MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS
FISHERIES DIVISION

JOB PROGRESS REPORT

STATE: MONTANA PROJECT TITLE: STATEWIDE FISHERIES INVESTIGATIONS

PROJECT NO.: F-46-R-3 STUDY TITLE: SURVEY AND INVENTORY OF COLDWATER LAKES

JOB NUMBER: II-b

JOB TITLE: WEST CENTRAL MONTANA COLDWATER LAKE INVESTIGATIONS

PROJECT PERIOD: JULY 1, 1989 THROUGH JUNE 30, 1990

ABSTRACT

Kokanee salmon average length was 8.7 inches in January, 1990 angler creel.

Rainbow trout average length in January, 1990 angler creel was 13.4 inches. This average is unchanged from that of January, 1989. Composition of the January, 1990, rainbow catch was 59% Arlee, 28% Eagle Lake, and 13% Kamloops. Reduced catch contribution from Eagle Lake resulted from reduced survival of 1988 stocked fish. Kamloops increased percentage resulted from a planting of 8.3 inch fish made in June, 1989. A 10.5 pound Kamloops was caught by an angler in October 1989.

A very large spawning run composed of 95%+ Eagle Lake rainbow was monitored in spring 1990. Spawners averaged 17.5 inches with 43% exceeding 18 inches and 10% over 20 inches.

Oxygen levels in Georgetown remained above 5 ppm O_2 below 2m through March 1990.

OBJECTIVES AND DEGREE OF ATTAINMENT

1. Develop an average size rainbow trout in the Georgetown Lake winter creel to 14 inches.

   Rainbow trout average length was unchanged between January 189 and 1990. Whether this reflects a leveling off of average size gains since 1985 or the greater difficulty encountered in successfully landing larger trout while ice fishing is unclear. Average sizes of spawning rainbows in tributaries of Georgetown Lake in spring 1989 and 1990 were 17.4 inches and 17.5 inches, respectively.

2. Develop a current mountain lake data base on all mountain lakes in Region 2.

   Lakes in the Flint Range were gill netted in summer 1989. Data are processed and a report is in preparation. Eighty lakes were surveyed and sixty-three were netted.

3. Develop mountain lake management plans for ecological units emphasizing wild trout.

   Data for Flint Range lakes collected in July, 1989 are being prepared. Management recommendations will favor natural reproduction. Forty-eight of sixty-three lakes surveyed may be suitable for wild trout management. The remainder either lack natural reproduction or are unsuitable for trout.

4. Increase trout populations to produce overnight gill net catches of 5 fish per net and a mean size of 12 inches.

   No work was done on this objective due to heavy work load in stream work.

5. Increase yellow perch mean size to 9 inches.

   No work was done on this objective due to heavy work load in stream work.

6. Increase size of kokanee in the creel to 10 inches or greater in the Georgetown Lake Winter Fishery.

   Georgetown Lake kokanee have not achieved 10 inch average size in the winter creel since January 1977. Average size of kokanee in 1990 was 8.7 inches. No indication of decrease in kokanee numbers and consequent increase in average size was apparent.

PROCEDURES

Changes in management practices at Georgetown have included the reduction of trout limits from 10 rainbow and 20 brook trout to 5 trout of any combination of species. Stocking of rainbows was changed from 100% Arlee to 1/3 Arlee, 1/3 Eagle Lake and 1/3 Kamloops in order to utilize less catchable and more piscivorous strains. Stocking numbers have been reduced from 250,000 to 180,000 to avoid growth rate reductions as the number of trout surviving has increased with the reduced catch limits. The development of natural reproduction will require further reductions in number of rainbows stocked.

Efforts to increase kokanee average size can only succeed if numbers of kokanee are reduced. Stream spawning kokanee were eliminated in the late seventies and early eighties. Spawning in springs within the lake has been sufficiently successful to compensate for the loss of reproduction in the tributaries and kokanee size has not increased significantly. Unlimited catch regulations were similarly ineffective in reducing kokanee numbers. The introduction of Kamloops and Eagle Lake rainbows to prey on kokanees may be successful but will require additional years of observation to determine.

Development of rainbow trout spawning runs were first documented in 1989 when substantial numbers were recorded in Stuart Mill Creek and the North Fork of Flint Creek. Data collection from spawners was expanded in 1990. Strain identification of spawning rainbows was achieved by starch-gel electrophoresis of fin tissues clipped from spawners and analyzed by the Genetics Laboratory at the University of Montana.

RESULTS AND DISCUSSION

Kokanee Salmon

Kokanee salmon constitute the majority of the winter catch both in number and poundage. Average size of January creeled kokanee decreased from 8.8 inches in 1989 to 8.4 inches in 1990 (Table 1.). Table 2 displays incremental growth of Georgetown kokanee between ages 2+ and 3+. Kokanee growth from 1989 to 1990 averaged 1.4 inches. This is similar to previous years' growth. Figures 1-7 are length frequency plots of Georgetown kokanee from January 1984 to January 1990. No major changes in kokanee sizes were observed in 1990. Three kokanee were observed during the January data collection period with large patches of scales missing apparently the result of failed attacks by predatory trout.

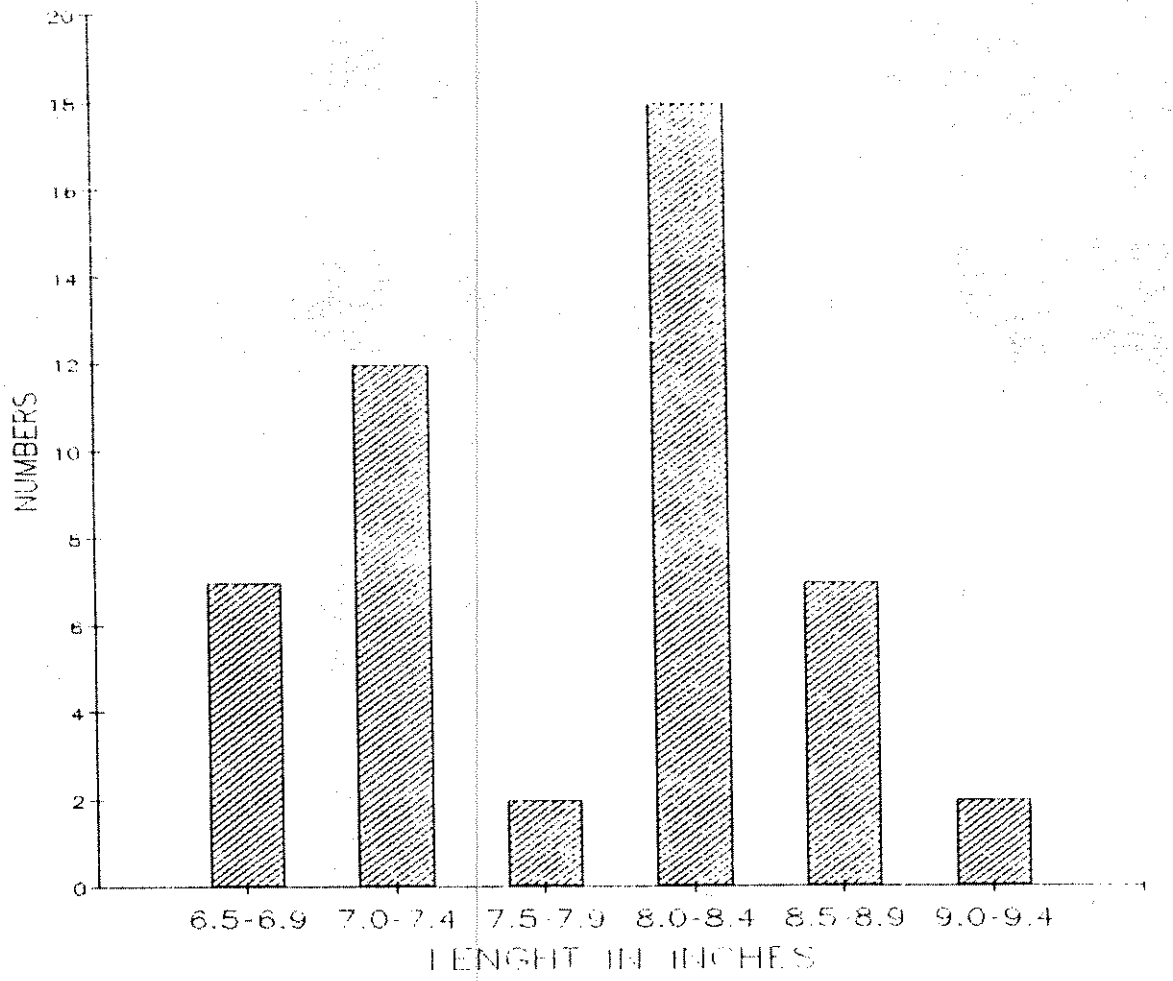
Table 1. Georgetown Lake Kokanee Average Lengths in Winter Angler Creel

Year	66–67	67–68	68–69	69–70	70–71	71–72	72–73	73–74
Sample Number	34	55	No	20	149	717	302	No
Average Length	12.3	10.7	data	11.4	10.9	10.6	9.9	data
Year	74–75	75–76	76–77	77–78	78–79	79–80	80–81	81–82
Sample Number	No	14	346	194	119	7	127	No.
Average Length	data	11.5	10.8	9.2	7.9	8.2	8.4	data
Year	82–83	83–84	84–85	85–86	86–87	87–88	88–89	89–90
Sample Number	No	46	96	133	187	384	403	205
Average Length	data	7.8	8.2	9.1	8.6	9.4	8.8	8.4

Table 2. Georgetown Lake Kokanee 2nd to 3rd Year Growth Increment in January Angler Creel Sample

	78	79	80	81	84	85	86	87	88	89	90
2+ average length	7.8	6.9	7.2		6.9	7.2	7.5	7.5	8.2	7.9	
3+ average length		8.7	8.3	8.8		8.4	9.3	9.2	9.7	9.5	9.3
average growth		0.9	1.4	1.6		1.5	2.1	1.7	2.2	1.3	1.4

Figure 1. Georgetown Lake kokanee length-frequency in January 1984 angler creels. N=48



