) GO TO 11
      WRITE(1,102) H(KBIG  ,2),H(KBIG,3),H(KBIG,20)
  102 FORMAT(13X,50HINSHORE(*) & OFFSHORE(+) ABUNDANCE PROFILE VS TI
     &ME,2X,3F3.0)
      YMIN = S(1,4)
      YMAX = S(1,4)
      DO 15 I = 2,39
      IF(S(I,1).LT.1.) GO TO 16
      IF(YMAX.LT.S(I,4)) GO TO 17
      IF(YMIN.GT.S(I,4)) GO TO 18
      GO TO 15
   17 YMAX = S(I,4) + 10000.
      GO TO 15
   18 YMIN = S(I,4) - 10000.
   15 CONTINUE
   16 KK = I
      CALL PLOT(X,Y,YMAX,YMIN,N,1,KK)
      LB = KK
      DO 10 I = 1,KK
      X = FLOAT(I)
```

```
      Y(1) = S(I,4)
      Y(2) = S(I,5)
      CALL PLOT(X,Y,YMAX,YMIN,N,0,LB)
   10 CONTINUE
   11 CONTINUE
      CALL DETACH(07,IS, )
      CALL CALLSS("L MOLLER\")
      STOP
      END
       SUBROUTINE CONTROL
       COMMON/ /H(40,20),F(40,3),KBIG,S(40,8)
       CALL ATTACH(01,"AGFCST1/PMPLOT,R;",3,0,ISTAT,)
       REWIND 1
       NN=KBIG
      DO 16 M=1,NN
       KBIG=M
       H(M,8)=15048.
       IF(M.GT.1) GO TO 9
       CALL DAYONE
       GO TO 16
    9 S(40,7)=H(M,18)
       CALL BPROF
       CALL DAYTWO
       CALL SYNCH
   16 CONTINUE
       RETURN
       END
       FUNCTION FC3(T)
       FC3=1./(1.+EXP(-(-7.4715+0.4395*T)))
       RETURN
       END
       SUBROUTINE DAYONE
       COMMON/ /H(40,20),F(40,3),KBIG,S(40,8)
       DIMENSION DF(40)
       M=KBIG
C.....LONG RANGE FORECAST=FLR
       FLR=54500000.
       H(M,5)=FLR/H(M,8)
       P=H(M,4)/H(M,5)
       J=1
       DO 1 I=1,40
       T=FLOAT(I)
       F(I,1)=  T
       F(I,2)=FC3(T)
       DF(I)= (P-F(I,2))**2
```

```
      F(I,3)=0.0
      IF(DF(I).GT.DF(J)) GO TO 1
      J=I
    1 CONTINUE
      H(M,6)=(H(M,4)/F(J,2))*H(M,8)
      H(M,11)= H(M,8)
      H(M,12)= DF(J)
      H(M,13)= H(M,4)*H(M,9)
      F(J,3)=P
      IP = J - 1
      H(M,14)=  FLOAT(IP)
      RETURN
      END
      SUBROUTINE BPROF
      COMMON/ /H(40,20),F(40,3),KBIG,S(40,8)
      DIMENSION SSUM(9)
      DO 16 I= 1,39
      DO 17 J=  1,8
   17 S(I,J)=  0.0
   16 CONTINUE
      BF=0.
      M=KBIG
      DO 1 I=1,M
      IF(H(I,20).GT.0.0) GO TO 2
      GO TO 1
    2 IF(BF.GT.0.0) GOTO 3
      ND=  I
    3 BF=BF+1.
    1 CONTINUE
      S(40,8)=  BF
      IF(ND.LT.5) GO TO 12
    4 DO 5 I=1,9
    5 SSUM(I)=0.0
      SUM=0.0
      KP=ND
      DO 6 J=4,9
      L=ND-J
      IF(L.GT.0) GO TO 7
      KP=KP+1
      L=1
    7 DO 8 I=KP,M
      SUM= (H(L,13)-H(I,20))**2 + SUM
    8 L=L+1
      LA=(M-KP)+1
      FF=FLOAT(LA)
```

