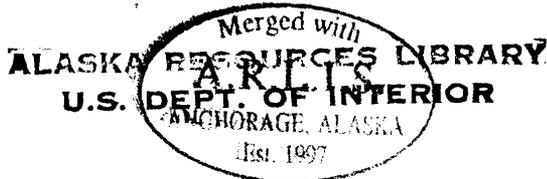


Volume 8



1966-1967

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STATE OF ALASKA
Walter J. Hickel, Governor

ANNUAL REPORT OF PROGRESS, 1966 - 1967
FEDERAL AID IN FISH RESTORATION PROJECT F-5-R-8
SPORT FISH INVESTIGATIONS OF ALASKA

ALASKA DEPARTMENT OF FISH AND GAME
Urban C. Nelson, Commissioner
Wallace H. Noerenberg, Deputy Commissioner

Alex H. McRea, Director
[Alaska Department of Fish and Game] Sport Fish Division

Louis S. Bandirola, Coordinator

INTRODUCTION

This report of progress consists of findings and work accomplished under the State of Alaska Federal Aid In Fish Restoration Project F-5-R-8, "Sport Fish Investigations of Alaska."

The project during this report period is composed of 20 separate studies. Some are specific to certain areas, species or fisheries, while others deal with a common need for information. Each job has been developed to meet the needs of various aspects of the State's recreational fishery resource. Seven jobs are designed to pursue the cataloging and inventory of the numerous State waters. These are divided into logical utilization areas and are jobs of a continuing nature. It will be many years before an index of the potential recreational fishing waters is completed. Six jobs are directed toward specific sport fish studies. These include special efforts toward the anadromous Dolly Varden of Southeastern Alaska, silver salmon in Resurrection Bay, king salmon stocks on the lower Kenai Peninsula, king and other salmon stocks in Upper Cook Inlet, and Arctic grayling and sheefish in Interior Alaska. Special reports have been prepared on specific phases of the Dolly Varden life history and appear in the Department's special "Research Report" series.

The Statewide access evaluation remains one of the most important jobs conducted under this Federal Aid Program. It provides the Department with a tool to recommend withdrawal of suitable access sites on potential recreational fisheries throughout the State.

The remaining jobs include creel census efforts on specific fisheries in high use areas of the State, an egg-take program directed toward locating suitable indigenous stocks, perfecting advanced techniques in taking, handling and rearing species that are not normally associated with standard fish cultural practices, and continuation of the evaluation of the Fire Lake System.

The material contained in this report is often fragmentary in nature. The findings, evaluations and interpretations contained herein are subject to re-evaluation as the work progresses and additional data are collected.

RESEARCH PROJECT SEGMENT

STATE: ALASKA Name: Sport Fish Investigations of Alaska.
Project No: F-5-R-8 Title: Salmonoid Rearing and Migration Study--Fire Lake System and Fort Richardson Cooling Pond.
Job No: 9-C-1

Period Covered: March 1, 1966 to February 28, 1967

ABSTRACT

The Upper Fire Lake weir was in operation from April 20 to October 23, and the Lower Fire Lake weir from May 9 to October 24, 1966.

A total of 14,972 salmonids was counted through the traps. Fish were anesthetized, checked for marks, and passed in the direction of migration. Samples of fish were measured and weighed and scales removed for age and growth studies.

Outmigration of silver salmon Oncorhynchus kisutch (Walbaum), smolts totaled 1,161 through the Upper Fire Lake weir and 8,857 through the Lower Fire Lake weir. Peak migration occurred the week ending June 4 at the Lower Fire Lake weir, and the week ending June 11 at Upper Fire Lake weir. Silver salmon parr moved upstream and downstream throughout the trapping period at both weirs with peak movements observed during the summer and fall. Thirteen freshwater adult silvers were also captured.

Silver salmon of the 1964 brood, marked and planted during 1965, produced minimum survivals of 53.2 percent and 30.4 percent from Upper Fire Lake and Lower Fire Lake, respectively. Two groups of 1965 brood silvers, in lots of 2,000 each, were marked and planted into Upper and Lower Fire Lakes.

No adult silvers arrived at the Lower Fire Lake weir, but a maximum count of 11 fish was observed spawning in Lower Fire Creek.

Two groups of 1965 brood king salmon O. tshawytscha (Walbaum), of Green River, Washington origin were marked and planted into Upper and Lower Fire Lakes to study the survival and migratory pattern of king salmon in the Fire Lake system. Eight marked fish from Lower Fire Lake and 16 from Upper Fire Lake had been recaptured by the end of the season. Four unmarked king salmon were captured during the year.

Seventeen red salmon O. nerka (Walbaum), smolts were captured at the Upper Fire Lake weir during the spring. Three adult kokanee entered the Upper Fire Lake upstream trap in the fall.

A total of 883 rainbow trout Salmo gairdneri (Richardson), was enumerated at both weirs. Peak movements occurred in spring and fall, with approximately equal numbers taken in upstream and downstream traps.

Two hundred seven Dolly Varden Salvelinus malma (Walbaum), were checked through all traps. Movement was primarily during spring and fall, with approximately equal numbers in upstream and downstream traps.

Water analysis in Lower Fire Lake revealed very low dissolved oxygen levels during late winter. The only significant quantity of oxygen appears to be near the inlet stream.

Two broods of rainbow trout and two broods of king salmon were reared in the Fort Richardson Cooling Pond during the period.

RECOMMENDATIONS

1. It is recommended that the study be continued with the present objectives.
2. Beaver dams in Lower Fire Creek should be removed permanently to enhance upstream passage of adult silver salmon.
3. A fence should be constructed around the Lower Fire Lake weir to reduce vandalism.

OBJECTIVES

1. To evaluate the rearing and migratory characteristics of various salmonoid stocks in the Fire Lake system.
2. To evaluate the rearing characteristics and potential capacity of the Fort Richardson Cooling Pond for salmonoid species.
3. Physical, chemical and other biological characteristics of the two systems will be investigated with emphasis on the Fire Lake system.
4. To determine the suitability of the stocks in the various aspects of the sport fish management program.

TECHNIQUES USED

The weir at the hatchery, called the Upper Fire Lake weir in this report, was installed on April 20, and removed on October 23. The Lower Fire Lake weir was in operation from May 9 to October 24. The upstream trap at Lower Fire Lake was inoperative from July 14 to 26, inclusive, for alteration and repairs.

Traps were checked daily during most of the period. At each check, fish were examined for missing fins, and released in the direction of migration. Groups of fish marked upon release from the hatchery were given additional marks when captured in the traps.

Throughout the year, samples of fish were measured at time of capture to the nearest 0.1-inch fork length. Measurements were converted to metric equivalents by the standard conversion chart. Samples of fish were weighed periodically to establish a weight-length relationship. Weights were recorded to the nearest 0.1 gram. Scales were taken from samples of fish for age and growth data.

Water samples were taken from Lower Fire Lake during the winter and analyzed for dissolved oxygen by the standard Winkler method, and for dissolved carbon dioxide by titration. Water analysis data for Upper Fire Lake were available from the Evaluation of the Fire Lake Hatchery Water Supply Study (Job 9-C-2). Water temperatures were taken with a pocket thermometer at each trap at intervals during the period June 15 to October 24.

FINDINGS

A total of 14,972 salmonids of all species was handled at the two weirs during the period covered. Data obtained are presented in this report by species.

Silver Salmon

A total of 13,834 silver salmon was checked through all the traps during 1966 (Table 1). Fish were designated as parr, smolt or freshwater adult upon capture. Parr were defined as fish that exhibited parr marks and colored fins typical of juvenile silvers. Smolts were defined as silvery fish on which parr marks were obscured or only faintly visible through a silvery coating, and showed no color in the fins. Many of these smolts also had a dark vertical band on the posterior portion of the caudal fin. Smolt movement was principally during the spring, but fish exhibiting the external characteristics were designated smolts at any time. A few freshwater adults were captured, and their sexual maturity was determined.

Because of the different nature of migration of fish in the three categories, they are discussed separately.

TABLE 1 - Number of Silver Salmon Trapped at the Upper and Lower Fire Lake Weirs During 1966, by Weekly Periods, and Parr, Smolt, or Freshwater Adult Designations.