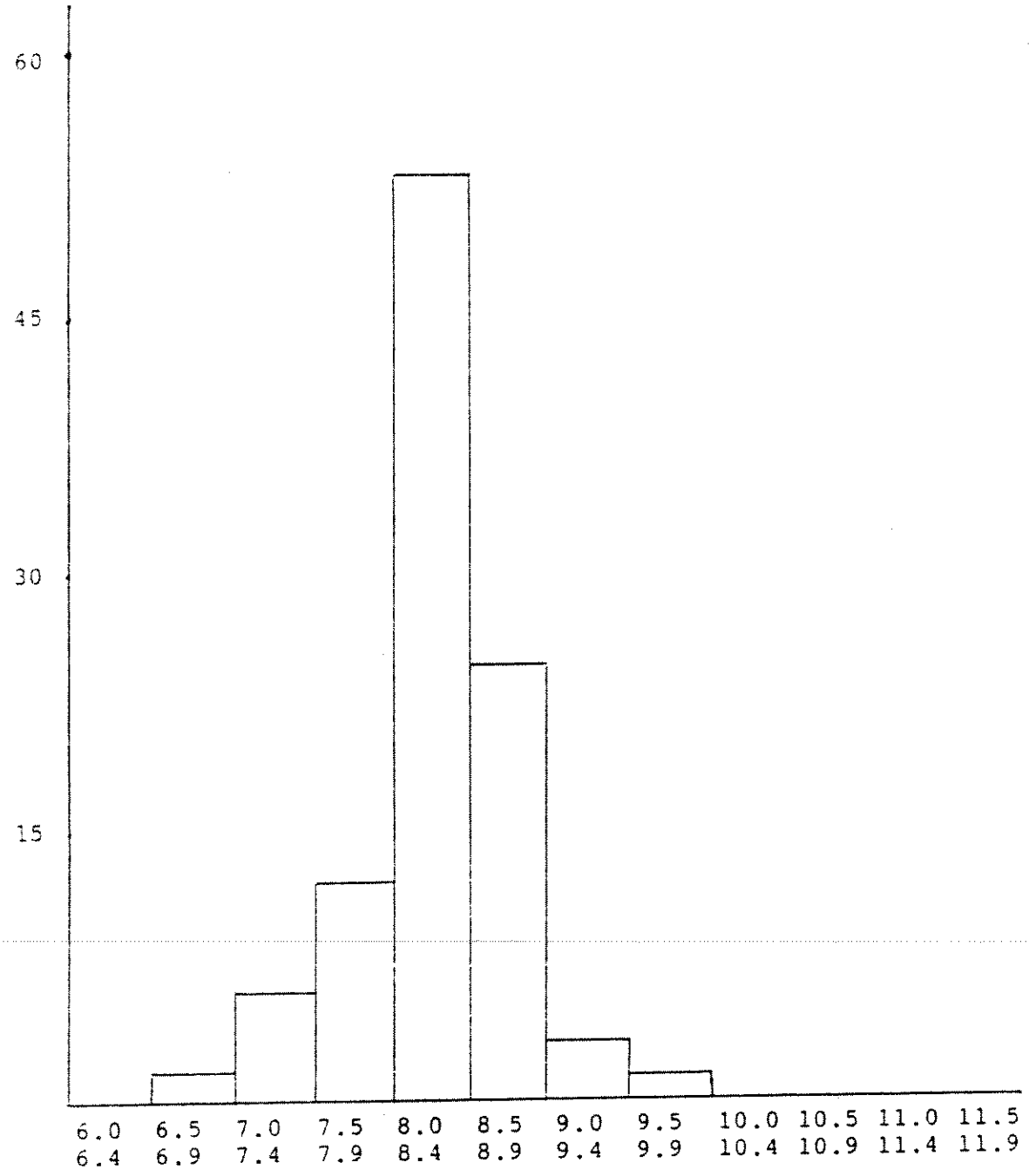


Figure 2. Georgetown Lake Kokanee Length-Frequency in January 1985 Angler Creel. N = 96

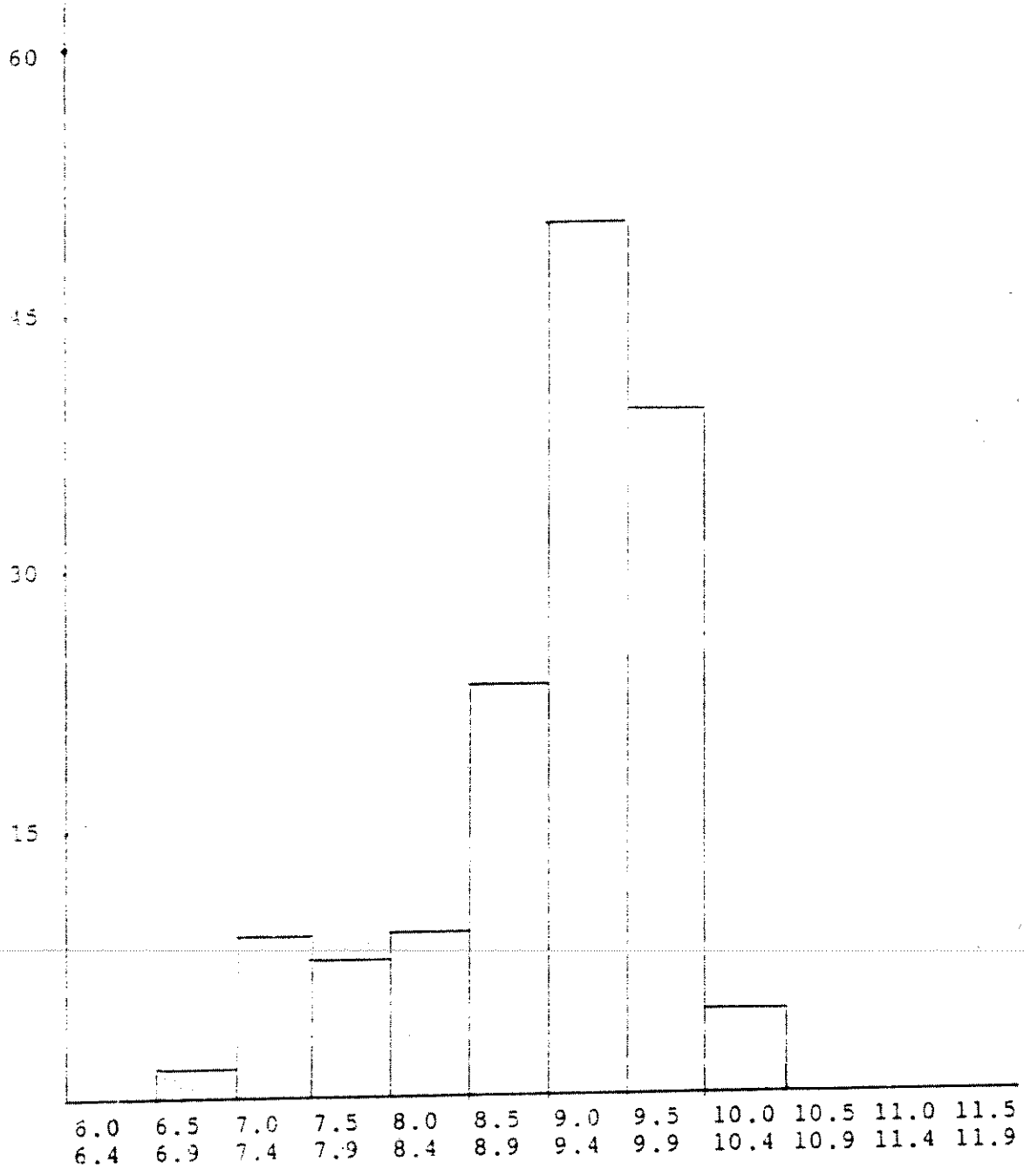


Figure 3. Georgetown Lake Kokanee Length-Frequency in January 1986 Angler Creel. N = 133

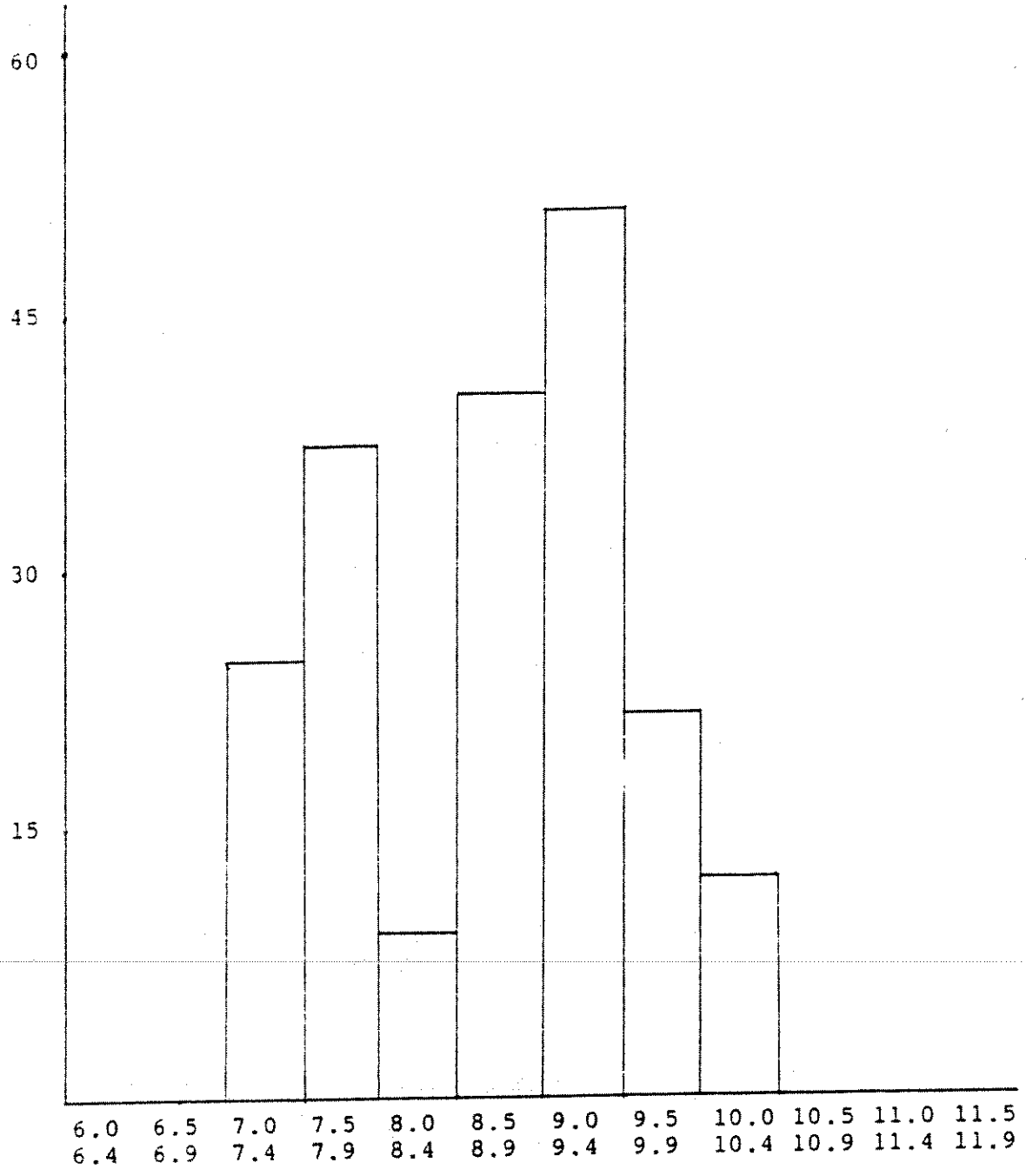


Figure 4. Georgetown Lake Kokanee Length-Frequency in January 1987 Angler Creel. N = 187.

