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FORECAST OF THE 1973 PINK SALMON RUNS, SOUTHEASTERN ALASKA

By:
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James W. Brooks
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ABSTRACT

Results of the 1972 pre-emergent fry sampling indicate a return in 1973 of 14.1 million pink salmon to southern Southeastern with a possible range of 12.2 to 16.1 million. A return of approximately 6.0 million is expected to northern Southeastern with a possible range of ± 2.5 million. The northern forecast based on pre-emergent fry values has been adjusted to take into consideration the possibility of unusually severe marine mortality. Although the magnitude of the total run (20.1 million pinks) to Southeastern Alaska is expected to be close to the 1972 return, the forecast by district and timing segments indicates that a much different distribution and timing pattern will occur. The harvest in southern and northern Southeastern Alaska is expected to be approximately 8.1 million and 2.0 million fish respectively.

INTRODUCTION

The purpose of this report is to present the 1973 pink salmon forecast, analyze the success of the 1972 forecast, and provide a reference for data needed for future forecasts. This report is the eighth in a series concerning forecast studies in Southeastern Alaska (Noerenberg, et al., 1964; Hoffman, 1965, 1966; Smedley and Seibel, 1967; Smedley, 1968; Valentine, et al., 1970; Durley and Seibel, 1972).

Annual pink salmon forecasts are of importance to the fishing industry, both fishermen and processors, and to fishery managers for operational planning and regulatory decision-making. To properly manage our fisheries, which means maintaining desired escapement levels, we must be able to forecast the magnitude of each segment of the runs which pass through the fisheries from early to late season.

Escapements to many sections of Southeastern Alaska have been below the level needed to build runs on a continuing basis. A new base-level of escapement must be set and adhered to, especially during expected periods of poor returns. Increasing escapements alone, does not provide the entire answer to the problem. The timing of escapements is also important to provide good distribution to and within the various spawning streams.

The primary objectives of the Southeastern Alaska pink salmon forecast program is to accurately predict: (1) the magnitude of the total run, (2) the magnitude by timing of the various segments of the run, and (3) the magnitude of the runs by management areas or districts. Other studies are being conducted to estimate the optimum escapement or carrying capacity of the salmon streams. Estimates of desired harvest levels can be established by subtracting escapement goals from predicted returns.

Southeastern Alaska, for the purpose of pink salmon forecasting, is divided into two parts, northern Southeastern and southern Southeastern (Figure 1), resulting in two separate forecasts. Tagging studies have indicated that upon approaching the outer coast of Southeastern Alaska pink salmon separate into two groups, the northern group entering via Icy Strait and the lower Chatham Strait and the southern group entering via Sumner Strait and Dixon Entrance.

Southeastern Alaska is also divided into 15 regulatory districts (Figure 2) for which forecasts are also provided.

Pink salmon forecasts are based on the relationship between pre-emergent fry abundance and subsequent adult return. Studies conducted in other areas of Alaska, in particular Prince William Sound, have demonstrated that annual vari-