Week Ending	Upper Fire Lake Weir					Lower Fire Lake Weir					
	Upstream			Downstream		Upstream			Downstream		
	Parr	Smolt	Adult	Parr	Smolt	Parr	Smolt	Adult	Parr	Smolt	Adult
5/14					0	0	0		3	40	
5/21		0			1	0	2		2	84	
5/28		0			5	2	4		1	46	
6/4		0		0	111	3	0		16	4,148	
6/11		4		0	575	37	0		21	3,628	
6/18		1		0	375	15	2		11	648	
6/25	0	1		6	64	59	7		4	185	
7/2	0	0		12	20	66	0		85	37	
7/9	0	1		39	7	78	3		101	21	
7/16	10	0		131	1	47	0		36	6	
7/23	16	0		176	0	--*	-		45	4	
7/30	11	0		165	0	472	-		18	0	
8/6	8			83	0	177	2		6	1	
8/13	3		0	101	0	137	2		6	1	
8/20	8		0	38	0	178	1		24	1	
8/27	5		0	19	0	147	1		17	0	
9/3	3		1	21	0	314	0	0	20	0	
9/10	1		5	31	1	214	3	0	44	1	0
9/17	0		4	28	1	125	2	0	65	4	0
9/24	1		0	3	0	102	1	1	33	1	0
10/1	0		0	0	0	44	1	0	13	0	1
10/8	0		1	0	0	12	1	0	7	1	0
10/15	0		0	3		1	0	0	15	0	0
10/22	0		0	0		0	0		1	0	0
10/29	0		0	0		10	2		6	0	
Total	66	7	11	856	1,161	2,240	34	1	600	8,857	1
Sampled	0	0	11	0	78	285	0	1	187	234	1
No. Released	66	7	0	856	1,083	1,955	34	0	413	8,623	0

* Trap inoperative

Smolt Migration

Downstream migration of smolts totaled 8,857 through the Lower Fire Lake weir and 1,161 through the Upper Fire Lake weir. Upstream movement of smolts was insignificant at both weirs. Fish were not marked for later identification as they passed through the weirs and it is likely that some individuals were counted more than once as they reversed direction through the weirs. However, such small numbers of smolts moving upstream were recorded that the multiple count is insignificant.

The peak movement of smolts through the Lower Fire Lake weir occurred during the week ending June 4. The peak day was June 1 when 2,005 smolts were enumerated (Figure 1). Peak movement through the Upper Fire Lake weir occurred the week ending June 11, with the peak day occurring the following week when 159 smolts were captured on June 13.

Smolts migrating from Lower Fire Lake averaged larger than those from Upper Fire Lake (Figure 2). Smolts from the Upper lake were age I fish with the exception of one individual, 168 mm in length, that was an age II fish. Smolts from Lower Fire Lake were a composite of age I and age II fish. The length distribution of age I and age II smolts from Lower Fire Lake is shown in Figure 3.

Parr Migration

Upstream migration of parr at the Upper Fire Lake trap consisted of 66 fish (Table 1). Fish began moving the week ending July 16 and continued through the week ending September 24, with peak movement in July (Figure 4). There were approximately equal numbers of fish-of-the-year and age I fish. Mean length of parr captured is presented in Figure 5.

Downstream movement of parr at the Upper Fire Lake trap began the week of June 25 and continued until October 15, with the peak movement in July. The fish consisted entirely of young-of-the-year and resulted from fish escaping from the hatchery. There was a gradual increase in size of fish with time (Figure 5).

Parr moved upstream through the Lower Fire Lake trap throughout the year (Table 1, Figure 4). Peak number trapped occurred the week ending July 30, but this peak is artificial. The upstream trap was inoperative during the period July 14 to July 26, and the large numbers trapped the week of July 30 resulted from an accumulation of upstream migrants during the inoperative period. With this exception, the numbers of parr trapped increased gradually throughout the spring and summer. The probable true peak was the week ending September 3, when the numbers trapped declined. The upstream movement consisted primarily of age I fish, but there was an increase in number of young-of-the-year late in the season.

Parr migrated downstream through the Lower Fire Lake weir throughout the year. The greatest movement occurred in July with the peak approximately one month later than the peak of the smolt migration. A second peak occurred about mid-September, following a lag in movement during the summer. Most of the downstream migrants during the period May-June were age I, but there was an increase of young-of-the-year from July to September.

Freshwater Adult

A total of 13 freshwater adults entered the traps during the year. Five of these were females and eight were males. The time of capture and size of the fish are listed in Table 2.

Three of the females showed normal sexual development and eggs were taken and incubated. A total of 781 eggs was obtained, but survival was very low (Table 3).

Marked Silver Salmon--Downstream Movement

Several groups of marked silver salmon were recovered at both weirs. A summary of the numbers, by mark and time period, is presented in Table 4. A summary of fin-marks applied to fish in the Fire Lake system is presented in Table 5.

Two thousand silver salmon fingerlings, marked by excision of the left ventral (LV) fin were planted into Upper Fire Lake in August, 1965. At the same time, 2,000 fingerlings marked by removal of the right ventral (RV) fin were planted into Lower Fire Lake.

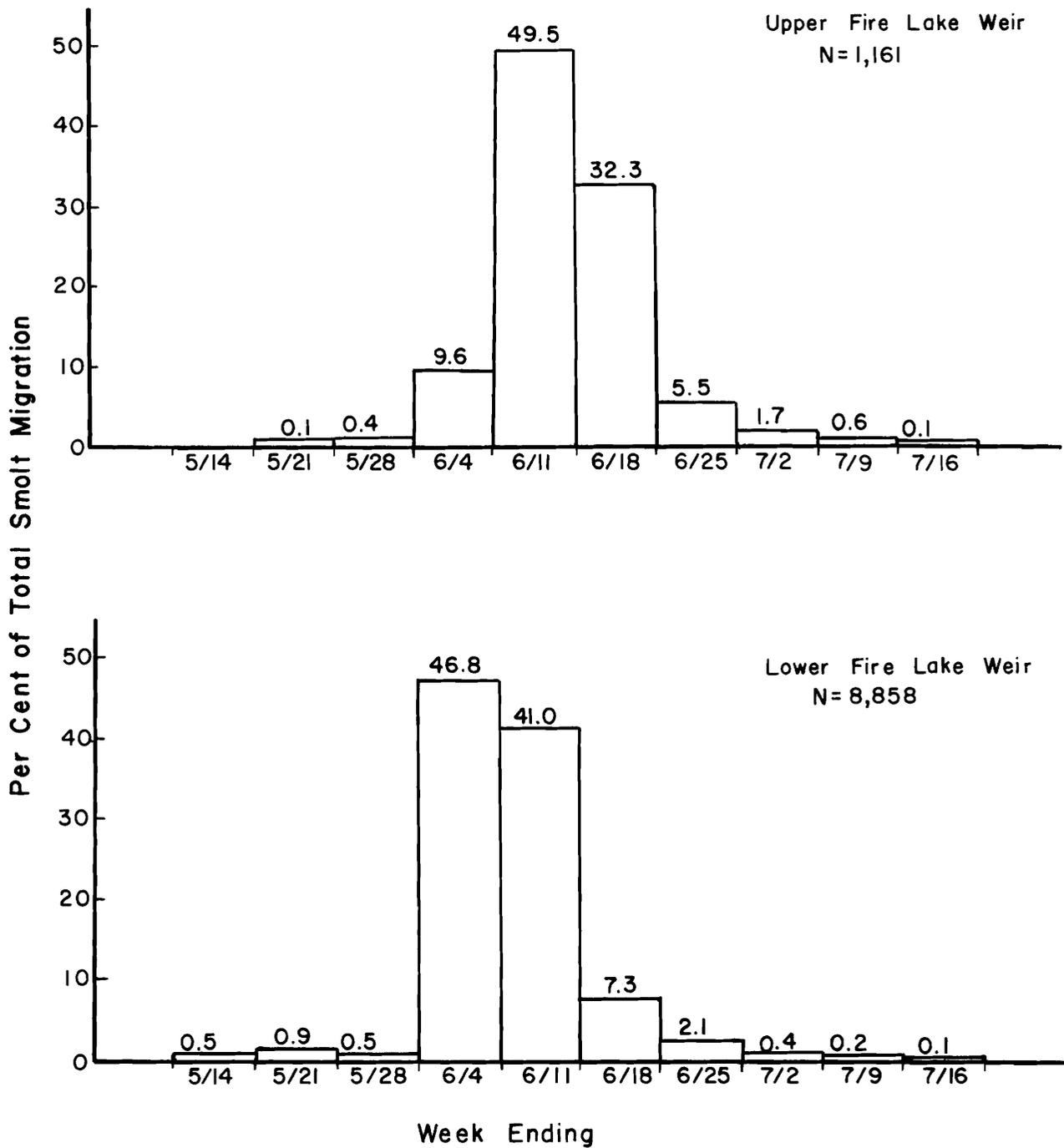


Figure 1. Time of Silver Salmon Smolt Migration from Upper and Lower Fire Lakes by Weekly Periods During 1966.

