ANNUAL REPORT

TO

THE SALMON MANAGEMENT COMMITTEE

ON THE

STATUS OF THE ODD-YEAR PINK SALMON STOCKS OF THE JOHNSTONE STRAIT STUDY AREA AND ON THE PROSPECTS FOR 1963

Department of Fisheries,
Vancouver, B. C.

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INTRODUCTION

The 1962 report submitted to the Salmon Management Committee described the results of an analysis conducted on the current status of the chum salmon stocks and of both the odd and even year stocks of pink salmon indigenous to the Johnstone Strait study area. Additionally, the report included an analysis on the effects of past regulation of the fishery, calculations on the anticipated size of the stocks returning in 1962, and a suggested basic fishing pattern for the main straits portion of the study area in 1962.

Further to the analysis presented on the odd-year pink salmon stocks in the 1962 report the following submission describes in greater detail the present status of those stocks, presents the best available estimate on the magnitude of the 1963 study area return, and outlines a suggested fishing pattern for the 1963 pink salmon season.

THE 1961 ESCAPEMENT

In order to assess the current strength of the odd-year pink salmon stocks originating in this study area, the 1961 spawning escapement must be evaluated in terms of previous recorded escapements to the spawning areas (See Location Map, Figure 1). This is in continuation of a similar assessment presented on the even-year pink salmon stocks of this study area in the annual report submitted in 1962 to the Salmon Management Committee.

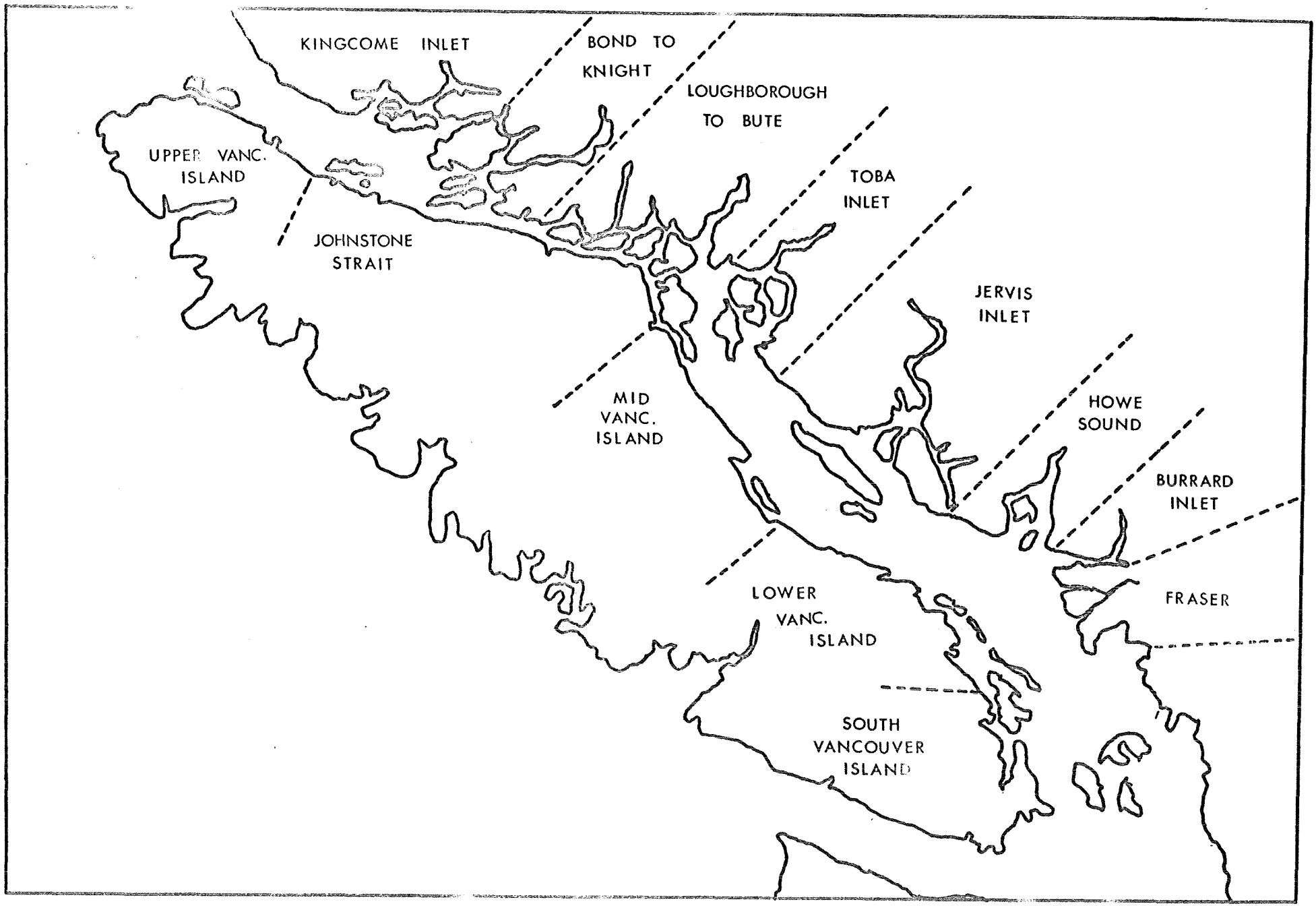
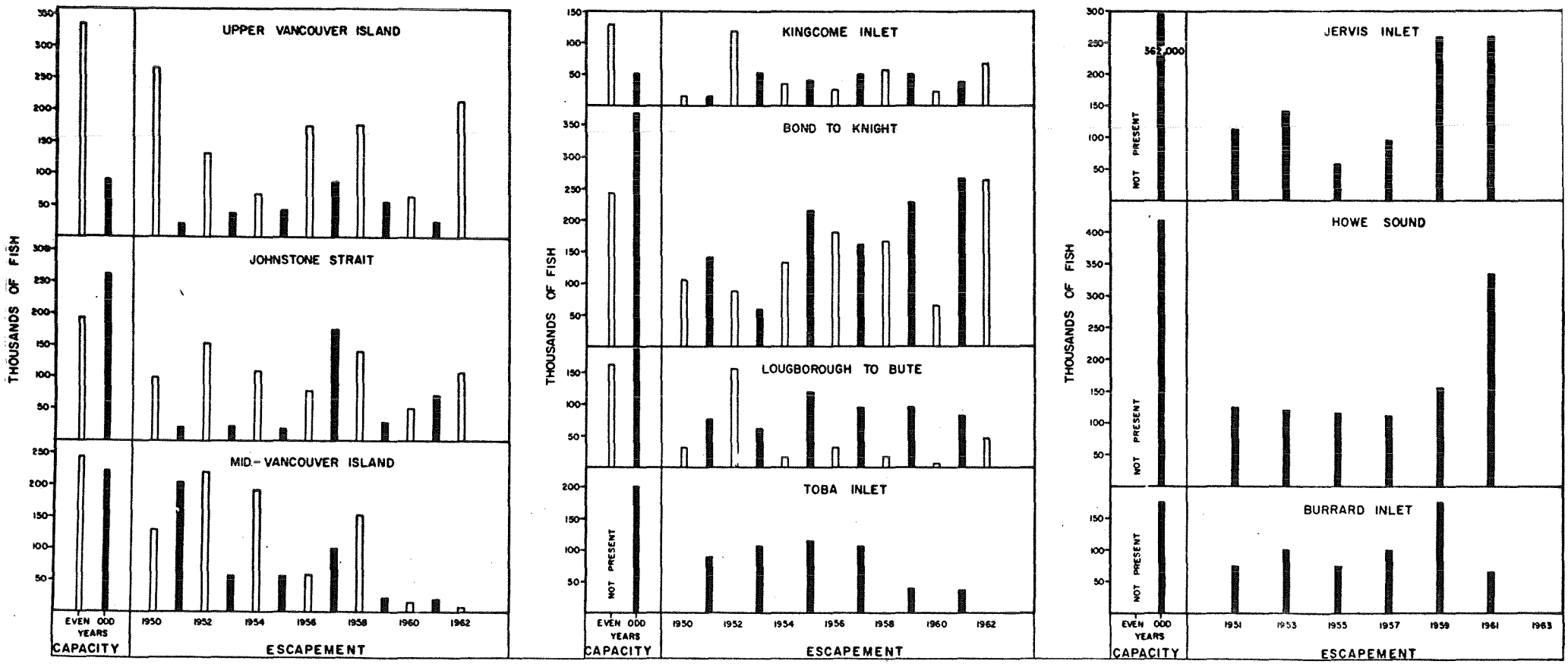


Figure 1. Location map of the Johnstone Strait study area.

