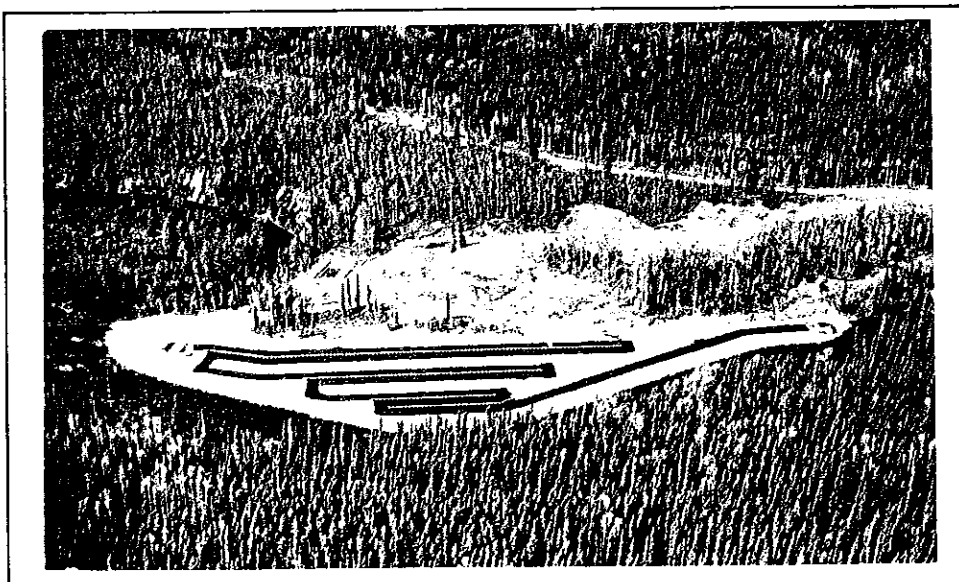


Skeena River Salmon Management Committee

Annual Report 1969

Technical Report No. PAC/T-75-17

Northern Operations Branch
Pacific Region



SKEENA RIVER SALMON MANAGEMENT COMMITTEE

ANNUAL REPORT 1969

Technical Report PAC/T-75-17

6

Canada

Department of the Environment

Fisheries Service

Pacific Region

SKEENA RIVER SALMON MANAGEMENT COMMITTEE

1969

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TERMS OF REFERENCE

The Skeena River Salmon Management Committee was established by the Minister of Fisheries in 1954 to:

- (1) Investigate the condition of the Skeena River salmon stocks,
- (2) Improve the management of the stocks, and
- (3) Increase the annual yield, if possible.

The Minister of Fisheries also appoints an Advisory Board to the Committee, made up of representatives drawn from concerned sectors of the B. C. fishing industry. The Advisory Board's purpose is to comment on the progress of investigations and advise on regulation of the fishery.

A list of present appointees and their affiliations are given on the title page of this report. All 1968 Advisory Board incumbents were re-appointed excepting Mr. H. Barton, who retired, and Mr. J. Stephens, who resigned. Mr. Stephen's position remains vacant.

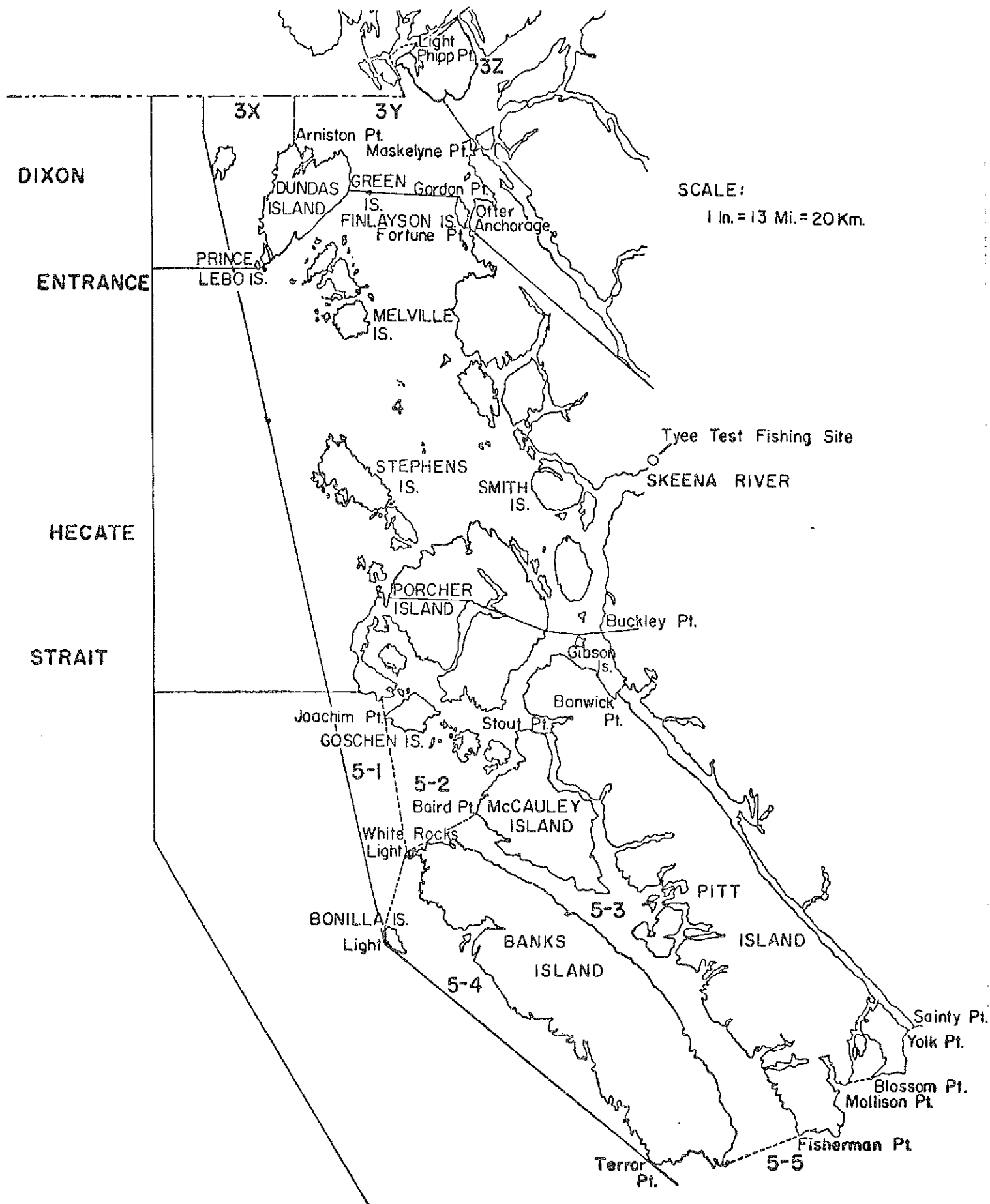


Figure 1. Boundaries of statistical areas

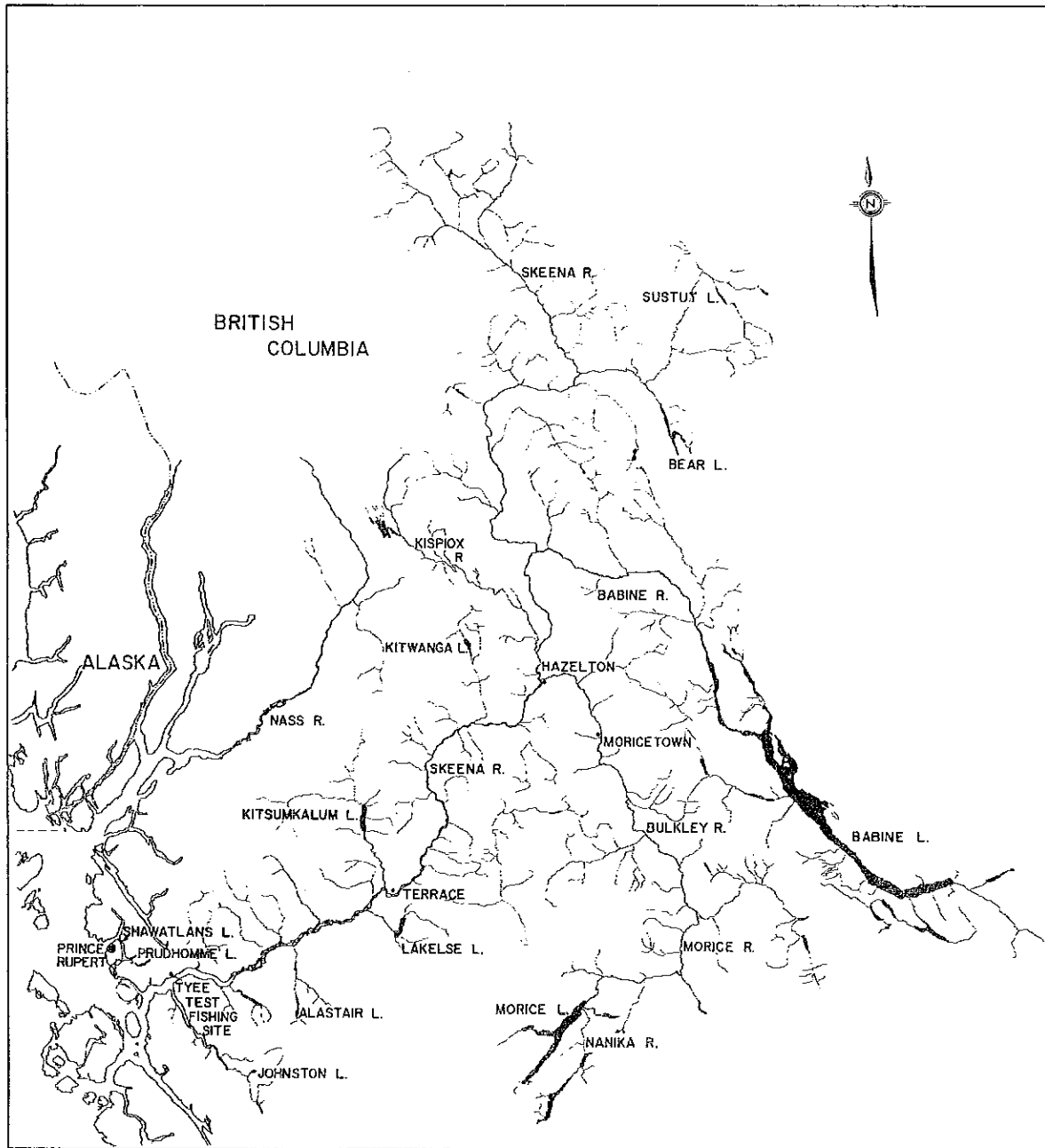


Figure 2. Skeena River Drainage Area.