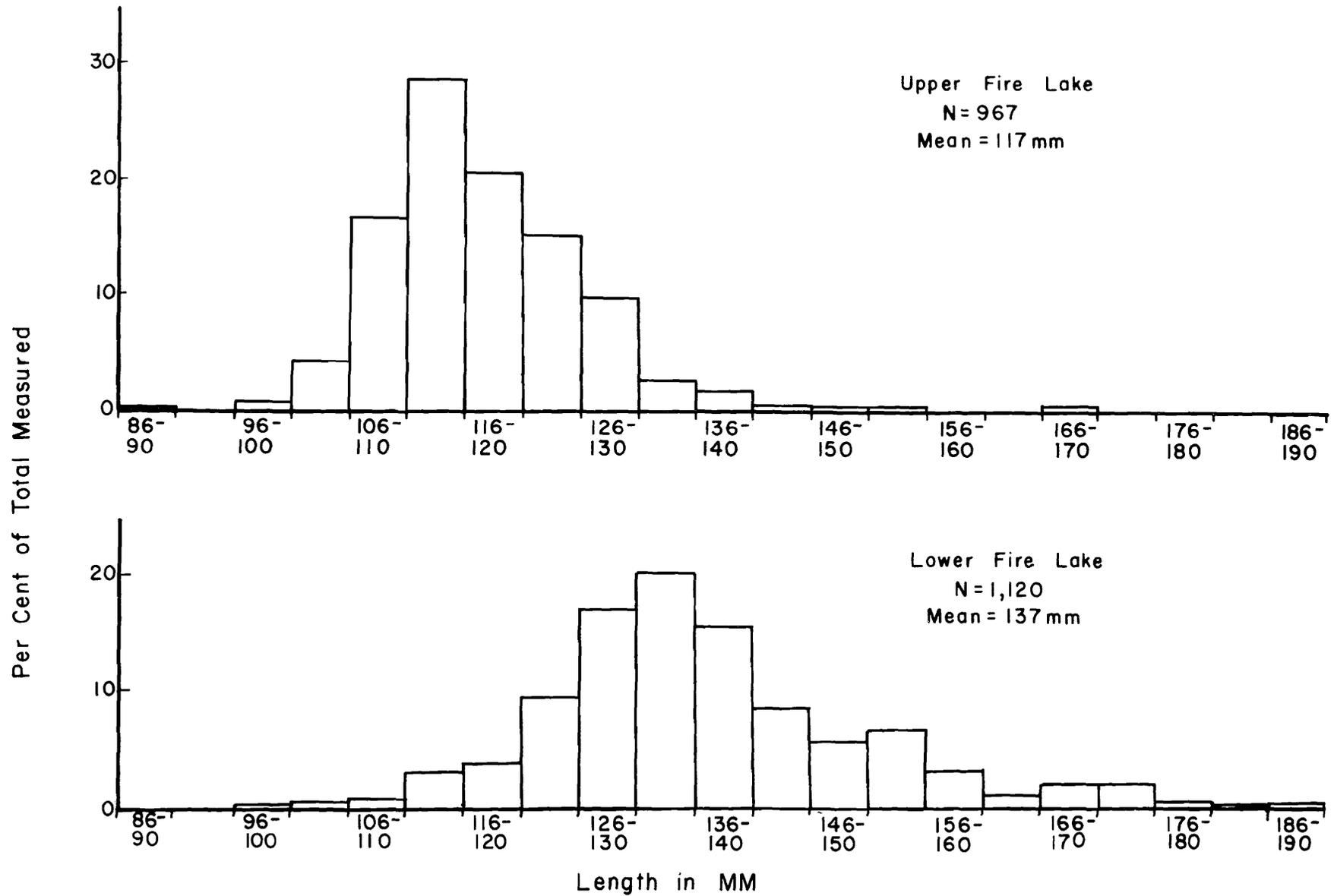


Figure 2. Size Composition of Silver Salmon Smolts from Upper and Lower Fire Lakes During the Period May 8 to July 23, 1966.

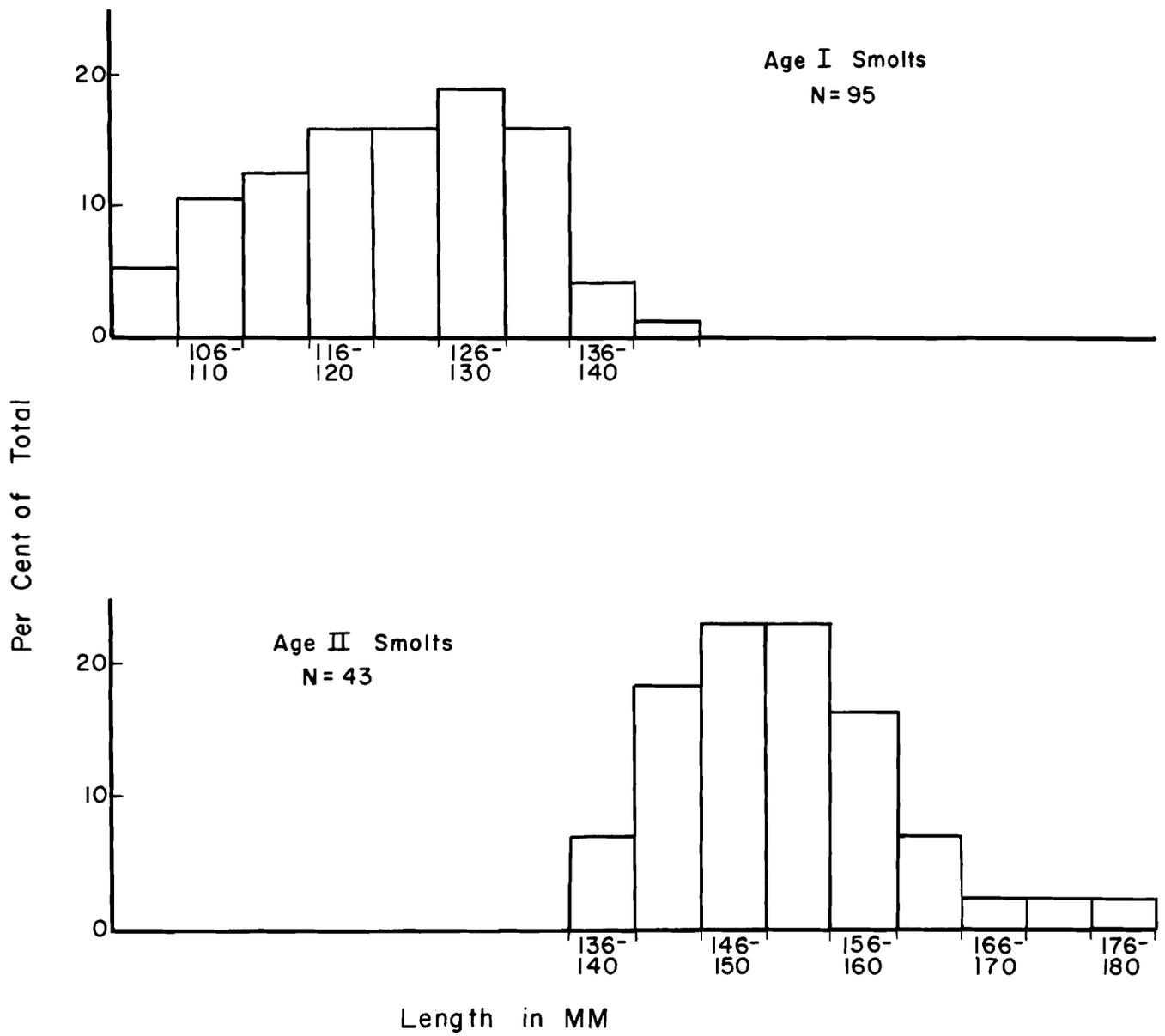


Figure 3. Length Distribution of Age I and Age II Silver Salmon Smolts at Lower Fire Lake Weir, 1966.