As shown in Table I, the 1961 escapement to all areas, excepting the Fraser River, totalled 1,194,300 which constituted the largest over-all odd-year escapement recorded to the study area since and including 1951. Although this escapement was relatively good in size it cannot be considered an entirely satisfactory one for two reasons.

Firstly, in total, it represents only 53 percent of the "Total Stream Capacity" figure calculated for the study area and proposed as a temporary optimum escapement goal in the 1962 report. This goal is based on the total of the highest recorded actual odd-year pink salmon escapement to each stream in the area in any year during the period 1951-61 inclusive. The highest recorded escapements for both even and odd years for the period are listed by stream, sub-area and study area in Table II. As proposed in the 1962 report, this "Total Stream Capacity" figure would not appear to be an unrealistic goal and in fact, is almost certainly lower than the actual maximum optimum escapement. The sub-area spawning capacity and annual escapement for both odd and even years are shown graphically in Figure 2. In Table III, the highest odd-year escapements actually recorded by sub-area have been compared to the total of the highest odd-year stream escapements recorded for the respective sub-areas. As indicated in that Table, the highest escapement recorded by individual sub-areas in any year during the period 1951-61 have actually constituted 78.3 percent of "Total Stream Capacity". It is on this basis and on the assumption that over-spawning has not



THE CAPACITY AND ANNUAL ESCAPEMENT OF PINK SALMON BY SUB-AREA

FIGURE 2

TABLE I.

ANNUAL PINK ESCAPEMENT IN THOUSANDS
TO REGIONS IN AREAS 12, 13, 14, 15, 16 & 28.

STREAM	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961
UPPER VANCOUVER ISLAND													
CLUXEWE R.		7.5	3.5	7.5	7.5	7.5	3.5	7.5	35.0	7.5	3.5	3.5	3.5
KEOGH R.		75.0	7.5	100.0	7.5	35.0	7.5	100.0	35.0	75.0	35.0	35.0	15.0
NAHWITTI R.		75.0	1.5	*14.5	*14.5	7.5	*14.5	15.0	7.5	7.5	7.5	7.5	1.5
QUATSE R.		100.0	.75	100.0	1.5	7.5	0.4	7.5	0.4	35.0	3.5	7.5	.75
SHUSHARTIE R.		1.5	1.5	3.5	0.75	0.75	*10.0	35.0	1.5	35.0	0.75	0.75	1.5
SANGHEES R.		* .5	* .5	* .5	0.4	0.75	0.4	0.75	0.75	1.5	0.2	0.4	.2
STRANBY R.		3.5	* 4.5	* 4.5	* 4.5	7.5	* 3.5	7.5	3.5	7.5	* 4.5	1.5	.75
TSULQUATE R.		3.5	0.4	0.75	1.5	1.5	* 2.0	1.5	3.5	7.5	0.75	0.4	.75
		266.5	20.1	131.2	38.1	68.0	41.8	174.8	87.2	176.5	55.7	62.6	23.90
JOHNSTONE STRAIT													
ADAM R.		35.0	3.5	7.5	7.5	15.0	7.5	15.0	100.0	35.0	15.00	7.5	50.00
BEAR R.		35.0	---	100.0	---	75.0	---	35.0	---	75.0	---	35.0	---
KOKISH R.		* 2.0	0.4	3.5	1.5	3.5	0.4	7.5	0.75	3.5	1.5	0.4	1.50
NIMPKISH R.		15.0	7.5	15.0	3.5	3.5	1.5	3.5	* 1.5	3.5	* 3.5	3.5	3.50
MENZIES CR.		1.5	* 1.0	3.5	.03	0.4	.03	0.4	* 1.0	0.4	* 1.0	0.4	0.40
MOHUN CR.		1.5	* .6	0.4	0.75	0.4	0.75	0.75	0.75	0.4	0.2	0.4	0.40
SALMON R.		7.5	0.75	15.0	0.75	1.5	0.75	1.5	35.0	7.5	15.0	3.5	15.00
TSITIKA R.		1.5	7.5	7.5	7.5	*10.00	7.5	15.0	35.0	15.0	7.5	0.2	.75
		99.0	20.20	152.4	21.5	109.30	18.4	78.6	174.00	140.3	28.7	50.9	71.50
MID VANCOUVER ISLAND													
ENGLISHMAN R.	* 1.0	3.5	0.07	1.5	0.2	0.75	0.75	0.4	3.5	0.4	0.02	0.2	.20
OYSTER R.	15.0	100.0	3.5	100.0	15.0	100.0	3.5	35.0	3.5	35.0	1.5	3.5	1.50
PUNTLEDGE R.	7.5	7.5	100.0	15.0	7.5	15.0	15.0	7.5	15.0	35.0	3.5	3.5	7.50
QUINSAM R.	* 2.5	3.5	0.2	3.5	0.07	0.75	* 2.5	0.07	3.5	7.5	3.5	0.75	3.50
TSOLUM R.	15.0	15.0	100.0	100.0	35.0	75.0	35.0	15.0	75.0	75.0	15.0	7.5	7.50
	41.00	129.5	203.8	220.0	57.8	191.5	56.70	57.9	100.5	152.9	23.5	15.4	20.20
KINGCOME INLET													
AHTA-VALLEY		0.2	0.4	0.75	* 2.50	3.5	1.5	3.5	7.5	3.5	7.5	0.4	.20
EMBLY R.		* 5.0	0.4	7.5	0.75	7.5	0.1	15.0	0.4	15.0	0.1	3.5	.02
KINGCOME R.		7.5	7.5	75.0	3.5	7.5	3.5	3.5	7.5	35.0	7.5	15.0	3.5
WAKEMAN R.		3.5	7.5	35.0	35.0	15.0	35.0	3.5	35.0	3.5	35.0	3.5	35.00
		16.2	15.8	118.2	41.70	33.5	40.1	25.5	50.4	57.0	50.1	22.4	38.70

ANNUAL PINK ESCAPEMENT
(TO REGIONS IN AREAS 12, 13, 14, 15, 16 & 28)