```
      SSUM(J)= SUM/FF
      SUM=0.0
      IF(M.EQ.KP) GO TO 18
    6 CONTINUE
      LU=  9
      GO TO 19
   18 LU=  J
   19 CONTINUE
      KT=4
      B=SSUM(4)
      DO 9 I=5,LU
      IF(B.LT.SSUM(I)) GO TO 9
      B=SSUM(I)
      KT=I
    9 CONTINUE
      H(M,15)=SSUM(KT)
      H(M,16)= FLOAT(KT)
      IF(M.LT.10) GO TO 40
      N=  M - KT
      H(M,10)=  H(M,20)/H(N,4)
   40 CONTINUE
      J=ND-KT
      IF(J.GT.0) GO TO 10
      KP=ND+(-J)+1
      J=1
   10 K=  1
      DO 11 I=KP,M
      DO 14 NZ=1,3
   14 S(K,NZ)=H(I,NZ)
      S(K,4)=H(I,20)
      S(K,5)=  H(J,13)
      KBT=  1
      DO 15 NZ=  6,8
      S(K,NZ)=  H(J,KBT)
   15 KBT=  KBT + 1
      K=  K + 1
      J=J+1
   11 CONTINUE
      GO TO 13
   12 H(M,15)=0.0
      H(M,16)=0.0
      H(M,10)=0.0
      S(40, 8)=  0.0
   13 RETURN
      END
```

```
      SUBROUTINE DAYTWO
      COMMON/ /H(40,20),F(40,3),KBIG,S(40,8)
      M=KBIG
      K = M-1
      KAP=H(K  ,14)
      KRD=KAP+M
      IF(KAP) 1,2,3
    1 KS=1
      L=(-KAP)+1
      GOTO 4
    2 KS=1
      L=1
      GOTO 4
    3 KS=KAP+1
      L=1
    4 LKOPY=L
      SUMY=0.0
      SUMC=0.0
      SUMP=0.0
      SUM= 0.0
      DO 5 I=KS,KRD
      SUMP=H(L,4)*F(I,2)+SUMP
      SUMC=H(L,4)**2 + SUMC
      SUMY=F(I,2)**2 + SUMY
      L=L+1
    5 CONTINUE
      H(M,5)=SUMC/SUMP
      H(M,12)= SUMY-((2./H(M,5)*SUMP))+((1./H(M,5)**2)*SUMC)
      IF(M.GT.9) H(M,7)=H(M,5)*H(M,10)
      IF(M.GT.4) GO TO 8
      H(M,6)=H(M,5)*H(M,8)
      GO TO 9
    8 H(M,6)=H(M,5)*H(M,9)
C.....SELECT EITHER H(M,8),H(M,9), OR H(M,10) FOR H(M,11)
    9 H(M,11)=H(M,9)
      RUN=(H(M,4)-H(K,4))*H(M,11)
      H(M,13)=H(K,13)+RUN
      J=1
      H(M,11)= H(M,9)
   10 L=LKOPY
      DO 12 I = 1,40
   12 F(I,3)=  0.0
      DO 11 I=KS,KRD
      F(I,3)=H(L,4)/H(M,5)
      L=L+1
```

```
   11 CONTINUE
      RETURN
      END
      SUBROUTINE SYNCH
      COMMON/ /H(40,20),F(40,3),KBIG,S(40,8)
      DIMENSION SSUM(13),KHOLD(13),T(40)
      SUM=0.0
      M=KBIG
      DO 1 I=1,13
    1 SSUM(I)=0.0
      DO 2 I=1,M
    2 T(I)= H(I,4)/H(M,5)
      KL=M/2
      IF(KL.LT.7) GO TO 3
      KL=6
    3 KSFT=(-KL)
      LL=1
    4 CONTINUE
      IF(KSFT) 5,6,7
    5 LT=(-KSFT)+1
      LY=1
      GOTO8
    6 LT=1
      LY=1
      GOTO8
    7 LT=1
      LY=KSFT+1
    8 J=LT
      KRD=KSFT+M
      DO 9 I=LY,KRD
      SUM=SUM+(F(I,2)-T(J))**2
      J=J+1
    9 CONTINUE
      SSUM(LL)= SUM/FLOAT(KRD)
      SUM=0.0
      KHOLD(LL)=KSFT
      LL=LL+1
      KSFT=KSFT+1
      IF(KSFT.GT.KL) GOTO 10
      GOTO4
   10 B=SSUM(1)
      LL=1
      IZ=(2*KL)+1
      DO 11 I=2,IZ
      IF(B.LT.SSUM(I)) GOTO 11
```