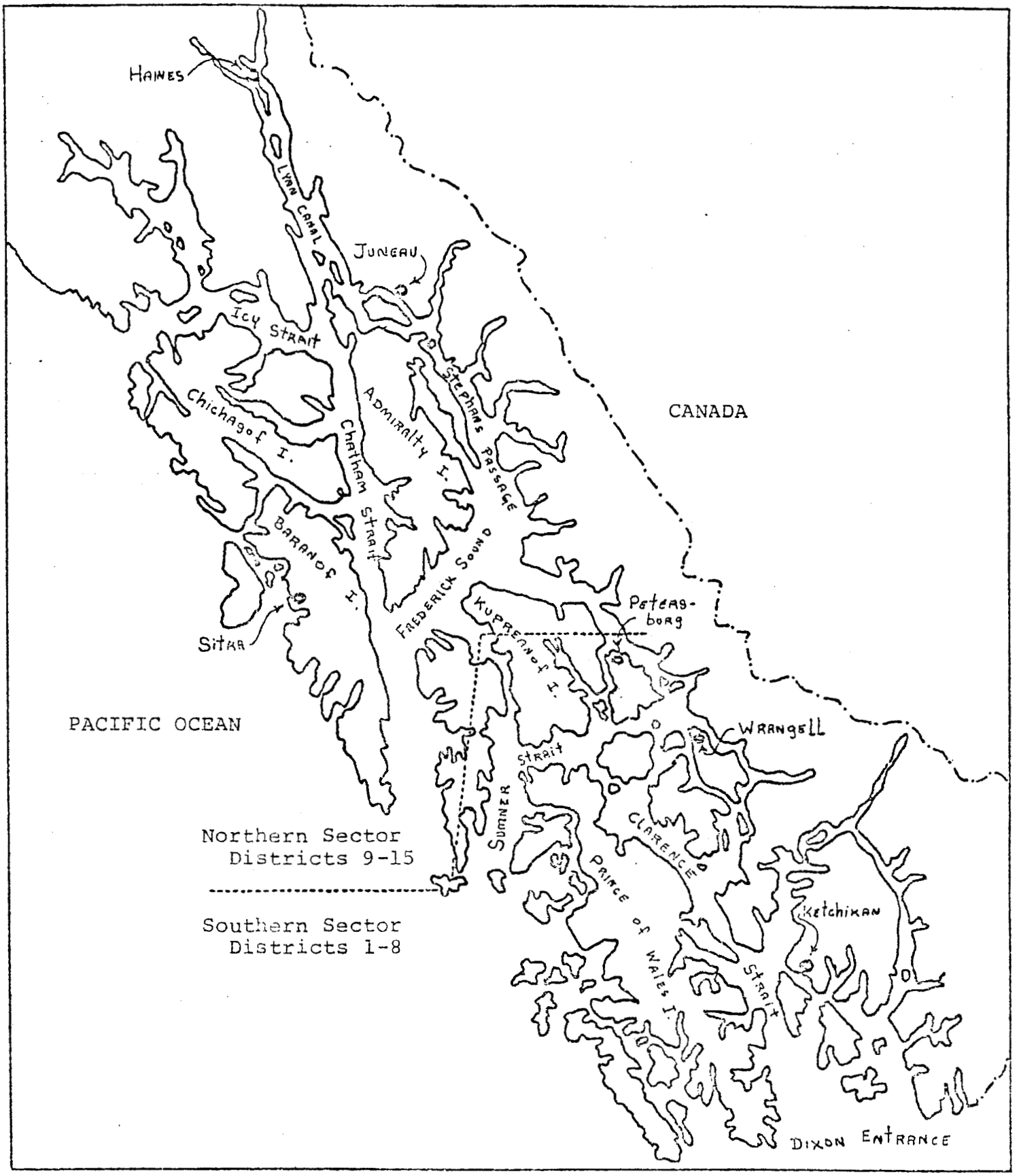

Figure 1. Map of Southeastern Alaska showing division between northern and southern areas.

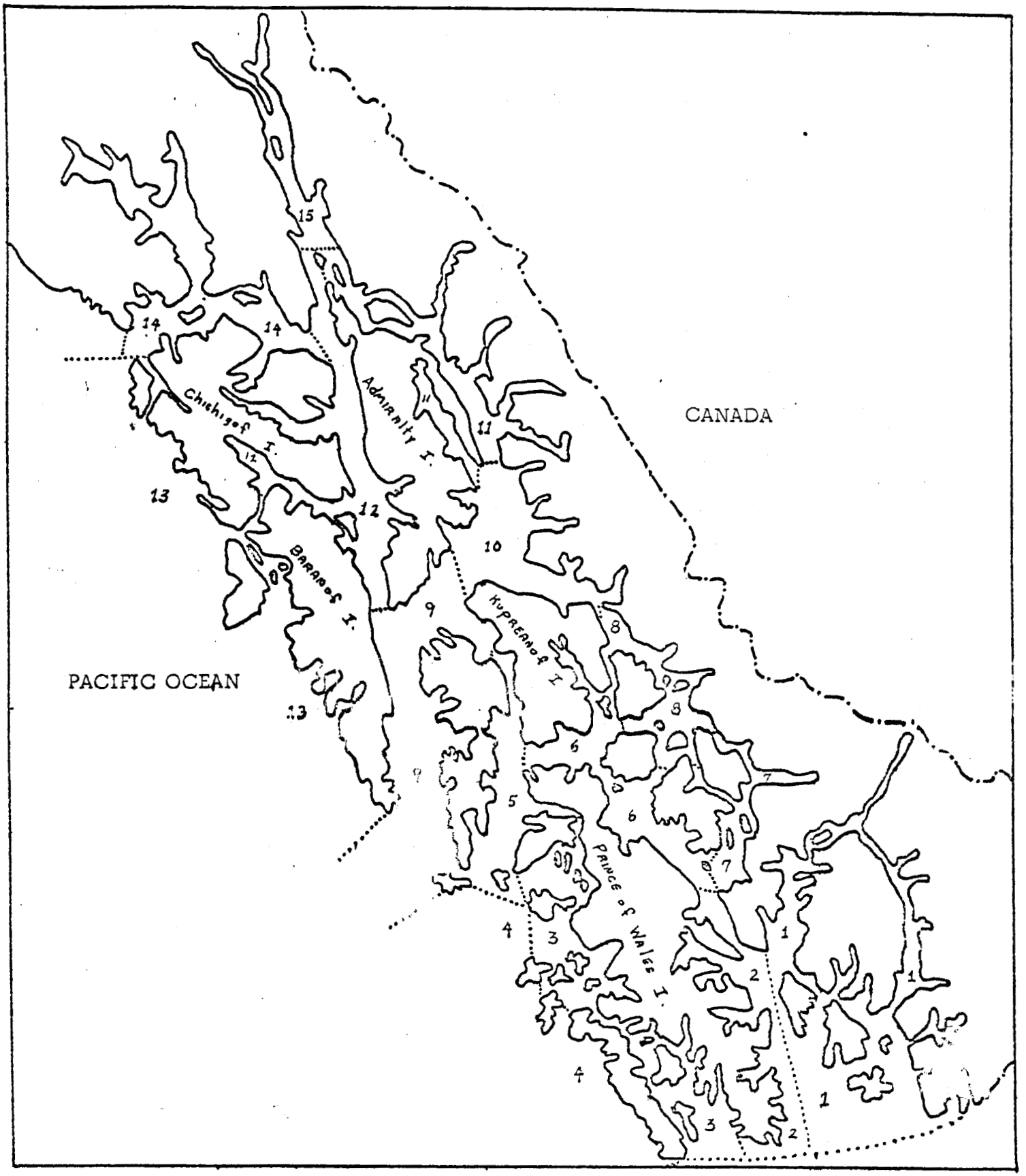

Figure 2. Map of Southeastern Alaska showing regulatory districts.

ations in estuarine and ocean mortalities are, on the average, small enough to permit forecasting of pink salmon returns on the basis of pre-emergent fry abundance with sufficient accuracy to be of value for fisheries management and industry use. In 1972, however, it appeared that unusually high marine mortality suppressed almost all Alaskan pink salmon runs. Because of the continuing cold conditions in Southeastern Alaska, the possibility that excessive marine mortality may have affected the 1973 run has been taken into consideration in arriving at the forecast.