STREAM	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961
BOND TO KNIGHT													
AHNUATTI	※ 8.0	7.5	7.5	15.0	3.5	0.4	7.5	0.4	0.75	7.5	7.5	7.5	35.00
FRASER	1.5	0.4	3.5	2.5	0.75	0.2	0.75	0.07	3.5	0.07	0.75	0.07	.02
GLENDALE	15.0	35.0	15.0	15.0	7.5	15.0	75.0	75.0	75.0	75.0	175.00	35.0	175.00
HOYEA	0.75	※ .40	0.75	0.75	0.4	7.5	3.5	15.0	7.5	7.5	1.5	1.5	.40
KAKWEIKEN	※45.00	35.0	100.0	35.0	35.0	75.0	75.0	35.0	35.0	35.0	35.0	7.5	35.00
KLINIKLINI	7.5	※ 5.00	3.5	※ 5.00	7.5	3.5	7.5	3.5	1.5	3.5	3.5	3.5	3.5
KWALATTE	0.75	0.75	0.75	1.5	0.75	0.75	0.75	0.75	0.4	0.75	1.5	1.5	.75
LULL	3.5	1.5	1.5	3.5	1.5	0.4	1.5	0.4	1.5	0.4	1.5	1.5	.02
VINER	0.4	1.5	0.75	7.5	1.5	15.0	1.5	15.0	0.75	1.5	0.4	0.4	1.5
WATERFALL	※18.00	※18.00	7.5	1.5	1.5	15.0	35.0	35.0	35.0	35.0	1.5	7.5	15.00
	100.40	105.00	140.8	87.2	59.9	132.8	214.8	180.1	160.9	166.2	228.2	66.0	266.20
LOUGHBOROUGH TO BUTE													
APPLE R.	7.5	0.02	15.0	3.5	15.0	0.07	15.0	0.02	15.0	0.02	35.0	0.02	15.00
GUMSACK CR.	0.75	1.5	3.5	1.5	3.5	0.2	0.2	0.02	0.2	0.02	0.2	0.02	.02
EVA CR.		0.75	3.5	3.5	3.5	0.4	1.5	0.2	0.75	0.07	0.4	---	1.50
FULMORE R.	1.5	0.4	1.5	3.5	0.7	1.5	0.75	1.5	1.5	1.5	0.1	0.1	---
GRANITE CR.	0.02	7.5	0.07	15.0	---	3.5	---	7.5	---	7.5	0.02	0.4	0.40
GRASSY	---	1.5	---	75.0	---	1.5	---	15.0	---	3.5	---	1.5	1.50
GRAYS CR.	0.2	3.5	0.02	15.0	0.2	0.2	0.2	0.75	1.5	0.75	0.2	0.75	0.20
HEYDON	1.5	3.5	0.2	1.5	0.2	0.75	0.2	0.2	1.5	0.7	1.5	0.4	---
HOMATHKO R.	3.5	0.75	7.5	1.5	7.5	0.4	3.5	0.2	0.4	0.2	7.5	---	7.50
KAMISH CR.		3.5	---	3.5	---	.75	---	3.5	.02	1.5	.02	0.4	---
ORFORD R.	35.0	0.4	15.0	1.5	15.0	.02	7.5	.07	15.0	0.2	3.5	---	15.00
PHILLIPS R.	7.5	3.5	15.0	7.0	3.5	3.5	75.0	.75	35.0	0.4	35.0	0.2	35.00
READ CR.	0.2	1.5	0.4	15.0	---	3.5	---	0.4	.07	0.4	0.2	0.2	0.20
STAFFORD	.75	1.5	7.5	7.5	3.5	---	7.5	0.2	15.0	0.4	3.5	0.2	3.50
SOUTGATE	1.5	.75	7.5	1.5	7.5	0.4	7.5	.07	7.5	.07	7.5	---	1.50
	59.9	30.5	76.7	156.0	60.1	16.7	118.8	30.3	93.4	17.2	94.6	4.2	81.30
TOBA INLET													
BREM R.	35.0	---	35.0	---	35.0	---	15.0	---	15.0	---	4.0		3.50
KLITE	15.0	---	15.0	---	35.0	---	7.5	---	15.0	---	12.0		15.00
QUATUM R.	0.2	---	3.5	0.4	0.4	0.7	75.0	0.4	1.5	.75	3.5		3.50
TOBA R.	35.0	---	35.0	---	35.0	---	15.0	---	75.0	---	20.0		15.00
	85.2		88.5		105.4		112.5		106.5		39.5		37.00

Table IV - The 1959 and 1961 study area escapements by sub-area

	1959		1961		1961 Compared with 1959
	Escapement	Capacity	Escapement	Capacity	
Upper Vancouver Is.	55,700	61.9 %	23,900	26.5 %	- 31,800
Johnstone Strait	28,700	11.0	71,500	27.4	+ 42,800
Mid-Vancouver Is.	23,500	10.6	20,200	9.1	- 3,300
Kingcome Inlet	50,100	98.8	38,700	76.3	- 11,400
Bond-Knight	228,200	62.0	266,200	72.3	+ 38,000
Loughborough-Bute	94,600	50.2	81,300	43.1	- 13,300
Toba	39,500	18.0	37,000	17.0	- 2,500
Jervis	256,900	71.0	257,000	71.0	+ 1,000
Howe Sound	156,000	46.8	333,500	100.0	+177,500
Burrard	175,000	100.0	65,000	37.0	-110,000
	1,108,200		1,194,500		+ 86,000

ANNUAL PINK ESCAPEMENT
TO REGIONS IN AREAS 12, 13, 14, 15, 16 & 28)

STREAM	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961
						JERVIS INLET							
BRITTAIN R.	3.5	0.2	3.5	.07	3.5	.07	3.5	.02	3.5	---	.75	---	3.50
DESERTED R.	15.0	.75	7.5	0.4	100.0	0.3	15.0	.07	7.5	---	15.0		7.50
LANG CR.	3.5	---	0.4	0.2	.75	---	.07	---	1.5	---	0.2		---
SKWAWKA R.	7.5	---	100.0	---	35.0	---	35.0	---	75.0	---	240.0		235.00
VANCOUVER R.	3.5	---	1.5	---	1.5	---	3.5	---	3.5	---	.75		3.50
TZOONIE R.	7.5	.02	.4	.02	.4	.02	0.2	.02	3.5	.02	0.2		7.50
	40.5		113.3		141.2		57.3		94.5		256.9		257.0
						HOWE SOUND							
ASHLU R.			1.5		1.5		.75		.75		3.5		3.50
CHEAKAMUS R.			15.0		15.0		15.0		35.0		75.0		300.00
MAMQUAM R.			7.5		3.5		.75		.75		3.5		15.00
SQUAMISH R.			100.0		100.0		100.0		75.0		75.0		15.00
			123.0		120.0		116.5		111.5		156.0		333.50
						BURRARD INLET							
INDIAN R.			75.0		100.0		75.0		100.0		175.00		65.00
GRAND TOTAL		646.7	877.2	865.0	745.7	551.8	851.9	547.2	1078.9	710.1	1108.2	221.5	1194.3

* - calculated from average

TABLE II.. The maximum recorded pink salmon escapement by stream for even and odd year during the period 1949-61 to the areas 12, 13, 14, 15, 16 and 28; totalled by sub-area, (In Thousands).

STREAM	EVEN YEAR	ODD YEAR
	UPPER VANCOUVER ISLAND	
CLUXEWE	7.5	35.0
KEOGH	100.0	35.0
NAHWITTI	75.0	7.5
QUATSE	100.0	3.5
SHUSHARTIE	35.0	1.5
SANGHEES	1.5	.7
STRANBY	7.5	3.5
TSULQUATE	7.5	3.5
	334.0	90.2
	JOHNSTONE STRAIT	
ADAM	35.0	100.0
BEAR	100.0	-
KOKISH	7.5	1.5
NIMPKISH	15.0	7.5
MENZIES	3.5	.4
MOHUN	1.5	.7
SALMON	15.0	35.0
TSITIKA	15.0	35.0
	192.5	260.6
	MID-VANCOUVER ISLAND	
ENGLISHMANS	3.5	3.5
OYSTER	100.0	15.0
PUNTLEDGE	35.0	100.0
QUINSAM	7.5	3.5
TSOLUM	100.0	100.0
	245.0	222.0
	KINGCOME INLET	
AHTA VALLEY	3.5	7.5
EMBLY	15.0	.7
KINGCOME	75.0	7.5
WAKEMEN	35.0	35.0
	128.5	50.7

STREAM	EVEN YEAR	ODD YEAR
	BOND to KNIGHT	
AHNUATTI	15.0	35.0
FRASER	2.5	3.5
GLENDALE	75.0	175.0
HOYEA	15.0	7.5
KAKWEIKEN	75.0	100.0
KLINIKLINI	3.5	7.5
KWALATTE	1.5	1.5
LULL	3.5	1.5
VINER	15.0	1.5
WATERFALL	35.0	35.0
	241.0	368.0
	LOUGHBOROUGH TO BUTE	
APPLE	3.5	35.0
CUMSACK	1.5	3.5
EVA	3.5	3.5
FULMORE	3.5	1.5
GRANITE	15.0	.4
GRASSY	75.0	1.5
GRAYS	15.0	1.5
HEYDON	3.5	1.5
HOMATHKO	1.5	7.5
KANISH	3.5	-
ORFORD	1.5	35.0
PHILLIPS	7.5	75.0
READ	15.0	.2
STAFFORD	7.5	15.0
SOUTHGATE	3.5	7.5
	160.5	188.6
	TOBA INLET	
BREM		35.0
KLITE		35.0
QUATUM		75.0
TOBA		75.0
		220.0

STREAM	EVEN YEAR	ODD YEAR
	JERVIS INLET	
BRITTAIN		3.5
DESERTED		100.0
LANE		7.5
SKWAWKA		240.0
VANCOUVER		3.5
TZOONIE		7.5
		362.0
	HOWE SOUND	
ASHLU		3.5
CHEAKAMUS		300.0
MAMQUAM		15.0
SQUAMISH		100.0
		418.5
	BURRARD	
INDIAN		175.0

SUMMARY

UPPER VANCOUVER ISLAND	334,000	90,200
JOHNSTONE STRAIT	192,500	260,600
MID-VANCOUVER ISLAND	245,000	222,000
KINGCOME INLET	128,500	50,700
BOND TO KNIGHT	241,000	368,000
LOUGHBOROUGH TO BUTE	160,500	188,600
TOBA INLET		220,000
JERVIS INLET		362,000
HOWE SOUND		418,500
BURRARD		175,000
TOTAL	1,301,500	2,355,600

Table III- The highest recorded sub-area pink salmon escapements during the period 1950-61 inclusive to Areas 12, 13, 14, 15, 16 and 28 expressed as per cent of the highest recorded stream escapement totals to the respective sub-areas.