RECORD OF MEETINGS

The Committee met in Vancouver on December 18, 1968, to;

- (1) review estimates of the size of the 1969 pink and sockeye runs to the Skeena River system, and
- (2) formulate appropriate regulations of the industry.

The best estimate of the 1969 sockeye run was 1,200,000 fish. This forecast was based on the size of the 1964 and 1965 spawning escapements (866,232 and 644,710 fish respectively), the number of 4_2 's¹ in 1964 (250,000 fish), the average adult return per parent spawner (1.25), the average ratio of return for 4- and 5-year-old sockeye produced from their brood escapements (1:1), and smolt-to-adult survival rate (0.04).

The best estimate of the 1969 pink run was 1,700,000 fish. This was based on the size of the 1967 escapement (563,000 fish), the 10 year average adult return per odd-year parent (3.0), and the 1965 egg-to-fry survival (average).

¹ Gilbert System - eg. 4_2 is 4 year old fish, going to sea in its second year.

The optimum escapement for sockeye, including 250,000 fish required to fill the Babine Lake spawning channels in operation in 1969, was estimated to be 1,050,000 fish. This would have limited catch to only 150,000 fish. The Committee therefore recommended a total Skeena escapement of 800,000 sockeye in 1969.

The optimum and recommended escapement for pink salmon was estimated to be 1,000,000 fish.

In order to achieve the desired catches of 400,000 sockeye and 700,000 pinks, the Committee recommended that fishing be permitted for 1½ days per week throughout the season.

Details of the proposed regulations were issued in a general release on January 10, 1969 (Appendix 1).

The Committee then met with its Advisory Board in Prince Rupert, B. C., on February 19 and 20, 1969. After considering representations made by the Board (with particular reference to the anticipated poor returns of salmon to the northern and central regions of British Columbia), the Committee reduced the escapement goal to 700,000 sockeye for 1969, with the proviso that this goal would be increased to 800,000 before an increase in commercial catch is provided, should the run be greater than expected.

The proposed regulations were altered to permit two days' fishing per week for the first six weeks of the season when sockeye predominate in the fishery, 1½ days per week for the following three weeks, and four days per week for the remainder of the season.

The Committee also stated that the closed period for any week or series of weeks would be increased if the proposed closures were deemed insufficient to provide adequate escapement of salmon, or decreased if the run was far larger than expected.

A final release was issued on May 21, 1969, outlining the 1969 regulations (Appendix 2).

THE 1969 SKEENA SALMON FISHERY

The 1969 Skeena sockeye run totalled 1,317,000 fish, which was 10% greater than expected. The escapement was 704,000 sockeye (including 38,000 taken in the native food fishery), which was 0.6% more than predicted. The catch was 613,000 sockeye, or 23% greater than forecast.

Age Analysis of 1969 Skeena Sockeye Stocks

	4 ₂ 's		5 ₂ 's		Other		Total
	Number	%	Number	%	Number	%	
Catch	310,000	50	267,000	44	36,000	6	613,000
Escape- ment	467,000	66	222,000	32	15,000	2	704,000
Total	777,000	59	489,000	37	51,000	4	1,317,000

The adult return from the 1964 brood year (866,000 spawners) totalled 694,000 sockeye (206,000 adults returned in 1968 as 4₂'s), or 0.8 returning adult per parent spawner.

The 1969 Skeena pink salmon run totalled 1,273,000 fish, which was 25% lower than predicted. Escapement was 901,000, which was 10% lower than expected. Catch was 372,000 pinks, 47% lower than forecast. The adult return per 1967 spawner (581,000) was 2.2.

Pre-season regulations (Appendix 2) were followed until July 27 and after August 24. Catches and escapement

to July 27 were greater than expected; consequently, the open period was increased by $1\frac{1}{2}$ days ($3\frac{1}{2}$ days total) for the next week. However, the escapement for the week was less than required, so the open period during the week ending August 2 was reduced to 1 day to compensate. During the week ending August 10, fishing was permitted for 3 days, the week following for 38 hr. (6 p.m. Tuesday to 8 a.m. Thursday). To conserve pink salmon, a complete closure was imposed during the week ending August 24.

Weekly fishery history for sockeyes and pinks is summarized in Figure 3. Total catches over the past years for all 5 species of salmon are listed in Table 1 and Figures 4 and 5. Tables 2 and 3 list the annual sockeye and pink escapements.