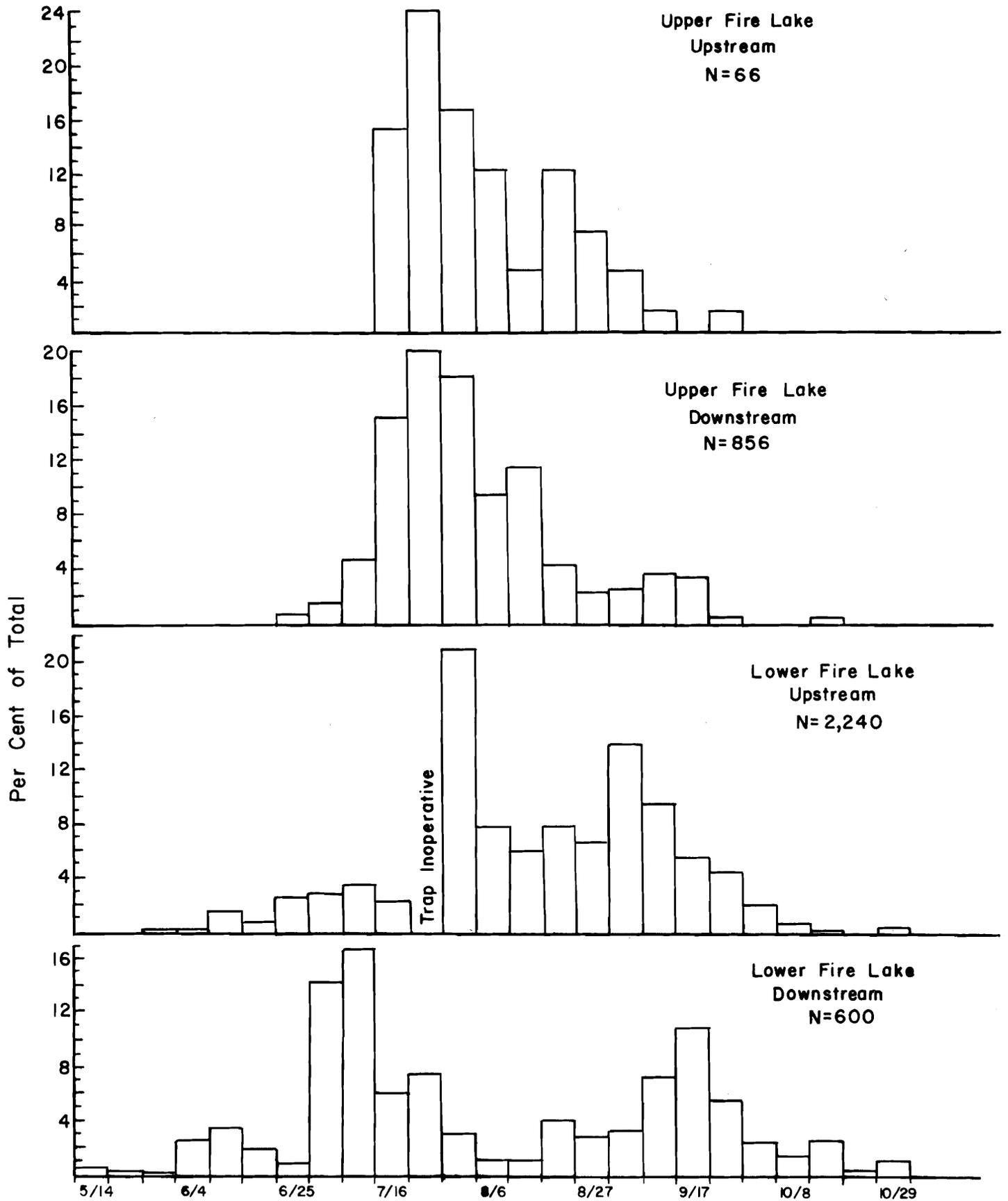


Figure 4. Time of Silver Salmon Parr Movement into Upper and Lower Fire Lake Traps, by Weekly Periods During 1966.

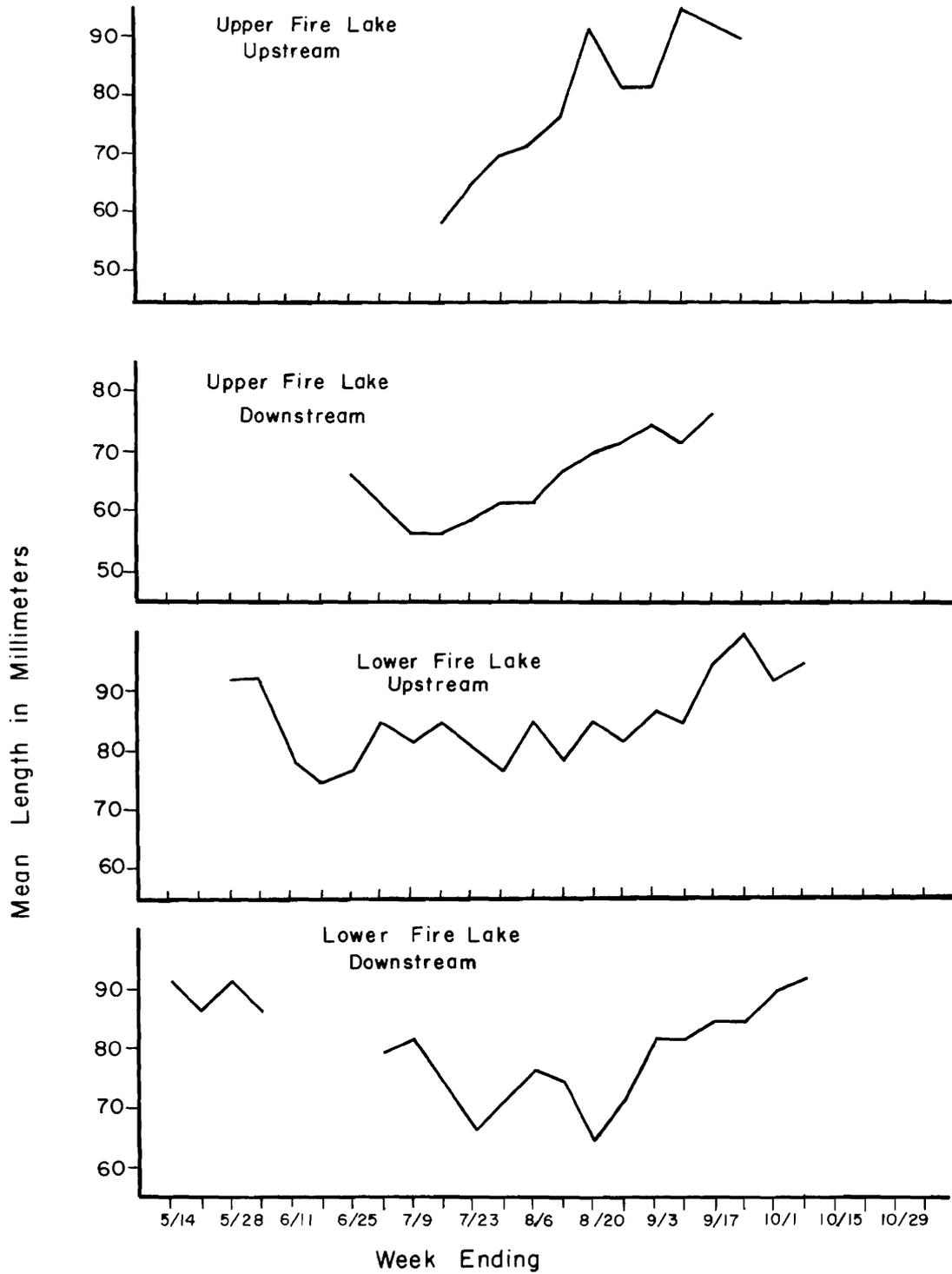


Figure 5. Mean Fork Length of Silver Salmon Parr at Upper and Lower Fire Lake Weirs, by Weekly Periods, 1966.

TABLE 2 - Time of Capture and Size of Freshwater Adult Silver Salmon in the Fire Lake System, 1966.

<u>Date</u>	<u>Size (mm)</u>	<u>Sex</u>	<u>Trap</u>
8/29	249	Female	Upper Fire Lake--Upstream
9/5	165	Male	Upper Fire Lake--Upstream
	168	Male	Upper Fire Lake--Upstream
9/6	251	Female	Upper Fire Lake--Upstream
	168	Male	Upper Fire Lake--Upstream
	170	Male	Upper Fire Lake--Upstream
9/11	170	Male	Upper Fire Lake--Upstream
	170	Male	Upper Fire Lake--Upstream
9/12	246	Female	Upper Fire Lake--Upstream
	267	Female	Upper Fire Lake--Upstream
10/6	368	Female (Spawned out)	Upper Fire Lake--Upstream
9/20	196	Male	Lower Fire Lake--Upstream
9/26	178	Male	Lower Fire Lake--Downstream

TABLE 3 - Size of Mature, Freshwater Silver Salmon Females, Number of Eggs Obtained, and Incubation Loss, Fire Lake Hatchery, 1966-67.

<u>Date Spawned</u>	<u>Length of Females (mm)</u>	<u>Number of Eggs</u>	<u>Egg Loss</u>		<u>Fry Loss</u>		<u>Live Fry (3/1/67)</u>
			<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>	
9/18	267	215	210	97.7	--	--	--
9/20	249	337	214	62.9	--	--	--
10/6	251	<u>229</u>	<u>229</u>	<u>100.0</u>	<u>--</u>	<u>--</u>	<u>--</u>
TOTAL		781	653	83.6	56	43.8	72

During 1966, 1,064 smolts marked LV were enumerated at the Upper Fire Lake weir for a minimum survival of 53.2 percent. The group marked RV and planted into Lower Fire Lake provided 609 smolts to the Lower Fire Lake weir, for a minimum survival of 30.4 percent. It is possible that additional fish moved downstream when weirs were not installed or during periods the trap overflowed. Additional fish may migrate during 1967 as age II smolts.

LV-marked fish comprised 91.7 percent of the smolt migration through the Upper Fire Lake weir. Characteristics of the marked and unmarked smolt migration were similar.

Migration of RV-marked fish differed slightly from the entire out-migration from Lower Fire Lake. The peak out-migration of marked fish from Lower Fire Lake occurred during the week ending June 11, one week later than for the total out-migration. Peak day for marked fish was June 5, compared to June 1 for the total.

