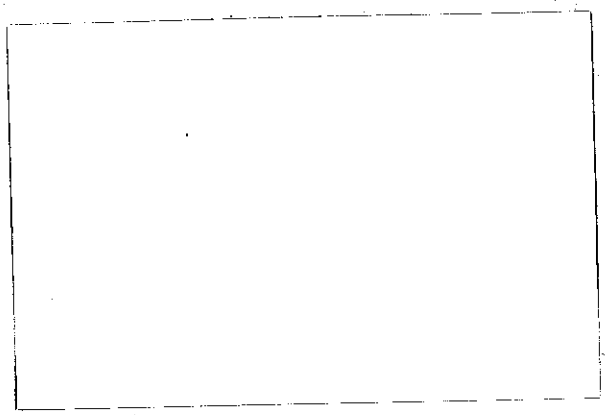
SMITH INLET SOCKEYE SALMON
UPSTREAM ENUMERATION PROGRAM
1963, 1968



TECHNICAL REPORT 1970-5

By F. E. A. Wood

CANADA
Department of Fisheries and Forestry
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INTRODUCTION

A sockeye salmon enumeration program was initiated in July 1963, on the Long Lake system (Figure 1) in order to obtain an early indication of the strength of the escapement. It was considered that an early indication of the magnitude of the escapement would permit more effective management of the commercial sockeye fishery in Smith Inlet. Sockeye normally appear at the entrance to Wyclees Lagoon (Area 1, Figure 2) as early as late June, and migrate through the lagoon and into Long Lake during July. In past years the magnitude of the escapement has not been assessed until the fish have appeared on the spawning grounds in early September.

The commercial fleet distribution and its catches suggest that Smith Inlet sockeye stocks on spawning migration enter Smith Sound from numerous directions but migrate predominantly along the north shore of the sound past Margaret Bay into Smith Inlet (see Figure 1). There are indications that a significant percentage of the fish entering Smith Inlet migrate as far up the inlet as Burnt Island (Figure 1) before returning to the mouth of Quashella Creek (Figure 1). The length of time which the fish hold off the mouth of this creek appears to be quite variable. In most years, the upstream migration is initiated when large tides occur, i.e., on the new or full moon. Migration into Wyclees Lagoon appears to occur day or night on tides in excess of 11 feet when the direction of Quashella Creek flow reverses to carry