Sub-Area	ODD YEAR			EVEN YEAR		
	Highest Recorded Stream Escapement (Capacity)	Highest Recorded Sub-Area Escapement	Per Cent of Capacity	Highest Recorded Stream Escapement (Capacity)	Highest Recorded Sub-Area Escapement	Per Cent of Capacity
Upper Vanc.Is.	90,200	87,200 (1957)	96.6	334,000	266,500 (1950)	79.8
Johnstone St.	260,600	174,000 (1957)	66.8	192,500	152,400 (1952)	79.2
Mid-Vancouv.Is.	222,000	203,800 (1951)	91.8	245,000	220,000 (1952)	89.8
Kingcome Inlet	50,700	50,400 (1957)	99.4	128,500	118,200 (1952)	91.8
Bond to Knight	368,000	266,200 (1961)	72.3	241,000	180,100 (1956)	74.7
Loughborough to Bute	188,600	118,800 (1955)	63.0	160,500	156,000 (1952)	97.2
				1,301,500	1,093,200	84.0
Toba Inlet	220,000	112,500 (1955)	51.1			
Jervis Inlet	362,000	256,900 (1959)	71.0			
Howe Sound	418,500	333,500 (1961)	79.7			
Burrard	175,000	175,000 (1959)	100.0			
	2,355,600	1,778,300	75.5			

occurred at any time during the period described, that an odd-year escapement goal of 2,272,000 is proposed for the total study area: this would be comprised of individual totals as listed in Table II by stream and by sub-area.

Secondly, the 1961 escapement was less than satisfactory because it was not proportionately balanced. The fact can be best emphasized in the following manner. Of the recorded 1,194,300 pink salmon comprising the study area escapement, 710,000 or 60 percent were accommodated in only three streams. These were the Glendale (175,000), Skwawka (235,000) and Cheakamus (300,000) Rivers. In that these streams received near maximum escapements, the over-all escapement to the rest of the study area, which totalled 484,300 would have to be raised by a factor of 4.7 if the "Total Stream Capacity" escapement were to be realized. Further to this, the total escapement for the balance of the streams was well below the 1951-59 average of 735,000 and in fact, comprised only 78 percent of the lowest previous escapement of 618,200 which occurred in 1959. This analysis would indicate that a major rehabilitation program is in order for certain of the sub-area stocks.

THE 1961 CATCH

The contribution of the odd-year study area stocks to the commercial fishery cannot be directly determined because the beginning of the Fraser River pink salmon migration overlaps the end of the local stock migration in Johnstone Strait. After

August 15 the Fraser River stocks predominate in the catches of both areas 12 and 13. As a measure of the relative catch of fish destined to areas other than the Fraser River, however, the available odd-year catches in areas 12 and 13 for the period preceding the nearest week ending August 15 are listed below.

Year	Area 12 (week ending)	Area 13 (week ending)
1951	564,731 (Aug. 18)	148,374 (Aug. 18)
1953	708,660 (Aug. 15)	228,039 (Aug. 15)
1955	513,336 (Aug. 13)	42,276 (Aug. 13)
1957	1,476,630 (Aug. 17)	392,567 (Aug. 17)
1959	421,594 (Aug. 15)	90,832 (Aug. 15)
1961	977,251 (Aug. 19)	116,530 (Aug. 19)

In 1961 the catch in area 12 for the pre-August 15 period was the second highest recorded for the period; this in spite of the extremely low 1959 escapement level of the stocks from the mid-Vancouver Island, Johnstone Strait and Toba Inlet sub-areas. The area 13 catch was fourth highest of the six years presented, almost certainly reflecting the low stock level of the three sub-areas described above.

CONDITION OF STOCKS BY SUB-AREA

The condition of the sub-area pink salmon stocks, as measured by escapement, is listed by stream and by sub-area in Table I and the size of the 1961 sub-area escapement in relation

to both "Total Stream Capacity" and to the 1959 escapement are compared in Table IV.

In comparison to 1959, the composition of the 1961 escapement was basically similar. The only real differences were that significant gains were made in the Johnstone Strait and Bond to Knight sub-areas and that in Area 28, a large gain was made in the Howe Sound escapement but this was offset by a significant decline in the escapement to Burrard Inlet.

A comparison of the 1961 sub-area escapements with the respective sub-area "Total Stream Capacity" figures provides a varied picture.

1. Upper Vancouver Island

The escapement of 23,900 comprised only 26.5 percent of the stream capacity figure of 90,200. The principal odd-year producers, the Keogh and Cluxewe Rivers obtained a total seeding of only 18,500. Consideration should be given to providing local protection to the stocks returning to this sub-area in 1963.

2. Johnstone Strait

Although this area showed an increase of more than 40,000 over the 1959 escapement, only 39.7 percent of capacity was achieved. The increase obtained was largely due to a good return to the Adam River. The possibility of providing additional protection from local exploitation in the vicinity of stream mouths must be considered, with particular reference to the Salmon, Adam and Tsitika Rivers.

3. Mid-Vancouver Island

The stocks indigenous to the mid-Vancouver Island area for both the odd and even year classes are by far the weakest of the study area in relation to "Total Stream Capacity". The principal producers of this sub-area are the Puntledge, Tsolum and Oyster Rivers. The 1961 sub-area escapement totalled only 20,000 as compared to a stream capacity figure of 222,000 which in turn constitutes 10 percent of the over-all study area escapement goal. The stocks of this area as pointed out in the 1962 report, have now reached the point where they are in real danger of elimination. Unfortunately, the fresh water survival in the main spawning streams may now be so adversely affected by the effects of logging, irrigation and a number of miscellaneous factors that it may now be either impossible or impractical to rebuild and to maintain these stocks at a commercially valuable level solely by regulation of the commercial fishery.

To this end, studies have now been initiated by the Fish Culture Development Branch of the Department on the Tsolum River in order to determine the feasibility of improving the spawning and incubation conditions of that system for salmon production.

4. Kingcome Inlet

The stocks to this sub-area returned in fair strength. The main producer of the area is the Wakeman River which obtained an escapement of 35,000.

5. Bond to Knight

The 1961 escapement of 266,200 pink salmon constituted 72.3 percent of capacity and comprised the best total escapement recorded in the 1949-61 period. The only real improvement possible in the escapement to this sub-area would have been to the Kakweiken River and to Waterfall Creek.

6. Loughborough to Bute

While the 1961 escapement of 81,300 is almost identical to the average odd-year escapement for the period 1949-61, it represents only 43.1 percent of the odd-year "Total Stream Capacity". The three major streams of the sub-area, the Apple, Orford and Phillips Rivers, were only moderately seeded.

7. Toba Inlet

The escapement to this sub-area in 1961 totalled only 37,000 and although this is comparable to that of 1959, it represents the lowest recorded odd-year total in the 1949-61 period. In terms of "Total Stream Capacity", the escapement represents only 17 percent of the suggested escapement goal. Unless the survival of this year class has been unusually high, these stocks will require additional protection from exploitation, either local or otherwise, in 1963.