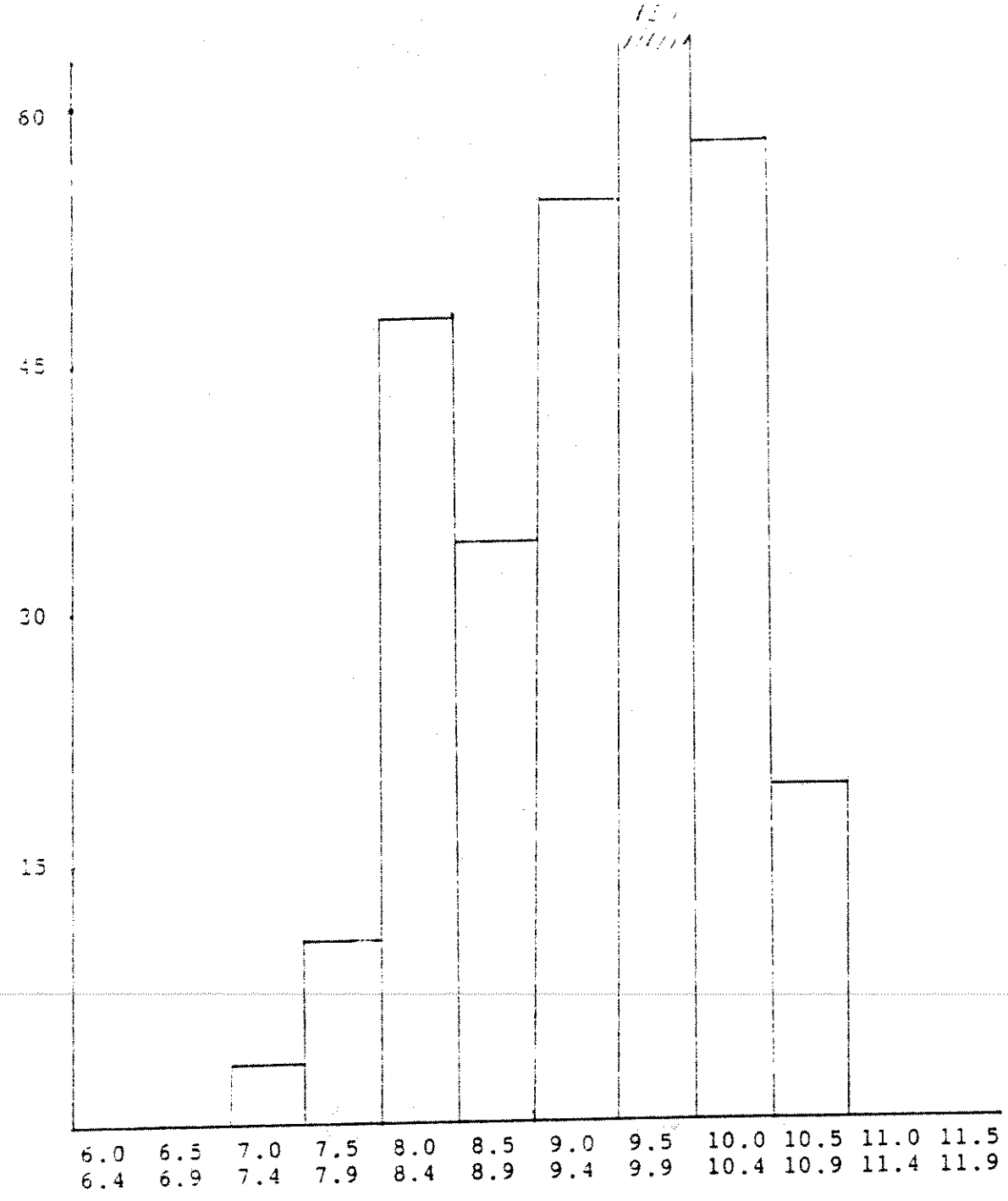


Figure 5. Georgetown Lake Kokanee Length-Frequency in January 1988 Angler Creel. N = 387.

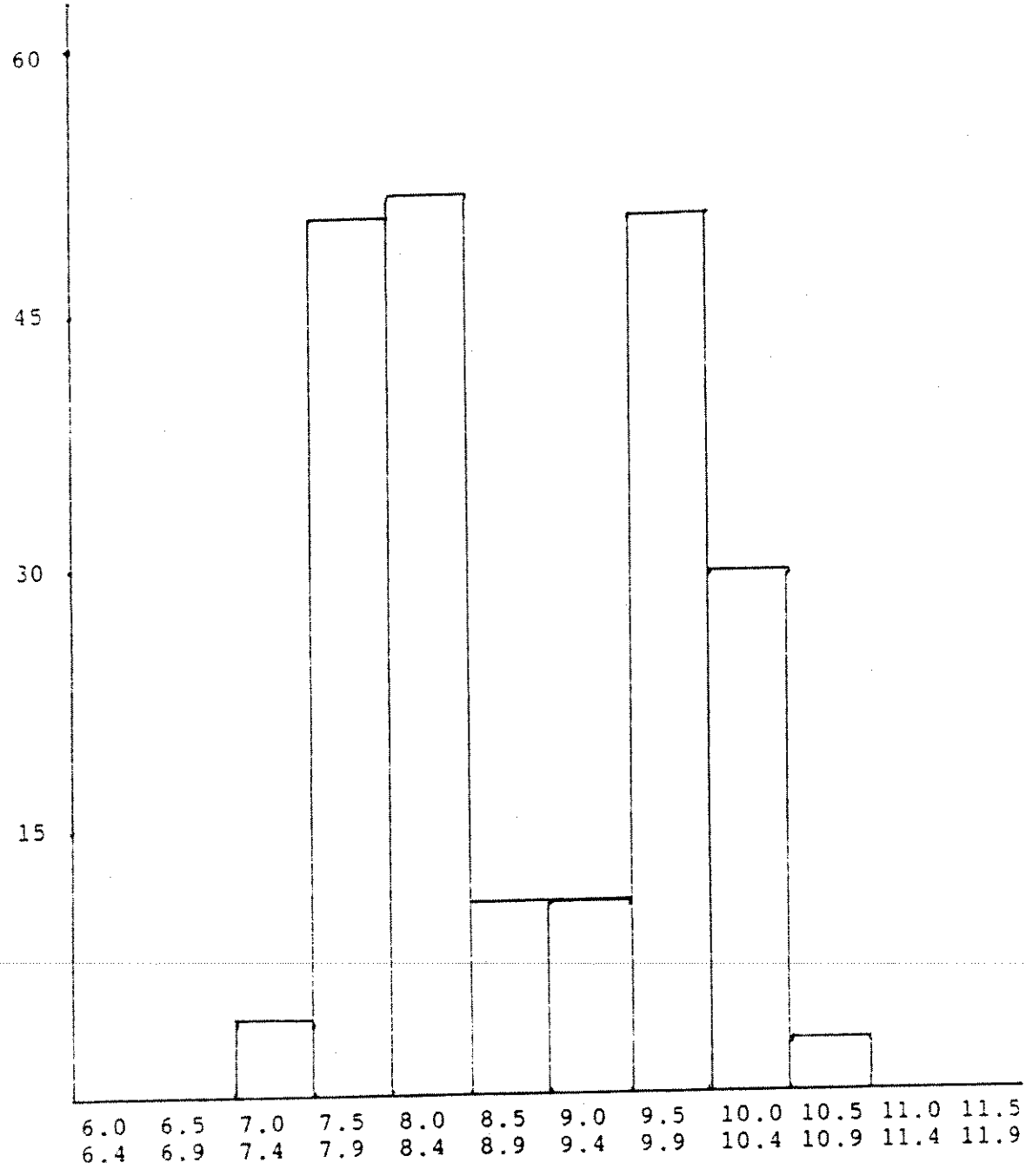


Figure 6. Georgetown Lake Kokanee Length-Frequency in January 1989 Angler Creel. N = 200.

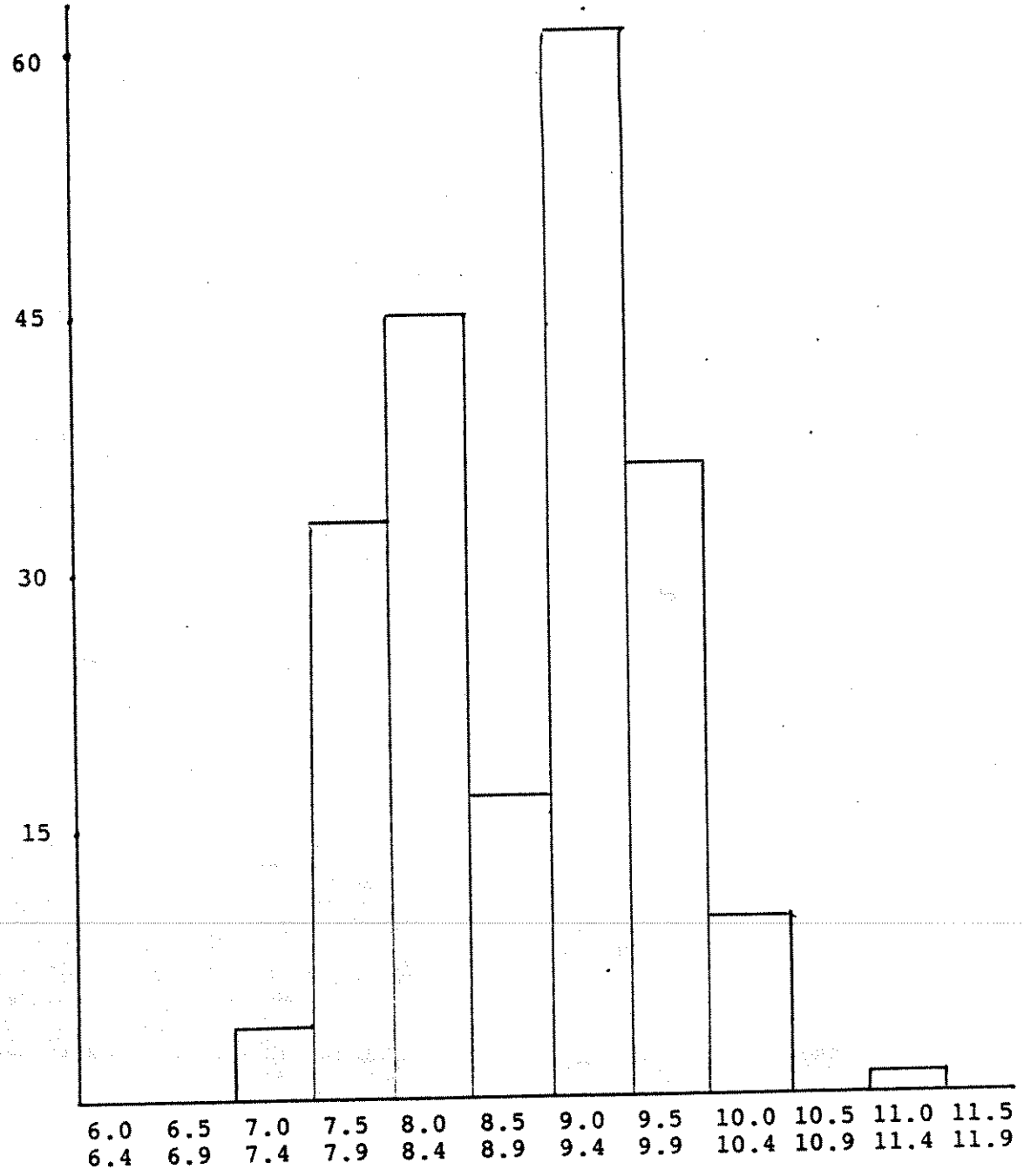


Figure 7. Georgetown Lake kokanee length-frequency in January 1990 angler creel N = 205

Brook Trout

Brook trout provide a small but valued fraction of the Georgetown fishery. Table 3 summarizes brook trout data collected during recent years. Average size and proportion of the trout catch seems to be relatively stable for brook trout in Georgetown Lake.

Table 3. Georgetown Lake Creel Samples of Rainbow and Brook Trout.

	Summer		Winter					
	1979	1980	1980	1981	1987	1988	1989	1990
Number Sampled								
Rainbow	88	774	141	730	244	303	221	305
Brook	4	124	11	123	18	57	23	47
Brook Trout Length								
Average	10.1	10.8	11.8	11.1	12.1	12.1	12.2	12.0
Maximum					17.2	16.5	16.0	17.2
Rainbow to Brook Ratio	22:1	6:1	13:1	6:1	14:1	5:1	10:1	6:1
Brook Trout % of Catch	4	14	7	14	7	16	9	15

Rainbow Trout

Rainbow trout provide the vast majority of trout in the Georgetown catch. Regulation and management changes in 1985 were designed to increase average size of the rainbow catch and to provide a trophy component of rainbows in excess of 18 inches. The altered management strategy has been successful in meeting these objectives.