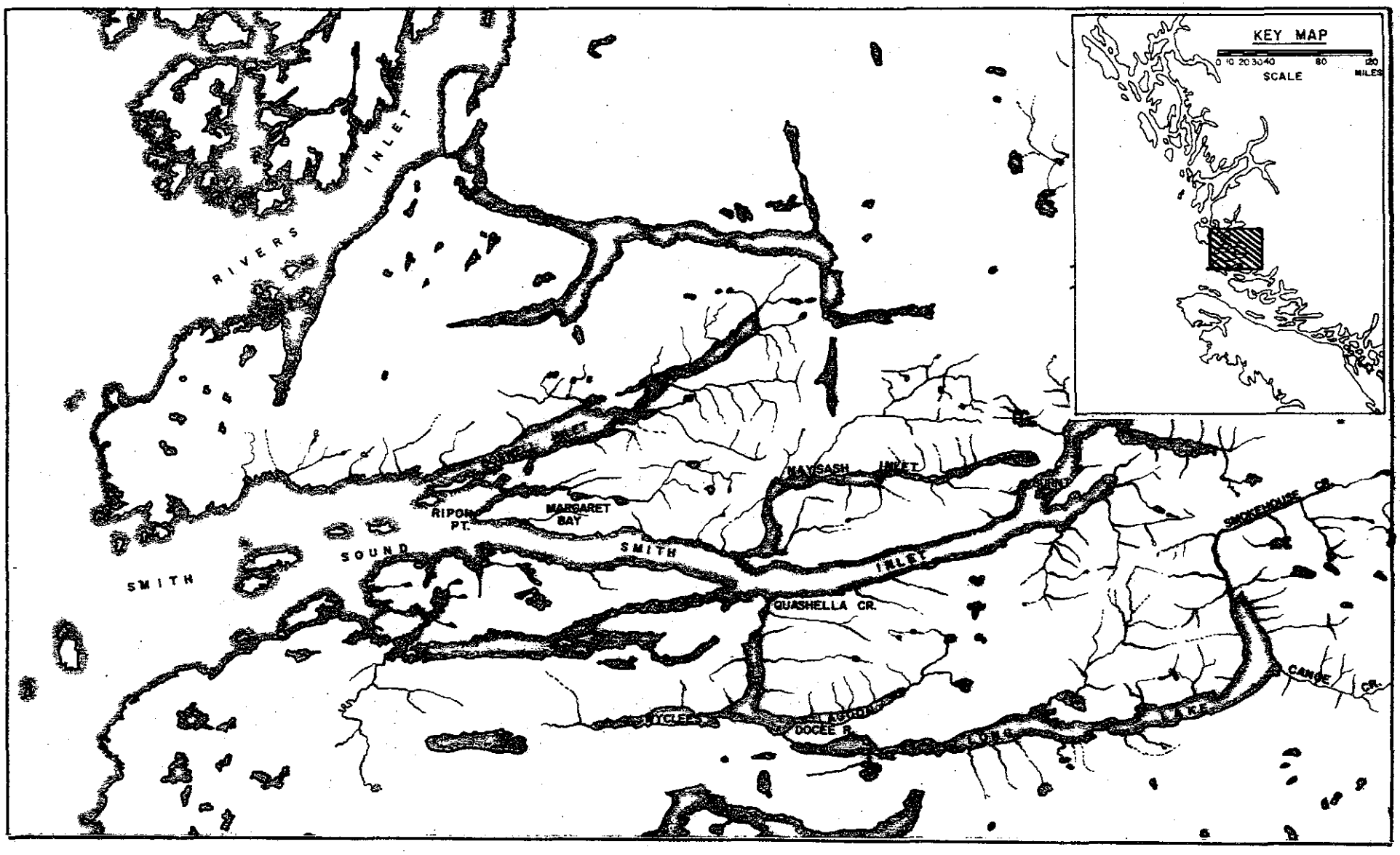

Figure 1. Location map of Smith Inlet and adjacent areas.

sea water into Wyclees Lagoon. The fish move into the creek in the tongue of salt water that moves in along the bottom with an incoming tide. When the tongue of salt water is far enough up the creek that it flows over the sill into Wyclees Lagoon the fish move into the lagoon with it. The lagoon has a layer of fresh water from 5 to 15 feet deep on top of a base of salt water. As the fish migrate through the lagoon, they appear to move predominantly in salt water. Upon entering the lagoon, fish migrate directly to the mouth of the Docee River. Data collected in 1968 suggest that the migration through the lagoon takes about four to six hours. Migration up the Docee appears to be governed by light intensity, with peak migration usually occurring from 7:00 A.M. to 11:00 A.M. and 5:00 P.M. to 8:00 P.M. There is essentially no migration from 1:00 A.M. to 5:00 A.M. Also, high water conditions in the Docee tend to reduce the rate of migration upstream.

Sockeye entering Long Lake migrate in the general direction of the spawning areas at the head of the lake where they mill until early September when the first fish enter the spawning streams. Spawning peaks in October and is usually finished by mid-November.

METHODS

To obtain the earliest possible index of escapement, an attempt was made in 1963 to establish a counting site on Quashella Creek at the narrow entrance to Wyclees Lagoon

(Area 3, Figure 2). This site proved impractical because of excessive water depth, velocity, and generally poor visibility caused by tidal changes.

A secondary site was chosen on the Docee River, immediately downstream of its exit from Long Lake (Figure 2). A tower was erected by July 10, 1963, and a strip of white sand bags was placed across the river to provide better visibility. A string of lights was also installed above the counting strip for use during the hours of darkness.

The daily counting pattern was established as follows:

(a) hourly counts - a basic pattern of 15 minutes on - 15 minutes off was followed, except during periods of heavy migration when counting was continuous.