Time of migration of the LV group through the Upper Fire Lake weir and both groups through the Lower Fire Lake weir was similar although peak migration of the LV group was slightly later at both weirs than the RV-marked fish (Figure 6). Fish were not marked as

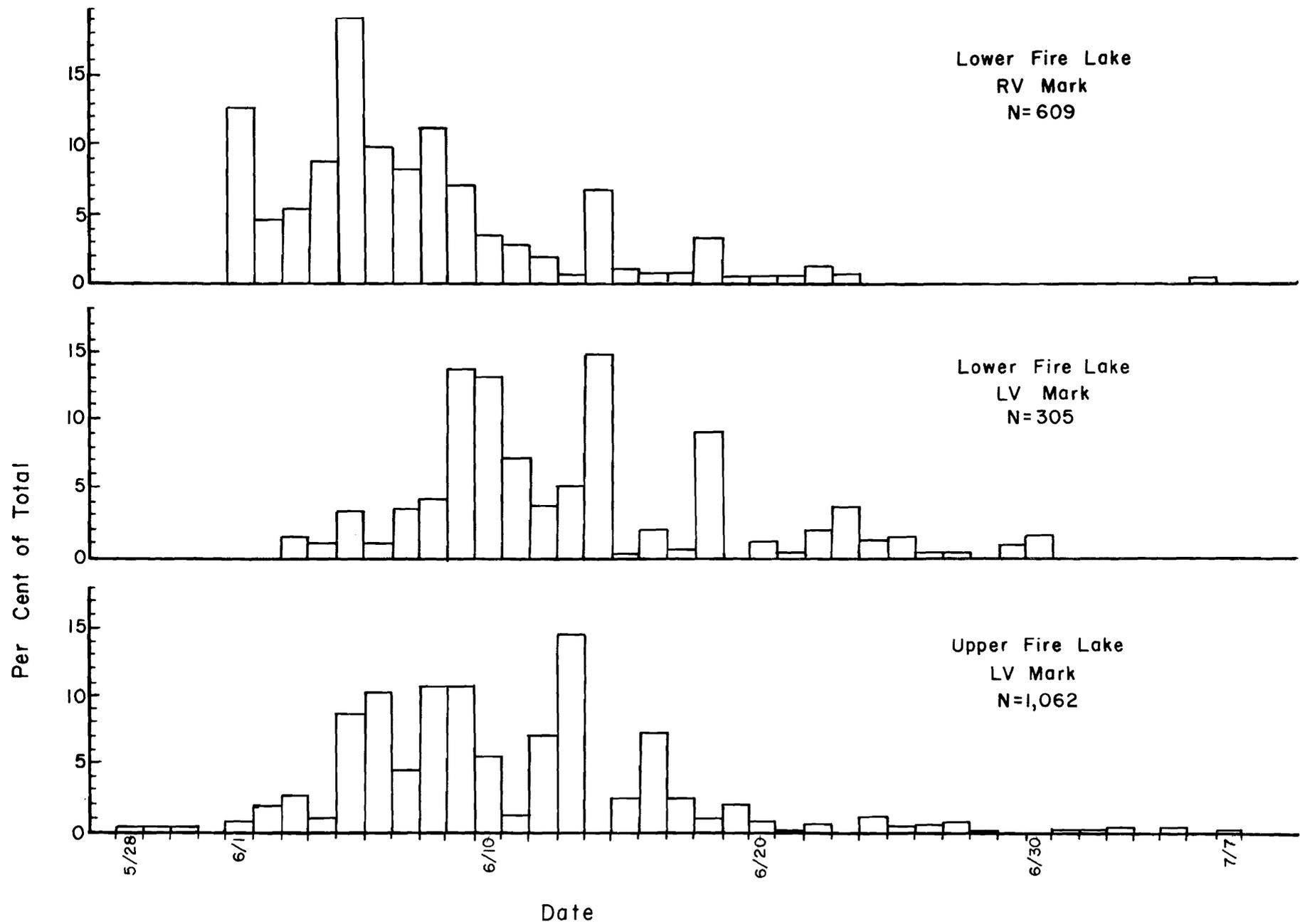


Figure 6. Time of Downstream Migration of Marked Silver Salmon from Upper and Lower Fire Lakes, by Day, During the 1966 Spring Migration Season.

TABLE 4 - Numbers of Marked Silver Salmon Captured in the Upper and Lower Fire Lake Downstream Traps by Weekly Periods During 1966.

Week Ending	Lower Fire Lake									Upper Fire Lake				
	<u>RV</u>	<u>LV</u>	<u>LV*</u>	<u>Ad</u>	<u>Ad</u> <u>RV</u>	<u>Ad</u> <u>BV</u>	<u>BV</u>	<u>LV</u> <u>RP</u>	<u>Ad</u> <u>LP</u>	<u>Ad</u> <u>RP</u>	<u>LV</u>	<u>BV</u>	<u>Ad</u>	<u>Ad</u> <u>RP</u>
5/14	0	0	0	0	3	0	0	0	0	0	0	0	0	0
5/21	0	0	0	5	2	0	0	0	0	0	0	0	0	0
5/28	0	0	0	2	0	0	0	0	0	0	2	0	0	0
6/4	132	8	2	31	50	2	9	0	0	0	70	0	0	0
6/11	372	141	0	16	24	2	7	0	0	0	545	3	0	0
6/18	89	110	0	0	3	0	3	0	0	0	365	1	0	0
6/25	15	32	0	0	0	0	1	0	0	0	57	0	0	0
7/2	0	11	0	0	2	0	1	0	0	0	18	0	1	0
7/9	1	3	0	0	1	0	0	0	0	0	5	0	0	0
8/13	0	3	0	0	0	0	0	0	0	0	1	0	0	0
8/20	0	1	0	0	0	0	0	0	4	1	0	0	0	1
8/27	0	0	0	0	0	0	0	1	3	0	0	0	0	0
9/3	0	0	0	0	0	0	0	0	1	0	0	0	0	0
9/10	0	0	0	0	0	0	0	0	3	0	0	0	0	0
9/17	0	0	0	0	0	0	0	0	5	0	1	0	0	0
9/24	0	0	0	0	0	0	0	0	3	0	0	0	0	1
10/8	0	0	0	0	0	0	0	0	2	0	0	0	0	0
10/15	0	0	0	0	0	0	0	0	4	0	0	0	0	0
Total	609	309	2	54	85	4	21	1	25	1	1,064	4	1	2
Killed	7	3	0	0	0	0	0	0	0	0	78	0	0	1
No. Released	602	306	2	54	85	4	21	1	25	1	986	4	1	1

* Age II fish; remainder of LV-marked fish were age I.

they passed through the Upper Fire Lake weir and it is not possible to determine precisely how long it took for fish to move from the Upper Fire Lake trap to the Lower Fire Lake trap. Peak movements of LV-marked fish at the Lower Fire Lake weir occurred about one to two days after peaks at the Upper Fire Lake trap.

TABLE 5 - Summary of Fin-Marks Used on Silver Salmon in the Fire Lake System.

<u>Year</u>	<u>Mark</u>	<u>Identification</u>
1962	Left Ventral	4,000 fingerlings released from hatchery into Fire Creek, 9/7/62.
1963	Left Ventral Right Ventral Adipose--Left Pectoral Adipose--Right Pectoral	Upper Fire Lake--Downstream Trap. Upper Fire Lake--Upstream Trap. Lower Fire Lake--Downstream Trap. Lower Fire Lake--Upstream Trap.
1964	Adipose--Right Ventral Adipose--Left Ventral	Lower Fire Lake--Downstream Trap. Lower Fire Lake--Upstream Trap.
1965	Adipose Left Ventral Right Ventral	All seaward migrating fish. 2,000 fingerlings planted into Upper Fire Lake in August, 1965. 2,000 fingerlings planted into Lower Fire Lake in August, 1965.
1966	Right Pectoral and Adipose--Right Pectoral Left Pectoral and Adipose--Left Pectoral	2,000 fingerlings at 233/pound planted into Upper Fire Lake 8/10/66. Adipose removed upon recapture at UFL trap. 2,000 fingerlings at 224/pound planted into Lower Fire Lake 8/10/66. Adipose removed upon recapture at LFL trap.

Of the 1,064 LV-marked smolts captured at the Upper Fire Lake downstream trap, 986 were released to continue their migration. However, only 309 LV-marked smolts (31.3 percent) were enumerated through the Lower Fire Lake trap. Reasons for the reduced numbers of marked fish moving out of Lower Fire Lake are unknown. It could be due to mortality or to an undue delay in moving through Lower Fire Lake. In the latter case, marked fish may migrate during 1967.

RV-marked smolts from Lower Fire Lake averaged 124 mm in length (Figure 7). LV-marked smolts averaged 117 mm in length when they passed through the Upper Fire Lake weir downstream into Lower Fire Lake, and a small sample (31 fish) averaged 124 mm when they passed through the Lower Lake weir.

The fin-marks of both groups were of very poor quality with some fins showing almost complete regeneration. If fins were not expected to be missing, many of the marked fish would have gone undetected in a normal examination. Since most of the fish from Upper Fire Lake were expected to be marked, it is felt that a greater proportion were detected than at the Lower Fire Lake trap. This factor should not be overlooked in comparing survival rates of the two groups.

On August 10, 1966, a group of 2,000 silver salmon fingerlings averaging 233 fish per pound and marked right pectoral (RP) was planted into Upper Fire Lake. A second group of 2,000 fish marked left pectoral (LP) averaging 224 per pound, was planted into Lower Fire Lake. When the fish were captured in the downstream traps, the adipose fin was removed for further identification.