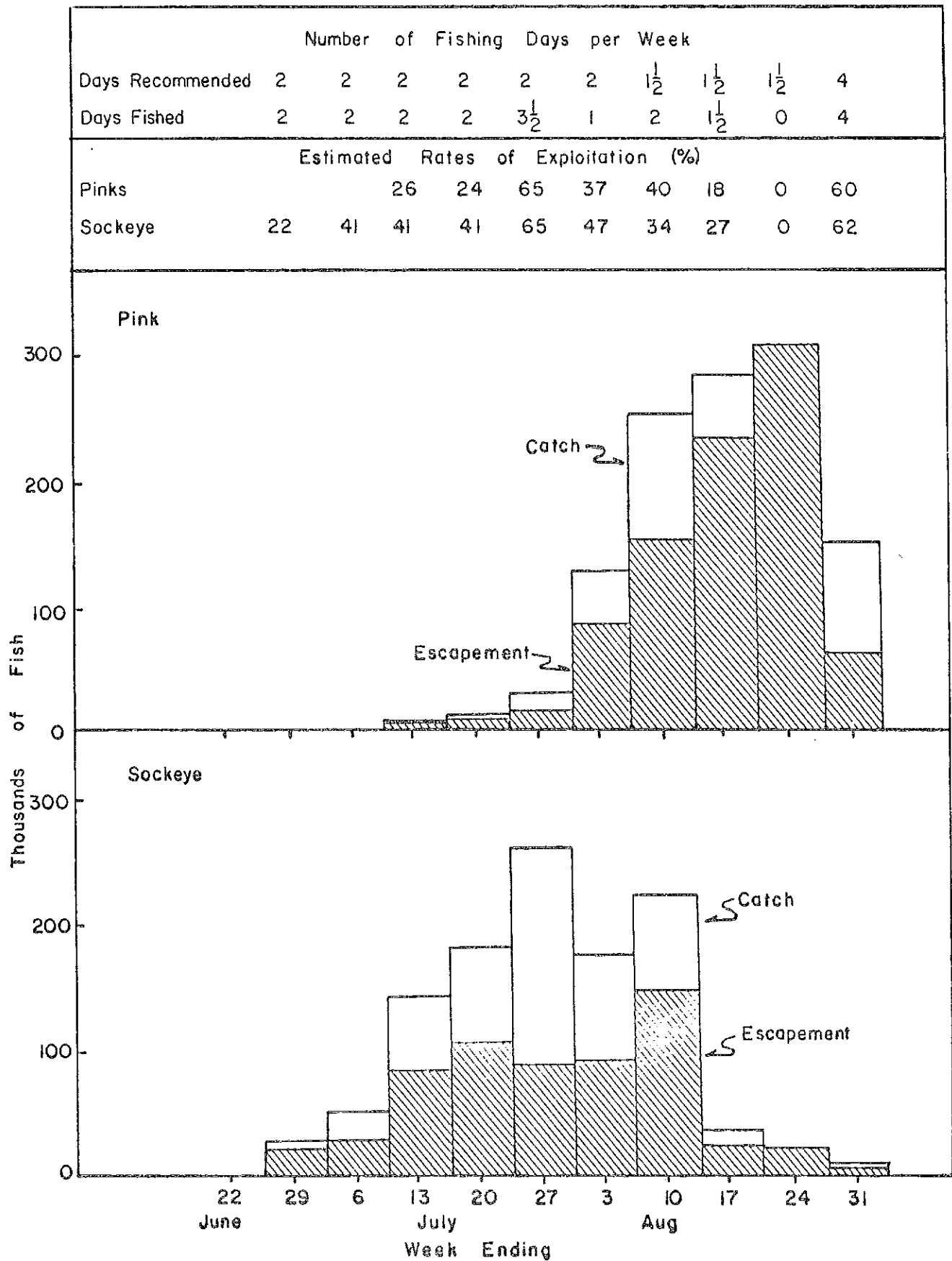


FIGURE 3. Weekly Sockeye and Pink Catches and Escapements—1969

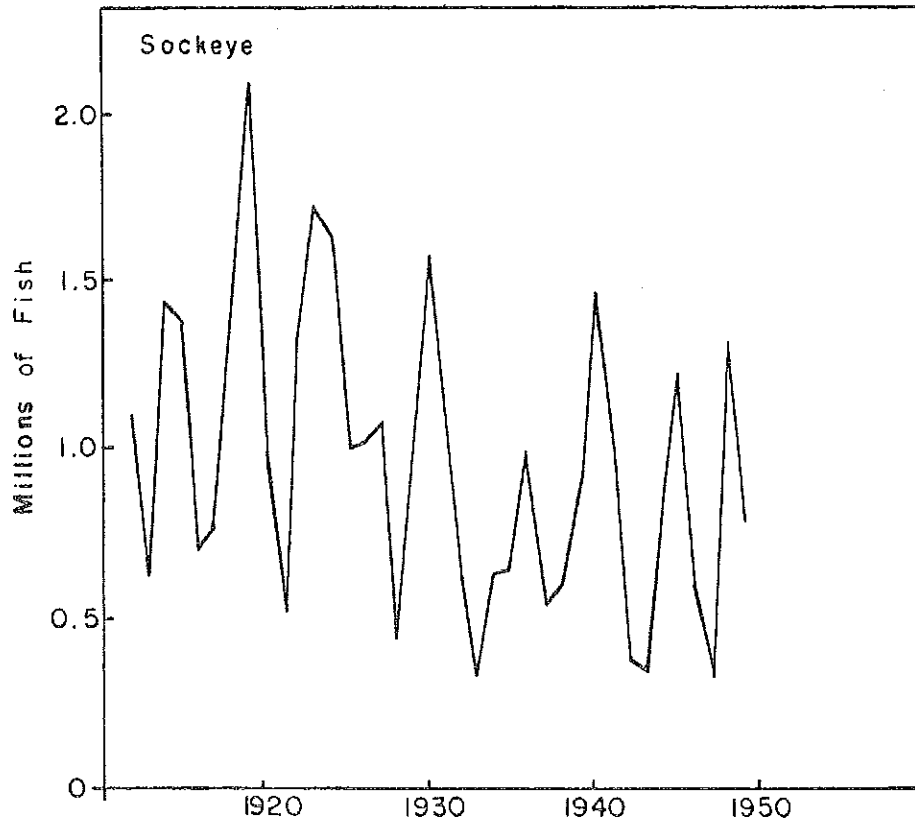


Figure 4. Annual Catch of Sockeye in Area 4 From Pack and Sampling Data 1912-1949.

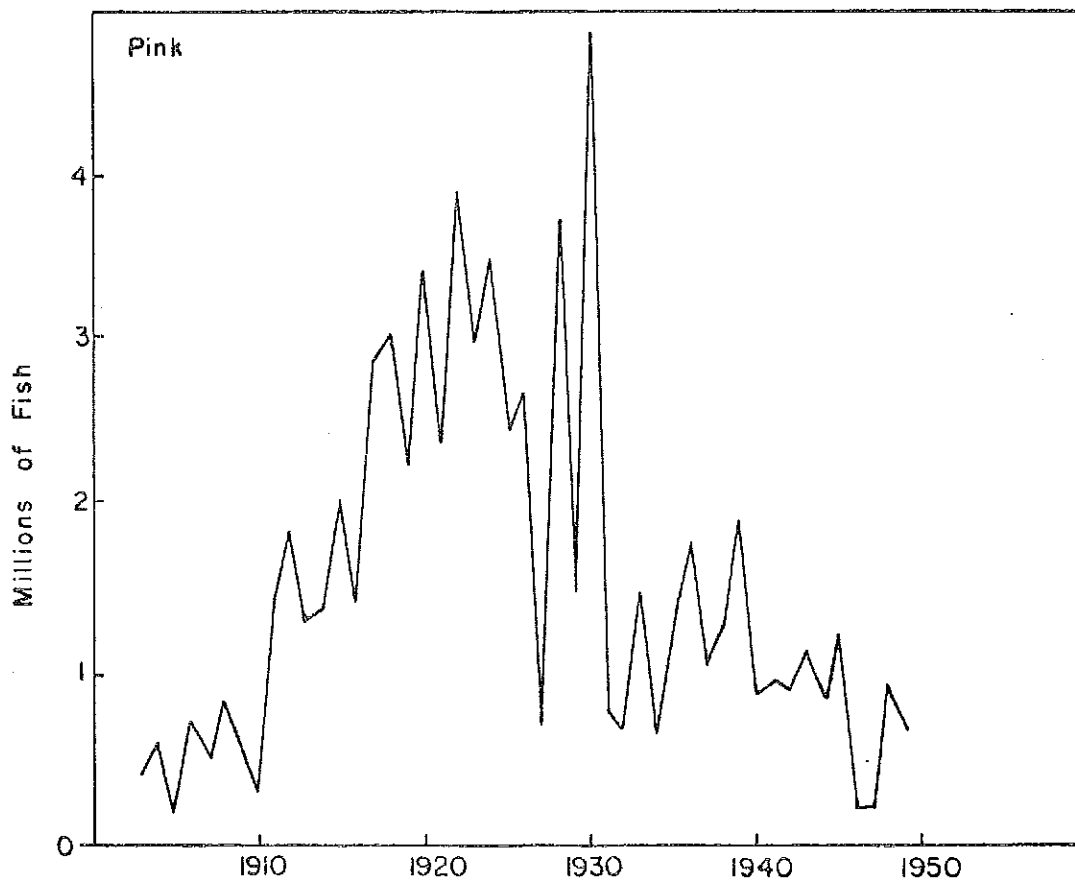


Figure 5. Annual Catch of Pink Salmon in Area 4 From Pack and Sampling Data 1903-1949

Table 1. Salmon catches in Area 4, 1950-1969 (from
B. C. Catch Statistics by Area and
Type of Gear).

Year	Sockeye	Coho	Pinks	Chums	Chinooks
(thousands of fish)					
1950	531	59	394	84	15
1951	692	212	452	70	34
1952	129	150	1451	38	52
1953	659	89	426	56	35
1954	572	179	739	121	34
1955	157	143	1330	30	26
1956	149	121	416	51	29
1957	282	99	2342	36	22
1958	602	88	901	44	36
1959	196	87	577	32	34
1960	186	60	170	21	36
1961	895	61	1054	27	19
1962	484	147	580	22	28
1963	142	123	491	27	25
1964	766	184	965	38	50
1965	294	134	150	8	37
1966	593	291	108 1046	37	48
1967	104	81	420	27	56
1968	781	241	413	45	56
1969	540	71	372	17	41

Table 2. Sockeye Escapements from Area 4

	10-Year Average 1950-1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
Babine Fence	448,980	262,719	941,711	548,000	588,000	827,487 ¹	580,000	389,000	603,000	552,000	660,000
Babine Indian Catch	24,640	16,754	32,304	18,122	20,021	19,855	18,540	21,312	18,992	19,146	17,263
Babine spawning escapement	424,340 242,540	245,965	909,407	529,878	567,979	807,632	561,460	367,688	584,008	532,854	642,737
Alastair Lake	24,085	15,000	14,250	15,000	5,000	8,000	5,000	8,450	8,000	7,500	1,500
Kitsungallum Lake	4,125	2,000	1,750	2,000	N.R.	4,000	3,000	2,700	3,000	2,700	1,500
Lakelse Lake	8,680	6,000	5,170	13,000	12,000	20,500	33,300	15,081	13,800	15,000	6,500
Kitwanga Lake	3,850	1,000	200	N.R.	N.R.	200	400	200	-	200	N.R.
McDonnell Lake	2,630	600	750	500	N.R.	400	3,000	4,000	200	2,500	1,000
Morice Lake	24,483	3,300	13,500	8,500	2,000	10,000	20,500	6,800	4,600	3,800	3,300
Kispiox Lake	4,650	5,000	5,000	3,000	3,500	3,500	2,000	3,000	5,000	3,000	4,000
Bear Lake	9,058	5,000	1,400	1,500	2,000	3,500	7,000	900	950	2,800	N.R.
Sustut Lake	1,000	500	800	1,500	1,000	1,500	2,000	50	50	500	N.R.
Total spawning escapement above test fishing	507,533	284,365	952,227	574,878	593,479	859,232	637,660	408,869	619,608	570,854	660,537
Total Indian catch above test fishing	41,437	28,808	46,584	29,924	38,687	39,248	35,839	39,412	37,292	36,446	31,763
Total escapement above test fishing	548,970	313,173	998,811	604,802	632,166	898,480	673,499	448,281	656,900	607,300	692,300
Shawatlan Lake	3,120	3,500	3,500	3,500	3,500	3,500	3,500	2,000	3,500	1,500	2,000
Prudhomme Lake	5,375	3,500	7,500	3,500	7,500	3,500	3,500	1,500	4,500	3,500	3,500
Johnson Lake	838	100	50	-	-	-	50	50	750	750	500
Total spawning escapement below test fishing	9,333	7,100	11,050	7,000	11,000	7,000	7,050	3,550	8,750	5,750	6,000
Total Indian catch below test fishing	412	390	1,400	1,010	8,800	300	2,653	1,768	1,859	6,950	5,756
Total escapement below test fishing	9,745	7,490	12,450	8,010	19,800	7,300	9,703	5,318	10,609	12,700	11,756
Total spawning escapement	516,866	291,465	963,277	581,878	604,479	866,232	644,710	412,419	628,358	576,604	666,537
Total Indian catch	41,850	29,198	47,984	30,934	47,487	39,548	38,492	41,180	39,151	43,396	37,519
Total escapement	558,716	320,663	1,011,261	612,812	651,966	905,780	683,202	453,599	667,509	620,000	704,056

