MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS
FISHERIES DIVISION

JOB PROGRESS REPORT

STATE: MONTANA PROJECT TITLE: STATEWIDE FISHERIES INVESTIGATIONS

PROJECT NO.: F-46-R-5 STUDY TITLE: SURVEY AND INVENTORY OF COLDWATER LAKES

JOB NUMBER: II-b

JOB TITLE: WEST CENTRAL MONTANA COLDWATER LAKE INVESTIGATIONS

PROJECT PERIOD: JULY 1, 1991 THROUGH JUNE 30, 1992

ABSTRACT

Georgetown Lake angler caught kokanee averaged 8.9 inches total length in January 1992. Average lengths of 2+ and 3+ kokanee were 8.0 and 9.4 inches respectively. Second to third year growth measured in January equaled 1.3 inches.

Rainbow trout in the January, 1992, angler creel was 12.6 inches, the lowest average size since new management goals were implemented in 1985. The 1992 catch was composed of 67% Arlee and 33% Eagle Lake rainbow. No kamloops were observed in 1992.

Brook trout in January, 1992, averaged 12.7 inches in total length. They were present in the catch in a 4:1 ratio, rainbow to brook trout and comprised 20% of the trout creeled.

Basic information on catch rates was collected in January, 1992. Six-hundred-forty-six anglers fished 2,110 hours to catch 5,132 trout and salmon. Catch per angler was 2.4 fish comprised of 2.25 kokanee, 0.13 rainbow and 0.03 brook trout.

Spawning runs of rainbow trout were 18.8 inches in total fish length, an increase of about 1 inch over previous years. Sixty-six percent of spawners were 18 inches or greater while 25% exceeded 20 inches. New regulations reduced the legal catch of spawning rainbows to a small fraction of the 1991 spawner harvest.

Oxygenation of under ice water in Georgetown Lake in 1992 remained at or above 5 ppm at 2 meters until March when only the uppermost meter of water retained 5 ppm or more.

OBJECTIVES AND DEGREE OF ATTAINMENT

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

   Average length of January 1992 angler caught rainbow trout was 12.6 inches. This is the lowest average length observed since January 1986. The decrease in average size resulted from failed stocking of Eagle Lake rainbows in 1988 and 1989. Absence of normal numbers of 14 to 17 inch fish is reflective of these failures and, coupled with natural decrease in numbers of larger size groups, serves to reduce average size significantly. This situation should improve in 1993.

2. Expand opportunities to catch rainbow trout in excess of 3 pounds in Brown's Lake.

   The series of drought years during the late 1980s and early 1990s have resulted in frequent winterkills in Brown's Lake. Until a wetter cycle begins, no opportunity will exist to expand trout longevity in Brown's Lake.

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

   No activity was focused on this goal in 1991-92.

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

   No effort was expended on this objective due to need for additional interval between management change and evaluation.

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

   No activity was focused on this goal in 1991-92.

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

   Average size of kokanee remained at 8.9 inches in January, 1992. Efforts to reduce kokanee numbers and therefore increase size are now focused on trout predation. No impact has been observed to date.

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. Monitoring of 1991 spawning runs was reduced to a single sample of 96 rainbows. In 1992 spawner studies were reduced to 48 fish due to increased awareness of electrofishing injury potential.

RESULTS AND DISCUSSION

Kokanee Salmon

Kokanee salmon constitute the majority of the Georgetown Lake winter catch. In January 1992, kokanee taken averaged 8.9 inches, slightly larger than in previous years (Table 1). Growth between second and third years was 1.7 inches, up somewhat from previous years (Table 2). January angler caught kokanee length frequencies are shown in Figures 1-9. Kokanee population in Georgetown seems stable.