SUCCESS OF 1972 FORECAST

Success of the 1972 forecast and how it compares to past years' results are summarized (Table 1). In northern Southeastern the actual return of 6.0 million was 6.9 million less than the predicted level of 12.9 million and fell outside the range estimate of 7.1 to 18.7 million pinks (80% probability level).

The over-estimate of 6.9 million pinks was believed not to indicate a failure of the pre-emergent fry-adult return relationships. Some changes in sampling design were made in 1971 and these changes may have affected the fry density values in relation to those of past years. However, it is believed that the sampling changes would not account for such a large error, and moreover the same changes in sampling design in southern Southeastern had no apparent affect on that forecast.

Evidence exists that indicates the unexpected poor return to the north was the result of unusually high marine mortality. Several reasons indicate this: 1) the 1972 pink salmon forecasts based on pre-emergent fry values in northern Southeastern, Prince William Sound, Cook Inlet, Kodiak and the Alaska Peninsula were all considerably higher than the actual return and 2) the spring weather conditions and surface water temperatures during March, April, May and June 1971, when fry were in the estuaries, were considerably colder than average throughout Alaska and in northern Southeastern fell several degrees below the 6-year average (Table 2). It is known that variations in estuarine and ocean mortality occur, however it was believed that since forecasts at Kodiak and Prince William Sound areas have been relatively accurate, the variation in ocean mortality would not decrease the accuracy of the forecasts below acceptable limits. However, in 1972 marine mortality appeared to have caused considerable error in most forecasts.

To anticipate how abnormal departures in estuarine conditions may affect future forecasts, a monitoring study to measure temperatures and salinities throughout northern Southeastern was initiated in the spring of 1973.

Table 1. Comparison of forecast and actual returns of pink salmon for northern and southern Southeastern Alaska, 1967-1972 (in millions of salmon).

Return year	Predicted return	Actual return	Forecast Error Number	Forecast Error Percent 1/
		Southern Southeastern		
1967	4.8	2.2	+2.6	+118
1968	21.5	20.6	+0.9	+ 4
1969	3.2	3.2	+0.0	0
1970	18.7	9.7	+9.0	+ 93
1971	4.3	11.0	-6.7	- 61
1972	13.7	13.9	-0.2	- 1
		Northern Southeastern		
1967	4.9	4.1	+0.8	+ 20
1968	6.2	12.6	-6.4	- 51
1969	4.0	5.8	-1.8	- 31
1970	9.0	7.6	+1.4	+ 18
1971	8.5	5.5	+3.0	+ 55
1972	12.9	6.0	+6.9	+115

1/ Percent forecast error is defined by

$$\frac{\text{Predicted Return} - \text{Actual Return}}{\text{Actual Return}} \times 100$$

Table 2. Deviations in salt water surface temperatures in degrees centigrade, Southeastern Alaska.

	March	April	May	June
Juneau				
Ave. temp. (1965-1970)	2.8	4.6	7.6	10.4
1971 Deviation	-1.1	-1.1	-0.8	-0.3
1972 Deviation	-1.3	-1.0	-1.2	-1.7
Sitka				
Ave. temp. (1965-1970)	4.5	5.9	8.9	11.4
1971 Deviation	-1.1	-1.0	-2.0	-1.1
1972 Deviation	-1.6	-2.1	-1.0	-1.1
Ketchikan				
Ave. temp. (1965-1970)	5.4	6.5	8.9	12.4
1971 Deviation	-0.7	-0.8	-0.8	-0.6
1972 Deviation	-1.2	-1.9	-1.4	-1.6

Source: Monthly publication by National Ocean Survey, NOAA, Rockville Maryland.

Distribution of Returning Salmon

The relative size of the 1972 returns to the various districts in southern Southeastern did not correspond closely to the district forecasts, although harvests of mixed stocks make it difficult to determine total returns to districts. The early and middle-run mainland areas had a stronger than predicted return and the middle to late-run outside area, particularly outside Prince of Wales Island, appeared to have fallen short of the prediction. Escapement indices for all southern districts (District 1-7) were below the escapement index goals set for 1972.

In northern Southeastern the district returns differed considerably from the predicted returns. The early runs to Districts 10, 11, and Tenakee Inlet in District 12 were far below prediction values. District 11 was the only area in which the escapement index exceeded the 1972 goal. All other districts received less escapement than desired.

In spite of the difficulties in estimating total returns to districts, and consequently, in evaluating the accuracy of district forecasts, these forecasts do provide additional information on probable areas of especially strong or weak returns. The same is true when estimating returns by timing segment.

1973 PINK SALMON FORECAST

1972 Pre-emergent Fry Sampling Methods

The standard technique employed to enable forecasting has been hydraulic sampling of pre-emergent fry in the spawning riffles during the spring months. Spawning riffles in important and accessible streams are excavated in a manner which should give reliable year-to-year comparisons of relative fry abundance. Sampling is conducted just prior to fry migration to salt water, when early freshwater mortality is no longer a major consideration. All excavated fry are counted and then related to the number of samples dug and the prior years' escapement into the streams to arrive at an index of abundance.

The stream sampled annually comprise an index group which remains constant. Streams are not selected at random each year therefore, several weighting factors must be employed. First, the fry index for a given district is obtained by dividing the total number of fry collected while sampling in the district by the total number of samples taken in the district. This procedure results in weighting stream indices according to sampling effort; which approximates stream relative production potential. The district fry indices are then

weighted by the district average escapement for the past 5 years thus weighting district indices by measures of their relative production potential. In both the above weighting procedures, indirect measures of production potential of streams and district are used. However, in conjunction with current optimum escapement studies, attempts are being made to develop direct estimates of production potential for individual streams.