(b) daily period - during the first two days of steady migration it was established that the period of 5:00 A.M. to 10:00 P.M. encompassed the major period of sockeye movement. This period was therefore designated as the range within which all daily counts would be made.

(c) 24 hour counts - the degree of daily migration which occurred outside the standard daily counting period was determined by periodic 24 hour continuous counts.

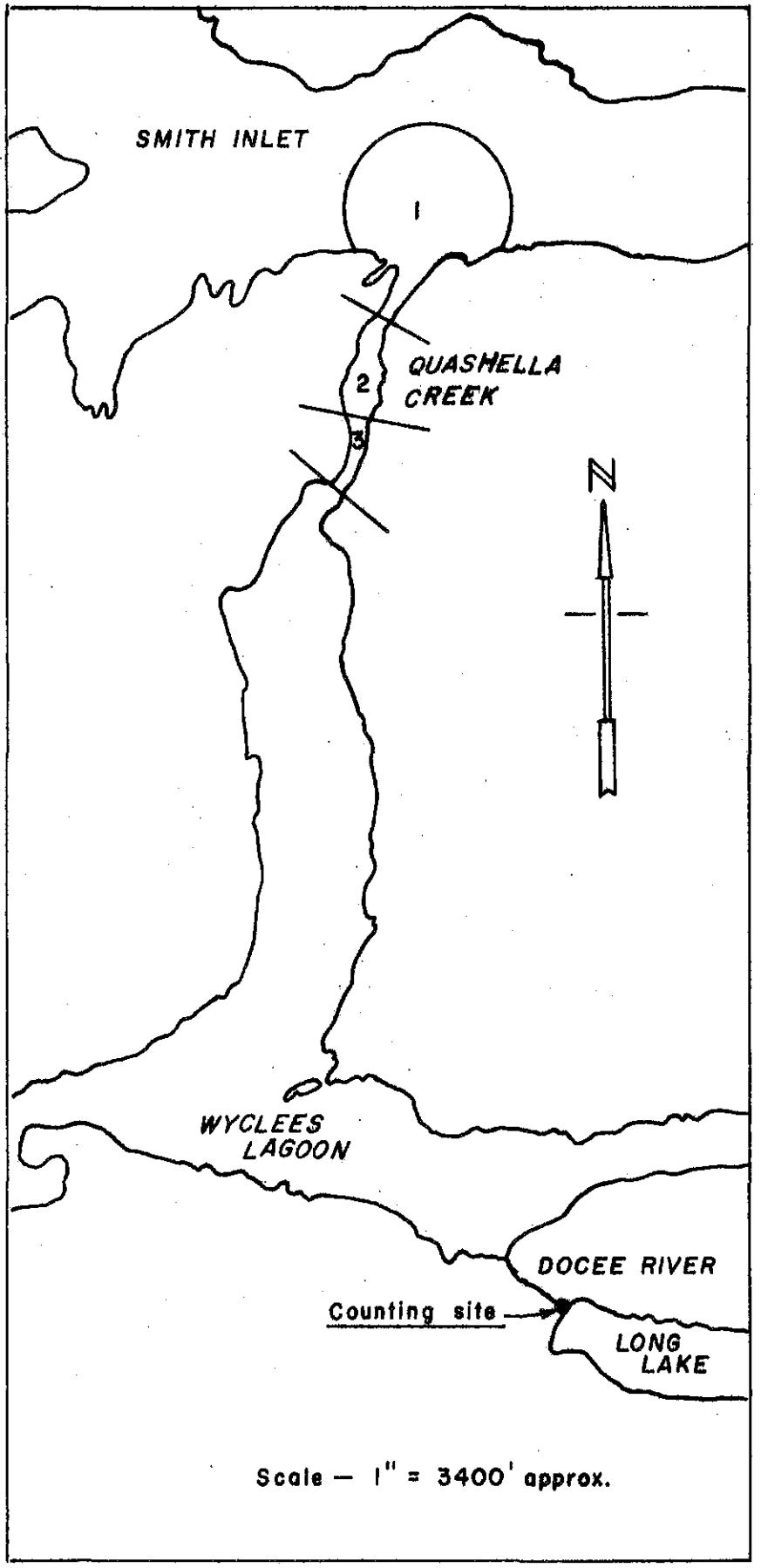

Figure 2. Detail map of area from Smith Inlet to Long Lake.