```
      B=SSUM(I)
      LL=I
   11 CONTINUE
      H(M,14)=KHOLD(LL)
      RETURN
      END
C.....PLOT
      SUBROUTINE PLOT(X,Y,YMAX,YMIN,N,IND,NTOT)
      CWIDTH = 70.
      DIMENSION YLABEL(5),Y(9)
      CHARACTER M72*1(72),IBLANK*1,MARKX*1,MARKI*1,MARK*1(9)
      DATA IBLANK,MARKX,MARKI/" ","X","I"/
      DATA MARK/"*","+",".","(",")","#","$","-",","/
      IF(IND)20,20,1
    1 NCOUNT=0
      ISIGN = 0
      ICOUNT=0
      SCALE=(YMAX-YMIN)/CWIDTH
      LPO=-YMIN/SCALE+1.5
      IF(LPO.EQ.1)LPO=2
      IF(LPO)2,2,3
    2 LPO=2
    3 DO 10 J=1,72
   10 M72(J)=" "
      YLABEL(1)=YMIN
      YLABEL(5)=YMAX
      YLABEL(3)=(YLABEL(1)+YLABEL(5))/2.
      YLABEL(2)=(YLABEL(1)+YLABEL(3))/2.
      YLABEL(4)=(YLABEL(3)+YLABEL(5))/2.
      WRITE(1,115) YLABEL
      WRITE(1,110)
      RETURN
   20 ICOUNT=ICOUNT+1
      IF(X)910,888,910
  888 ISIGN=1
      WRITE(1,110)
      GO TO 907
  900 WRITE(1,106)
      GO TO 907
  907 RETURN
  910 DO 930 J=1,N
      IF(Y(J).LE.YMIN)GO TO 921
      Z=(Y(J)-YMIN)/SCALE+1.5
      IF(Z-1.)921,921,920
  920 IF(Z-CWIDTH)928,928,925
```

```
  921 L=2
      GO TO 929
  925 L=72
      GO TO 929
  928 L=Z
      IF(L)921,921,929
  929 M72(LPO)=MARKI
      M72(L)=MARK(J)
  930 CONTINUE
  931 DO 934 J=1,72
      IF(M72(J).EQ.IBLANK)GO TO 934
  933 JJ=J
  934 CONTINUE
      NCOUNT=NCOUNT+1
      IF(NCOUNT-1)900,940,936
  936 IF((NCOUNT/10)*10-NCOUNT)938,940,938
  938 WRITE(1,102)(M72(J),J=2,JJ)
      GO TO 962
  940 M72(LPO)=MARKX
  950 WRITE(1,103) X,(M72(J),J=13,JJ)
  962 DO 970 J=1,72
  970 M72(J)=IBLANK
      IF(ICOUNT.EQ.NTOT.AND.ISIGN.NE.1)GO TO 975
      RETURN
  975 ISIGN=1
      WRITE(1,110)
      WRITE(1,115) YLABEL
  102 FORMAT(1X,71A1)
  103 FORMAT(1X,1PE11.4,60A1)
  106 FORMAT(" INPUT ERROR")
  110 FORMAT(2H Y,2(16(1H-),1HY),2(17(1H-),1HY))
  115 FORMAT(1X,1PE11.4,1PE14.4,1P3E15.4)
      RETURN
      END
      SUBROUTINE REPORT
      CHARACTER*10 BLOCK
      DATA AMINUS/"-"/,ANULL/" "/,PLUS/"+"/
      COMMON/ /H(40,20),F(40,3),KBIG,S(40,8)
      J=KBIG
      IF(H(J,14)) 3,4,5
    3 A=AMINUS
      GOTO 6
    4 A=ANULL
      GOTO 6
    5 A=PLUS
```