Study streams and areas within study streams have changed somewhat over the past 6 years. However, the number of index streams has been stabilized at about 100 in recent years. In a continuing effort to upgrade the forecast, better coverage within the large streams is being achieved by sampling select spawning riffles throughout the length of streams, thereby covering segments of the entire distribution of the spawning populations. Upstream areas of the larger streams generally provide the greater portion of productive spawning area and, therefore, to provide a total production index, should be sampled along with the lower reaches of the streams. Until recently many of the larger index streams had sample areas only in the easily accessible intertidal and lower stream areas; however, refinements leading toward lighter, more efficient gear and increased use of helicopters have improved coverage, thus increasing the quality and quantity of sampling.

Fry density information obtained from new upstream areas will not be incorporated into the forecast analysis until it is determined how the data will affect the existing index-return relationship. Several years' data from these new areas may be required before a base is established which can be used to provide more accurate forecasts.

The pre-emergent index streams receive approximately 42% of the escapement to Southeastern Alaska. Therefore, they can be said to produce nearly half of the returning runs. These same streams, and the same areas within the streams, are sampled annually, thus establishing an index study area. It is believed that salmon production from the index study area is generally indicative of production from all Southeastern Alaska pink salmon streams.

In 1972, pre-emergent field work began the first week in March and continued into the second week of April. Geographical progression of sampling was from Ketchikan and Sitka, north and east to Petersburg and Juneau as streams thawed. A total of eight crews worked throughout Southeastern Alaska sampling 95 streams.

Of the 95 streams sampled, 46 were located in the southern half and 49 in the northern half. The total of 5,544 samples collected was an increase over last year, because of the addition of upstream areas and several new streams.

Fry development at the end of March appeared to be normal in comparison with past years and there was no apparent early migration of fry which may have been missed by sampling.

Estimated 1973 Pink Salmon Return

The 1973 forecast for Southeastern Alaska was obtained by relating past fry indices for southern and northern Southeast to corresponding returns of adult pink salmon (Table 3). Resulting regression equations (Figures 3 and 4) indicate that for northern Southeastern the return in 1973 should be close to 10.3 million pinks (1972 point considered an outlier) with a range of 7.7 to 12.9 million. The return to southern Southeastern should be about 14.1 million pinks with a range of 12.2 to 16.1 million.

In northern Southeastern the pre-emergent fry data was adjusted to eliminate possible error resulting from annual variation in contributions of the sample streams to the total production (Table 4). Seibel (1972) found that by such an adjustment of Prince William Sound pre-emergent fry data the standard error of forecast was significantly reduced. Adjustment of the northern Southeastern fry indices (1966-1972) resulted in a coefficient of determination (r^2) of 0.84 as compared to a r^2 value of 0.72 where no adjustments are made. Similar adjustment of the southern data did not reduce the standard error and therefore was not applied.

The above forecasts are based completely on the fry abundance-adult return relationship and do not take into consideration the possibility of variable marine mortality.

Analysis of the fry-return relationship for the years 1966 through 1972 suggest that the marine mortality of the southern Southeastern stocks has remained relatively constant even though estuarine water temperatures appear to have been considerably colder than normal during the past two springs. Spring and early summer ocean water temperatures at Juneau, Sitka and Ketchikan during March through June, 1971 and 1972, when fry were in the estuaries show similar deviations from the five-year average, 1965-1970 (Table 2). In the spring of 1972, estuarine temperatures in southern Southeastern were considerably colder than normal but, considering the success of the 1972 forecast, this departure probably did not have a significant effect on average estuarine survival. The waters of southern Southeastern normally are several degrees warmer than those of northern Southeastern, thus a minus deviation of several degrees may not affect survival as adversely in the south.

In northern Southeastern the fry-return relationship for the same years

Table 3. Comparison of pre-emergent fry indices and magnitude of returning pink salmon to Southeastern Alaska, 1966-1972.

Southern Southeastern

Brood year	Resulting 1/ pre-emergent fry index	Return year	Return in millions
1965	72.6	1967	2.2
1966	161.3	1968	20.6
1967	85.2	1969	3.2
1968	124.8	1970	9.7
1969	121.3	1971	11.0
1970	133.9	1972	13.9
1971	135.7	1973	(14.1)

Northern Southeastern

Brood year	Resulting 2/ pre-emergent fry index	Return year	Return in millions
1965	94.8	1967	4.1
1966	183.2	1968	12.6
1967	80.3	1969	5.8
1968	131.8	1970	7.6
1969	120.1	1971	5.5
1970	180.0	1972	6.1
1971	162.3	1973	(6.0)

1/ Fry indices based on pre-emercent fry densities of sample streams weighted by 5-year average district escapements.

2/ Fry indices based on pre-emergent fry densities of sample streams weighted by 5-year average district escapements, and adjusted for proportion of total fry production due due to sample streams.

Prediction equation
$Y = -2.66 + 0.08x$

Point estimate
= 10.3 million pinks

Range estimate (80% probability level)
= 7.7 to 12.9

Note: Years shown by plotted points refer to year of adult return.