8. Jervis Inlet

The 1961 escapement to the Jervis Inlet sub-area totalled 257,000; virtually identical to that of the brood year and the highest recorded in the 1951-61 period. In

terms of recorded stream capacity this represents 71.8 per cent of the suggested optimum. The only possible improvement would have been a larger escapement to the Deserted River.

9. Howe Sound

The escapement to the Howe Sound streams in 1961 totalled 333,500 and represented by far the best recorded return to this sub-area. Almost the entire strength, however, appeared in the Cheakamus River and the escapement to the Squamish River was actually poor.

10. Burrard Inlet

The escapement of 65,000 pink salmon to the Indian River, the only major pink producer in the sub-area, constituted only 37 percent of capacity and represented a drop of 110,000 fish from the brood year escapement.

In summary, this study area, which extends for a distance of more than 225 miles and which is characterized by the entrance of salmon to its inside waters via both a northern and a southern route, can be readily separated on the basis of relative strength of escapement into three broad divisions. Beginning from the northern end of the area, the respective divisions would be comprised of the following sub-areas:

	SUB-AREA	1961 Escapement in Numbers	1961 Escapement as Percent of Total Stream Capacity
NORTHERN DIVISION	Upper Vancouver Is.	23,900	26.5
	Kingcome Inlet	38,700	76.3
	Bond-Knight	266,200	72.3
CENTRAL DIVISION	Johnstone Strait	71,500	39.7
	Loughborough-Bute	81,300	43.1
	Toba Inlet	37,000	17.0
	Mid-Vancouver Is.	20,200	9.1
SOUTHERN DIVISION	Jervis Inlet	257,000	71.8
	Howe Sound	333,500	100.0
	Burrard Inlet	65,000	37.0

The general picture described is one of relatively strong stocks at either end of the area and relatively weak stocks in the centre.

REASON FOR THE UNBALANCED STATUS OF THE STOCK

In the 1962 report, the probable effects of differential exploitation imposed by the Johnstone Strait fishery in the pink salmon stocks as they migrated southward was discussed at some length. The over-all problem determining the size of individual stocks and affecting the relative balance of the escapement to the study area is dependent, of course, upon a number of additional factors, particularly during the odd-year migration period. The most important of these, in addition to that of differential exploitation would be:

1. The Combined Exploitation of Main Straits and Local Fisheries

In this study area, almost every possible combination

of the above factor exists. The Knight Inlet stocks are not exploited heavily in the main straits fishery but are fished heavily by a local fleet; the Jervis Inlet stocks are exploited heavily by both a Johnstone Strait and Juan de Fuca fishery and then additionally by a local fishery; the Howe Sound and Burrard stocks are not fished locally after being exploited by the very efficient Johnstone Strait and Juan de Fuca fisheries. In the Johnstone Strait sub-area and in portions of Area 13, the "main" fishery is also the "local" fishery.

2. Basic Strength of Individual Stocks

In an area as extensive in range as this study area, incubation conditions, as affected by weather alone can be expected to vary greatly and superimposed upon this is a range in stability of both streambed and flow regime. The Tsolum and Oyster Rivers, for example, in their present state cannot be expected to produce at the same rate as other more stable streams or perhaps even at a comparable rate to their recent past production.

3. Timing

Timing of migration can affect the size of escapement in several ways. A year class of one species may be over-exploited in the course of harvesting a major run of another species; the daily exploitation rate of the fleet at the peak of migration in Johnstone Strait will almost certainly differ from that at either end of the season; a closure to protect

a particular stocks, or as in 1959 an industrial strike, may favour one segment of the total migration.

The factors, therefore, which combine to form a complex control over the size of the relative annual sub-area escapement are varied and a change in any one may significantly alter the end result. Looking at the situation from a practical viewpoint, however, on the basis of the total as well as sub-area 1961 escapements, it would seem obvious that additional protection must be provided in 1963 to differentially increase the escapements to the sub-areas situated in the central portion of the study area; specifically, these are Johnstone Strait, Loughborough-Bute, Toba Inlet and mid-Vancouver Island (See Figure 1). Once again it is emphasized that the stocks of mid-Vancouver Island are in such critical condition that some approach additional to that of increased protection of the stock through regulation must be developed before the escapement level drops even further.

TIMING

1. Pink Salmon

Information on the odd-year timing of individual pink salmon stocks through Both Johnstone Strait and Juan de Fuca Strait is available from the results of the pink salmon tagging program conducted by the participating agencies of the Pink Salmon Co-ordinating Committee, appointed pursuant to Article VI of the pink salmon protocol between Canada and the United States. Although the analysis of the various data

is virtually complete certain of the calculations are not yet finalized and are still subject to minor revision.

(a) Johnstone Strait

The timing of stocks destined to individual areas is shown graphically in Figures 3 and 4 and the total non-Fraser and Fraser timing comparison is illustrated in Figure 5. The most significant factor which emerges from the timing data is that in 1959 there were virtually no significant numbers of Fraser River pink salmon present until after the week ending August 15 and that non-Fraser stocks actually outnumbered the Fraser River stocks during the week ending August 22. Following that period Fraser River pink salmon predominated in the main Johnstone Strait area.

(b) Juan de Fuca

The 1959 studies indicated that the Canada non-Fraser pink salmon stocks demonstrated a peak of availability to the Canadian Juan de Fuca fishery near mid-August. Results of tagging indicate the following approximate timing peaks in that area:

(i) Howe Sound - August 4

(ii) Burrard Inlet - August 10

(iii) Jervis Inlet - August 12

(iv) Miscellaneous stocks north of Jervis Inlet - August 18

In the Juan de Fuca area the Canadian non-Fraser

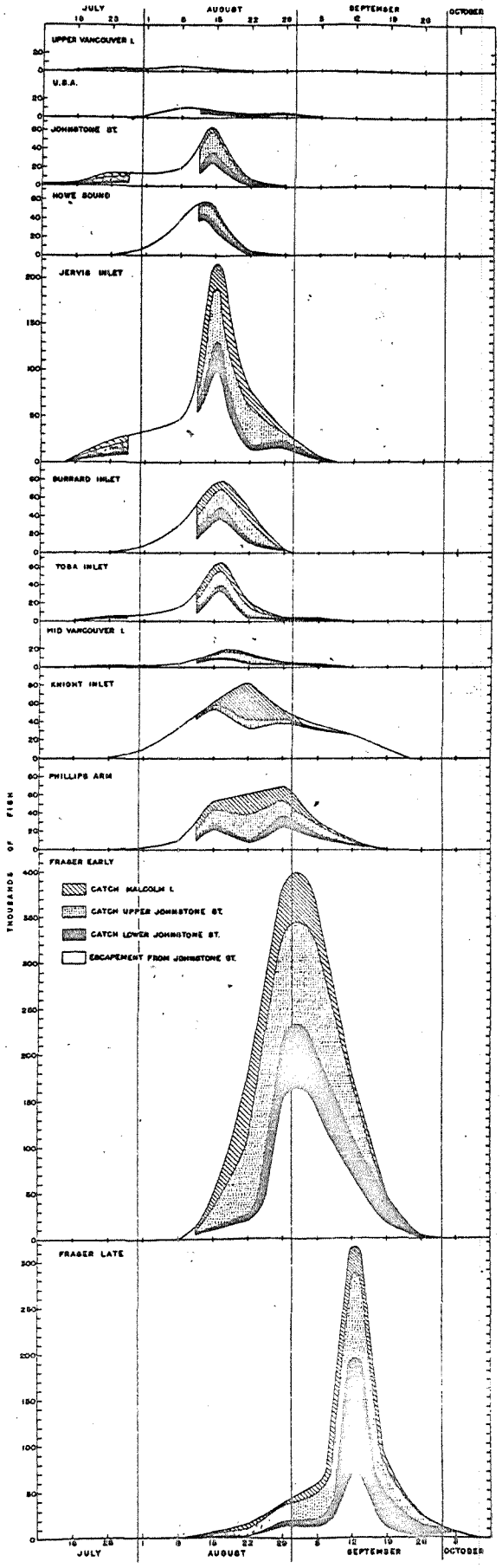


Fig. 3. Times of passage of the stocks of pink salmon through Johnstone Strait in 1959, showing weekly the abundance of the total run, the escapement and the catch in the Malcolm Island and Upper and Lower Johnstone Strait fisheries.