```
    6 CALL DISPLA(IFIX(H(J,6)),BLOCK)
      WRITE(7,106) A,IFIX(H(J,14))
  106 FORMAT("     ENTRY PATTERN ANALYSIS :",/,"     RUN TIMING
     & "A1,I3," DAYS COMPARED TO AVERAGE")
      IF(J.LT.4) WRITE(7,200) BLOCK
      IF(J.GT.4) WRITE(7,210) BLOCK
      IF(S(J,1).GT.9)CALL DISPLA(IFIX(H(J,7)),BLOCK)
      IF(S(J,1).GT.9) WRITE(7,220) BLOCK
  200 FORMAT(/,"     FORECAST  ",A10," USING MEAN PASSAGE RATE OF 15048")
  210 FORMAT(/,"     FORECAST  ",A10," USING MEAN LENGTH PASSAGE RATE")
  220 FORMAT(/,"     FORECAST  ",A10," USING INSHORE RETURN-LAG TIME PASSAGE RATE")
   17 RETURN
      END
      SUBROUTINE MAIN
      COMMON/ /H(40,20),F(40,3),KBIG,S(40,8)
      CHARACTER*10 BLOCK(4),MARK*1(40)
      DIMENSION CP(100,2)
      EXTERNAL FUNC1
      COMMON /SSQ/T(100),Y(100)
      DIMENSION CNT(100,2),CPT(100,2),DAY(100,2)
      DIMENSION PMI(62),AVGFL(100)
      DIMENSION NPTS(2),A(2),B(2)
      DIMENSION FF(100),XX(3),X(3),XJAC(300),XJTJ(6),WORK(221)
      DIMENSION ISETS(62),DCAT(62)
      DIMENSION DSAVE(60,2)
      CHARACTER MDY*8
      CALL CALLSS('LINE 140\')
      IPASS=0
      ISW=0
      CALL ATTACH(08,"AGFCST1/PMDATA,R;",3,0,ISTAT,)
      CALL ATTACH(04,"AGFCST1/INSHORE,R;",3,0,ISTAT,)
   30 DO 230 IPART=1,2
      IF(IPART.EQ.1) J=1
      IF(IPART.EQ.2) J=0
      TEMP=0.0
      I=1
   50 IF(IPART.EQ.2) GO TO 60
      READ(08,2000,END=150) FMO,DATE,SET,STATION,FATH,TIME,CATCH,XINDEX,WT,FL
      MO=IFIX(FMO)
 2000 FORMAT(2X,10F9.2)
      GO TO 70
   60 READ (04,3000,END=180) MO,DATE,CPT(I,2)
 3000 FORMAT (V)
      GO TO 90
C.....CONVERT CALENDER DATE TO DAY, VALID FOR JUNE AND JULY ONLY
```

```
4510C.....IF FIRST DATE, ASSIGN AS DAY 1
4520   70 IF(IPASS.GT.0) GO TO 90
4530      IPASS=1
4540      IF(MO.EQ.7) GO TO 80
4550      DCONV=DATE-1.0
4560      FIRST=DATE
4570      GO TO 90
4580   80 DCON=DATE-1.0
4590      IPASS=2
4600   90 IF(IPASS.EQ.2) GO TO 100
4610C.....IF CHANGE FROM JUNE TO JULY...
4620      IF(MO.EQ.6) GO TO 100
4630      DCON=FIRST-31.0
4640      IPASS=2
4650  100 K=I
4660      IF(MO.EQ.6) DAY(I,IPART)=DATE-DCONV
4670      IF(MO.EQ.7) DAY(I,IPART)=DATE-DCON
4680      I=I+1
4690      IF(IPART.EQ.2) GO TO 170
4700C.....CALCULATE DAILY MEANS
4710      IF(ISW.EQ.1) GO TO 120
4720      ISW=1
4730      H(J,1)=DAY(K,1)
4740      DSAVE(J,1)=DAY(K,1)
4750      H(J,2)=MO
4760      H(J,3)=DATE
4770  110 SFH=0.
4780      PMI(J)=0.
4790      MARK(J)=" "
4800      GO TO 130
4810  120 IF(DSAVE(J,1).NE.DAY(K,1)) GO TO 160
4820  130 FH=FATH*TIME
4830      DIN=6000.*CATCH
4840      IF(SET.GT.0) XINDEX=DIN/FH
4850      PMI(J)=PMI(J)+XINDEX
4860      IF(SET.GT.0.0) ISETS(J)=ISETS(J)+1
4870      IF(SET.EQ.0.0) MARK(J)="*"
4880      DCAT(J)=DCAT(J)+CATCH
4890      IF(WT.EQ.0.) GO TO 140
4900      SWT=SWT+WT*XINDEX
4910      SWN=SWN+XINDEX
4920  140 IF(FL.EQ.0.0) GO TO50
4930      SFL=SFL+FL*XINDEX
4940      SFLO=SFLO+XINDEX
4950      GO TO50
```