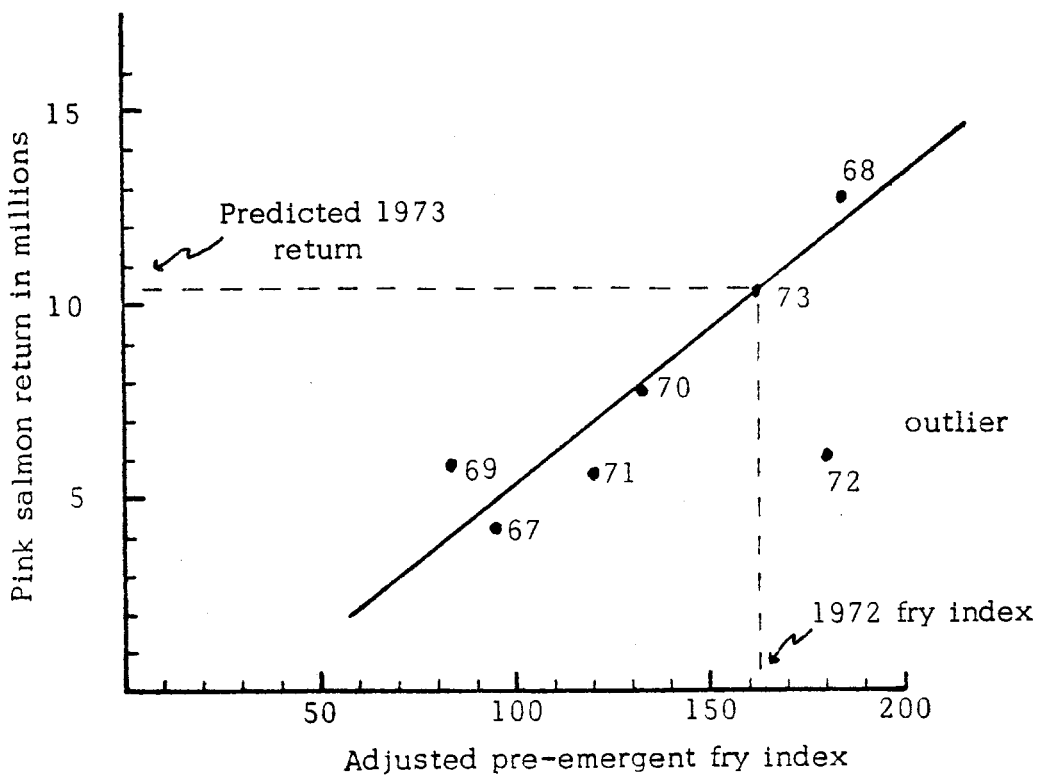

Figure 3. Forecast of the 1973 return of pink salmon to northern Southeastern Alaska using fry indices weighted by average escapement and adjusted for proportion of total fry production due to sample streams.

Prediction equation
$Y = -14.40 + 0.21x$

Point estimate
= 14.1 million pinks

Range estimate (80% probability level)
= 12.2 - 16.1

Note: Years shown by plotted points refer to year of adult return.

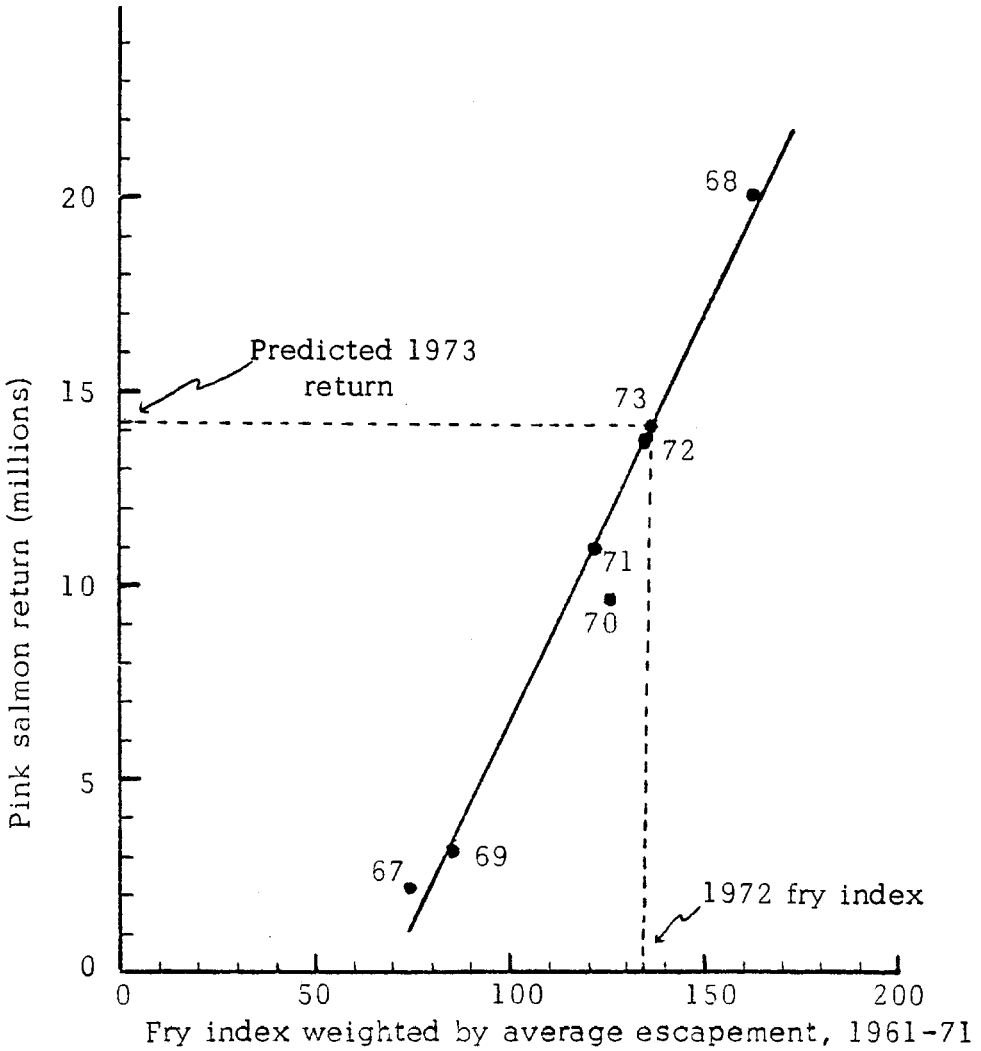

Figure 4. Forecast of the 1973 return of pink salmon to southern Southeastern Alaska using comparative pre-emergent data.