Calculation of Total Escapement

From these actual counts, total escapement of sockeye to Long Lake was calculated as follows:

(a) hourly counts - the migration during the two 15-minute periods within each hour when counting was not conducted was calculated by interpolation of the preceding and following 15-minute counts.

e.g.

	Actual	Interpolated
0900-0915	27	27
0915-0930	NC	26
0930-0945	24	24
0945-1000	NC	49
1000-1015	74	74

(b) daily counts - due to low light intensity, artificial light was required until approximately 7:00 A.M. On several days, counting was not conducted during this period because of a breakdown of the generating plant. In periods in which counting was not conducted, estimates were calculated as follows:

(1) the daily distribution in percentage of average number of sockeye per hour was calculated from the six days in which counts were made for every hour during the standard daily period.

e.g.

percentage of average daily migration during 0600-0700 from total of 6 days counts $\frac{2916}{23441} \times 100 = 12.44$ percent.

(2) On July 18, 1963, no counts were made during the period 0600 to 0700. From (1) above, 12.44 percent of the total daily migration passed the counting site during this period. The actual count from 7:00 A.M. to 10:00 P.M. totalled 7291, which equalled 100 - 12.44 = 87.56 percent of the total migration. The total migration on July 18, therefore equalled 8327 sockeye.

Sampling by gill net was conducted at the mouth of the Docee River on July 8-10, 12, and 22-25, 1963, in an effort to determine the start and finish of migration into the river.

In 1964 the program was to be repeated, but before any number of fish had migrated upstream a flood washed out the counting strip making it virtually impossible to continue counts. The counting site was not operated from 1965 to 1967.

The counting site was repaired and operated in July 1968. As expected, migration into Wyclees Lagoon started on the high tide of the full moon on July 10. Sockeye started to migrate up the Docee in numbers at about 8:00 A.M. on July 10. The migration up the Docee followed a daily pattern similar to that of the 1963 migration.

From July 5 through to the morning of July 10 counts were conducted for 10 minutes every half hour. On the morning of July 10, the number of upstream migrants increased markedly, therefore, counting time was increased to 15 minutes every half hour. On July 23 counts were reduced to 10 minutes every half hour.

All counts in 1968 were interpreted in a similar manner to those of 1963.

A Bendix Electronic fish counter was to be installed and operated in the Docee River in 1968 to enumerate sockeye stocks and to evaluate the counter. Unfortunately, high water conditions prevented installation of the unit early enough to be of any value so the counter was not evaluated in this stream.

DISCUSSION

Pattern of Migration

Wyclees Lagoon

In 1963, sockeye were first observed in numbers at the mouth of Quashella Creek in Smith Inlet (Area 1, Figure 2) on July 5. On July 10 sockeye were observed in the creek near the lagoon (Area 2, Figure 2) for the first time and movement into the lagoon (through Area 3, Figure 2) was observed first on July 12. The fish held in the creek below the lagoon (Area 2, Figure 2) until approximately two hours before the high tide, and migration apparently ceased before the change of the tide. The fish were not observed

on their migration through the main body of the lagoon, nor were they apparent in numbers at the mouth of the Docee River. Observations were carried out daily. The above described behaviour pattern remained consistent throughout the period of migration.

Docee River

Although counts were conducted on July 10 and 11, 1963, at the Docee River counting site, no sockeye were observed. An adjusted count of 6066 sockeye was made on July 12. The daily counts, as shown in Table I, continued at a relatively uniform level until July 20 when they dropped from the high levels recorded during the previous days. From July 22 to 26 inclusive, daily counts did not exceed 95 fish. On the succeeding three days a second peak of migration occurred; this was followed by an immediate decline (see Table I). As few sockeye were observed at the mouth of Quashella Creek, on August 1 counting was terminated.