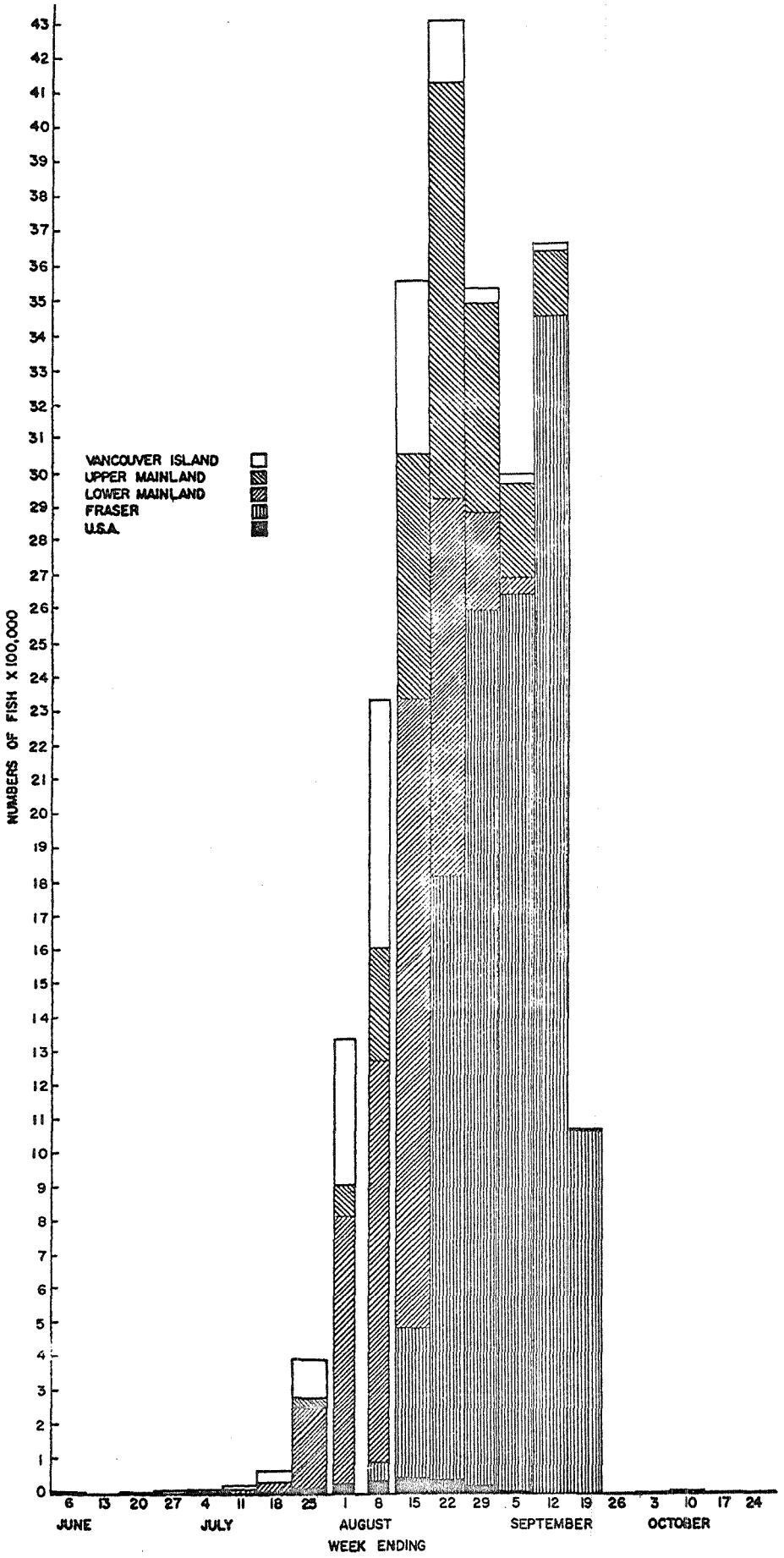


Fig. 4. Weekly contributions of pink salmon spawning in 5 major regions in the study area to the 1959 Johnstone Strait fishery.

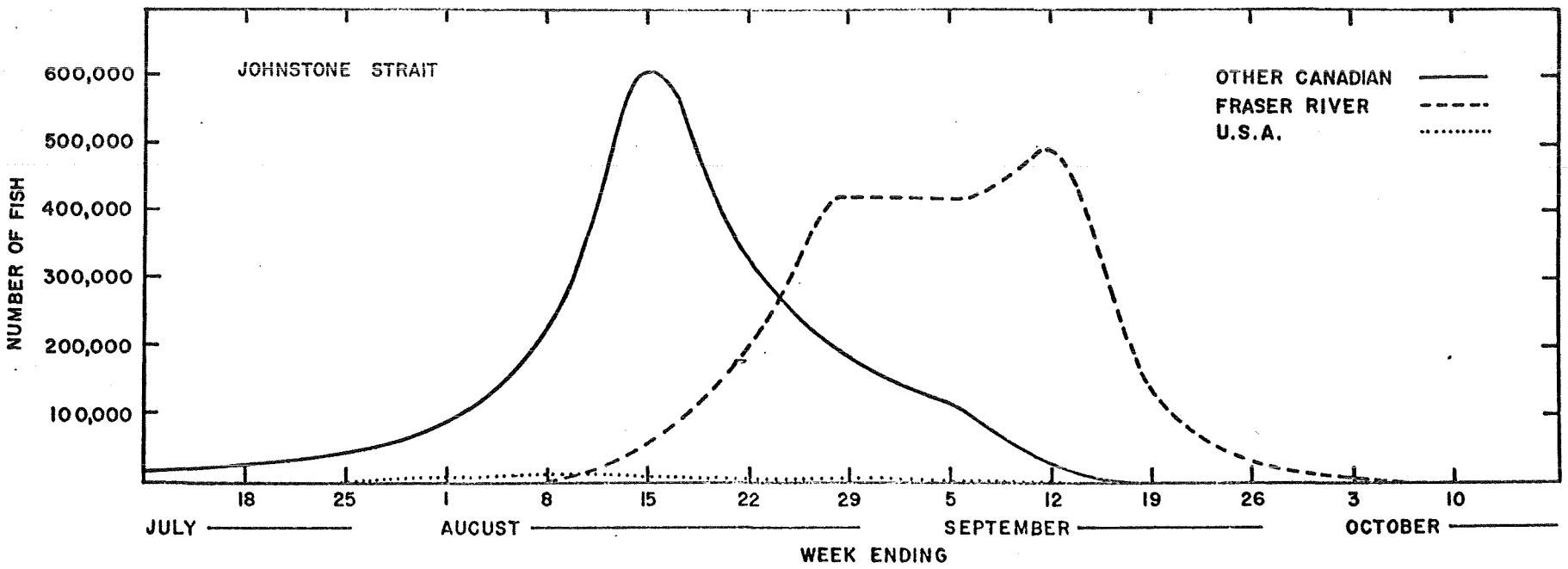


Fig. 5 Timing of pink salmon runs to Canadian streams (other than the Fraser), to United States streams and to the Fraser River through the Johnstone Strait fishery in 1959.

stocks were present in strength until August 22; the Fraser River stocks predominated from that time until the end of migration in late September. The early and late Fraser River stocks demonstrated peak periods of abundance in the Juan de Fuca area during the weeks ending August 29 and September 12, respectively.

2. Sockeye

The timing of the sockeye salmon migration through the Johnstone Strait area will be of particular importance during 1963. This will be the year of the dominant Chilko River cycle and as indicated in Figure 6, the timing exhibited by the 1959 brood in Johnstone Strait coincided closely with that of the 1959 non-Fraser pink salmon. As shown by the figure, however, this stock was actually present in Johnstone Strait in real abundance in only one of the last three cycle years.

