

A STATISTICAL TREATMENT OF THE COUNTS MADE OF THE 1948 SOCKEYEYEARLY MIGRATION IN ORDER TO ESTIMATE THE TOTAL RUNDesired

To arrive at some figure which would be a fairly reliable estimate of the total number of yearling sockeye migrants from Lakelse Lake in 1948; and the most probably rate of migration.

How

By comparison of the information available on the 1948 yearling migration with that of the preceding years of 1946 and 1947.

Assumptions

- (1) The migration when plotted will present a curve of normal distribution.
- (2) That 20% of the total migration occurs in the first two weeks following the inception of migration.
- (3) 50% of fish blocked by river block pass trap in 5 days, when it is opened.

Calculations

From May 13 to May 17, 1948, the Lakelse River was blocked to prevent migration of yearlings downstream. The daily runs, therefore, for an undetermined period following May 17 will be a composite of those fish which would have normally passed through the trap and those fish which had accumulated at the block from May 13-17 inclusive. The effectiveness of the operating traps in acting as a deterrent to migration will determine the extent of the period in which the fish held up from May 13 - 17 was operative. This would be found by following the progress of a given number of identifiable yearlings through the trap and the nature of this migration would follow a Poisson distribution in all likelihood. Experiments made in 1947 (Brett, MS) show that 50% of marked fish placed above the fence pass through by the end of the 5th day after their being put above the fence. Many of the factors operating in 1947 to impede the progress of migration were absent in 1948 (i.e. numbers of larger fish, slower rate of water flow) and the traps are considered as less efficient than those used in 1948. If it is assumed that 50% of the fish held up from May 13-17, 1948 has passed through the traps by May 22, a minimum figure can be arrived at to estimate the numbers of yearlings thus effected by the block for that period. It then follows that the inception and early progress of the run can be plotted so as to eliminate the effect of the block.

Inception of run - correcting for the blockage

Rate of return of marked fish through the trap in 1947 (Brett - graph):

$$Y = Y_0 e^{Gt} \quad \text{and} \quad e^{Gt} = \frac{Y}{Y_0}$$

$$e^{Gt} = 1.91$$

$$\therefore Gt = 0.64$$

$$G = \frac{0.64}{5} = 0.012 \text{ or } 1.2\% = \text{rate of return in the 5 day period for return of 50\% of the total}$$

∴ the run of May 13-17 (the count of May 18) - 6755 sockeye

∴ the part of that days run which have been held up would be $6755 \times .012 = 81$ sockeye.

This remainder will decrease to 0 by May 22. (end of 5 day period)

• May 18 run of blocked fish = 81 }
 19 = 36 } (Refer to Figure 1)
 20 = 9
 21 = 3
 22 = 0 (1) for purposes of facilitating calculations.

These fish represent:

50% of those originally blocked.

The progress of the "backlog" migration is plotted in figure 2.

• the total backlog = 2 x (81 + ---- + 0) = 258 sockeye.

As the period from May 13-17 is equally applicable to the 5 day block assumption, itself being a five day period, the migration would then commence on May 13; vis.:

May	<u>No. of Sockeye</u>
13	2
14	6
15	18
16	72
17	162
18	6755 - 81 = 6664
19	13392 - 36 = 13356
20	8792 - 9 = 8783
21	13870 - 3 = 13867
22	7996 - (1) = 7995 etc.

(See figure 3)

and as 129 fish, or 50% of those blocked are still included in the total from May 23 on, these would be expected (subject to error thru the effect of differential mortality on the 1947 experimental results basis) to pass thru the traps by May 27 (2 week period). The 127 fish thus remaining is a small group and will be neglected.

Note: The sudden increase in the number of migrants appears to be a true event.

Comparison of Migrations, 1946-48

1946 - 558,000 Migrations				1947 - 372,000			
			diff.				diff.
April	30	- 0.0	%) 0.005 app	April	30	- 0.0	) 1.3
May	5	- 0.005	) 0.005 app	May	5	- 1.3	) 4.6
	10	- 0.01	) .79		10	- 5.9	) 8.9
	15	- 0.8	) 4.9		15	- 14.8	) 25.8
	20	- 5.7	) 41.2		20	- 40.6	) 40.1
	25	- 46.9	) 26.5		25	- 80.7	) 12.0
	30	- 73.4	) 14.4		30	- 92.7	) 5.9
June	4	- 87.8	) 10.0	June	4	- 98.6	) 0.8
	9	- 97.8	) 2.1		9	- 99.4	
	14	- 99.8					

(see figure 4).

The 1946-47 peak daily migrations occurred 21-22 days after the start of the run at 41% of the total. If this assumption can be applied for 1948 (the 20% line appears too affected by initiating "run" factors).

∴ for 1948, the peak would occur on June 3. The slope of the midpart of the 1948 line is:

$$e^{Gt} = \frac{Y}{Y_0} = \frac{350000}{100000} = 3.5$$
$$\therefore Gt = 1.25$$
$$G = 1.25/4 = .31$$

The cumulative total migration is extrapolated from figure 5., = 610,000.

Thus if 610,000 = 41% of the expected run

The total run will be 1,487,800 or
1,490,000 sockeye

Very approximate limites would be app. 20%, i.e. 1,490,000 ± 298,000 fish.

See figure 6

It is necessary to view the preceeding section with extreme caution. Due to the fact that the midpart of the 1948 migration line is so straight, with no indication of a leveling off, ~~consequently~~ no upper limit can be set with fair accuracy of estimation.

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Additional note:

A fairly complete block of the river was re-established by June 12th. By June 14th, only a few hundred sockeye were observed above the fence, indicating a termination of the run.