¹ Estimate

TABLE 3. SKEENA RIVER PINK SALMON ESCAPEMENTS

	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
								(thousands)							
Lakelse River	175	75	140	262	185	122	325	635	505	1321	835	397	236	1112	368
Kispiox River	540	75	360	66	650	45	280	50	32	8	23	2	74	5	180
Skeena River	10	5	50	50	150	10	450	37	40	200	120	76	90	111	21
Kitwanga River	125	35	160	158	250	27	100	65	170	50	47	90	100	175	190
Sabine River	5	3	27	10	77	7	75	40	93	24	69	46	44	90	90
Bear River	6	-	15	-	20	-	5	-	15	-	2	-	-	-	-
Bulkley River	7	1	1	1	5	1	24	4	35	2	34	2	4	+	3
Other	112	9	112	9	49	4	76	4	10	6	166	10	17	61	21
Total above test fishing	980	203	865	556	1386	216	1335	835	900	1611	1296	633	565	1554	873
Coastal	78	75	105	116	95	45	99	165	128	no data	45	3	16	179	28
TOTAL	1058	278	970	672	1481	261	1434	1000	1028	1611+	1341	636	581	1733	901

INVESTIGATIONS AND FISH CULTURAL PROJECTS

MIGRATION OF ADULTS

A co-operative study of sockeye spawning migration rates and routes was initiated in Area 4 in 1969. Sockeye were sonic-tagged and tracked in Chatham Sound by Fisheries Research Board and University of Wisconsin personnel, in Skeena River by Resource Development personnel, and in Babine Lake by Fisheries Research Board personnel.

ESCAPEMENT FROM AREA 4

Sockeye

Test-fishing was used to estimate daily escapement from the fishing area. In 1966, the test-fishing operation was decreased to one fisherman instead of two. This eliminated the previous problem of individual variation in catch efficiency, but required calculation of a new test-fishing index (use of the old index had over-estimated escapements by up to 40% in 1966-1968). Linear regression analysis of weekly test-fishing catches (x) against weekly escapements (y) over the 1966-1968 seasons gave a new conversion equation of $y = 612x - 187.5$. This gave a reasonably close (13% underestimate) escapement estimate of 611,000 sockeye in 1969. A new regression equation will be calculated

annually, as more data becomes available.

An echo-sounding program continued in 1969 in conjunction with the test-fishing. When complete, this program should produce another index of abundance of both pink and sockeye stocks.

Pink

Test-fishing catches of pinks are multiplied by a constant of 1000 to estimate escapement. In 1969, the estimated escapement was 917,000 pinks, which was a 2% overestimate of the true escapement.

ESCAPEMENT ABOVE TEST-FISHING

Sockeye

1. Babine System

Babine Lake (Figure 6) has in recent years contributed approximately 90% of the total Skeena stock. Total escapement in 1969 to this major spawning and rearing area was estimated at 660,000 sockeye, or 94% of the total Skeena escapement (see also Table 2).

Babine escapement is monitored at a counting fence which has operated since 1946 (see Table 4 for annual counts of all species). In 1969, the fence was installed on July 15

and 634,000 adult sockeye passed through the fence during the season. An additional 16,000 were estimated to have entered the lake before the fence was installed. Also, 154,000 'jacks' (3_2 sockeye) were counted. The return of jacks has exceeded 100,000 fish only 5 times since 1946.

At the peak of the run (July 20-August 4), sockeye were abnormally delayed 1-2 wk. in the section between the test-fishing area and the counting fence. (Fig. 7). No precedent exists. Discharges during this period were abnormally low in both the Skeena and Babine Rivers, and may explain this delay.

2. Nanika System

The Nanika River sockeye escapement suffered a drastic decline in 1954-1959, probably due to a native food fishery operating at a point of difficult ascent (Hagwilget Canyon). This obstacle was removed in 1959, and a hatchery program was initiated in 1960. An incubation channel was added to the hatchery facility in 1964. The operation of both the hatchery and the channel was discontinued in 1966, pending evaluation of the contribution made to adult returns by these facilities.

The 1969 escapement to the spawning grounds totalled 3,200 sockeye, of which 90% had spent 2 years in

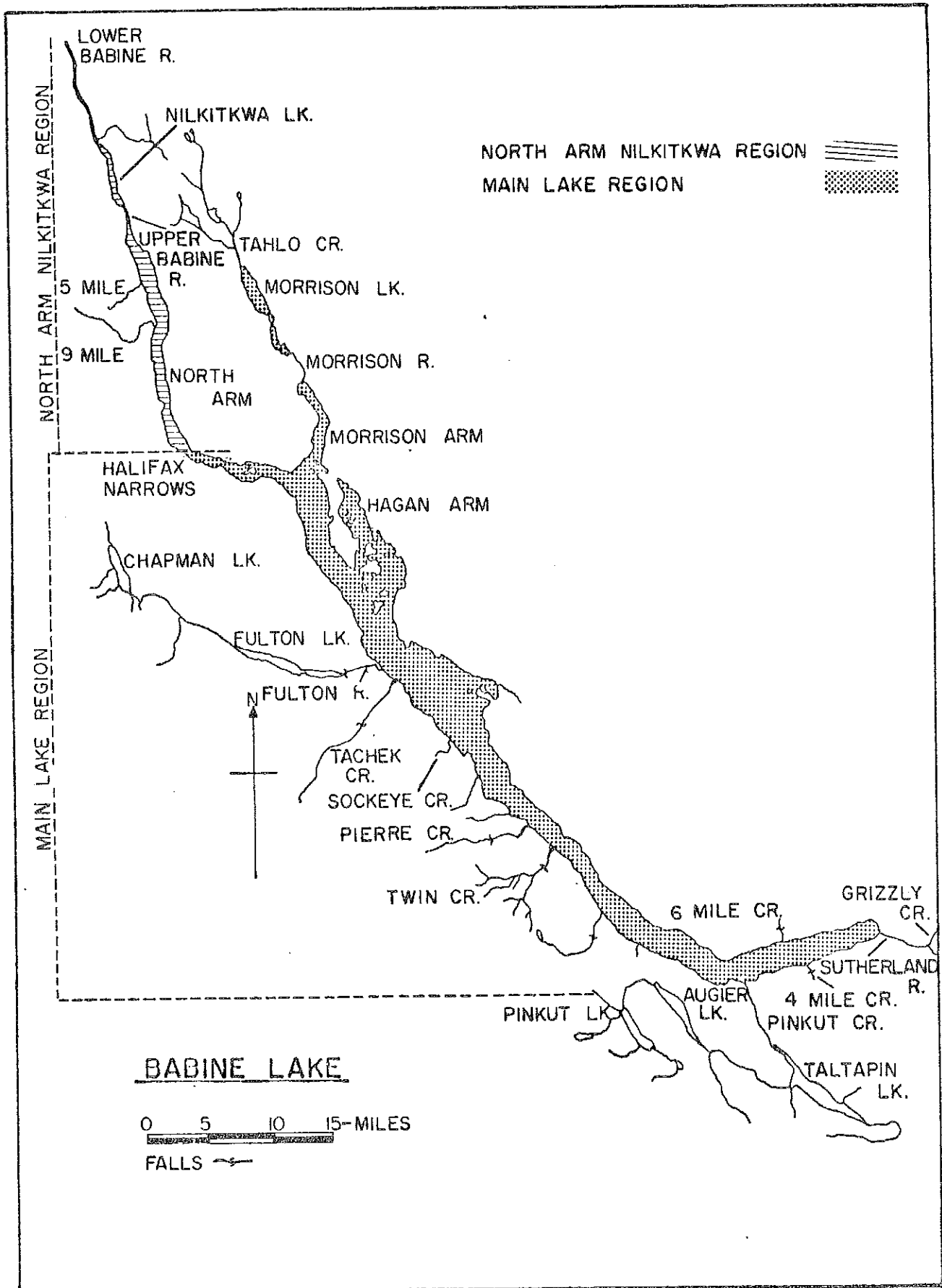


Figure 6.

Table 4. Counts of salmon passing the Babine fence (data from Drs. Jordan and Smith, Pacific Biological Station).