```
  150 ISW=2
  160 CPT(J,1)=PMI(J)
      IF(SWN.GT.0.) H(J,18)=SWT/SWN
      IF(SFLO.GT.0.) AVGFL(J)=SFL/SFLO
      IF(ISETS(J).EQ.6.) H(J,19)=0.0
      IF(ISETS(J).LT.6.) H(J,19)=1.0
      IF(ISETS(J).LT.2.) H(J,19)=2.0
  170 J=J+1
      IF(IPART.EQ.2) GO TO 171
      H(J,2)=MO
      H(J,3)=DATE
      H(J,1)=DAY(K,1)
  171 DSAVE(J,IPART)=DAY(K,IPART)
      IF(IPART.EQ.2) GO TO 60
      IF(ISW.EQ.2) GO TO 180
      GO TO 110
  180 IF(IPART.EQ.1)J=J-1
      IF(IPART.EQ.1) KBIG=J
      NPTS(IPART)=J
      IF(IPART.EQ.2) GO TO 186
C.....CALCULATE CATCHABILITY BY SIZE
      FCSTW=302481.8546*(H(NPTS(1),18)^(-2.903247256))
      IF(AVGFL(NPTS(1)).GT.0.) FCSTL=EXP(ALOG(1.317046)+(56*ALOG(10.0))-(18.89759*ALOG(AVGFL(NPTS(1)))))
C.....CALCULATE ACCUMULATIVE NUMBERS
  186 TEMP=0.0
      DO 190 I=1,NPTS(IPART)
      TEMP=TEMP+CPT(I,IPART)
      CNT(I,IPART)=TEMP
      IF(IPART.EQ.1) H(I,4)=CNT(I,1)
      IF(IPART.EQ.2) H(I+NPTS(1)-NPTS(2),20)=CNT(I,2)
      H(I,9)=FCSTL
  190 CONTINUE
      IF(IPART.EQ.2.AND.NPTS(2).LT.7) GO TO 230
C.....CALCULATE ACCUMULATIVE PROPORTIONS
      DO 440 N=1,NPTS(IPART)
      CP(N,IPART)=CNT(N,IPART)/CNT(NPTS(IPART),IPART)
  440 CONTINUE
      IXJAC=NPTS(IPART)
C.....CALCULATE ACCUMULATIVE CURVE
      DO 220 I=1,IXJAC
      T(I)=DSAVE(I,IPART)
      Y(I)=CP(I,IPART)
  220 CONTINUE
      N=2
      NSIG=3
```