Table 4. Northern Southeastern Alaska pink salmon data, brood years 1965-1971. Brood year escapements, pre-emergent fry densities and adult returns with numbers of adult fish in thousands and pre-emergent densities in fry per square meter.

Brood year	Escapement indices: Total	Escapement indices: Sample streams	Escapement indices: Percent in sample streams	Pre-emergent fry densities: Original	Pre-emergent fry densities: Adjusted	Adult return
1965	2422	1130	46.7	105.7	94.8	4.1
1966	2653	1034	39.0	171.2	183.2	12.6
1967	1636	617	37.7	72.3	80.3	5.8
1968	2722	1109	40.7	128.0	131.8	7.6
1969	2197	796	36.2	107.2	120.1	5.5
1970	2317	954	41.2	183.7	180.0	6.1
1971	2614	1235	47.2	186.5	162.3	

1/ Total escapement index based on approximately 200 streams. Sample stream escapement based on escapements to approximately 45 streams which form the set of pre-emergent fry sample streams.

2/ Original fry density based on pre-emergent fry densities of sample streams weighted by 5-year average district escapements, and adjusted density based on original density adjusted for proportion of total fry production due to sample streams.

(1966-72) indicates that the marine mortality of the northern stocks may have remained relatively stable until spring 1971 when estuarine waters were considerably colder than normal. Now, it appears that northern pink salmon stocks which spawned in 1971 and are expected to return as adults in 1973 have encountered similarly severe estuarine and ocean conditions as the adults which returned in 1972. So, although our pre-emergent fry data alone suggests a return to northern Southeastern of near 10.3 million pinks, evidence exists which indicates that the return will actually be similar to that experienced in 1972. Consequently, our best estimate at this time is for a return in 1973 of 6.0 million pinks to northern Southeastern. Since the point estimate of 6.0 million was not calculated the use of a range estimate may be questionable, but ± 2.5 million fish surrounding the point estimate could be used as a guideline.

The predicted return to southern Southeastern of 14.1 million pink salmon is several hundred thousand more than in 1972 and would exceed the largest odd-year run since 1961.

1973 Escapement Goals and Expected Harvest Levels

Having developed a forecast of anticipated run size in 1973, it is essential to develop a pre-season estimate of the allowable harvest if the actual run is of the forecasted magnitude. Estimates of allowable harvest depend on the escapement goals established. Studies are currently being intensified to determine escapement goals consistent with the achievement of maximum sustained harvest of Southeastern Alaska pink salmon.

Because the term escapement frequently occurs in the following discussions and because of its importance in salmon management, it is important to include a brief explanation of the term.

The term escapement is used as an abbreviation for 'escapement index'. As an alternative to the cost prohibitive estimation of the total number of spawners, an index or relative measure of escapement is obtained. This is accomplished by estimating escapements to a number of streams which receive a large and relatively constant proportion of the total area escapement, as is required to validate the use of an escapement index as opposed to an estimate of total escapement. Relative changes in total escapement from year to year must be reflected by similar relative changes in the escapement index. For example, a twofold increase in total escapement should be reflected by a twofold increase in the escapement index. If the above relationship between total escapement and an escapement index is satisfied, the escapement index can be substituted for total escapement for in-season management and for estimating

optimum escapement, maximum sustained harvest and other parameters used in salmon management.

Only limited data are presently available for the estimation of optimum escapement levels for Southeastern Alaska pink salmon, therefore annual escapement goals should not be construed to necessarily be estimates of optimum escapements which will remain unchanged. Changes in escapement goals can be expected to occur as additional information becomes available on the carrying capacity of pink salmon spawning areas. Meanwhile, the necessity to manage salmon runs each year requires that annual escapement goals be established on the basis of the best information available.

Present escapement index goals are based on the escapement history of major producing streams for the past ten year period. The size of the escapement, the distribution of spawners and subsequent fry densities and returns to each stream give some indication of the production capabilities of each stream and district. Spawning gravel area which has been measured in approximately fifteen streams throughout Southeastern Alaska, provide another basis for estimating carrying capacity in some more important salmon streams.

Escapement index goals for 1973 are approximately 6.0 million pink salmon for southern Southeastern and 4.0 million for northern Southeastern. The goal of 10 million pink salmon for Southeastern Alaska is the same as that in 1972 but represents an increase of several million over the goals of recent years.

The escapement index goal of 10 million spawners appears consistent with the estimated maximum sustainable harvest of 25-30 million pink salmon for Southeastern Alaska. The average rate of adult return per parent spawner for the years 1960-1971 is approximately 3.6. Using the rate of 3.6 in conjunction with the estimated maximum sustainable harvest level of 25-30 million indicates that in order to achieve this level of harvest, escapement indices in the range of 9.6-11.5 million would be required. The fact that the rate of adult return per parent spawner tends to decrease with increasing spawner density may require additional adjustments in escapement goals as more data becomes available from larger returns.

When the escapement index level is raised to 10 million fish some streams may initially have what appears to be an "over-escapement" while others will remain depleted for several brood cycles until the population can build back to optimum size. Since Southeastern pink salmon fisheries are necessarily managed for mixed stocks, a reduction in management precision results in large escapements for some streams so that even moderate escapements will be realized in others.

It is impossible to precisely regulate escapements to specific streams or bays because many salmon are intercepted up to 100 miles from their destination. Until more is known of the movements and timing of runs, precise management to allow proper escapement will be a problem of concern equal to the one of actually determining how many spawners are needed in the streams for maximum production.