Average lengths of Georgetown rainbow taken in the winter fishery are presented in Table 4. The data clearly reflect the effects of the management changes implemented in 1985. Prior to the change, rainbow average lengths had been in slow decline through the preceding 19 years. During the five years since the winter of 1984, average size of winter caught rainbow has increased 3.6 inches. Maximum length of rainbow recorded during sampling has increased from 13.9 inches in 1984-85 to 19.3 inches in 1988-89.

Table 4. Georgetown Lake Rainbow Average Lengths in Winter Angler Creel

Year	66-67	67-68	68-69	69-70	70-71	71-72	72-73	73-74
Sample Number	214	306	No	247	555	1407	888	No
Average Length	11.7	11.3	data	11.1	10.1	10.6	10.7	data
Year	74-75	75-76	76-77	77-78	78-79	79-80	80-81	81-82
Sample Number	No	45	247	171	165	30	124	No
Average Length	data	10.4	10.6	10.0	9.9	11.2	9.7	data
Year	82-83	83-84	84-85	85-86	86-87	87-88	88-89	89-90
Sample Number	No	3	42	296	242	303	227	305
Average Length	data	9.7	9.8	11.5	12.8	12.8	13.4	13.4

A major feature of the new management strategy at Georgetown was a change from the sole use of Arlee rainbow to the use of a total rainbow stocking composed of 1/3 Arlee, 1/3 Eagle Lake, and 1/3 Kamloops. The performance of the 3 strains has been compared through the years. Arlee are unmarked, Eagle Lake are tetracycline marked and Kamloops are adipose clipped. Comparison of rainbow strain performance may be made utilizing the data in Table 5. Arlee enter the fishery during their first months in the lake since they are stocked as 6 inch fish in June. Growth through the summer allows them to reach sizes desirable to some anglers. Eagle Lake rainbows are stocked in late August or early September due to their later spawning date and are not normally a part of the catch until the following June. Kamloops are planted in September at even smaller size than Eagle Lake and do not enter the fishery until the following summer.

In Table 5 the percentage of catch for each strain offers some interesting information. Arlee dominated the catch in 1985-86 and 1986-87. The percentage of Eagle Lake increased in 1987-88 and also in 1988-89. Arlee declined from 70% in the first 2 years of new regulation to 63 and 50%, respectively, in 1987-88 and 1988-89. Length histograms of Arlee, Eagle Lake, and Kamloops in January creels are shown in Figures 8-18. In 1990 percent composition of the catch changed substantially. Arlee contribution rose to 59% while Eagle Lake declined to 28%. Kamloops percentage increased from 4 in 1989 to 13 in 1990. These changes appear to be due to a reduced recruitment of 1988 stocked Eagle Lake into the January, 1990, catch. The 1988 Eagle Lake stocking was made on September 21 and 22 in contrast to other years where stocking took place about 1 month earlier. It is possible that the later planting date resulted in decreased survival of stocked fish and ultimately reduced recruitment into the ice fishery. The 1986 stocking of Eagle Lake was given a double tetracycline mark. Comparison of 1986 stocked Eagle Lake and 1988 stocked Eagle Lake at 16 months after introduction, the first data collection period when they enter the catch (Figures 15, 16, and 17), suggests that growth of 1988 stocked fish was about 1 inch less than that of 1986 plants. This may also be the result of the later planting date in 1988.

Kamloops percent contribution to the 1990 creel was much higher, 13%, than in previous year, 1-4%. This is the result of an experimental plants of Kamloops held in the hatchery an additional 9 months and stocked in mid-June, 1989, at an average size of 8.3 inches (Figure 18). These fish were prominent in summer 1989 catches inspected informally. In the January, 1990 collection period they comprised 76% of the total Kamloops catch. Twenty-seven percent of the June, 1989 stocked Kamloops sampled in January, 1990 angler creel were inadvertently included with

Table 5. Georgetown Lake Rainbow Strain Evaluation, Winter

	Sample No.	% Catch	Mean Length	Range (inches)
			1985-86	
Arlee	210	70	11.6	8.4-15.7
Eagle Lake	84	28	11.2	6.0-12.9
Kamloops	2	1	11.4	9.8-12.9
Total	296	100	11.5	6.0-15.7
			1986-87	
Arlee	169	70	12.6	7.7-16.8
Eagle Lake	70	29	13.6	8.3-16.4
Kamloops	3	1	11.1	9.3-14.8
Total	242	100	12.8	7.7-16.8
			1987-88	
Arlee	185	63	12.7	8.8-18.0
Eagle Lake	100	34	12.9	10.8-16.9
Kamloops	8	3	11.4	10.7-13.2
Total	293	100	12.8	8.8-16.9
			1988-89	
Arlee	85	52	13.6	9.2-19.3
Eagle Lake	71	44	13.9	11.1-18.4
Kamloops	6	4	12.6	10.6-15.8
Total	162	100	13.4	9.2-19.3
			1989-90	
Arlee	172	59	13.2	8.6-18.8
Eagle Lake	80	28	15.0	9.9-18.5
Kamloops	39	13	11.5	8.8-16.3
Total	291	100	13.4	8.6-18.8