Year	Sockeye		Chinook**	Pink	Coho	Chum
	Large	Jacks				
1946	444,551	31,154	10,528	28,161	12,489	18
1947	261,460	261,101	15,614	55,421	10,252	7
1948*	650,000**					
1949	461,139	47,993	7,433	13,663	11,938	5
1950	364,356	179,302	6,838	38,728	11,654	7
1951	141,415	11,042	2,778	50	2,122	0
1952	349,011	27,936	5,915	2,706	10,554	1
1953	686,586	28,028	8,353	1,108	7,648	17
1954	493,677	9,745	5,925	4,604	3,094	66
1955	71,352	30,624	3,528	2,151	8,947	3
1956	355,345	18,164	4,345	2,691	9,250	3
1957	433,149	50,162	7,509	25,865	4,421	15
1958	812,043	30,769	8,274	6,600	7,606	8
1959	782,868	31,920	9,597	57,766	10,947	20
1960	262,719	49,396	2,855	4,876	6,794	6
1961	941,711	27,853	2,921	70,044	10,024	4
1962	548,000	46,200	3,030	37,500	11,000	23
1963	588,000	173,000	3,400	90,600	3,600	9
1964	827,500	N.A.	5,700	23,400	8,400	-
1965	580,000	64,300	3,200	67,200	20,000	-
1966	389,000	182,000	4,100	46,000	72,001	2
1967	603,000	29,300	2,180	43,500	9,380	2
1968	552,000	53,400	3,450	84,000	6,600	3
1969	650,000	154,000	2,420	75,500	4,660	9

* Estimate by stream surveys

** Includes jacks and large

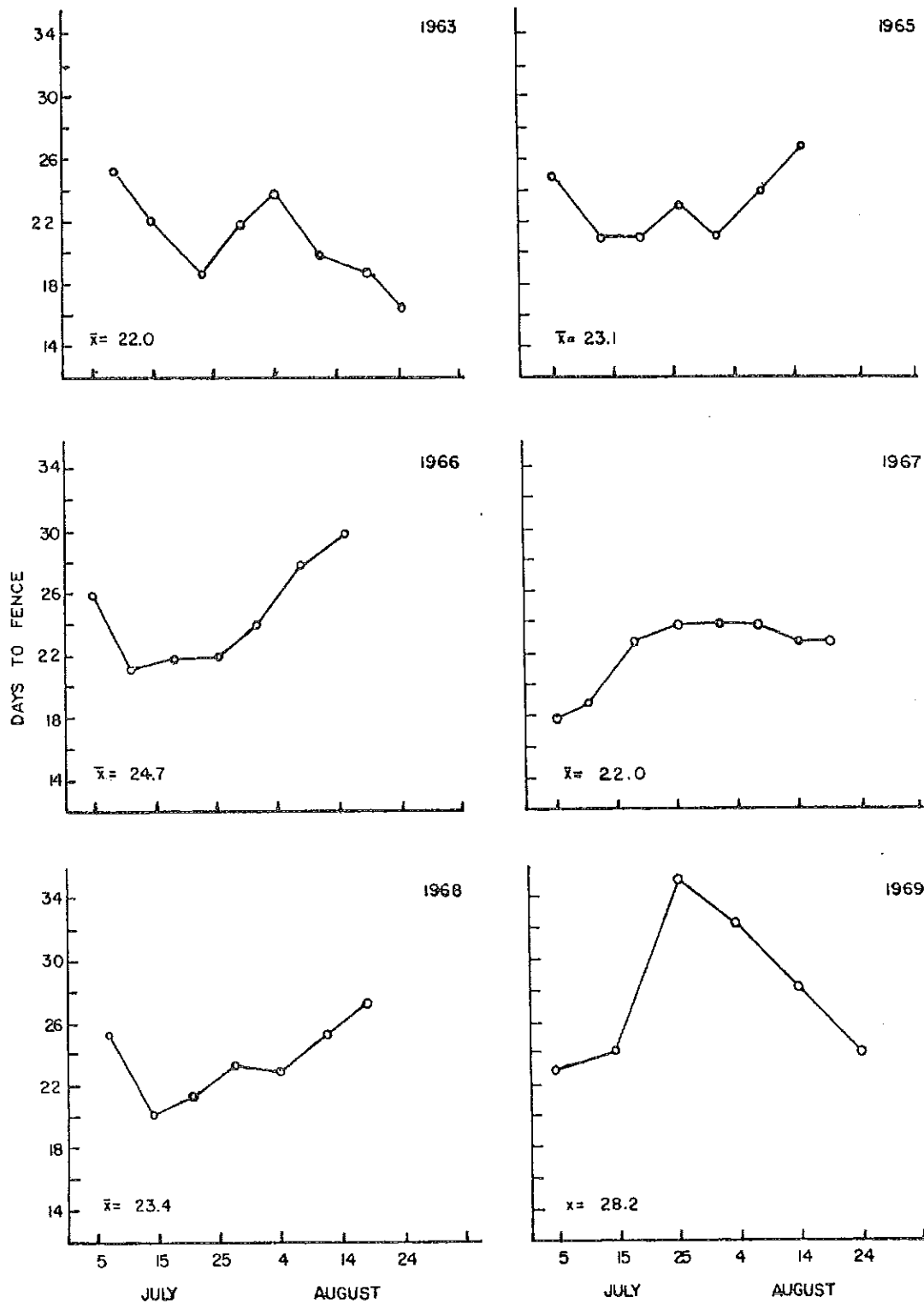


Figure 7. Time taken by sockeye salmon to migrate from test-fishing to Babine fence, by years (1963-1969). N.B. fence not installed in 1964.

fresh water (Table 5). Peak movement into the spawning area occurred on September 3 and 4, when water levels increased by 0.3 feet. Water levels were moderate over the spawning period.

The native fishery at Moricetown removed 515 sockeye, 45 pinks, 100 coho and 710 chinook. Of this total, 263 sockeye, 50 coho, and 342 chinooks - or about 40% - were gaffed. For each fish gaffed, 1.5 fish are lost, and most lost are injured too badly to spawn (S.R.S.M.C. Annual Reports 1962, 1967). A conservative mortality estimate for sockeye would therefore be 500 fish.

Thus, total sockeye escapement to Moricetown was 4,000 fish. There was no evidence that the artificial propagation facilities have made a significant contribution to the run.

Pink

Babine is a minor producer of pinks. Only 90,000 fish, 10% of the total Skeena stock, were counted in 1969. Lakelse River is the major spawning area, and received 41% of the spawners in 1969 (Table 3).

In 1969, a Bendix acoustical fish counter was installed in Lakelse River, to assess its usefulness for migrating pinks. The Bendix record was similar to that of

TABLE 5. Nanika River sockeye escapements above native fishery, and native catches as percentages of total escapements to Moricetown Falls.

<u>Year</u>	<u>Escapement</u>	<u>Age Composition By Percent</u>				<u>% Catch</u>
		<u>4₂</u>	<u>5₂</u>	<u>5₃</u>	<u>6₃</u>	
1945-1953	24,000-70,000	-	-	-	-	-
1954-1959	1,000- 6,000	0.8	4.6	51.7	42.9 ¹	over 35%
1960	3,500	1.2	18.8	61.4	18.1	-
1961	7,500	2.8	1.1	70.6	24.2	12
1962	3,500	7.8	1.7	38.6	51.0	7
1963	1,200	-	-	-	-	-
1964	6,000	1.2	7.7	85.7	4.8	-
1965	9,700	3.8	11.9	38.9	44.0	-
1966	10,700	1.4	1.4	86.9	10.4	-
1967	4,100	1.1	0.8	18.0	77.7	12
1968	3,300	3.3	1.5	64.8	29.6	15
1969	3,200	2.1	4.8	71.3	21.5	13

¹ 1959 escapement (1,000 fish) only year in 1954-1959 that was examined for age composition.

the Lakelse counting fence during lower flows. Complete calibration was not possible as the fence was lost just before peak migration. However, tag-and-recovery data indicated that the total run was underestimated by the Bendix (108,000 vs. 368,000). Another attempt at assessment will be made in 1970.

Odd-year runs have peaked 1 week earlier than even-year runs in the years 1955 to 1969 (Fig. 8).

Chinook

Babine counting fence records show a gradual decline in chinooks since 1946 (Table 4). Only 2,420 chinook were counted in 1969.

SPAWNING

Sockeye

Sockeye spawning distributions within the Babine system from 1960 are in Table 6. The return for 1969 was the highest since the 1964 brood year.

In 1969, the capacity of the artificial spawning channels in the Babine area was nearly doubled.

Fulton Channel No. 1 (completed 1966)	-	22,000
Pinkut Channel (completed 1967)	-	63,000
Fulton Channel No. 2 (completed 1969)	-	<u>50,000</u>
Total Spawners	-	135,000