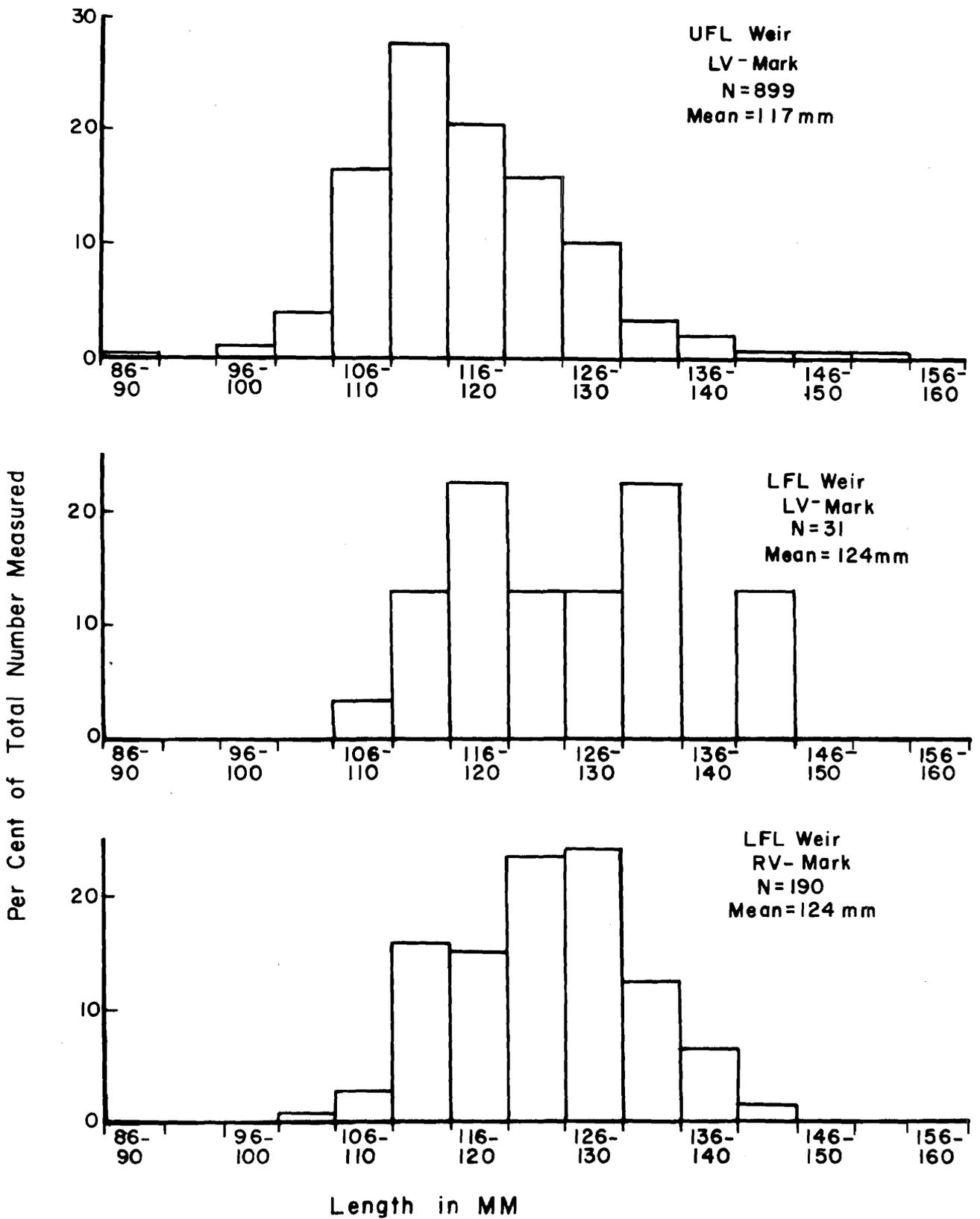


Figure 7. Size Composition of Marked Age-I Silver Salmon Smolts from Upper and Lower Fire Lakes During 1966.

Two RP-marked fish were recovered in the Upper Fire Lake downstream trap. The first was on August 14, and was marked by removal of the adipose fin. It was recovered in the Lower Fire Lake downstream trap on August 16. The second fish of this group was found dead in the Upper Fire Lake trap on September 19. Twenty-five LP-marked fish were captured in the Lower Fire Lake downstream trap during the period August 15 to October 11.

Length-Weight Data of Juvenile Silver Salmon

Individual weights of 377 silver salmon were taken to establish length-weight relationships at the Upper and Lower Fire Lake weirs. The data are presented in Table 6.

Surveys of Lower Fire Creek

Some time in September was devoted to breaching beaver dams on Lower Fire Creek to permit upstream passage of adult silvers. Complete surveys of the creek were not conducted due to manpower limitations. On September 9, six adults were observed below the lowermost beaver dam, approximately one mile above tidewater. On September 25, nine adult silvers were observed spawning above the uppermost beaver dam near the railroad culvert, and on September 28, eleven were observed spawning in the same area. No adults were observed at the Lower Fire Lake weir during 1966.

King Salmon Juvenile Movements

During the silver salmon smolt migration, four king salmon *O. tshawytscha* (Walbaum), were observed at the Lower Fire Lake weir. Three were recovered in the downstream trap, and one in the upstream trap (Table 7).

One thousand five hundred king salmon fingerlings of Green River, Washington origin were marked June 30, and released into Lower Fire Lake. On July 1, a group of 1,300 fingerlings was marked and planted into Upper Fire Lake. Both groups were marked by removal of the posterior portion of the dorsal (D) fin; they averaged 190 fish per pound at time of release. The right maxillary (RMx) was removed upon recapture at the Upper Fire Lake weir, and the left maxillary (LMx) was clipped at the Lower Lake weir.

A total of 16 fish from Upper Fire Lake and 8 from Lower Fire Lake had been recaptured at the end of the trapping season (Table 7).

Red Salmon Juvenile Movements

A total of 17 red salmon *O. nerka* (Walbaum), smolts was recorded at the Upper Fire Lake downstream trap during the period June 2 to 13. They ranged in length from 102 to 114 mm, with a mean length of 107 mm.

Three adult kokanee were captured in the Upper Fire Lake upstream trap. A 279 mm female was captured on August 20, and two males, 165 and 160 mm, were captured on August 26 and September 8, respectively.

Rainbow Trout

A total of 883 rainbow trout *Salmo gairdneri* (Richardson), was enumerated through the traps during the year (Table 8).

Mature rainbows first entered the Upper Fire Lake upstream trap on May 10, and the last adult was captured May 29. The adult run consisted of 22 fish, 14 males and 8 females. Males ranged in length from 213 to 434 mm and averaged 297 mm (11.7 inches). Females ranged from 325 to 516 mm, with a mean length of 427 mm (16.8 inches).

Six adult males were captured in the Upper Fire Lake downstream trap, but since those released upstream were not marked, it is not possible to determine if any had been enumerated through the upstream trap.

Fifteen adult rainbows were captured in the Lower Fire Lake downstream trap during the period May 14 to June 4. They ranged from 196 to 318 mm in length, with a mean of 234 mm (9.2 inches). One adult male, 244 mm in length, was captured in the upstream trap.

TABLE 6 - Length-Weight Relationship of Silver Salmon Trapped at the Upper and Lower Fire Lake Weirs, 1966.

Fork Length (mm)	Lower Fire Lake			Upper Fire Lake		
	Number In Sample	Weight in Grams Range	Mean	Number In Sample	Weight in Grams Range	Mean
61 - 65	1		4.1	--		
66 - 70	2	4.3 - 4.4	4.4	2	4.2 - 4.4	4.3
71 - 75	1	---	4.7	--	---	---
76 - 80	3	6.1 - 6.3	6.2	1	---	5.9
81 - 85	2	5.9 - 7.1	6.5	--	---	---
86 - 90	1	---	8.9	--	---	---
91 - 95	0	---	---	1	---	7.6
96 - 100	4	10.8 - 12.6	11.8	4	10.5 - 11.3	10.9
101 - 105	9	11.6 - 15.9	14.3	9	11.8 - 14.7	13.5
106 - 110	19	12.9 - 18.2	15.9	28	13.0 - 17.4	14.7
111 - 115	31	15.6 - 20.0	18.1	31	14.8 - 21.2	17.1
116 - 120	44	15.3 - 23.4	20.2	17	16.9 - 22.2	19.1
121 - 125	49	19.4 - 25.7	22.6	11	20.0 - 28.4	22.4
126 - 130	47	21.0 - 29.8	25.6	6	22.2 - 26.9	24.6
131 - 135	31	24.1 - 32.3	28.3	--	---	---
136 - 140	5	30.0 - 31.6	30.5	--	---	---
141 - 145	5	32.3 - 34.9	33.2	--	---	---
146 - 150	3	36.7 - 39.2	37.9	--	---	---
151 - 155	3	39.6 - 43.0	40.9	--	---	---
156 - 160	5	42.8 - 49.0	45.9	--	---	---
161 - 165	2	49.8 - 52.6	51.2	--	---	---
TOTAL	267			110		

TABLE 7 - King Salmon Captured at the Upper and Lower Fire Lake Weirs, 1966.