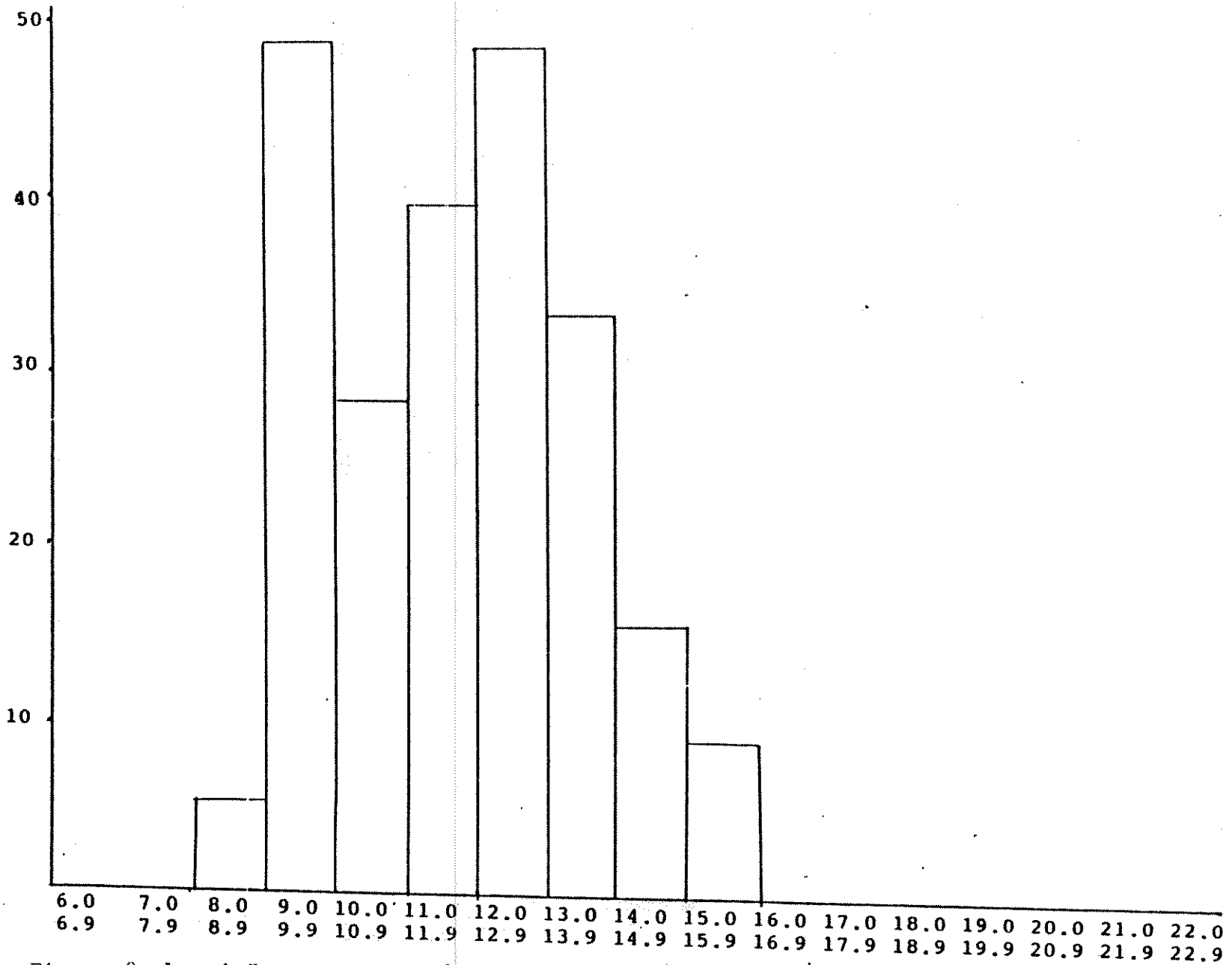


Figure 8 Length Frequency of Georgetown Arlee Rainbow. January 1986. N = 210

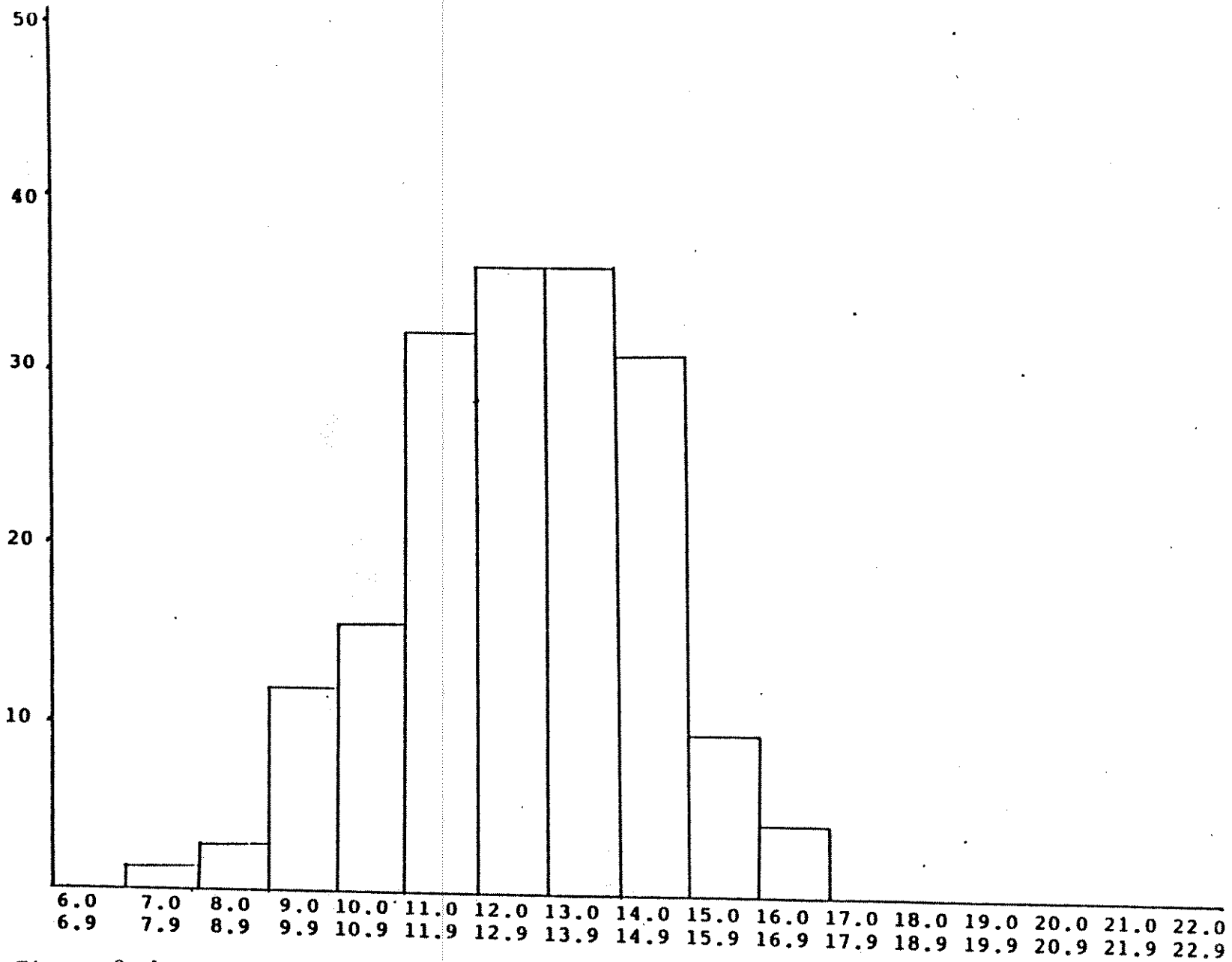


Figure 9 Length Frequency of Georgetown Arlee Rainbow. Winter 86-87. N = 169

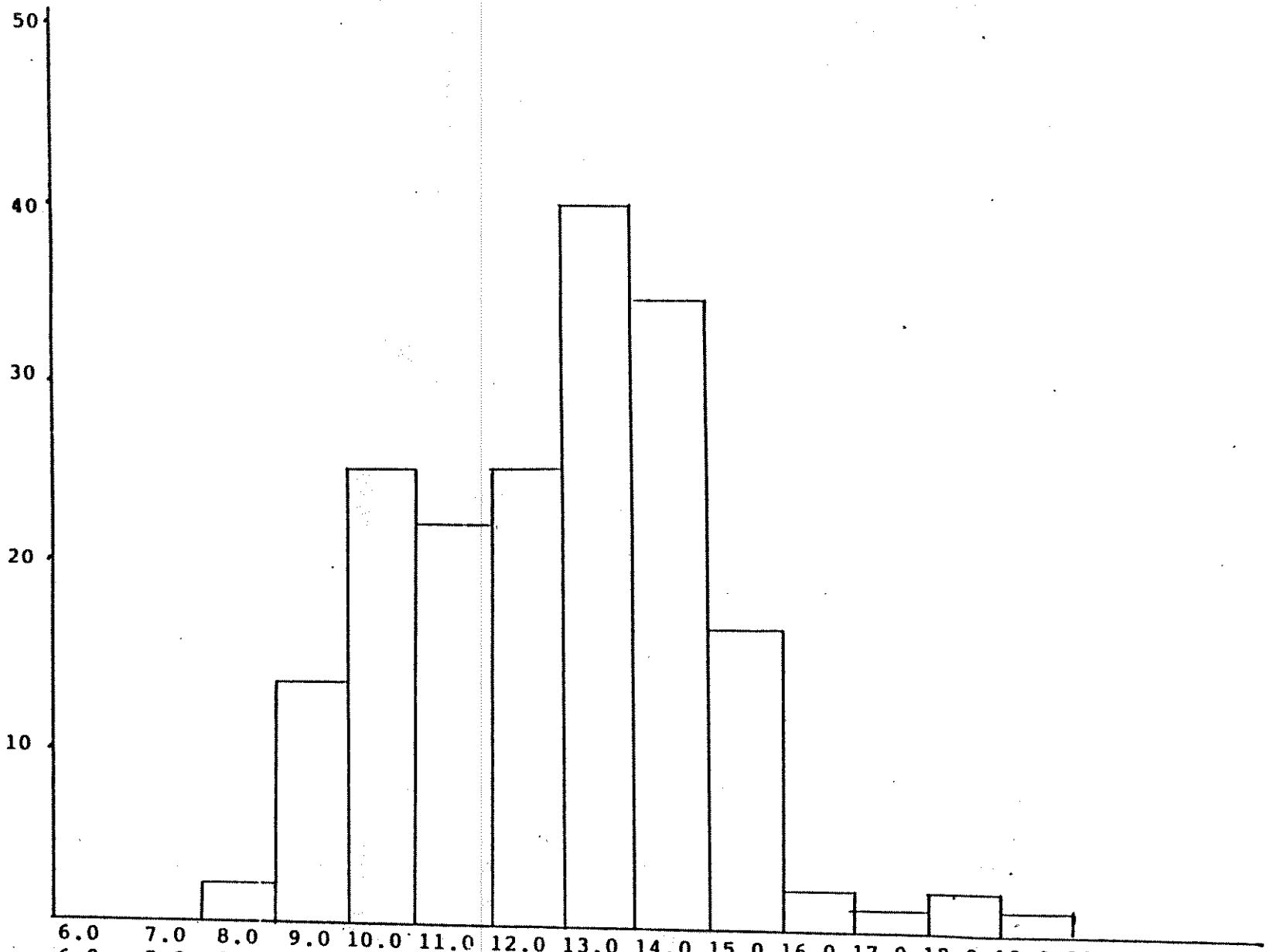


Figure 10 Length Frequency of Georgetown Arlee Rainbow. January 1988. N= 197

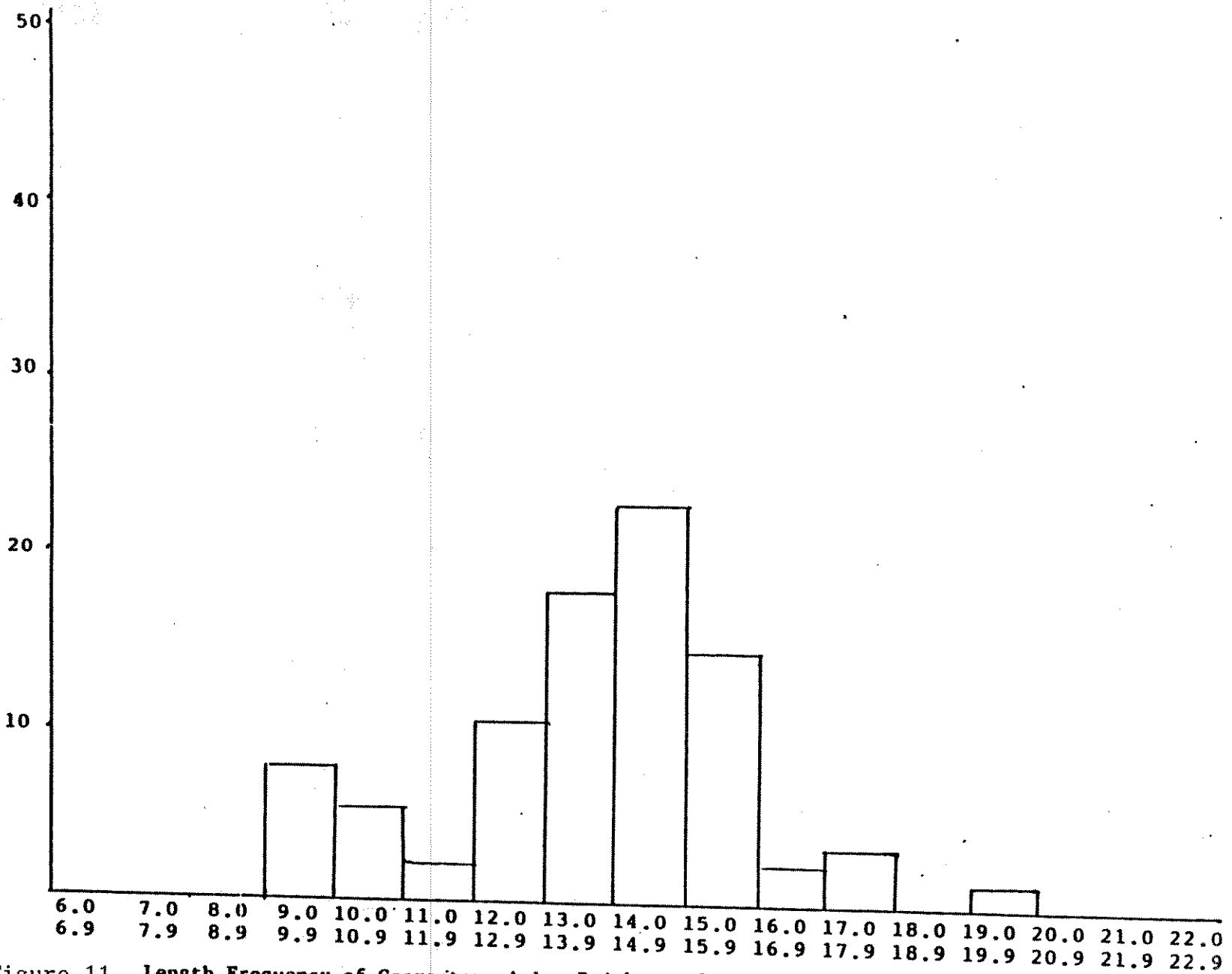