```
5410        EPS=0.0
5420        DELTA=0.0
5430        MAXFN=500
5440        IOPT=1
5450        X(2)=.5
5460        X(1)=-1.0
5470        IF(IPART.EQ.2) X(1)=-10.
5480        XX(1)=X(1)
5490        XX(2)=X(2)
5500        CALL ZXSSQ(FUNC1,IXJAC,N,NSIG,EPS,DELTA,
5510      & MAXFN,IOPT,PARM,X,SSQ,FF,XJAC,IXJAC,XJTJ,WORK,INFER,IER)
5520        A(IPART)=X(1)
5530        B(IPART)=X(2)
5540   230  CONTINUE
5550        IF(IPART.EQ.2.AND.NPTS(2).LT.7) GO TO400
5560C.....F I N D   L A G   T I M E
5570        SUMSAV=999999.
5580        DO 290 I=1,NPTS(2)
5590        TLAG=I-1
5600        SUM=0.
5610        DO 280 J=1,NPTS(2)
5620        EX=J
5630        EE=EX+TLAG
5640        Y(1)=1./(1.+EXP(-(A(1)+B(1)*EX)))
5650        Y(2)=1./(1.+EXP(-(A(2)+B(2)*EE)))
5660   280  SUM=SUM+(Y(1)-Y(2))^2
5670        SUM=SUM/FLOAT(NPTS(2))
5680        IF(SUM.GE.SUMSAV) LAG=TLAG-1.0
5690        IF(SUM.GE.SUMSAV) GO TO 305
5700        SUMSAV=SUM
5710   290  CONTINUE
5720C.....F O R E C A S T
5730   305  PRINT,"LAG TIME=", LAG," DAYS"
5740        PRINT," LAG TIME =?"
5750        READ,LAG
5760        DO 306 I=1,NPTS(2)
5770   306  IF(DSAVE(I,2).EQ.NPTS(1)) GO TO 315
5780   315  FPT=CNT(I,2)/CNT(NPTS(1)-LAG,1)
5790   400  CONTINUE
5800        WRITE(7,6000)
5810        CALL DATIM(MDY,HM)
5820        WRITE(7,6010) MDY,HM
5830  6010  FORMAT(A8,F6.2," VERSION")
5840        WRITE(7,6000)
5850  6000  FORMAT (" ")
```

```
      WRITE(7,200)IFIX(H(KBIG,2)),IFIX(H(KBIG,3))
  200 FORMAT("TABLE           PORT MOLLER OFFSHORE TESTFISH SOCKEYE SALMON
     &DATA AND ANALYSIS AS OF ",I2,"/",I2,"/80")
      WRITE(7,6000)
      WRITE(7,300)
  300 FORMAT(28X,"RUNNING MEAN       ESTIMATED DAILY PASSAGE     ESTIMATED
      & ACCUM PASSAGE")
      WRITE(7,310)
  310 FORMAT("  DATE SETS CATCH INDEX WEIGHT(LBS) LENGTH(MM) METHOD  I
     &     METHOD II      METHOD I     METHOD II")
      DO 900 NS=1,NPTS(1)
      ICLT=IFIX(FPT*CNT(NS,1))
      ICC=IFIX(CNT(NS,1)*H(NPTS(1),9))
      IDLT=IFIX(PMI(NS)*FPT)
      IDC=IFIX(PMI(NS)*H(NPTS(1),9))
      CALL DISPLA(IDC,BLOCK(1))
      CALL DISPLA(IDLT,BLOCK(2))
      CALL DISPLA(ICC,BLOCK(3))
      CALL DISPLA(ICLT,BLOCK(4))
      WRITE(7,4000)IFIX(H(NS,2)),IFIX(H(NS,3)),ISETS(NS),IFIX(DCAT(NS)),PMI(NS),H(NS,18)*2.2,
     & IFIX(AVGFL(NS)),(BLOCK(I),I=1,4),MARK(NS)
 4000 FORMAT(I3,"/",I2,I5,I5,1X,F6.2,F8.2,4X,I7,4X,4(A10,4X),2X,A1)
  900 CONTINUE
      CALL DETACH(08,IS,)
      WRITE(07,6000)
      WRITE(07,6050)
 6050 FORMAT("* INCLUDES INTERPOLATED VALUES FOR MISSED FISHING TIME")
      WRITE(7,6000)
      CALL DISPLA(IFIX(H(NS,9)),BLOCK(1))
      WRITE(7,5100) BLOCK(1)
 5100 FORMAT("METHOD I: BASED ON", A10," INSHORE RETURNS PER PORT MOLLER INDEX"
     &,/,"CALCULATED FROM SIZE-CATCHABILITY RELATIONSHIP")
      CALL DISPLA(IFIX(FPT),BLOCK(1))
      CALL DISPLA(IFIX(H(NS,20)),BLOCK(2))
      WRITE(7,5200)(BLOCK(I),I=1,2),IFIX(H(NS,2)),IFIX(H(NS,3)),
     &IFIX(CNT(NS-LAG,1)),IFIX(H(NS-LAG,2)),IFIX(H(NS-LAG,3)),LAG
 5200 FORMAT(/"METHOD II: BASED ON", A10," INSHORE RETURNS PER INDEX "
     &,/,"CALCULATED FROM ACCUMULATIVE INSHORE RETURN
     & OF  ",A10," SOCKEYE THROUGH",I2,"/",I2,
     &,/,"AND ",I5," ACCUMULATIVE PORT MOLLER INDEX POINTS",
     &" THROUGH",I2,"/",I2," WITH LAG TIME OF ", I3," DAYS")
      WRITE(7,6100)
 6100 FORMAT(/"TOTAL RUN SIZE ESTIMATED FROM:",/)
      IF(AVGFL(NS).GT.0.) WRITE(7,5300) AVGFL(NS),
     & IFIX(EXP(ALOG(1.31722)+(85*ALOG(10.0))-(30.60436*ALOG(AVGFL(NS)))))
```