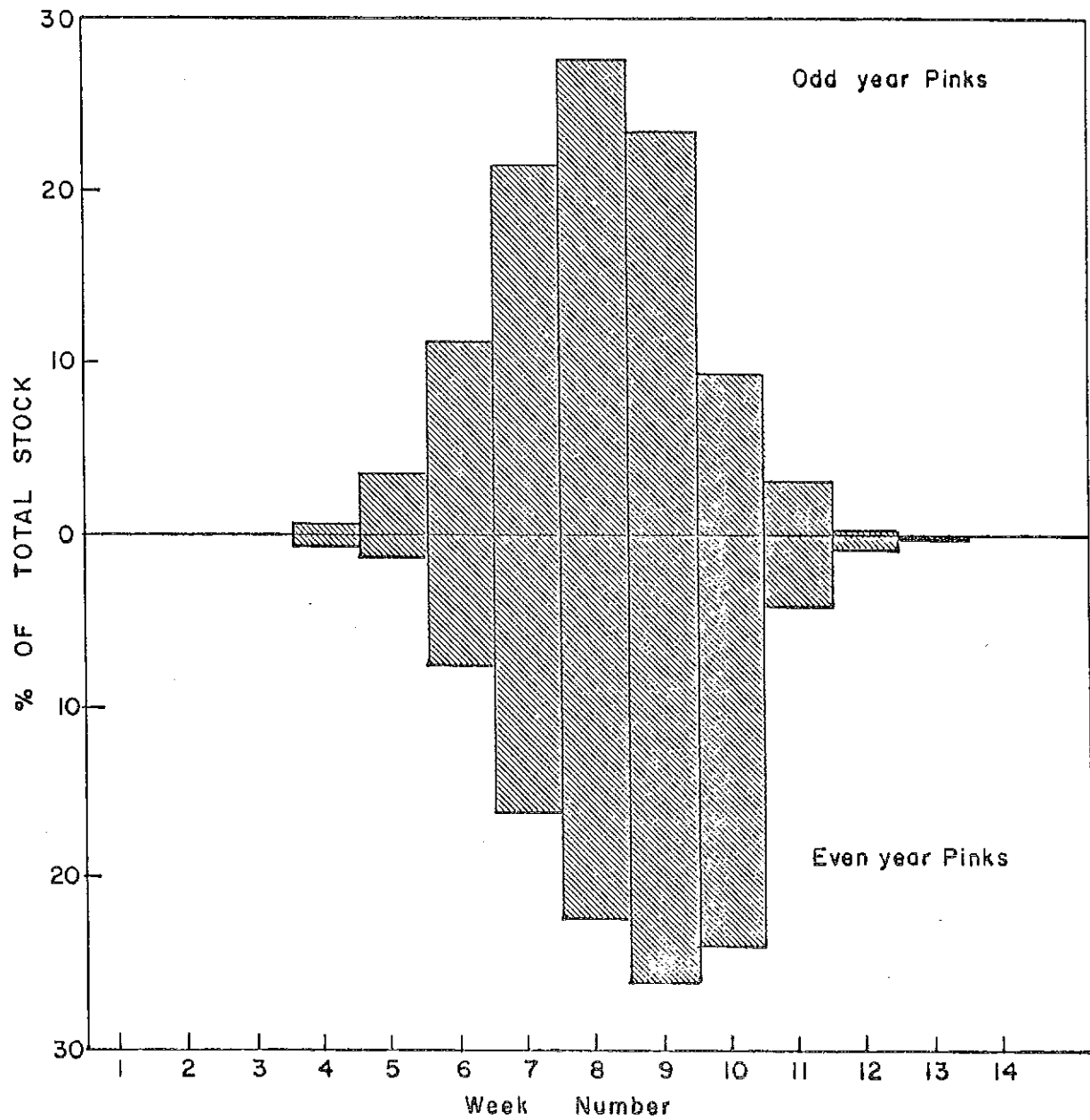


Figure 8. Timing of Skeena River Pink Salmon runs.
(August 1 falls in Week 7)

Table 6. Distribution of Babine sockeye (jacks excluded) escapement (1960-69 incl.)

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
Babine fence count	263	942	548	588	828*	580	389	603	552	660
Indian food catch	17	32	18	20	20	19	21	19	19	17
Potential spawning stock	246	910	530	568	808	561	368	584	533	643
							(thousands of fish)			
Upper Babine River	36.9	196.0	192.0	119.3	222.0	120.4	69.0	133.0	199.8	233.0
Lower Babine River	54.0	171.5	61.0	34.5	46.0	176.0	114.0	54.0	34.5	54.0
9 Mile	1.8	2.5	0.5	1.0	1.5	0.5	0.8	0.9	1.0	1.0
5 Mile	0	0.5	0.1	0	0.1	0.2	0.2	0.1	0.1	0.2
Morrison & Tahlo	9.9	23.6	12.5	41.8	27.0	8.5	8.8	17.3	46.0	22.0
Fulton River	36.0	170.1	86.4	98.6	117.0	123.3	40.9	110.8	103.2	60.5
Fulton Channel #1							18.2	21.8	26.0	21.0
Fulton Channel #2										23.8
Pinkut Creek	27.0	44.1	21.4	40.0	135.3	22.0	21.4	32.0	7.6	8.3
Pinkut Channel									13.5	28.8
Grizzly Creek	10.8	23.5	4.6	11.4	8.0	5.0	4.5	1.6	7.5	2.0
Twin Creek	5.4	6.9	1.3	11.4	9.0	3.0	2.0	7.7	12.0	15.0
Pierre Creek	9.9	24.5	4.1	28.4	22.0	10.0	8.8	26.3	25.0	25.0
4 Mile	1.8	1.0	2.8	2.8	2.5	1.4	1.7	2.9	4.0	4.0
Tachek	1.8	0	0.6	1.6	3.0	0.7	0.3	0.8	0.5	2.0
Sockeye	1.8	0	1.0	2.4	1.5	0.1	1.4	0.7	1.2	1.5
6 Mile	0.9	0	0.9	1.4	1.5	0.1	0.3	1.0	1.0	0.3
Pendleton	0	0	0.2	0	1.4	0	0	0	0	0
Other	0.5	51.8	6.2	6.2	9.3	1.8	0	0	0	0
% accounted for	198.3	716.0	395.6	400.8	607.1	475.0	292.3	410.9	482.9	502.4
	80.6	78.7	74.6	70.6	75.1	84.3	79.4	70.3	90.8	78.1

* Estimate, fence not installed.

192,500 sockeye utilized the Fulton and Pinkut Rivers and Channels in 1969. Distribution and egg deposition breakdowns are given in Tables 7 and 8. The Fulton escapement of 149,000 sockeye was the third highest in nine years, but egg deposition was 12,000,000 below the 9-year average of 169,000,000. This was due to the low percentage (33%) of females in the spawning stock..

The number of spawners in Fulton Channel No. 2 was to have been limited to 50,000 sockeye for the first year of operation. However, sockeye entry was low and spawning was in the bottom end of the channel, reducing the spawning population to 34,000. These behavioural problems were found to be decreased whenever river water was diverted or pumped into the channel. Water quality studies were made, and indicated that there were higher levels of alkalinity, calcium, and calcium carbonate in the channel water, and that the source of these increases was within the channel. It is assumed that this source was freshly-poured 'shotcrete' berms. Monthly water sampling will be continued, but it is anticipated that the rate of leaching will sharply decrease and that spawning will be normal in 1970.

Spawning in the Pinkut system also produced below-normal egg deposition (51,200,000) due to the low percentage (37%) of females in the sockeye return.

Table 7. 1969 Fulton adult distribution and egg deposition

Area	Spawners ¹	Percent Females	Total Females	Potential Deposition (millions)	Percent Retention	Average Retention (Eggs)	Apparent Deposition (Millions)
Spawning Channel No. 1	29,254 Dead Recovery Count	32.4	9,472	30.5	1.1	36	30.2
Spawning Channel No. 2	34,070 Dead Recovery Count	33.8	11,497	37.0	.4	13	36.9
Fulton River Area above Counting Fence	77,651 Live Count	33.1	25,694	82.8	1.7	53	81.4
Fulton River Area below Counting Fence	8,000 Estimated	33.1	2,648	8.5	1.7	53	8.4
Totals	148,975		49,311	158.8			156.9
¹ Jacks included							

Table 8. 1969 Pinkut adult distribution and egg deposition

Area	Total Spawners Live Count ¹	Percent Females	Total Females	Potential Deposition (millions)	Percent Retention	Average Retention (Eggs)	Apparent Deposition (Millions)
Pinkut Creek Spawning Channel	33,745	37.5	12,654	40.4	.5	16	40.2
Pinkut Creek Area above Counting Fence	7,331	35.5	2,603	8.3	1.1	34	8.2
Pinkut Creek Area below Counting Fence	2,450	35.5	870	2.8	1.1	34	2.8
Totals	43,526		16,127	51.5			51.2

¹ Jacks included

Pink

Except for the Skeena Mainstem, all major spawning populations exceeded that of the 1967 brood year (Table 3). The Kispiox escapement continued to improve from the cycle low of 1965. Babine and Kitwanga escapements were among the largest recorded in odd-numbered years. The Lakelse escapement was average for the odd-year cycle. The Skeena Mainstem escapement was among the lowest recorded.

A length-fecundity relationship for pink salmon was attempted by linear regression for each of 6 years between 1960 to 1969. Using the equation $y = A + Bx$ where y is the number of eggs, A is y-axis intercept, B is slope, and x is the fork length in mm, the following yearly values were generated:

	B	A	Y	X	N
1960	7.18	-2045.2	1807.8	536.5	92
1962	9.02	-3138.3	1755.3	542.4	16
1968	7.83	-2064.0	1408.5	476.7	96
1965	6.25	-1686.7	1553.4	517.9	77
1967	5.40	-1030.2	1842.2	532.0	25
1969	5.99	-1312.5	1821.2	523.5	98

Covariance analysis ($\alpha = 0.05$) indicated a common slope (i.e. the same length-fecundity relationship), but different

adjusted means (i.e. mean size of fish varied each year). Covariance analyses on odd-year runs only and even-year runs only did not produce a common adjusted mean for each run type (i.e. mean size of fish was not a function of the odd- or even-year cycles).

FRY PRODUCTION

Sockeye

A record 70,000,000 fry were produced by the Fulton and Pinkut systems in 1969 (Table 9). The artificial channels received 21% of the total egg deposition, but produced more than 50% of this record fry output. Egg-to-fry survivals in the channels have been triple that of the rivers. The low river egg-to-fry survivals may be partly due to siltation of spawning areas during channel construction. If this is the case, river survival rates should increase in the years following channel construction. At present, however, the most productive practice would be to seed each channel to capacity, even at the expense of subtracting fish from natural spawning areas.