THE ANTICIPATED RETURN - 1963

In order to provide additional background information on which to stage a basic fishing pattern during the 1963 pink salmon season, a calculation has been made to pre-determine the general magnitude of the non-Fraser River pink salmon return which can be expected in the Johnstone Strait area in 1963. Data on which to base calculations of return to this area are restricted to those available from the 1959 tagging results because in only that year are there separate figures available

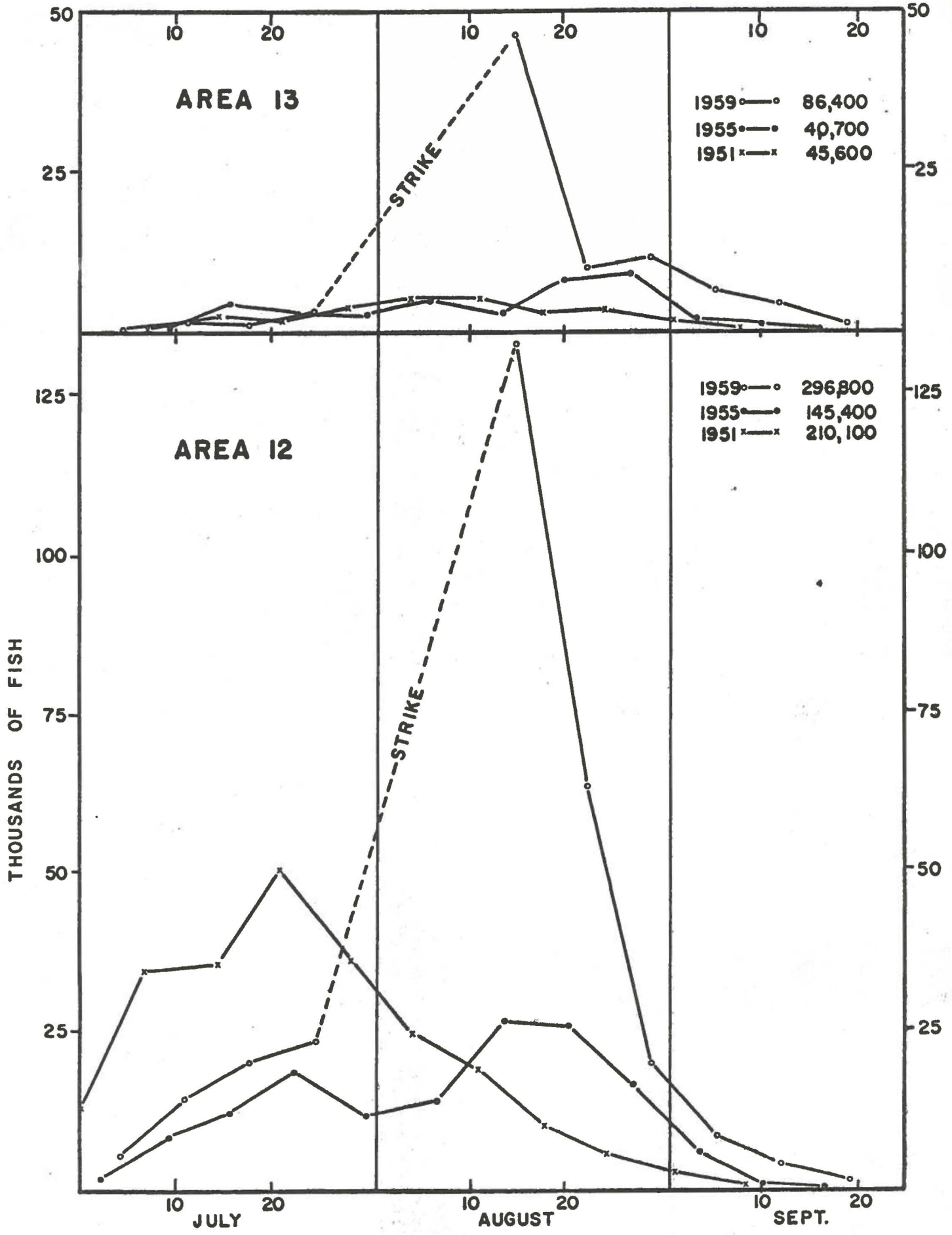


Figure 6. Weekly catches of sockeye salmon in Areas 12 & 13 in the years 1951, 1955, and 1959.

on the contribution made to the fishery by the Fraser and the combined non-Fraser pink salmon stocks.

The 1957 study area escapement according to the B. C. 16 spawning reports totalled 1,078,000. This escapement produced in 1959:

1. a catch along the Johnstone Strait route of 984,100
2. an escapement via the Johnstone Strait route of 664,400
3. a catch along the Juan de Fuca route of 330,700
4. an escapement via the Juan de Fuca route of 246,200
5. a total non-Fraser escapement (B. C. 16) of 1,108,200

for a total stock (catch plus B. C. 16 escapement) of 2,387,000 and a ratio of return of 2.2:1.

The 1959 escapement of 1,108,200 (B. C. 16) in turn produced a 1961 escapement of 1,194,300, 7.8 percent higher than that of 1961, plus an unknown contribution to the commercial fishery. Now, if the assumptions are made that the percentage of pink salmon approaching the home spawning areas utilize the two major entrances in the same proportion as in 1961; and on the basis that the ratio of return will be of the same order as that which produced the 1959 return, the total stock returning in 1963 would total 2,627,000 and the abundance in both areas would be 7.8 percent higher than in 1961.

In appraisal of the assumptions described above:

1. that the proportion of the total non-Fraser run utilizing the two routes in 1963 will be similar to that of 1961:
   (a) as described in Table IV, the 1959 and 1961

escapements were virtually identical both in total size and in regional composition. The only significant sub-area differences were these:

(i) Upper Vancouver Island - down 32,000 in 1961

(ii) Johnstone Strait - up 43,000

(iii) Howe Sound - up 178,000

(iv) Burrard Inlet - down 110,000

(b) further to this, if it is assumed that the sub-area percentages of pink salmon entering the area through both Johnstone Strait and Juan de Fuca Strait in 1961 were the same as those calculated for 1959, it can be calculated that 75.5 percent of the escapement portion of the total study area stock would have entered via the Johnstone Strait route in both years. This is presented simply to emphasize the similarity in the regional escapement composition for the study area as a whole in those two years.

2. that the ratio of return from the 1961 spawning will be similar to that which produced the 1959 return:

because of the fact that the contribution to the fishery by the Fraser and combined non-Fraser stocks was separated in 1959 only, there is no other measure on the expected rate of return available. By comparison to other areas, however, and also by comparison to the even-year Johnstone Strait pink

salmon rate of return, which has averaged 2.8:1, the 2.2:1 ratio would at least appear to be minimal. Additionally, spawning and incubation conditions for the area as a unit were not unfavourable.

The best estimate on the strength of return which emerges from the over-all analysis of the information available is that the total study area return will approximate 2.6 million. This would represent an increase over that of 1961 of 7.8 percent. Additionally, the regional composition of the brood stock for 1963 is virtually identical to that which produced the 1961 return and this is presented as an indication that the proportion of the total stock entering the area via Johnstone Strait will approximate that of 1961.

SUGGESTED FISHING PATTERN

In determining a suitable basic fishing pattern for this study area during the 1963 pink salmon season, a number of factors must be considered:

1. the best estimate on the size of the expected return indicates that it will be of the same magnitude and of similar composition to that of 1961. If the 1961 fishing pattern were adopted, therefore, an escapement pattern similar to that of 1961 should logically develop. This would not be a satisfactory situation for the reasons, as described previously, which are summarized below:
   (a) the 1961 escapement represented only 53 percent of the

"Total Stream Capacity" goal.

(b) 60 percent of the 1961 escapement was accommodated in only three streams.

(c) the stocks indigenous to streams located in Areas 13, 14 and 15, with special emphasis on those of Area 14, require additional protection.

(d) certain of the main straits streams apparently require local boundary protection.

In summary, virtually all streams situated between Knight Inlet and Jervis Inlet require protection additional to that provided in recent years.

2. the abundance and timing of the 1963 sockeye migration through Johnstone Strait.

3. the timing in Johnstone Strait of pink salmon destined to the Fraser River. As described previously, if the 1961 migration timing closely approximates that of 1959, there will be virtually no Fraser River pink salmon in the area during the current year until after the week ending August 17.