```
      WRITE(7,6000)
 5300 FORMAT("     PORT MOLLER RUNNING MEAN LENGTH OF",F7.2,"=",I10," MILLION")
      IF(H(NS,18).GT.0.) WRITE(7,5400) H(NS,18)*2.2,
     & IFIX(7864070.377*((H(NS,18)*2.2)^(-7.27950)))
 5400 FORMAT("     PORT MOLLER RUNNING MEAN WEIGHT OF",F7.2,"=",I10," MILLION")
      WRITE(7,6000)
      RETURN
      END
      SUBROUTINE FUNC1(X,M,N,FF)
      COMMON /SSQ/T(100),Y(100)
      DIMENSION X(N),FF(M)
      DO 5 I=1,M
    5 FF(I)=Y(I)-1.0/(1.0+EXP(-(X(1)+X(2)*T(I))))
      RETURN
      END
      SUBROUTINE DISPLA(NUM,INBLOCK)
C.....ENTERS COMMAS INTO NUMBERS FOR EASY READABILITY
C.....HANDLES NUMBERS UP TO 99 MILLION - RETURNS A10
C.....HANDLES NEGATIVE NUMBERS UP TO -9 MILLION
C.....LARGER, OR LESS THAN 1000 RETURNED UNPROCESSED
      CHARACTER*1 COMMA/","/,MINUS/"-"/,BLANK/" "/,HOLD/" "/
      CHARACTER*10 INBLOCK,OUTBLOCK
      OUTBLOCK = BLANK
      ENCODE(INBLOCK,10) NUM
   10 FORMAT(I10)
      IF(NUM.LT.1000 .AND. NUM.GT.-1000) GO TO 200
      IF(NUM.GE.1E+8 .OR. NUM.LE.-1E+7) GO TO 200
      L = 10
      DO 100 I=1,8
      LL = 10-I+1
      CALL CONCAT(OUTBLOCK,L,INBLOCK,LL,1)
      L = L-1
      IPTR = MOD(I,3)
      IF(IPTR.GT.0) GO TO 100
      CALL CONCAT(HOLD,1,INBLOCK,LL-1,1)
      IF(HOLD.EQ.BLANK) GO TO 150
      IF(HOLD.EQ.MINUS) GO TO 50
      CALL CONCAT(OUTBLOCK,L,COMMA,1,1)
      L = L-1
      GO TO 100
   50 CALL CONCAT(OUTBLOCK,L-1,INBLOCK,LL-1,1)
      GO TO 150
  100 CONTINUE
  150 INBLOCK = OUTBLOCK
  200 RETURN
      END
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