In the past, river fry had emerged and emigrated earlier than channel fry, due to sudden increases in river flows. In 1969, partial flow control was implemented on the river to curtail these increases, and the timing of

TABLE 9. Sockeye fry production from the Fulton and Pinkut systems, 1965-1968 brood years

Fulton River					Fulton Channel No. 1				
Brood Year	Adult Return (x10 ³)	Egg Deposition (x10 ⁶)	Fry Production (x10 ⁶)	Percent Survival	Adult Return (x10 ³)	Egg Deposition (x10 ⁶)	Fry Production (x10 ⁶)	Percent Survival	
1965	123.3	189.0	23.6	12.5					
1966	40.9	77.5	24.0	31.0	18.2	36.9	25.5	69.1	
1967	110.8	171.6	28.8	16.7	21.2	32.8	16.0	48.9	
1968	103.2	213.6	38.7	17.6	26.8	57.7	24.7	42.7	

Pinkut Creek					Pinkut Channel				
Brood Year	Adult Return (x10 ³)	Egg Deposition (x10 ⁶)	Fry Production (x10 ⁶)	Percent Survival	Adult Return (x10 ³)	Egg Deposition (x10 ⁶)	Fry Production (x10 ⁶)	Percent Survival	
1965	22.0	51.2	6.9	13.5					
1966	21.4	26.9	3.7	12.5					
1967	32.0	41.2	2.7	6.1					
1968	7.6	19.2	1.9	10.0	13.5	30.8	11.4	36.9	

river fry migration was closer to, but still earlier than that of the channel fry. In the Pinkut system, the river migration occurred over a longer period (5 more days).

This delayed migration of channel fry produced a more mature, heavier, and longer migrant, but the differences (about 5%) were not as marked as in the past two years. It is unsure whether these statistically significant differences really have any biological significance. Marked fry from the Fulton Channel and river have shown no significant differences in distribution or survival to the smolt stage in the past 3 years. Earlier migrants (river fry) do become slightly larger, probably as a result of being exposed to lake food conditions for a longer period.

Pink (Egg-to-Fry Survivals)

A hydraulic redd sampler has been used since 1965 to obtain an index of survival in the river for incubating pink salmon juveniles. Procedures have been standardized since February 1966 and sampling is weighted toward the areas with the highest spawning densities. Results of redd sampling surveys since 1964 are listed in Table 10.

These survival estimates indicate direction from mean rate of return for pink return predictions. Returns from the 1964 and 1965 broods were predicted to be well

TABLE 10. Indicated survival of pink salmon embryos in the Lakelse River.

Brood Year	Sampling Date	Herman Creek to Coldwater Creek		Upper 3-Miles		Total River		Spawning population (thousands)			
Live per Percent Samples											
		sample	live	sample	live	sample	live	sample	live		
1964	January 23-February 5	16.0	23.9	75	19.5	40.7	29	10.2	41.4	111	1321
	March 5	14.9	38.0	21							
1965	November 25-28	26.9	72.5	102							835
	December 19	23.5	47.0	50							
	February 9-13	7.8	34.8	50	6.7	36.7	65	9.1	55.6	150	397
1966	November 22-29	2.4	85.7	10	11.6	60.0	50	8.1	73.0	155	
	February 10-16	16.9	57.9	35	9.7	63.8	100	9.4	67.2	150	
1967	November 14-18	12.8	85.8	35	8.5	84.1	100	8.0	79.4	175	236
	February 9-14	16.9	70.5	35	11.3	81.2	100	8.3	82.9	165	
1968	November 15-18	50.7	74.9	35	55.0	84.8	100	48.0	85.7	135	1112
	February 10-14	38.1	65.0	35	35.4	79.1	50				

below normal and produced the poor returns of 1966 and 1967 respectively. The 1966 and 1967 broods were expected to be normal; the 1968 return was 11% higher, and the 1969 return 26% lower than predicted. The 1968 brood sampling was characterized by high survival and high densities. On this basis, the 1970 rate of return per spawner would be above the normal 3 to 1 ratio. The low fecundity of the 1968 females makes it unlikely that the ratio of return will be much above normal, but this would still produce one of the largest runs on record.

SMOLT PRODUCTION

Sockeye

A record production of over 46,000,000 smolts occurred in 1969 (1967 brood year) in the Babine system (Table 11).

Smolt production is estimated by mark-and-recovery. Since 1961, smolts have been separated into early and late runs on the basis of tag recoveries, timing, size, and behaviour. The early run originates from Babine River and Nilkitkwa Lake; the late run, from the Main Basin and Morrison Arm regions of Babine Lake.

The late run was dominant in numbers from 1961 to 1966; since that time, the early run has become equal

Table 11. Babine sockeye smolt production

Year	Early	% of Total	Late	% of Total	Total
1961	6.1 million	31.7	13.2 million	68.3	19.3 million
1962	1.7 "	11.2	13.7 "	88.8	15.4 "
1963	6.8 "	46.7	7.7 "	53.3	14.5 "
1964	16.5 "	36.0	29.4 "	64.0	45.9 "
1965	4.5 "	18.1	20.4 "	81.9	24.9 "
1966	21.5 "	61.0	13.8 "	39.0	35.3 "
1967	9.0 "	54.1	7.6 "	45.9	16.6 "
1968	11.2 "	36.3	19.7 "	63.7	30.9 "
1969	22.0 "	47.7	24.2 "	52.3	46.2 "

in importance, suggesting that fry have increased utilization of the Babine River - Nilkitkwa Lake regions.

ACKNOWLEDGEMENTS

This report summarizes 1969 investigations conducted under the auspices of the Skeena River Salmon Management Committee.

D. Harding and P. Murray wrote the original draft of this report, which was revised in 1975 by B. Shepherd. This large time gap makes acknowledgement of individual contributors very difficult. Rather, the staffs of the Pacific Region Fisheries Service and the Pacific Biological Station are generally acknowledged for their efforts.

R. Ginetz, R. Palmer, H. Smith, and E. Zyblut commented on the revised manuscript.

The cover photograph of Fulton Spawning Channel No. 1 was taken by J. Beyer.

APPENDIX 1



CANADA

DEPARTMENT OF FISHERIES
MINISTÈRE DES PÊCHERIES
VANCOUVER

January 10, 1969

Dear Sir:

Re: Skeena Salmon Management Committee

Attached for your information please find copy of a statement issued to-day by the above Committee, concerning prospects for the 1969 Skeena salmon runs and regulations proposed for the 1969 fishery.

You will note that the Committee plans to hold a public meeting at the Fishermen's Hall in Prince Rupert on February 19, 1969 to review the results of the 1968 season and to discuss prospects for the forthcoming year.

Yours very truly,

A handwritten signature in dark ink, appearing to read "W. R. Hourston", with a long, sweeping horizontal stroke extending to the right.

W. R. Hourston,
DIRECTOR, PACIFIC REGION.

Enc.

SKEENA SALMON MANAGEMENT COMMITTEE

Re: Tentative Regulations for 1969

(1) The Skeena Salmon Management Committee met on December 18, 1968 to review the 1968 Skeena salmon runs and to consider information bearing on the expected abundance of the 1969 sockeye and pink salmon stocks. Regulations based on the probable abundance of the runs, escapement requirements, and the effectiveness of the fishing fleet, are proposed in this release for consideration by the Committee's Advisory Board and the industry in general.

(2) The 1968 sockeye run totalled 1,368,000 in Area 4. The catch in Area 4 totalled 765,700; an additional 137,000 sockeye caught in Areas 3X and 3Y are also considered to have been bound for the Skeena, which brings the total catch to 902,700 and the total run to 1,505,000. The age 5₂ sockeye produced from the 1963 brood escapement totalled 1,160,000 which, in addition to the 1,030,000 4₂'s produced in 1967, represents an above average rate of return of 3.5:1 from the brood escapement of 597,000.

The 4₂'s produced from the 1964 escapement of 858,000 totalled 250,000, which is far below the anticipated level.

The escapement above test-fishing totalled 602,500, of which 552,000 entered Babine Lake. Escapements to all other areas were light.

(3) The 1968 pink salmon run totalled 2,100,000 in Area 4 which represents a 3.3:1 rate of return from the brood escapement of 640,000. The catch of pinks in Area 4 totalled 365,000; the prime reason for this low catch was the extremely small size of the pinks which rendered them less susceptible than normal to gillnets. Escapements to all areas with the exception of Kispiox River and the Bulkley system were very good; 1,100,000 to Lakelse River, 175,000 to Kitwanga, 110,000 to Skeena mainstem, 90,000 to Babine.

(4) The anticipated abundance of sockeye in 1969 has been forecast mainly on the basis of the brood year escapement magnitude and the past performance of Skeena sockeye with respect to the average return per spawner, the average rate of survival from smolt to adult, and the average ratio of 4- and 5-year olds produced. Extreme variability in production rates and age composition has occurred in the past however, and this forecast merely provides an objective basis for formulating fishing regulations at this time. As has been the case in past years, appropriate changes in the fishing regulations will be required during the 1969 season, and these will be implemented as the runs develop and their strength becomes apparent.

The 1969 sockeye run will be composed of 52's produced from the 1964 escapement and 42's produced from the 1965 escapement. The number of 42's (250,000) which returned from the 1964 escapement provides one basis upon which to estimate the number of 52's which will return in 1969. In the past, the 42 production has ranged between 20% and 80% and has averaged 50% of the total production from a given brood. On this basis, the number of 52's returning in 1969 could be expected to total approximately 250,000 sockeye and would not exceed 1,000,000. In the past, however, the rate of production from adult : adult has not fallen below .8 : 1 and on this basis the minimum number of 52's expected in 1969 is 400,000. Thus the anticipated range in number of 52's lies between 400,000 and 1,000,000; for the purpose of formulating regulations at this time, a figure of 700,000 has been used.

The 42's expected in 1969 will be returning from the 1965 escapement of 580,000 which produced 17.1 million smolts. In consideration of average rates of survival from smolt to adult and assuming that 42's and 52's arising from the 1965 brood will return in equal numbers, the number of 42's expected in 1969 totals 350,000.

In view of the above information, the most probable size of the 1969 sockeye run is considered to be 1,200,000 (1,050,000 42's and 52's plus 150,000 of other age groups), and this figure has been used for the purpose of formulating fishing regulations at this time.