When increasing the escapement goals over those of past years a marked increase in escapement goals from one year to the next could significantly affect the harvest estimates. The predicted return of pink salmon is based on past returns which consist of harvest plus escapement indices and, are in fact, indices or relative measures of the true or actual total returns. This being the case, the predicted returns are less than the actual returns, by the difference between the escapement index and total escapement. This difference is not standardized for all districts but a rough estimate can be made based on observed versus unobserved spawner counts in individual streams. If on this basis the escapement indices are assumed to be roughly 40% of the total escapements and this difference is added to the returns for the years 1965-1971 and then compared to the resultant fry indices the actual total 1973 return is estimated at 18.0 million for the south and 7.5 million for the north. If 60% is applied to the escapement index goals for 1973 (6.0 and 4.0 million) a desired actual total escapement of 10.0 million to the south and 6.7 million to the north results. These total escapement goals and total return estimates suggest the estimated harvest should be roughly 1.0 million in the north and 8.0 million in the south. The allowable catch figure for northern Southeastern is reduced from the 2 million fish originally forecast, if this method is followed.

Estimated Returns for Early, Middle and Late Run Segments

It is necessary to know the magnitude of the pink runs by different timing segments so management can ensure that proper harvest rates are achieved for each segment. The northern and southern area forecasts are broken down further into timing segments based on fry densities and the relative escapement levels of streams that are grouped into each segment.

For the purpose of this forecast the timing of runs is based on the time fish enter and spawn in their home streams. Most of the information on timing was provided by Area Management Biologists throughout Southeastern Alaska. Timing to spawning streams is divided into three segments--early (prior to August 10); middle (August 10 to September 1); and late (September 1 and later). Some difficulty was encountered in grouping streams because of the overlap in timing of runs to many streams. Preliminary stream groupings were used to

forecast the 1973 returns by timing (Figure 5). These groupings will change somewhat as more knowledge on timing of runs is acquired.

The estimated size of runs by timing is based on the predicted return of 14.1 million to southern and 6.0 million to northern Southeastern (Table 5). The timing through the established fishing areas can be inferred from the timing of escapements into the streams. For instance, in northern Southeastern timing of runs through the Icy Strait fishery can be grouped as early (prior to mid-July), middle (mid-July to late July), and late (late July to early August).

The 1972 escapement index goals and estimated catch for each timing segment have been established (Table 5) as based upon estimates of expected total return. The escapement goals to early, middle and late streams were calculated by estimating the optimum escapement indices of all major surveyed streams, separating them into early, middle and late and determining the percentage contribution of each segment to the total. The percentages were then applied to arrive at the total desired escapement index of 6.0 million for the south and 4.0 million for the north.

All timing segments returning to northern Southeastern are expected to be weak because of the overall poor return. Harvest of the early run should be about 1.0 million pinks assuming an accurate forecast. Another 1.0 million pinks assuming an accurate forecast. Another 1.0 million can be expected for harvest from the middle-late runs.

For southern Southeastern the returns to early run streams are expected to be weak, particularly in the back Behm Canal area of District 1. The middle and late runs to most streams in the southern section are expected to be average.

The magnitude of runs by timing may be misleading. For example in northern Southeastern an overall surplus of 0.5 million pinks is expected in the middle run; however the returns to some middle run streams in Gambier, Pybus, and Hoonah Sound are all expected to be poor. In southern Southeastern an overall surplus of 2.1 million pinks is expected in the middle run, however a few middle run streams on Kupreanof Island, outside of Wales Island, Etolin Island, are expected to have weak returns.

Estimated 1973 District Returns

The pink salmon fishery can be better managed when data are available regarding an estimate of expected returns to each management district. The expected 1973 returns (Table 6) were determined by weighting the percent of the total 1971 escapement returning to each district by the subsequent fry