Figure 11 **Length Frequency of Georgetown Arlee Rainbow. January 1989. N = 87**

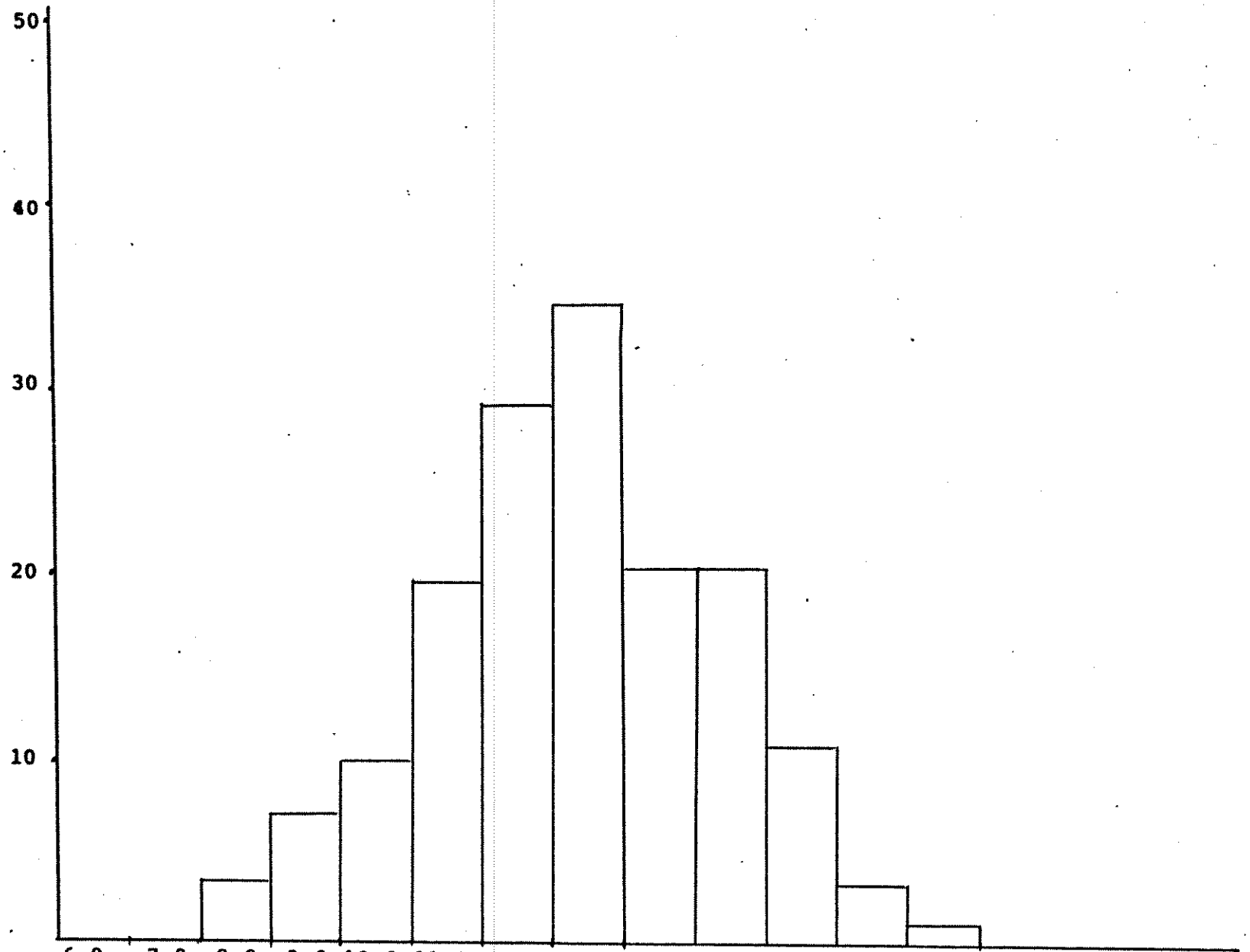


Figure 12. Length frequency of Georgetown Arlee Rainbow, January 1990. N = 174

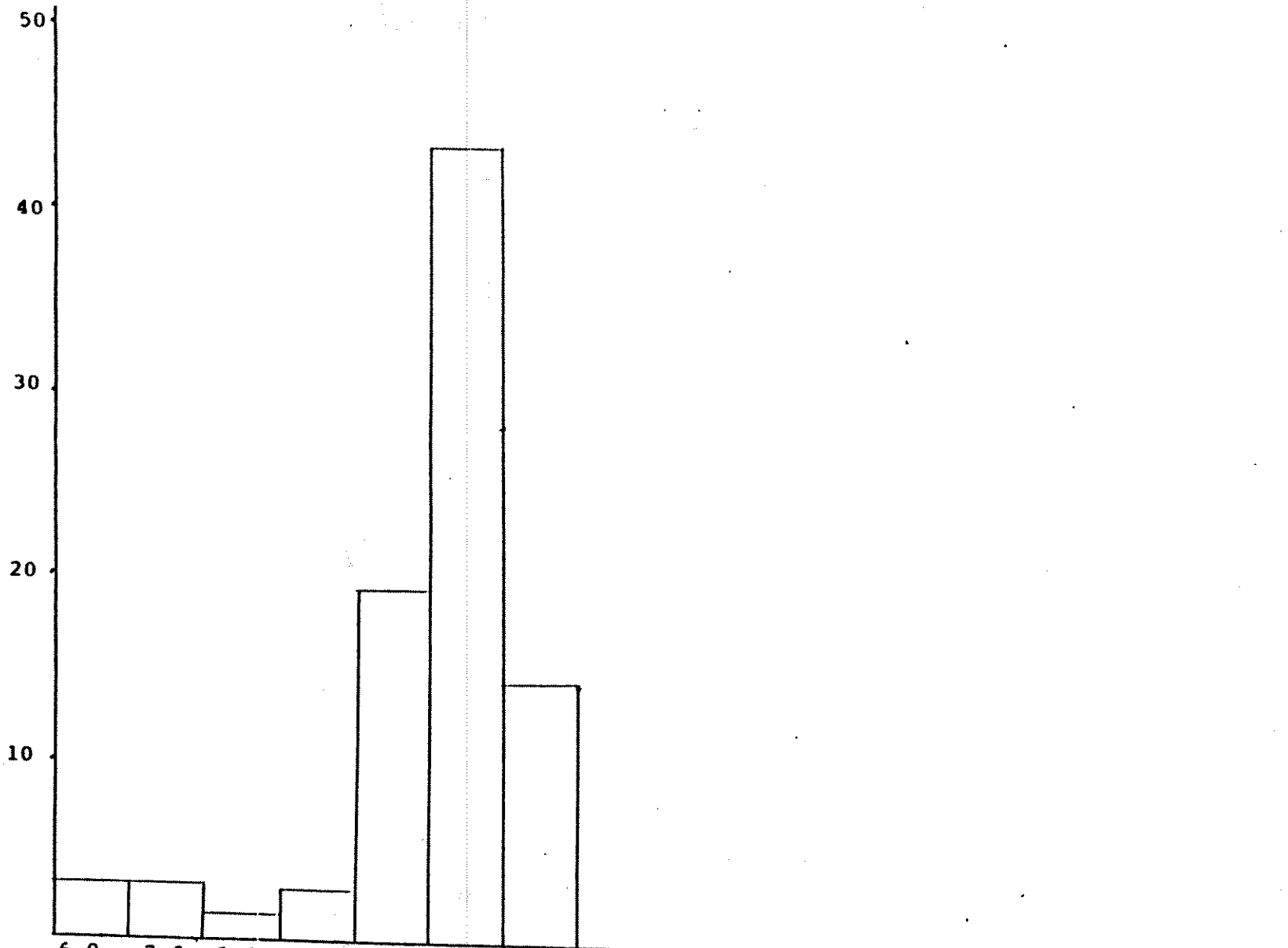


Figure 13Length Frequency of Georgetown Eagle Lake Rainbow. January 1986. N = 84.

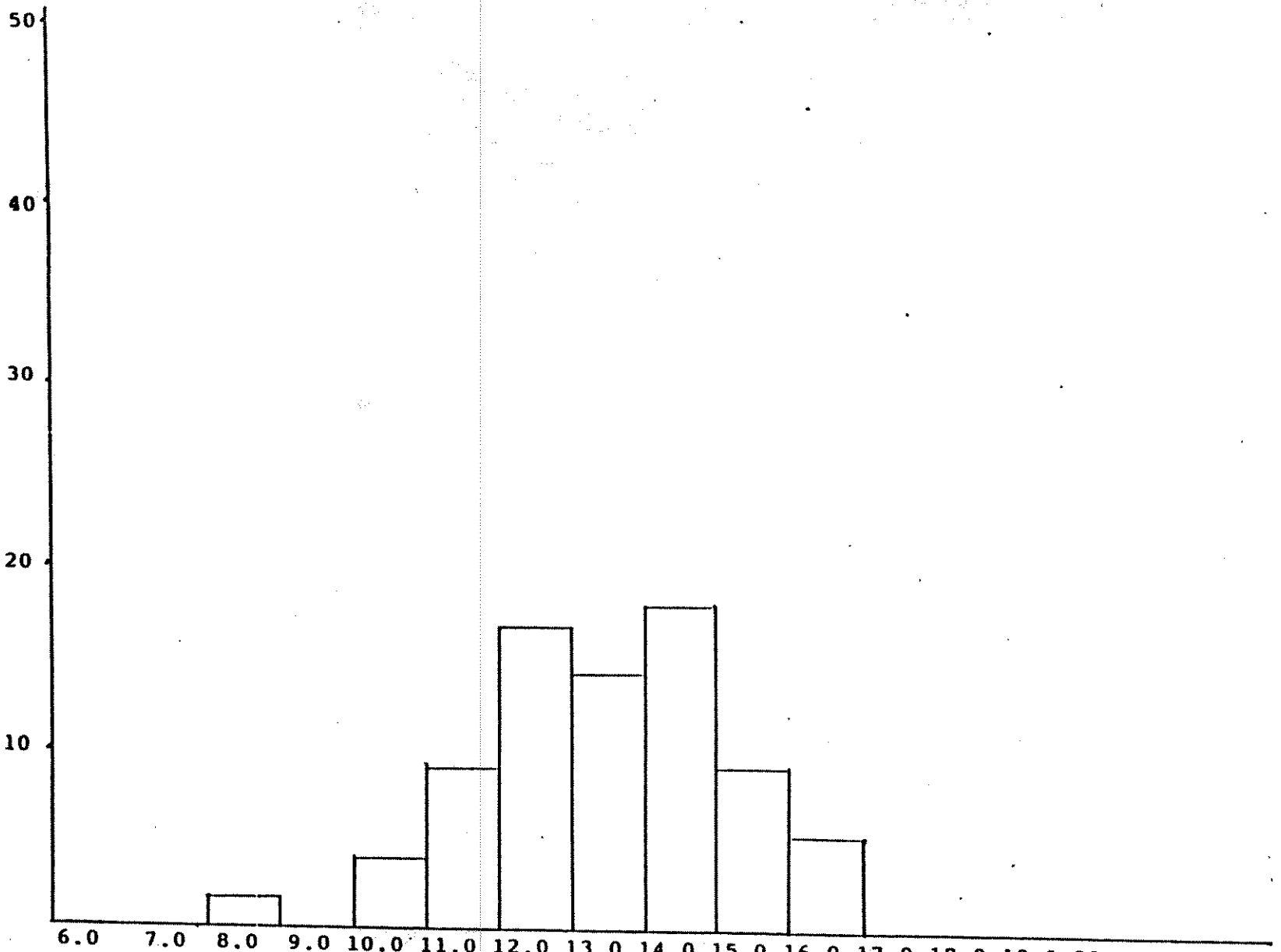


Figure 14 Length Frequency of Georgetown Eagle Lake Rainbow. January 1987. N = 70