The adjusted escapement to Long Lake in 1963 totalled 68,686 sockeye.

The reduced migration which occurred during the period of July 20 to 26, 1963, coincided with heavy rainfalls which increased water levels by several feet. Following this high discharge the migration demonstrated a secondary peak.

Table 1. 1963 Docee River adjusted daily escapement counts

Date	Adjust. Count	Date	Adjust. Count	Date	Adjust. Count
July 12	6,066	July 19	7,075	July 26	45
13	4,412	20	2,140	27	3,094
14	6,980	21	2,222	28	6,427
15	5,813	22	22	29	1,931
16	6,350	23	21	30	91
17	7,141	24	10	31	28
18	8,629	25	95	Aug. 1	94
				Total	68,686

Sampling by gill net in 1963 at the mouth of the Docee River, provided the following results. No fish were caught during the July 8 to 10 period, the net was not set on July 11. On the evening of July 12, however, the net was reset and 16 sockeye were caught. The net was again fished during the period of July 22 to 25 and nightly catches did not exceed two sockeye. This sampling was taken as evidence that low daily counts recorded at the tower during the same period were representative of the actual daily migration. The net was also fished on July 30 and 31 with similar results, which in conjunction with the observations recorded at Quashella Creek, indicated that the majority of the escapement had passed the counting site.

The daily migration in 1963 (Figure 3) at the Docee River site generally exhibited a peak period of movement between 7:00 A.M. and 11:00 A.M., and a secondary one between 5:00 P.M. and 8:00 P.M. A 24-hour count on July 20 indicated that virtually no migration occurred between 1:00 A.M. and 5:00 A.M.

Table II. 1968 Docee River adjusted daily escapement counts

Date	Adjust. Count	Date	Adjust. Count	Date	Adjust. Count
July 8	66	July 14	13,515	July 20	4,787
9	970	15	24,558	21	3,907
10	18,336	16	27,705	22	2,737
11	7,902	17	24,134	23	1,954
12	13,963	18	28,030		
13	19,074	19	6,292		
				Total	197,929

Varying confidence can be placed on the individual counts of 1968 because of physical conditions under which they were made. The weather was extremely poor for accurate fish counts from July 9 to 14. At times during this period the visibility was reduced to zero by rain and wind. By July 11 the Docee had risen one and one-half feet and was quite turbid. The high water conditions not only made counting difficult but also greatly reduced the number of upstream migrants (Table I). By July 14 the turbidity and water level returned to normal. From July 15 to the