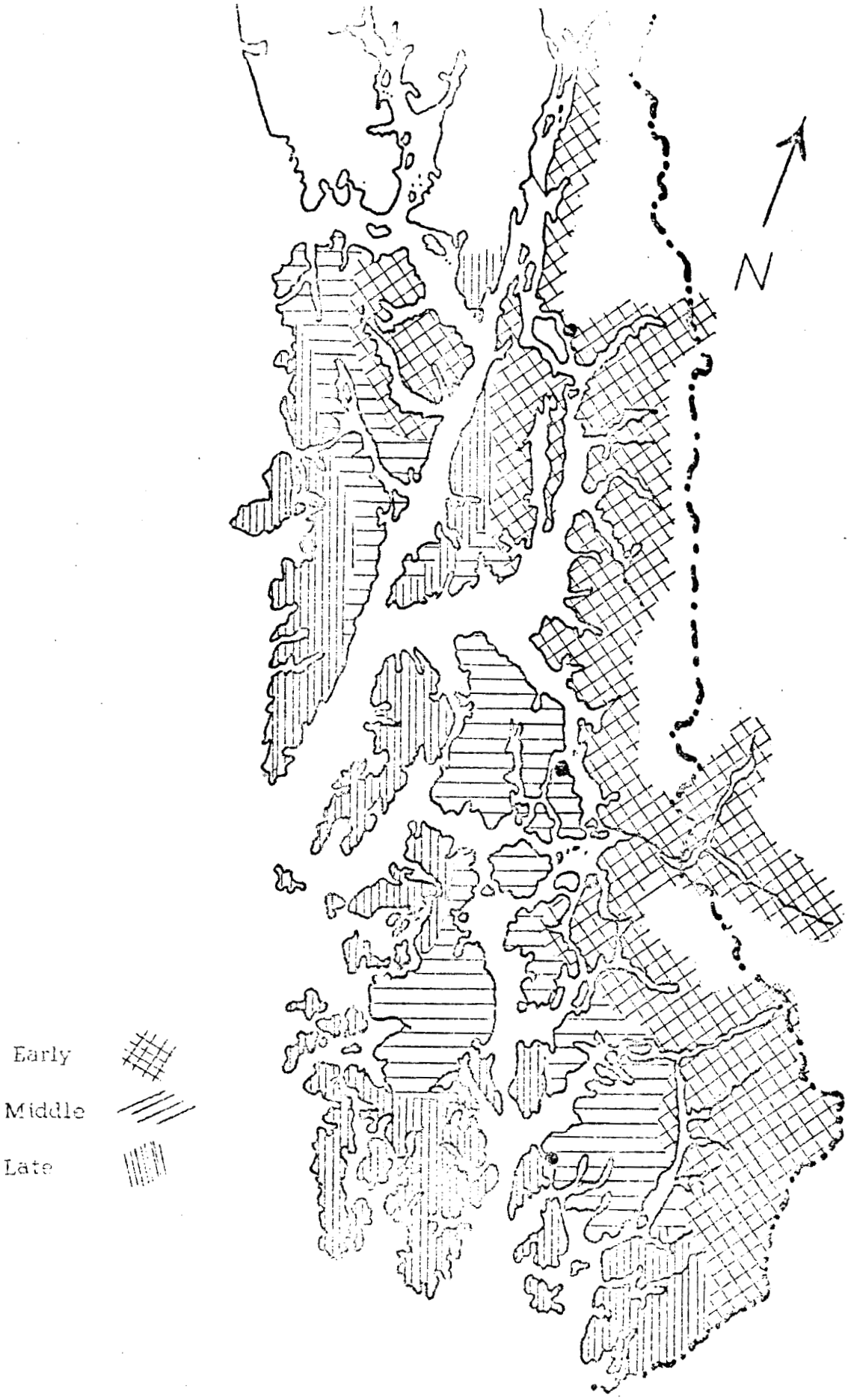

Figure 5. Time zones of pink salmon escapements in Southeastern Alaska used for 1973 timing forecasts.

Table 5. Estimated return by timing, escapement index goals and catch - Southeastern Alaska, 1973.

Northern Southeastern

Timing 1/	Run in millions of salmon	Escapement 2/ index goals	Catch in millions of salmon
Early	2.7	1.7	1.0
Middle	1.4	0.9	0.5
Late	1.9	1.4	0.5
Totals	6.0 3/	4.0	2.0

Southern Southeastern

Timing	Run in millions of salmon	Escapement index goals	Catch in millions of salmon
Early	1.6	1.1	0.5
Middle	5.0	2.9	2.1
Late	7.5	2.0	5.5
Totals	14.1	6.0	8.1

1/ Timing based on time pinks enter streams and commence spawning,
Early - prior to August 10
Middle - August 10 to September 1
Late - September 1 and later

2/ Desired escapement goals estimated from escapement history, 1960-1971.

3/ Pre-emergent fry data indicated return of 10.3 million fish, but apparently high marine mortality of fish comprising the 1972 return is expected to be repeated for the 1973 return.

Table 6. 1973 district forecasts, escapement index goals and estimated allowable harvest. (numbers of salmon in millions)

Southern Southeastern

District	Forecasted return	Escapement Index[1/] goals	Allowable harvest
1	2.6	2.0	0.5
2	3.5	0.6	2.9
3	3.9	1.7	2.2
5	1.4	0.5	0.9
6	1.4	0.6	0.8
7	1.3	0.6	0.7
Totals	14.1	6.0	8.1

Northern Southeastern

District	Forecasted return	Escapement Index goals	Allowable harvest
9	0.9	0.6	0.3
10	1.1	1.0	0.1
11	0.9	0.5	0.4
12	1.1	0.6	0.5
13	1.1	0.8	0.3
14	0.9	0.5	0.4
Totals	6.0[2/]	4.0	2.0

1/ Desired escapement goals estimated from escapement history, 1960-1971.

2/ Analysis of pre-emergent fry-return data indicated a return of 10.3 million; the 6.0 million estimate takes into consideration probable high marine mortality of young pinks.

indices and then applying these percentages to the total run prediction.

The breakdown by district indicates a rather uniform return to northern Southeastern. Applying the escapement index goals to the expected return by district indicates that District 10 will have the least number of harvestable pinks. The major portion of District 10 pinks will be destined to the early mainland streams.

In southern Southeastern the areas of major concern are the early streams of District 1 and early-middle-late streams of Districts 5, 6 and 7. The middle run streams in District 3 will also be weak.

Districts 4, 8 and 15 are not included in the forecasts because of inadequate escapement data and no pre-emergent data. Based on existing escapement estimates, these three districts together probably have been producing about 500,000 pinks annually in recent years.

SUMMARY

The 1973 forecast estimates a return of 14.1 million pink salmon to southern Southeastern and a return of 6.0 million to northern Southeastern for a total return of 20.1 million pinks.

A linear regression analysis relating pre-emergent fry abundance to adult return was used to arrive at a prediction equation for the 1973 forecast. The northern forecast was adjusted to compensate for assumed high marine mortality. The range for southern Southeastern is 12.2 - 16.1 million and the range for northern Southeastern arbitrary at about ± 2.5 million fish. Although point estimates are stressed, a great degree of confidence can be placed only on the limits of the forecast range.

Estimated returns by timing segments and districts indicate poor runs to all of northern Southeastern with exceptionally weak returns expected to the early-middle run streams in Peril Strait-Hoonah Sound and Gambier-Pybus Bay areas. A very weak early run to the back Behm Canal is expected and weak middle runs to the west coast of Prince of Wales Island can be expected.

Assuming a fair degree of accuracy in the 1973 forecast, the catches in southern and northern areas of Southeastern Alaska should amount to approximately 8.1 million and 2.0 million, respectively.

If total returns occur in the lower or higher range of the forecast, the percentage contribution may be substantially correct but the number returning

in each timing category or to each district would of course be lower or higher.

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