4. the strength of the Jervis Inlet and Howe Sound stocks. The stocks destined for both of these areas will probably be exploited heavily by both the Johnstone Strait and Juan de Fuca fisheries but during the past two cycles the Jervis stock has also been able to withstand some additional local exploitation. Enumeration of the fry output from the 1961 Cheakamus River escapement indicated a high survival rate and the possibility that this stock may require a degree of

local exploitation must also be considered.

In order to most effectively manage the stocks destined to and passing through the Johnstone Strait area in 1963, the regulation of the fishery should be so designed that the stocks of Area 12 and the stocks destined to areas from Jervis Inlet and south are utilized to optimum and yet conversely, that the stocks destined to Areas 13, 14 and 15 be provided sufficient protection to permit a significant degree of rehabilitation.

In 1961, as shown in Figure 7, the basic fishing pattern during the pink salmon migration, for both Areas 12 and 13, approximated a 3-day week although a 4-day week was permitted during the early season up until the week ending July 29 and a 2-day week was imposed in Area 13 for the week ending August 19. Although the escapement pattern which resulted from the 1961 regulations was not balanced, the over-all degree of exploitation would appear to have been within a satisfactory range. On the assumption that the 1963 stock will be similar in size and composition to that of 1961 and in order to provide a better balance in the escapement, the following fishing pattern has been developed for consideration;

Area 12

1. a 4-day fishing week until and including the week ending July 20.
2. a 3-day fishing week for the subsequent 4 weeks, until the week ending August 17.

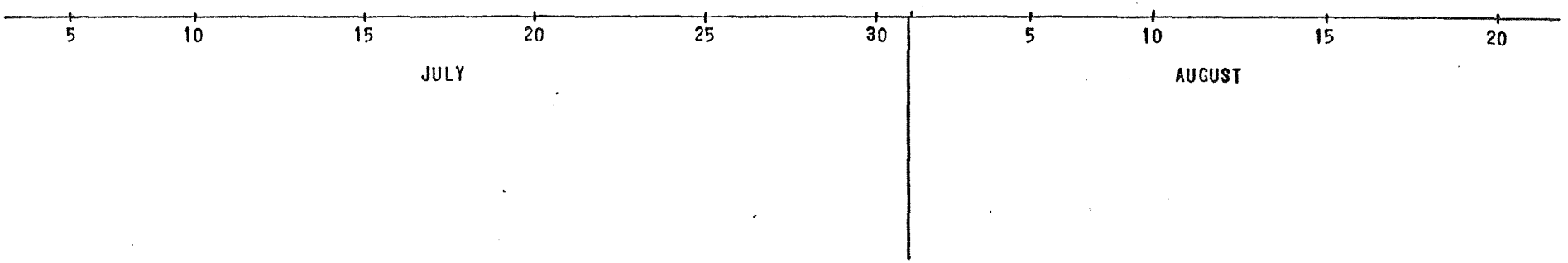
3. immediately following this date, the fishing pattern will be governed by the strength of the pink salmon stocks destined to the Fraser River.

As shown in Figure 6, the fishing pattern described above would represent a reduction in fishing time of one day over that of 1961. In 1961, the elimination of that day, specifically July 27, would have reduced the total Area 12 catch for the period July 10 to August 16 by 22,900 or 2.8 percent.

Area 13

1. a 4-day fishing week until and including the week ending July 20.
2. a closure to all salmon net fishing for the subsequent 4 weeks until the week ending August 17.
3. immediately following this date the fishing pattern will be governed by the strength of pink salmon stocks destined to the Fraser River.

This action will meet the requirement of reducing the differential exploitation by the fishery on stocks passing through Johnstone Strait and destined to streams located south of Area 12. The result should be a significant increase in the escapement to Areas 13, 14 and 15. Additionally, of course, this closure will not significantly affect the exploitation in Area 13 of stocks destined for the Fraser River. In 1961, such a fishing pattern, according to the migration timing established in 1959, would have reduced the total study area pink salmon catch of 1,724,000 by only 107,000 pieces or 6.2 percent. In



THE 1961 FISHING PATTERN AND THE DAILY NET CATCHES

		1,329	1,865	1,775	1,717				7,099	8,590	10,797	8,643			27,653	23,574	26,215	22,911			58,170	43,614	46,432		70,527	46,718	47,196				162,805	113,343	86,935		TOTAL
8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
		1,400	2,000	1,900	1,900				7,700	9,300	11,600	9,300			29,800	25,400	28,300				62,700	47,000	50,100		76,000	50,400	50,900				175,500	122,200	93,700		TOTAL
																																							857,100

THE 1963 PROPOSED FISHING PATTERN AND THE ANTICIPATED DAILY NET CATCHES

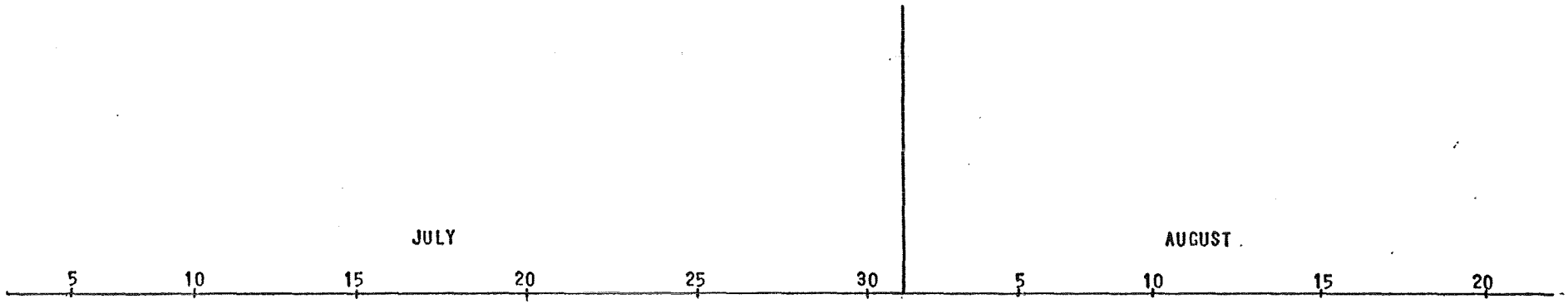


FIGURE 7. THE AREA 12 FISHING PATTERN AND DAILY PINK SALMON CATCHES IN 1961 AND THE PROPOSED FISHING PATTERN AND ANTICIPATED DAILY PINK SALMON CATCHES IN 1963 DURING THE PERIOD JULY 8 TO AUGUST 16.

terms of escapement south of Area 12, however, this action would have represented an increase of 13.2 percent.

Area 14

In order to complement the action taken in Areas 12 and 13:

1. closure to salmon net fishing from 6.00 P.M., July 21 until 6:00 P.M., September 15.

Area 15

For the protection of pink salmon:

1. closure to all net fishing inside Brettel Point at 6:00 P.M., August 4 and continuing until pink salmon clear the commercial fishing areas.

Areas 16 and 28

Suggest fishing times for both areas be determined on conditions which develop during the season.

SUMMARY

The status of the odd-year pink salmon stocks originating from the Johnstone Strait study area have been described in terms of the available past catch and escapement data. The analysis indicates that although the 1961 total escapement was the highest recorded in the 1951-61 period, 60 percent of the spawning stock was accommodated in three streams and that because of this the over-all escapement was not well balanced. The region in which the low escapements were recorded is situated between Knight and Jervis Inlets and includes the sub-areas of

Johnstone Strait, Loughborough to Bute, Toba Inlet, and mid-Vancouver Island.

The analysis indicated also that the best estimate on the size of the 1963 return would be 2.6 million, 7.8 percent higher than the total stock of 1961. The regional composition of the brood stock for 1963 is virtually identical to that which produced the 1961 return and the relative regional strength of the 1963 return is expected to parallel that of 1961.

A fishing pattern has been developed for the 1963 pink salmon season. The pattern has been designed in an attempt to allow maximum utilization of the stocks destined to Area 12 and to areas from Jervis Inlet south and at the same time to permit significant rebuilding of stocks destined to Areas 13, 14 and 15.