Week Ending	UFL-Downstream Trap			LFL-Downstream Trap			LFL-Upstream Trap		
	Number	Length (mm)	Mark	Number	Length (mm)	Mark	Number	Length (mm)	Mark
6/4	-	---	--	1	201	--	-	---	--
6/17	-	---	--	2	Appr. 200 mm	--	-	---	--
6/25	-	---	--	-	---	--	1	211	--
7/2	1	64	D-RMx	-	---	--	-	---	--
7/9	6	64 - 72	D-RMx	-	---	--	-	---	--
7/13	3	72 - 76	D-RMx	1	71	D-LMx	-	---	--
7/20	3	79 - 84	D-RMx	-	---	--	-	---	--
8/27	1	102	D-RMx	1	89	D-LMx	-	---	--
9/3	1	104	D-RMx	-	---	--	-	---	--
9/17	-	---	--	3	97 - 107	D-LMx	-	---	--
9/24	-	---	--	1	117	D-LMx	-	---	--
10/15	-	---	--	2	102 - 112	D-LMx	-	---	--
10/29	1	112	--	-	---	--	-	---	--
TOTAL	16			11			1		

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TABLE 8 - Numbers of Rainbow Trout Trapped at the Upper and Lower Fire Lake Weirs During 1966, by Weekly Periods.

Week Ending	Upper Fire Lake Weir		Lower Fire Lake Weir	
	Upstream	Downstream	Upstream	Downstream
4/23	0	1	--	--
4/30	0	0	--	--
5/7	0	0	--	--
5/14	15	2	0	8
5/21	0	2	19	26
5/28	8	0	31	6
6/4	1	1	33	39
6/11	1	2	34	24
6/18	0	0	2	5
6/25	1	1	4	3
7/2	1	1	15	6
7/9	0	1	16	18
7/16	6	1	2	3
7/23	12	128	--	3
7/30	10	32	12	1
8/6	14	24	10	0
8/13	12	16	4	1
8/20	5	13	11	3
8/27	7	5	9	4
9/3	8	6	11	4
9/10	2	7	19	8
9/17	3	16	35	7
9/24	3	1	42	1
10/1	0	3	11	0
10/8	0	3	3	1
10/15	0	1	1	3
10/22	0	0	0	2
10/29	0	2	4	1
TOTAL	109	269	328	177

Most of the upstream movement of juvenile rainbows at the Upper Fire Lake trap were recorded during July and August. Downstream movement consisted largely of young-of-the-year that inadvertently escaped from the hatchery.

Peak upstream movement of juvenile rainbows at the Lower Fire Lake trap occurred in June and again in September. Most of the fish were in a size range of 75 to 150 mm (3 to 6 inches), with a gradual increase in size with time as illustrated by three arbitrary time periods in Figure 8. Peak downstream movement at the Lower Lake weir occurred in June. There was no pronounced peak in the fall. Juveniles were comparable in size to those moving upstream during the spring and summer, but the limited numbers during fall were largely young-of-the-year (Figure 9).

Dolly Varden Char Movements

A total of 207 Dolly Varden Salvelinus malma (Walbaum), was checked through all traps during 1966 (Table 9).

The small number of fish captured at the Upper Fire Lake weir was inadequate to demonstrate a preference for time of movement. In the fall there were a few sexually mature adults ranging in size from 198 to 277 mm (7.8 to 10.9 inches).

At the Lower Lake weir there were peak movements, both upstream and downstream during the spring and fall. Fish in the upstream trap ranged from 71 to 188 mm (2.8 to 7.4 inches). They were well distributed throughout the size range with no definite pattern by season. In the downstream trap, fish ranged in size from 74 to 272 mm (2.9 to 10.7 inches). Most of the fish were well distributed in the size range 74 to 163 mm (2.9 to

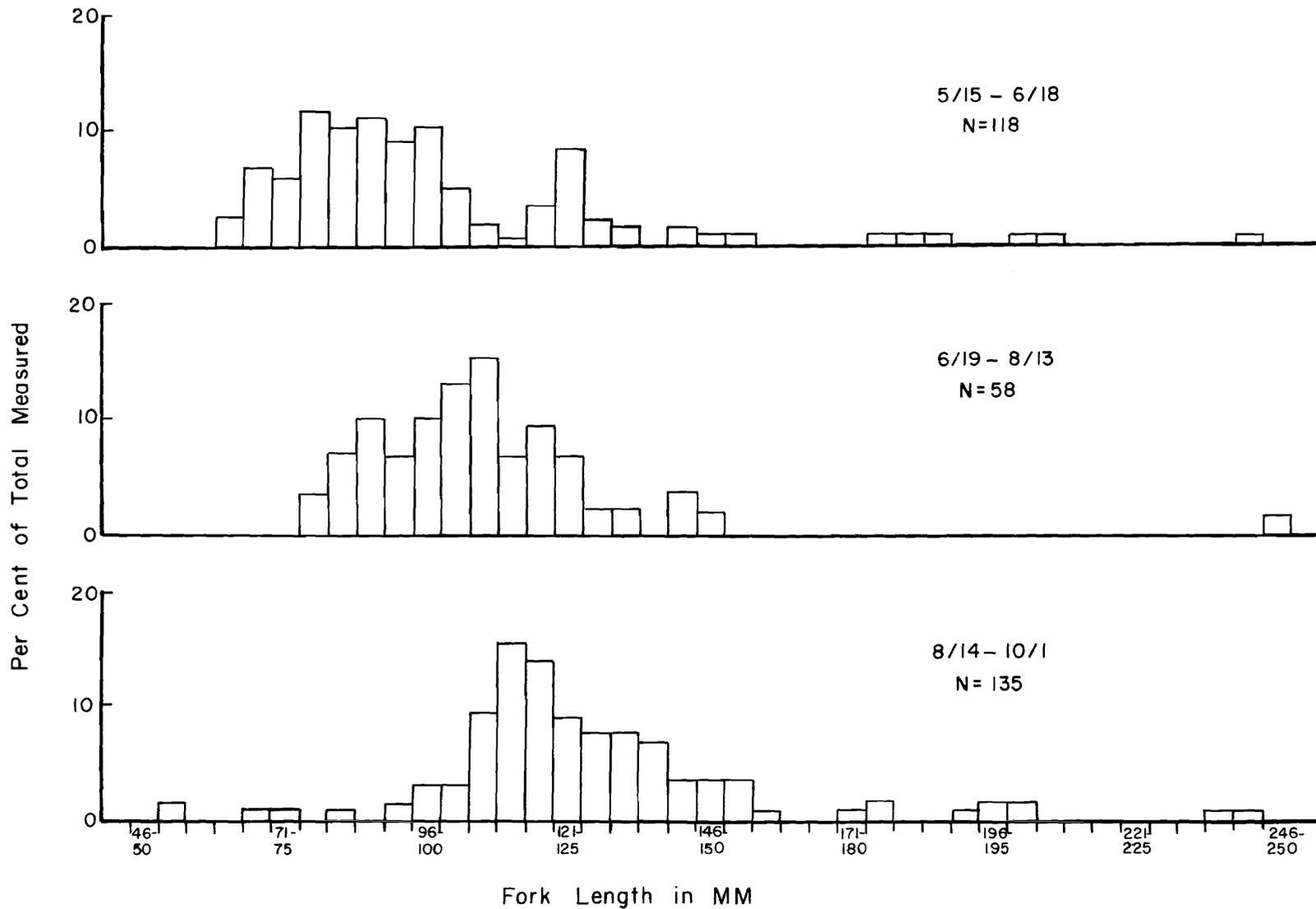


Figure 8. Size Composition of Rainbow Trout at the Lower Fire Lake Upstream Trap by Three Time Periods During 1966.

