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THE RELATIONSHIP OF PINK SALMON ESCAPEMENT TO
RETURNING RUNS IN PRINCE WILLIAM SOUND AND
THE EXPECTED RETURN IN 1957

SPECIAL MANAGEMENT STUDY 57-2

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The long and consistent records of escapement that have been obtained in Prince William Sound show clearly that there is a direct relation between the number of spawners and the subsequent return of adult pink salmon two years later. In this paper the relationship between the catch, escapement and return for the last seventeen years is presented. From these data are derived the most probable return for 1957 and the reliability of the prediction.

There are about 200 streams in which pink salmon (Oncorhynchus gorbuscha) are produced in the Sound. Most are short, of steep gradient, and with broad intertidal zones. The water is clear in nearly all, and spawning fish are readily seen when surveyed from the air or on foot. The escapement to individual streams and the commercial catch for the entire Sound have been recorded for many years. The catch and the total escapement observed in all streams surveyed and the return (catch plus observed escapement) of pink salmon are summarized in Table I.

Prior to 1950 escapement surveys were conducted on foot with occasional supplemental aerial counts. Surveys were conducted at or after the peak of spawning activity. Not all streams were covered and the portion of the total escapement included in these surveys is unknown. Certainly, a major fraction is included since the surveys covered the most important streams in the Sound.

After 1951 all streams were surveyed by air, and several counts were made during the course of the season. These differences in the method of counting the escapement and the unequal coverage obtained create some difficulty in estimating the total returning run in various years. Probably the escapement observed in the later aerial surveys represented a greater proportion of the true total escapement than that observed on the earlier foot surveys. These shortcomings in the data do not impose serious restrictions on a regression analysis of escapement versus return since estimates of the total escapement have been small in relation to the catch.

Both surface and aerial counts are estimates, and no measure of their reliability is available. They were, however, obtained consistently through the years by two observers, the second of whom was trained by the first. Further confidence is gained from the rather consistent relation of return to escapement, especially for 1954 when most fishing was prohibited. Both the return from the 1952 spawning in 1954, and the return from the 1954 spawning in 1956 were close to the trend line (Figure 1).

For this analysis seventy "key" streams were selected which comprise almost all of the streams for which continuous escapement records are available for the years 1940 through 1955. This sample includes important streams from every major bay in the Sound.

TABLE I: Commercial catch and observed escapement of pink salmon in Prince William Sound 1940 to 1956

YEAR	CATCH IN 1,000's	OBSERVED ESCAPEMENT IN 1,000's	RETURN 2 yrs. LATER IN 1,000's	AVERAGE ESCAPEMENT 70 KEY STREAMS IN 1,000's
1956	4,800	1,100		
1955	27	551		5.5
1954	12	896	5,900	9.3
1953	2,318	197	578	2.7
1952	2,300	238	908	2.5
1951	960	464	2,515	4.6
1950	2,100	351	2,538	4.2
1949	5,460	472	1,424	4.7
1948	2,420	359	2,451	4.6
1947	7,600	600	5,932	5.8
1946	6,320	830	2,779	9.9
1945	11,632	1,249	8,200	15.5
1944	8,340	931	7,150	11.0
1943	10,814	852	12,881	14.9
1942	7,140	1,000	9,271	13.4
1941	4,260	663	11,666	14.1
1940	11,543	1,014	8,140	11.5

Source of Data - U. S. Fish and Wildlife Service Central District Annual Reports 1940 - 1956

PRINCE WILLIAM SOUND
70 KEY PINK SALMON STREAMS

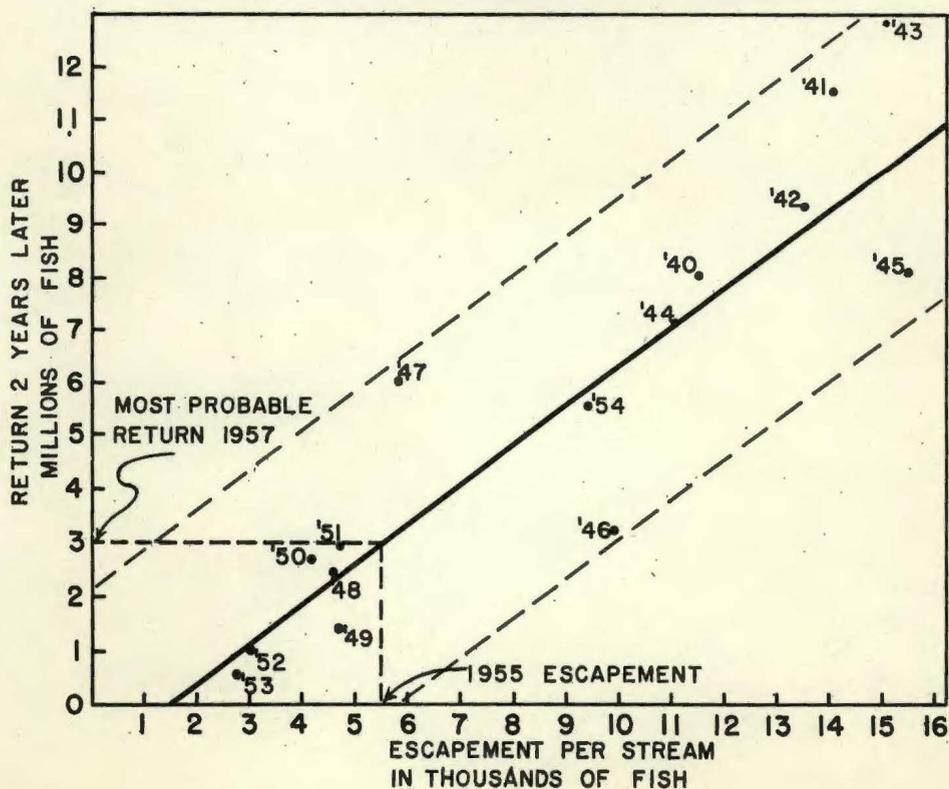


Figure 1

For purposes of fitting a trend line to these data it was convenient to use the linear equation $y = a + bx$ although the data when plotted exhibit a slight curvilinearity. The equation of the line best fitting the data is $y = -1.1 + .76x$ where x equals the average escapement for seventy streams in thousands of fish and y equals the expected return two years later in millions of fish. Using this equation and inserting observed high and low values of escapement, the trend line was established (Figure 1). Clearly, a greater escapement has yielded a better return.

On the basis of this trend the outlook for a good run of pink salmon in 1957 must be pessimistic. The average escapement for the seventy streams in the parent year 1955 was only 5.5 thousand. The most probable return is 3.1 million fish (Figure 1).

Of course, there is always a chance that a greater or lesser return per spawner will occur. The figure shows considerable variation from the trend line. This variation is expressed by the standard deviation from regression which has been computed as 1.6 million. A band indicating plus and minus two standard deviations is indicated in Figure 1 by the dotted lines.

The chances are two out of three that the actual return will be 3.1 million plus or minus one standard deviation, or between 1.5 million and 4.7 million salmon. Similarly, the chances are only about one in forty that the return will be greater than 3.1 million plus twice the standard deviation or more than 6.3 million fish.



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