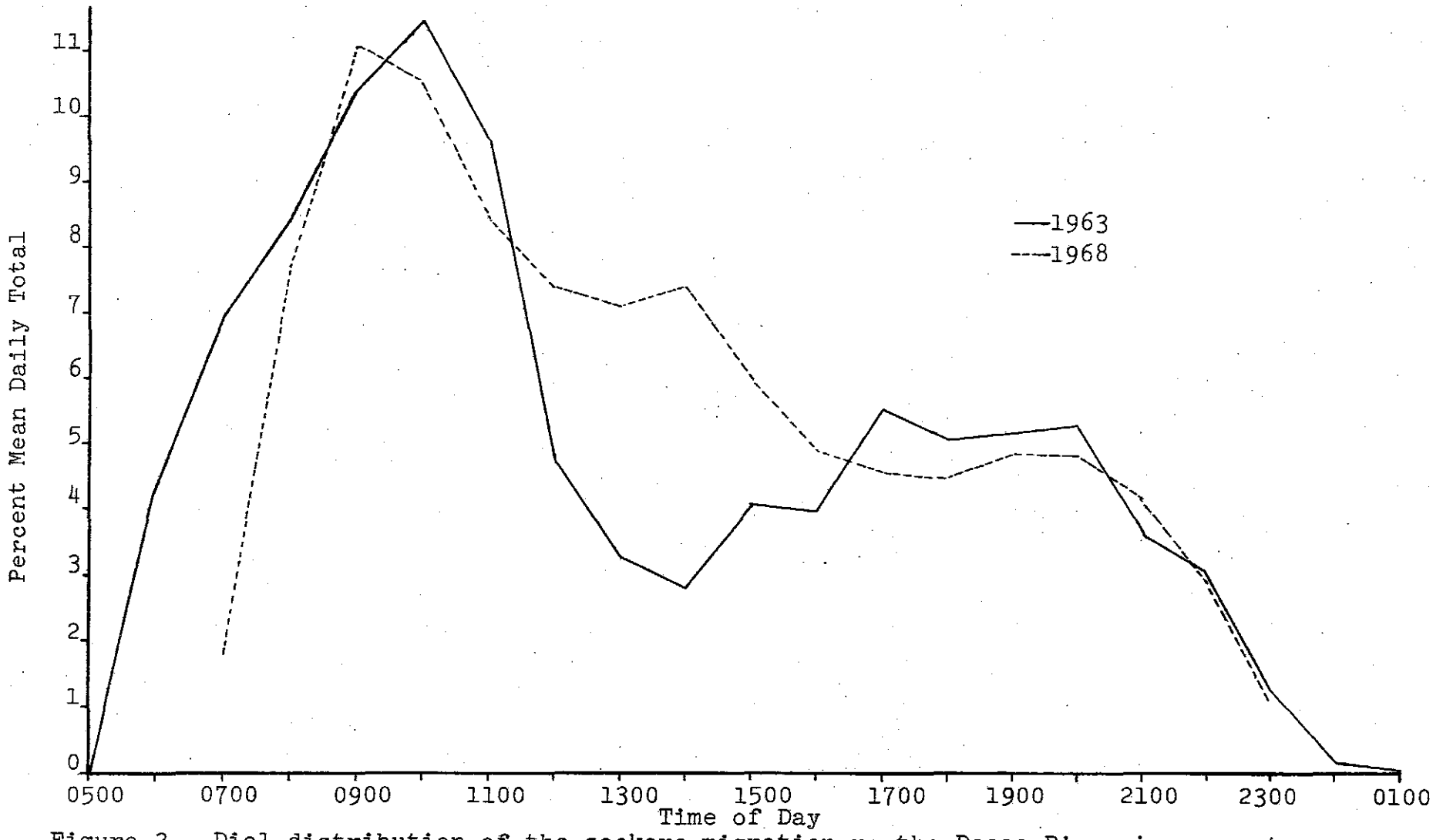

Figure 3. Diel distribution of the sockeye migration up the Docee River in percent mean daily count per hour over the daily counting period in 1963 and 1968.

end of the survey, counting conditions ranged from good to excellent. Only limited confidence can be placed on some counts because of the large numbers of fish passing over the strip in a short time; over 1000 fish in a 15-minute period.

A further source of error occurs because most counts were from 6:00 A.M. to 10:00 P.M. Twenty-four-hour counts indicated that up to 12 percent of a migration might occur outside this time period. All counts were adjusted accordingly.

The daily migration pattern in 1968 (Figure 3) at the Docee River site differed from that of 1963 by the lack of the period of low migration rate in the early afternoon of 1968. Also, early morning migration rate appeared delayed relative to that in 1963. Comparison of the 1968 and 1963 diel migration timing is of questionable value as escapement of the former was almost three times that of the latter, and tidal stages were markedly different.

SUMMARY

1. Migration into Wyclees Lagoon appears to be coordinated with the tides: the fish migrate just before the high tide.
2. Migration up the Docee River varies with the time of day: peak migrations tend to occur from 7:00 A.M. to 11:00 A.M. and 5:00 P.M. to 8:00 P.M. and apparently no movement takes place from 1:00 A.M. to 5:00 A.M.

3. The total escapement of adult sockeye salmon into Long Lake in 1963 has been calculated to be 68,686.

4. The total escapement of adult sockeye salmon into Long Lake in 1968 has been calculated to be 197,929.