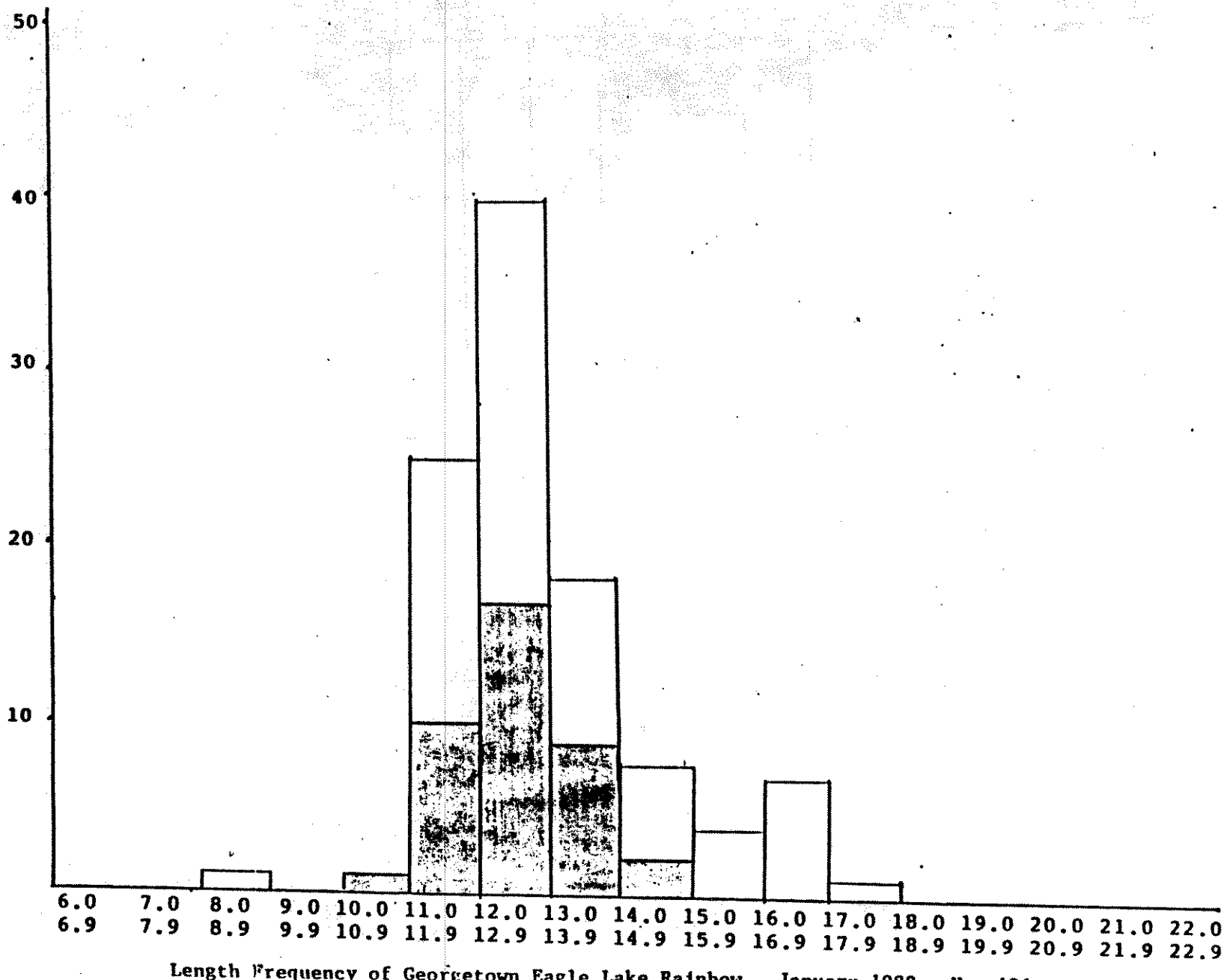


Figure 15. Shaded area 1986 plant N = 39

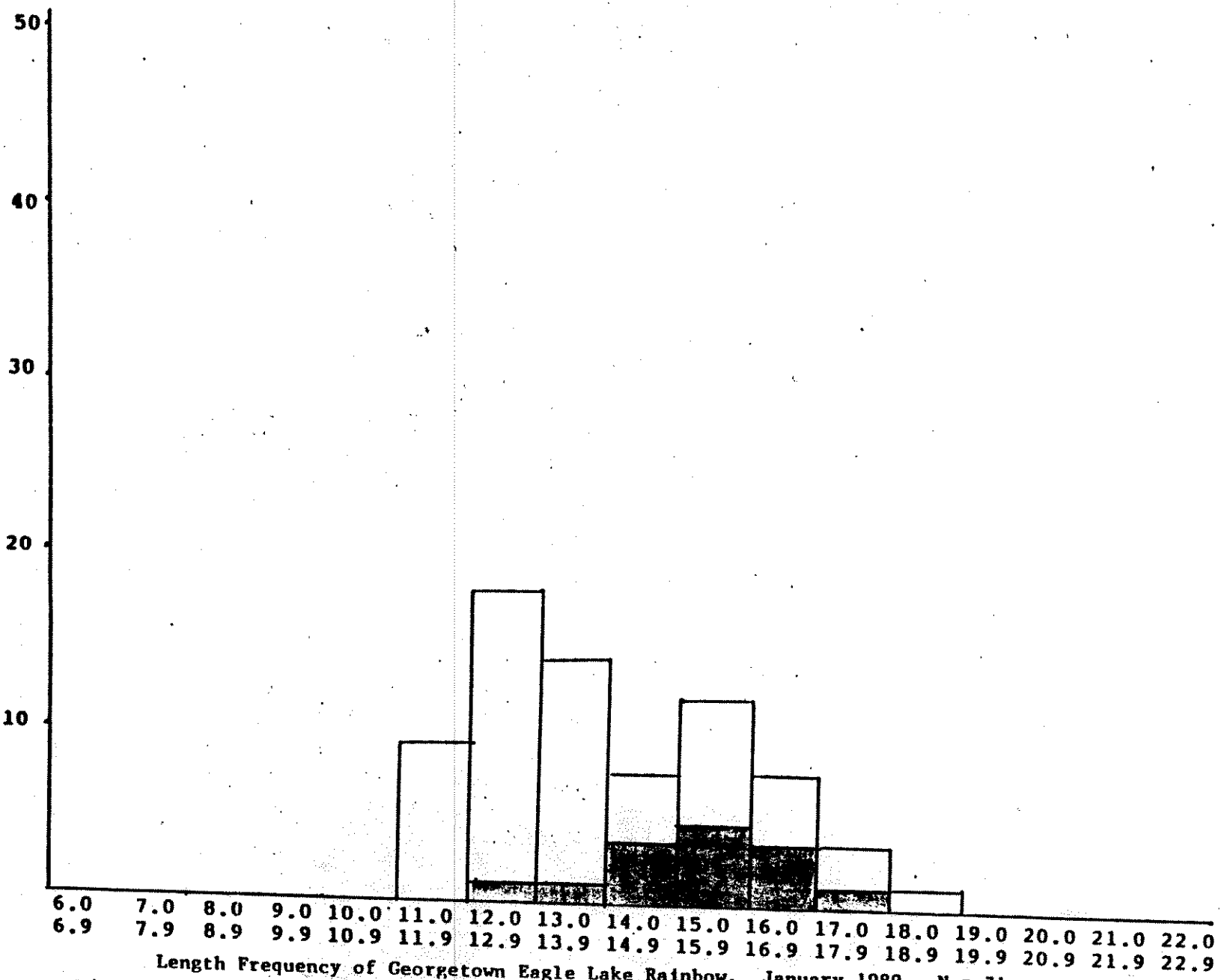


Figure 16. Shaded area - 1986 plant N = 13

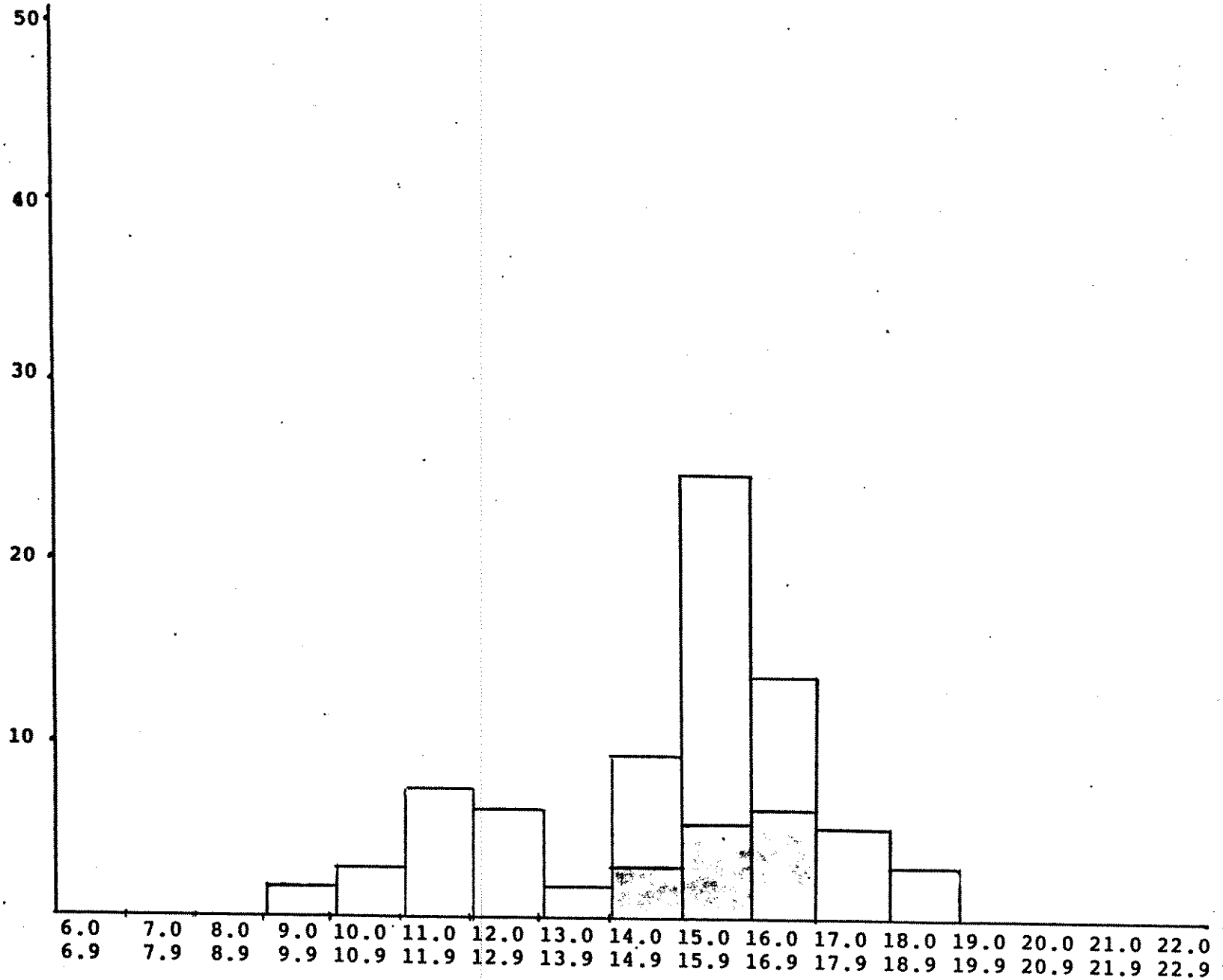


Figure 17. Length frequency of Georgetown- Eagle Lake Rainbow, January 1990 N = 80
Shaded - 1986 Plant N = 14