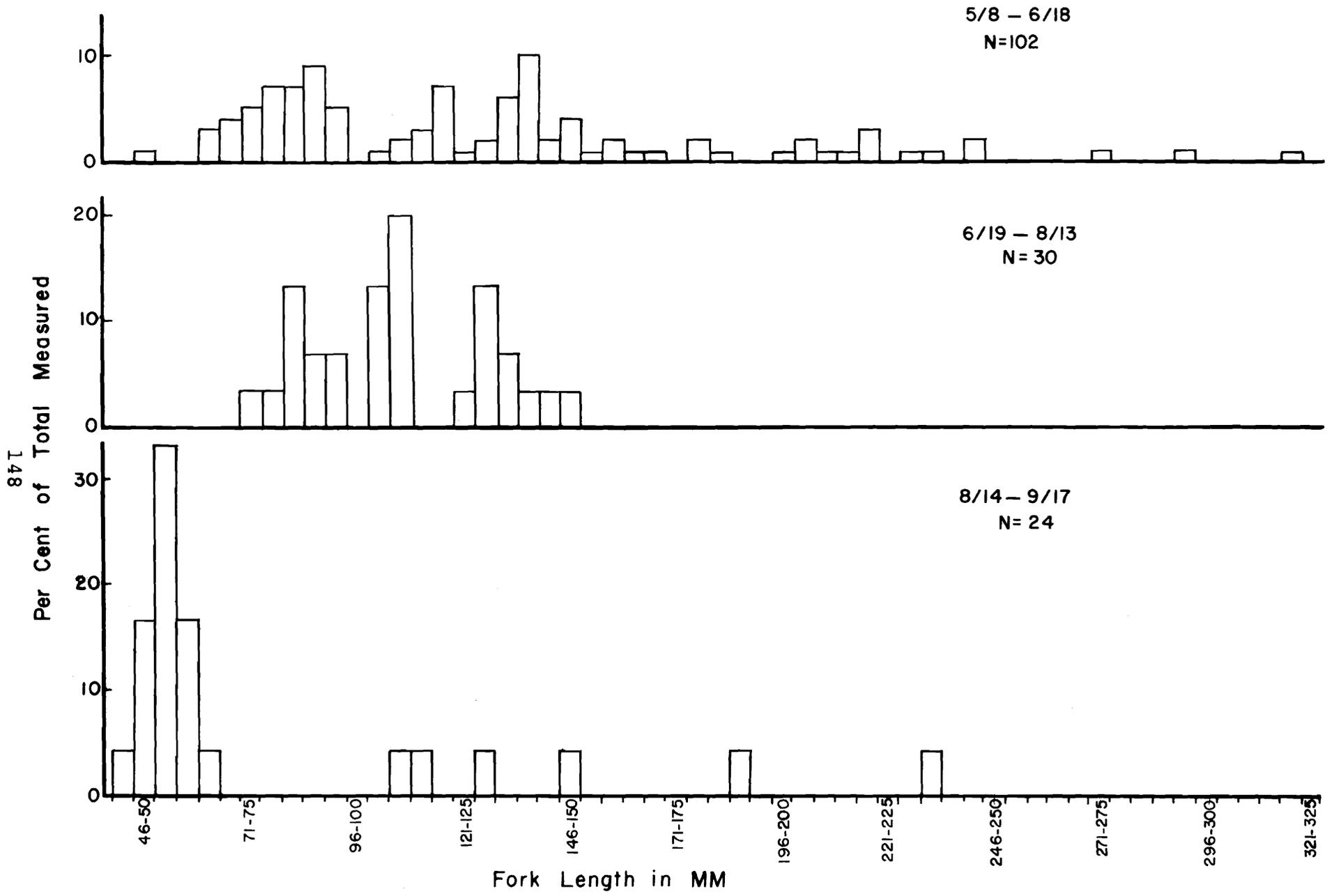


Figure 9. Size Composition of Rainbow Trout at the Lower Fire Lake Downstream Trap by Three Time Periods During 1966.

6.4 inches), with relatively few larger ones. Four sexually mature fish were recorded in the downstream trap in September.

TABLE 9 - Numbers of Dolly Varden Trapped at the Upper and Lower Fire Lake Weirs During 1966, by Weekly Periods.

Week Ending	Upper Fire Lake Weir		Lower Fire Lake Weir	
	Upstream	Downstream	Upstream	Downstream
5/21	0	0	7	4
5/28	0	0	7	1
6/4	1	1	11	20
6/11	0	1	2	19
6/18	1	0	1	6
6/25	0	0	5	3
7/2	2	2	6	6
7/9	1	0	2	2
7/16	3	0	2	5
7/23	3	0	--	0
7/30	0	0	1	0
8/6	0	0	1	0
8/13	0	0	1	0
8/20	1	0	1	1
8/27	2	0	3	0
9/3	1	0	10	3
9/10	0	0	5	6
9/17	2	0	9	4
9/24	1	0	19	3
10/1	0	0	3	2
10/8	1	0	1	0
10/15	0	0	0	2
TOTAL	19	4	97	87

Water Analysis

Detailed water analysis data for Upper Fire Lake are presented in the annual completion report for Job No. 9-C-2, Evaluation of the Fire Lake Hatchery Water Supply. Water samples were taken from three stations in Lower Fire Lake during the winter, primarily to determine dissolved oxygen levels in the lake during winter. Results are presented in Table 10.

Water temperatures were recorded at each weir at intervals during the period June 15 to October 24. The maximum temperature recorded at the Upper Fire Lake weir was 69° F. on July 10, and a minimum of 40° F. was recorded on October 23. A maximum of 73° F. was recorded at the Lower Lake weir on July 23, and a minimum of 40° F. on October 24.

Fort Richardson Cooling Pond

Two broods of rainbow trout and two of king salmon were reared in the cooling pond at Fort Richardson during the report period. A production summary for 1965-brood rainbows is presented in Table 11.

An excessive silt load in Ship Creek created mechanical problems in the cooling plant during April and part of May. It was therefore necessary to reduce the flow through the plant, which resulted in a reduction of dissolved oxygen in the pond. An emergency pump and aeration equipment were installed, and water directly from Ship Creek was turned into the pond to alleviate the problem of low dissolved oxygen. Oxygen levels as low as 2.5 parts per million were recorded during the period April 24 to 26, but had been increased to levels above 5 ppm by the evening of April 26. Murky water prevented complete recovery of dead fish, but the total unaccounted loss indicates that a few thousand fish were probably lost during this period.

TABLE 10 - Lower Fire Lake Water Analysis, March 17, 1966 to January 19, 1967.

<u>Date</u>	<u>Station Number*</u>	<u>Snow Depth (inches)</u>	<u>Ice Depth (inches)</u>	<u>Water Depth (feet)</u>	<u>Water Temperature (° F.)</u>	<u>DO (ppm)</u>	<u>CO₂ (ppm)</u>	<u>pH</u>
3/17/66	1	12	36	0	33	Trace	--	---
				5	34	Trace	--	---
				10	36	0.5	--	---
3/27/66	1	6	37	0	33	Trace	20	6.6
				5	34	0.0	20	6.6
				7	36	0.0	22	6.6
	2	--	28	0	33	5.8	--	---
				5	34	5.0	--	---
				7	38	5.2	--	---
	3	6	34	0	33	4.2	--	---
				5	34	3.4	--	---
				10	37	Trace	--	---
				15	38	0.0	20	6.7
12/22/66	1	3	22	0	32	4.0	--	---
				7	38	3.0	25	---
	2	8	16	0	32	11.0	4	---
				3	32	6.4	--	---
	3	8	16	5	35	5.4	--	---
				10	36	1.4	--	---
				15	38	0.7	21	---
1/19/67	1	9	26	5	34	1.0	--	---
				3	34	---	5	7.6
	2	14	20	0	34	6.2	5	7.2
				5	36	2.5	--	---
	3	14	22	10	36	0.6	--	---
				15	38	0.5	14	7.0

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* Station #1 - Approximately 100 yards above lake outlet.
 Station #2 - Near inlet stream.
 Station #3 - Approximately midway between island in upper end and east shore.

TABLE 11 - Production Summary of 1965-Brood Rainbow Trout Reared at the Fort Richardson Cooling Pond.

Date Stocked	September 7 & 16, 1965
Initial Number	47,000
Total Recorded Loss	900
Total Unaccounted Loss	4,000
Total Loss	4,900 (10.5%)
Total Planted & Transferred	42,100
Total Pounds Planted	17,062
Total Fish Weight Gain	16,545
Total Pounds Food Fed	30,600
Food Conversion	1.85

A total of 50,000 rainbow fingerlings averaging 290 per pound was transferred to the pond on September 6 and 7, 1966. Total recorded mortality through February was 3,700 with 1,500 transferred to Fairbanks. Total number on hand on February 28, 1967, was 44,800, and they averaged 8 fish per pound.

A production summary of 1965-brood king salmon of Green River, Washington origin which were reared in the cooling pond is presented in Table 12. All the king salmon were marked by excision of the posterior portion of the dorsal fin, and released directly into Ship Creek following marking. A total of 166,900 fish, averaging 98 per pound, was released into Ship Creek during the period July 7 to 20, 1966.

TABLE 12 - Production Summary for 1965-Brood King Salmon Reared in the Fort Richardson Cooling Pond.

Date Stocked	June 8, 9, & 11, 1966
Initial Number	166,600
Total Recorded Loss	150 (approx.)
Total Unaccounted	400 (gain)
Total Number Planted	166,900
Total Pounds Planted	1,698
Total Fish Weight Gain (Pounds)	838
Total Pounds Food Fed	800
Food Conversion	0.95

A total of 70,000, 1966-brood king salmon of Ship Creek origin was transferred to the cooling pond from the Fire Lake Hatchery on December 27, 1966. The fish had been feeding for a period varying from two weeks to two months, and averaged 1,080 fish per pound when

transferred. Total recorded mortality through February was 1,500, leaving 68,500 on hand. Average weight on February 28 was 122 fish per pound.

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