(5) The 1969 pink salmon run will return from an escapement of 563,000 in 1967. The 1967 Lakelse River escapement totalled 250,000 and thus will again play a dominant role in determining the magnitude of the total return to the area in 1969. Sampling of pre-emergent juveniles in Lakelse River during the 1967-68 incubation period suggested that survival to the fry stage would be about average. An average rate of return might therefore be expected, and on this basis the total run to the Skeena area should approximate 1,700,000 pink salmon.

(6) In proposing regulations for 1969, the Committee noted that in order to satisfy escapement requirements for sockeye, including the numbers required to fill spawning channel facilities that will be completed in 1969, the commercial catch would be limited to approximately 150,000 sockeye from the anticipated total run of 1,200,000. In consideration of the anticipated poor returns of salmon to the northern and central regions of British Columbia, however, the Committee has recommended that the total Skeena escapement goal for 1969 be established at 800,000 sockeye. If the run returns at a higher level than forecast, then the escapement will be adjusted accordingly to meet maximum requirements.

In order to satisfy escapement requirements for both sockeye and pinks, the Committee therefore recommends that fishing be permitted for 1½ days per week throughout the season. It is anticipated that these regulations will result in a commercial catch of approximately 400,000 sockeye and 700,000 pinks.

Proposed Regulations 1969

(a) That prior to 6:00 p.m. Sunday June 22, 1969 only gill-nets having mesh not less than 8" linen or 8½" synthetic fibre, stretched mesh, be permitted; and that prior to this date a 96-hour weekly closed period from 6:00 p.m. Wednesday to 6:00 p.m. Sunday be maintained.

(b) That fishing for salmon with gillnets of any mesh size be permitted after 6:00 p.m. Sunday June 22, 1969 until the end of the fishing season as follows:

- (i) from June 22 to August 24 - 130 hour weekly closed period from 8:00 a.m. Tuesday to 6:00 p.m. Sunday;
- (ii) from August 24 to the end of the fishing season; 72 hour weekly closed period from 6:00 p.m. Thursday to 6:00 p.m. Sunday.

(c) The Committee proposes the following recommendations for adjacent fishing areas in order to extend similar protective measures to Skeena-bound sockeye and pink salmon while passing through those areas:

(i) Area 3 Nass River - Sub-areas 3X and 3Y only:

- (a) from July 6 to August 17 - 130 hour weekly closed period from 8:00 a.m. Tuesday to 6:00 p.m. Sunday.

(ii) Salmon Purse Seine Area 5 - Sub-areas 5-1 and 5-2 only:

- (a) from July 20 to August 17 - 130 hour weekly closed period from 8:00 a.m. Tuesday to 6:00 p.m. Sunday.

(d) Provisoes:

- (i) That the weekly closed periods outlined above shall be extended in the event that for any week or series of weeks during the progress of the fishing season the proposed weekly closures, in the opinion of the Committee, are deemed insufficient to provide adequate escapement of salmon for reproduction purposes.
- (ii) That extra fishing time will be granted if, in the opinion of the Committee in the light of the development of the sockeye and pink runs at the time, such might safely be permitted consistent with attaining adequate escapements for reproduction.

(e) The Committee will discuss the results of investigations and the basis for the proposed 1969 regulations with its Advisory Board at a public meeting to be held Wednesday, February 19, 1969 at 1:00 p.m. at the U.F.A.W.U. Hall, Prince Rupert, B. C. A further meeting with the Advisory Board only will be held February 20, 1969 at 9:00 a.m. again at the U.F.A.W.U. Hall, Prince Rupert.

W. R. Hourston
K. R. Allen

Committee Members

I. Todd
in charge of Investigations for the Committee
Issued - Department of Fisheries of Canada,
1155 Robson Street, Vancouver 5, B. C.

January 10, 1969

APPENDIX 2

SKEENA SALMON MANAGEMENT COMMITTEE

Re: Regulations for 1969

(1) The Committee, on January 10, 1969, released to its Advisory Board and to the industry in general, proposals for the regulation of the 1969 Skeena River salmon fishery. These proposals were discussed with the Advisory Board at meetings held by the Committee in Prince Rupert on February 19 and 20, 1969, where the prospects for the 1969 runs and the basis of the proposed regulations were reviewed. The views of Advisory Board members and other individuals and organizations were received.

(2) At the meeting held with its Advisory Board, the Committee indicated that in proposing regulations for 1969, the following factors had been considered:

- (a) The abundance of sockeye in 1969 has been forecast mainly on the basis of the magnitude of brood year escapements and the past performance of Skeena sockeye with respect to the average adult return per spawner and the average ratio of return for 4 and 5 year old sockeye produced from each brood escapement. The expected return of 1,200,000 sockeye has been used as the basis for formulating 1969 fishing regulations;
- (b) the magnitude of the 1969 pink salmon run has been forecast on the basis of the performance of the odd year cycle over the past 10 years and the magnitude of the 1967 brood year escapement which totalled 563,000. The 1967 Lakelse River escapement totalled 250,000 and thus will again play a dominant role in determining the magnitude of the total return to the area in 1969. Sampling of pre-emergent juveniles in Lakelse River during the 1967-68 incubation period suggested that survival to the fry stage would be about average, and on this basis the total run to the Skeena area should approximate 1,700,000 pink salmon.

(3) The Committee has considered all views and alternative proposals received which bear on the regulation of the 1969 runs and has concluded as follows:

- (a) that in consideration of the expected magnitude of the run; and in consideration of representations from its Advisory Board with particular reference to the anticipated poor returns of salmon to the northern and central regions of British Columbia, the Committee has established an escapement goal of 700,000 for 1969; with the proviso that should the run return at a level greater than anticipated, this goal will be increased to 800,000 before an increase in commercial catch is provided;
- (b) that the original proposal for sockeye salmon fishing in Area 4 will be altered so as to permit fishing for two days per week during the period June 22 to August 3, 1969; these regulations have been designed to provide for a catch of 500,000 and an escapement of 700,000 sockeye;
- (c) that no change in the original proposal for pink salmon fishing in Area 4 is warranted, i.e., fishing will be permitted for $1\frac{1}{2}$ days per week during the period August 3, 1969 to August 24, 1969; and for four days per week from August 24, 1969 until the end of the fishing season; these regulations have been designed to provide for a catch of approximately 700,000 and an escapement of 1,000,000 pink salmon;
- (d) that fishing in Areas 3X and 3Y will be permitted for two days per week during the period July 6 to August 3, 1969; and for $1\frac{1}{2}$ days per week from August 3, 1969 to August 17, 1969.
- (e) that fishing will be permitted in Salmon Purse Seine Area 5, Sub-Areas 5-1 and 5-2 only, for $1\frac{1}{2}$ days per week from July 20 to August 17, 1969;
- (f) that with regard to net fishing for chinook salmon in Area 4, additional fishing time or the movement of fishing boundaries to increase exploitation is not warranted. In the event that sockeye fishing is not permitted in any

given week, however, consideration will be given to permit spring salmon fishing with nets having mesh not less than 8 inches extension measure for linen nets and $8\frac{1}{2}$ inches extension measure for synthetic fibre nets during daylight hours in the Skeena River only.

(4) In view of the foregoing consideration, the Committee has recommended to the Department of Fisheries that the following regulations apply to the 1969 Skeena salmon fishery:

- (a) that prior to 6:00 p.m. Sunday June 22, 1969, only gillnets having mesh not less than 8" linen or $8\frac{1}{2}$ " synthetic fibre stretched mesh, be permitted; and that prior to this date a 96 - hour weekly closed period from 6:00 p.m. Wednesday to 6:00 p.m. Sunday be maintained;
- (b) that fishing for salmon with gillnets of any mesh size be permitted after 6:00 p.m. Sunday June 22, 1969 until the end of the fishing season as follows:
 - (i) from June 22 to August 3 - 120 hour weekly closed period from 6:00 p.m. Tuesday to 6:00 p.m. Sunday;
 - (ii) from August 3 to August 24 - 130 hour weekly closed period from 8:00 a.m. Tuesday to 6:00 p.m. Sunday;
 - (iii) from August 24 to the end of the fishing season - 72 hour weekly closed period from 6:00 p.m. Thursday to 6:00 p.m. Sunday.
- (c) The Committee proposes the following recommendations for adjacent fishing areas in order to extend similar protective measures to Skeena-bound sockeye and pink salmon while passing through those areas:
 - (i) Area 3 Nass River - Sub-areas 3X and 3Y only:
 - (a) from July 6 to August 3 - 120 hour weekly closed period from 6:00 p.m. Tuesday to 6:00 p.m. Sunday;
 - (b) from August 3 to August 17 - 130 hour weekly closed period from 8:00 a.m. Tuesday to 6:00 p.m. Sunday.

(ii) Salmon Purse Seine Area 5 - Sub-areas 5-1 and 5-2 only:

- (a) from July 20 to August 17 - 130 hour
weekly closed period from 8:00 a.m.
Tuesday to 6:00 p.m. Sunday.

(d) Provisos:

- (i) that the weekly closed periods outlined above shall be extended in the event that for any week or series of weeks during the progress of the fishing season the proposed weekly closures, in the opinion of the Committee, are deemed insufficient to provide adequate escapement of salmon for reproduction purposes;
- (ii) that extra fishing time will be granted if, in the opinion of the Committee in the light of the development of the sockeye and pink runs at the time, such might safely be permitted consistent with attaining adequate escapements for reproduction.

W. R. Hourston
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Committee Members

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