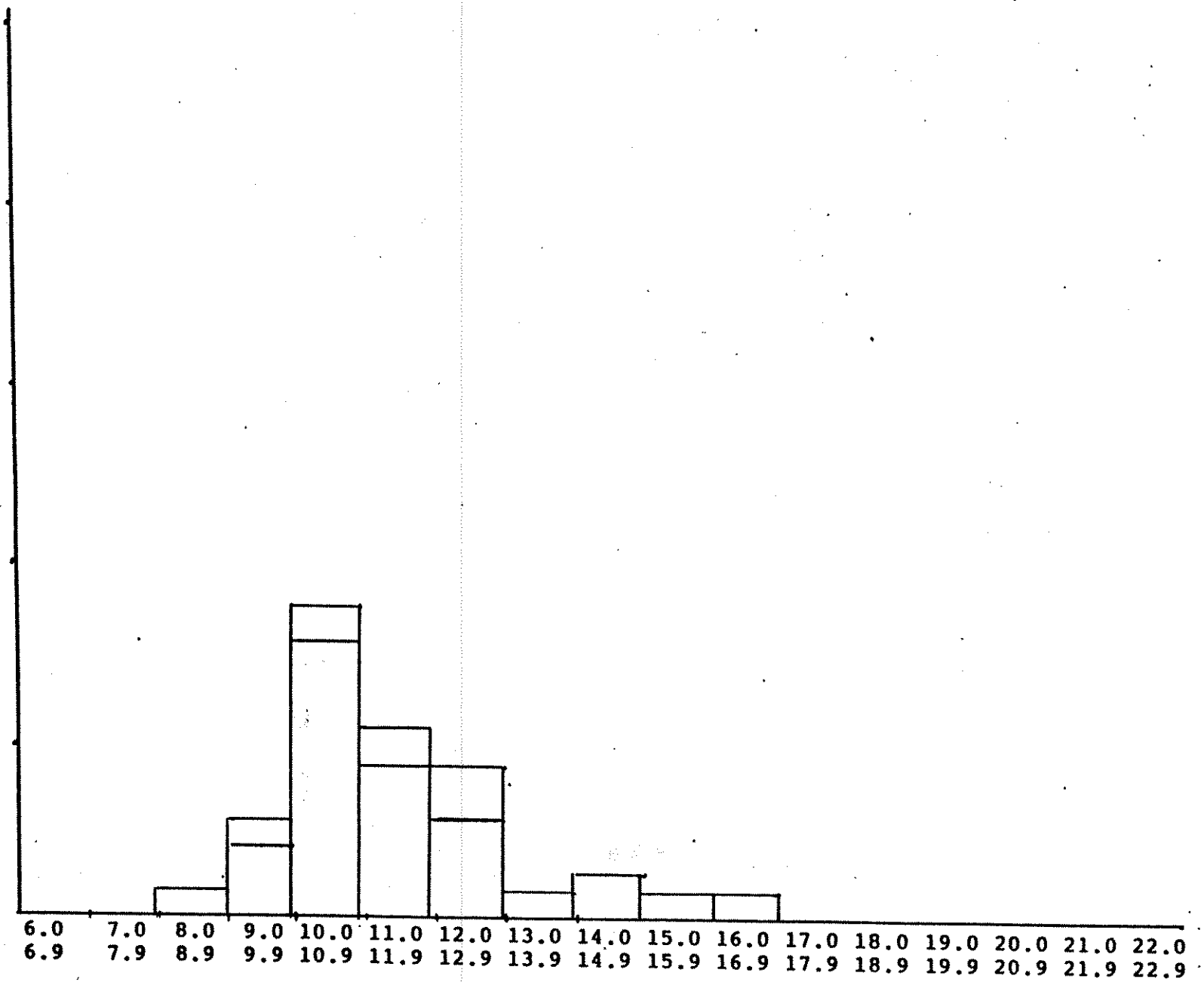


Figure 18. Length frequency of Georgetown Kamloops Rainbow, January 1990 N = 49
Shaded - June 1989 Plant N = 37

kokanee catches by the fishermen. At these sizes, Kamloops resembled kokanee rather closely, both being slender and predominately silver in color. Justification for longer hatchery rearing of Kamloops will not be possible before evaluation of January, 1991 data. A Kamloops taken in October, 1989, was determined to be in its fourth growth season, was 27 inches in length, and weighed 10.5 pounds.

Arlee rainbow dominated the 1990 catch, 59% (Table 5). Figures 8-12 show length distribution of Arlee for January catches from 1986-1990.

Spawning runs of rainbows in significant numbers were first known to occur in 1989. Subsequent shocking in August, 1989 found small numbers of yearling rainbows in the North Fork of Flint Creek, one of the two spawning tributaries. In 1990 both spawning tributaries were sampled by electrofishing on three occasions, in order to more thoroughly evaluate the characteristics of the run (Table 6). Sampling dates were selected to cover early, middle, and late segments of the runs. Since Stuart Mill Creek is fed by springs and the North Fork of Flint Creek by runoff, sampling dates varied. Data collected included length, weight, sex, spawning condition, presence or absence of hook scarring, and a portion of fin for electrophoretic analysis. Dr. Rob Leary of the UM Genetics Laboratory had determined that electrophoresis of fin tissue would allow strain determination. Different fins were clipped on each sample date, effectively providing a field mark allowing recognition of a sampled fish if it were recaptured during a later sampling effort.

Strain composition of rainbows spawning in 1989 showed 75% of 10 fish sampled to be Eagle Lake. The 1990 analyses of fin tissue electrophoresis is currently in progress. Preliminary results suggest that 95%+ of the 1990 run was composed of the Eagle Lake strain. From the limited growth data available, it appears that first spawning Eagle Lake fish are 3 and 4 year olds. No major differences were observed in sizes or strains of fish between the two spawning streams nor among early, mid and late season spawners (Table 6). Spawners averaged 17.5 inches with 43% exceeding 18 inches and 10% over 20 inches. Figure 19 shows length distribution for tributary spawning rainbows in spring 1990. Since fin clipping for electrophoretic analysis provided an easily recognizable mark, subsequent samplings offered an opportunity to assess residence time of individual fish in the spawning tributaries. Only a single fin clipped fish was recaptured, suggesting that time spent in a spawning stream was less than two weeks. Spawning success will be assessed by electrofishing in summer 1990.

Oxygen sampling (Table 7) under ice in January, February and March of 1990 showed higher than average concentrations. The level of 5 ppm O_2 concentration remained below 2m throughout the sampling period.

Table 5. Georgetown Lake Rainbow Strain Evaluation, Winter

	Sample No.	% Catch	Mean Length	Range (inches)
			1985-86	
Arlee	210	70	11.6	8.4-15.7
Eagle Lake	84	28	11.2	6.0-12.9
Kamloops	2	1	11.4	9.8-12.9
Total	296	100	11.5	6.0-15.7
			1986-87	
Arlee	169	70	12.6	7.7-16.8
Eagle Lake	70	29	13.6	8.3-16.4
Kamloops	3	1	11.1	9.3-14.8
Total	242	100	12.8	7.7-16.8
			1987-88	
Arlee	185	63	12.7	8.8-18.0
Eagle Lake	100	34	12.9	10.8-16.9
Kamloops	8	3	11.4	10.7-13.2
Total	293	100	12.8	8.8-16.9
			1988-89	
Arlee	85	52	13.6	9.2-19.3
Eagle Lake	71	44	13.9	11.1-18.4
Kamloops	6	4	12.6	10.6-15.8
Total	162	100	13.4	9.2-19.3
			1989-90	
Arlee	172	59	13.2	8.6-18.8
Eagle Lake	80	28	15.0	9.9-18.5
Kamloops	39	13	11.5	8.8-16.3
Total	291	100	13.4	8.6-18.8

Table 6. Georgetown Lake Tributaries Spawning Rainbow Survey, 1990.

North Fork Flint Creek			Stuart Mill Creek		
Date 4/27/90			Date 4/13/90		
Number	51	L 17.6	Number	76	L 17.2
Number Male	28		Number Male	43	
Number Female	23		Number Female	33	
Number Hook Scarred	1		Number Hook Scarred	8	
Date 5/10/90			Date 5/10/90		
Number	50	L 17.4	Number	50	L 18.1
Number Male	31		Number Male	20	
Number Female	19		Number Female	30	
Number Hook Scarred	2		Number Hook Scarred	4	
Date 5/23/90			Date 4/26/90		
Number	50	L 17.5	Number	50	L 17.3
Number Male	26		Number Male	33	
Number Female	24		Number Female	17	
Number Hook Scarred	7		Number Hook Scarred	0	

Table 7. Georgetown Lake under ice dissolved oxygen concentration (ppm).

	Surface	1m	2m	3m	4m	5m
January	10.5	8.0	7.0	6.0	2.1	1.6
February	10.0	10.0	7.0	5.5	.2	.2
March	7.5	7.5	6.0	4.2	.2	.3

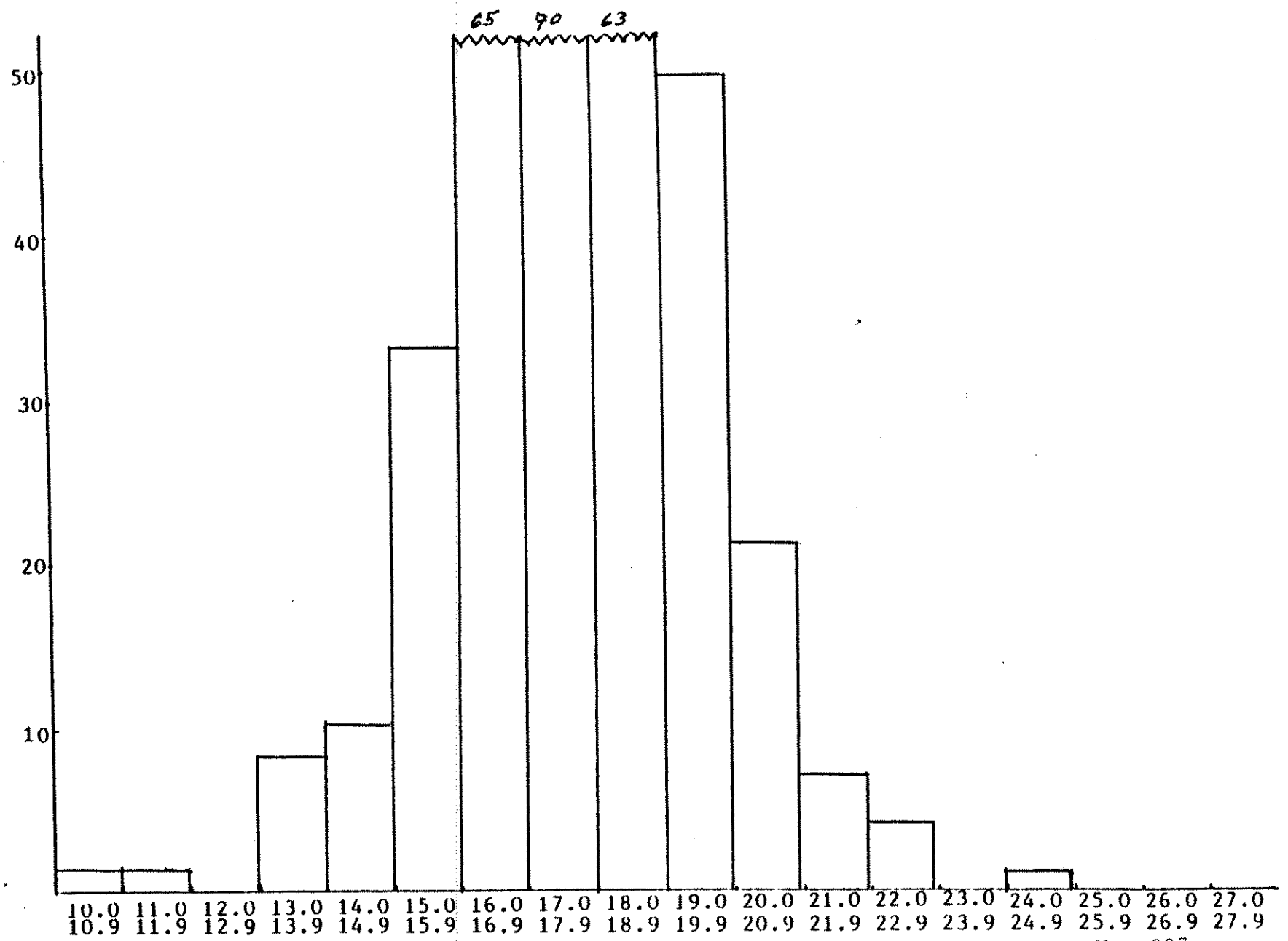


Figure 19. Length Frequency 1990 Georgetown Lake Spawning Run, Rainbows, N = 327

Waters Referred to:

Georgetown Lake
North Fork of Flint Creek
Stuart Mill Creek

Prepared by: Wayne F. Hadley

Date: August 1990