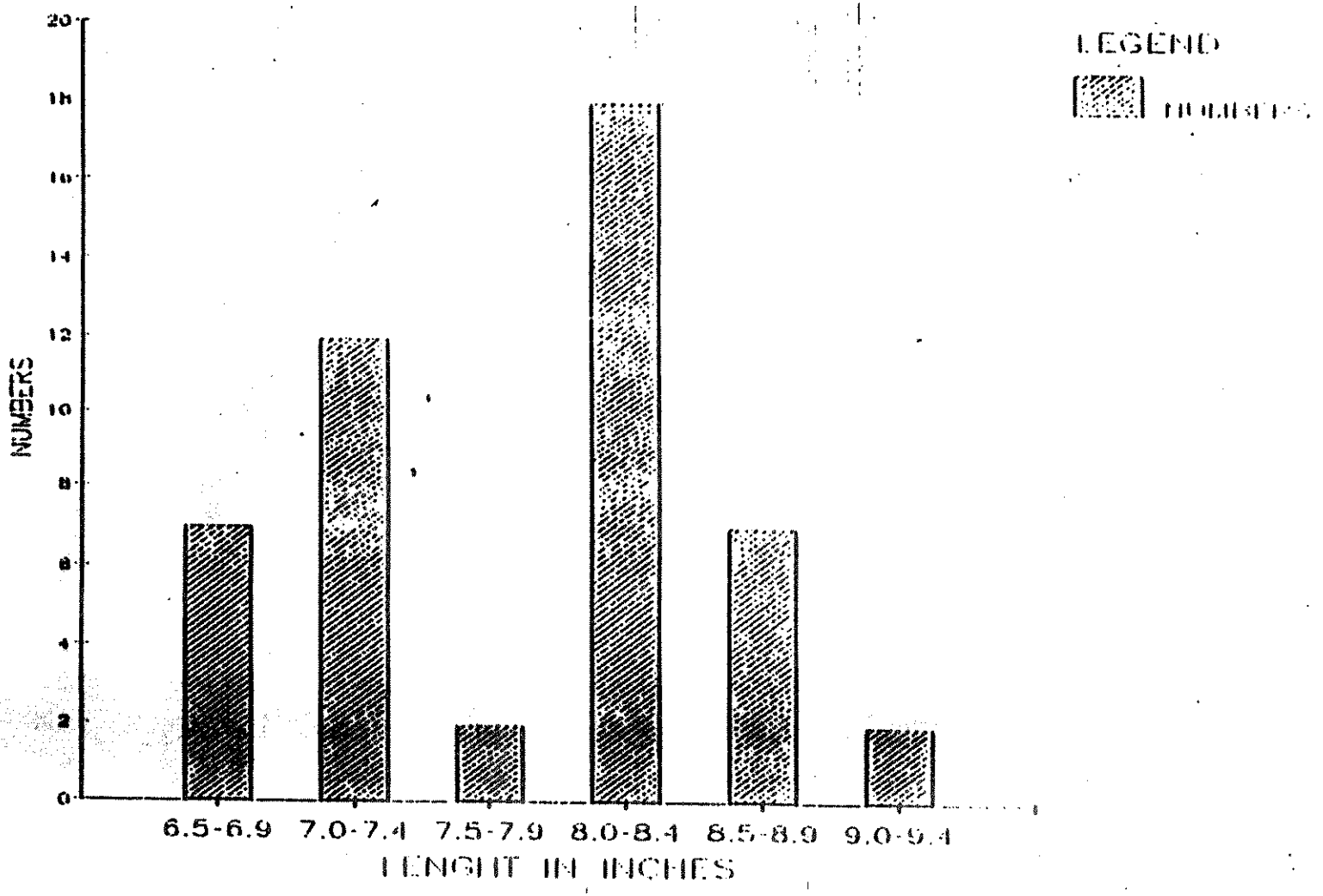
Table 1. Georgetown Lake Kokanee Average Lengths in Winter Angler Creel

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
Year	90-91	91-92						
Sample Number	208	207						
Average Length	8.7	8.9						

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	91	92
2+ average length	7.8	6.9	7.2		6.9	7.2	7.5	7.5	8.2	7.9	7.9	7.7	8.0
3+ average length		8.7	8.3	8.8		8.4	9.3	9.2	9.7	9.5	9.3	9.3	9.4
average growth		0.9	1.4	1.6		1.5	2.1	1.7	2.2	1.3	1.4	1.4	1.7

Figure 1. Georgetown Lake kokanee length-frequency in January 1984 angler creels. N=47.



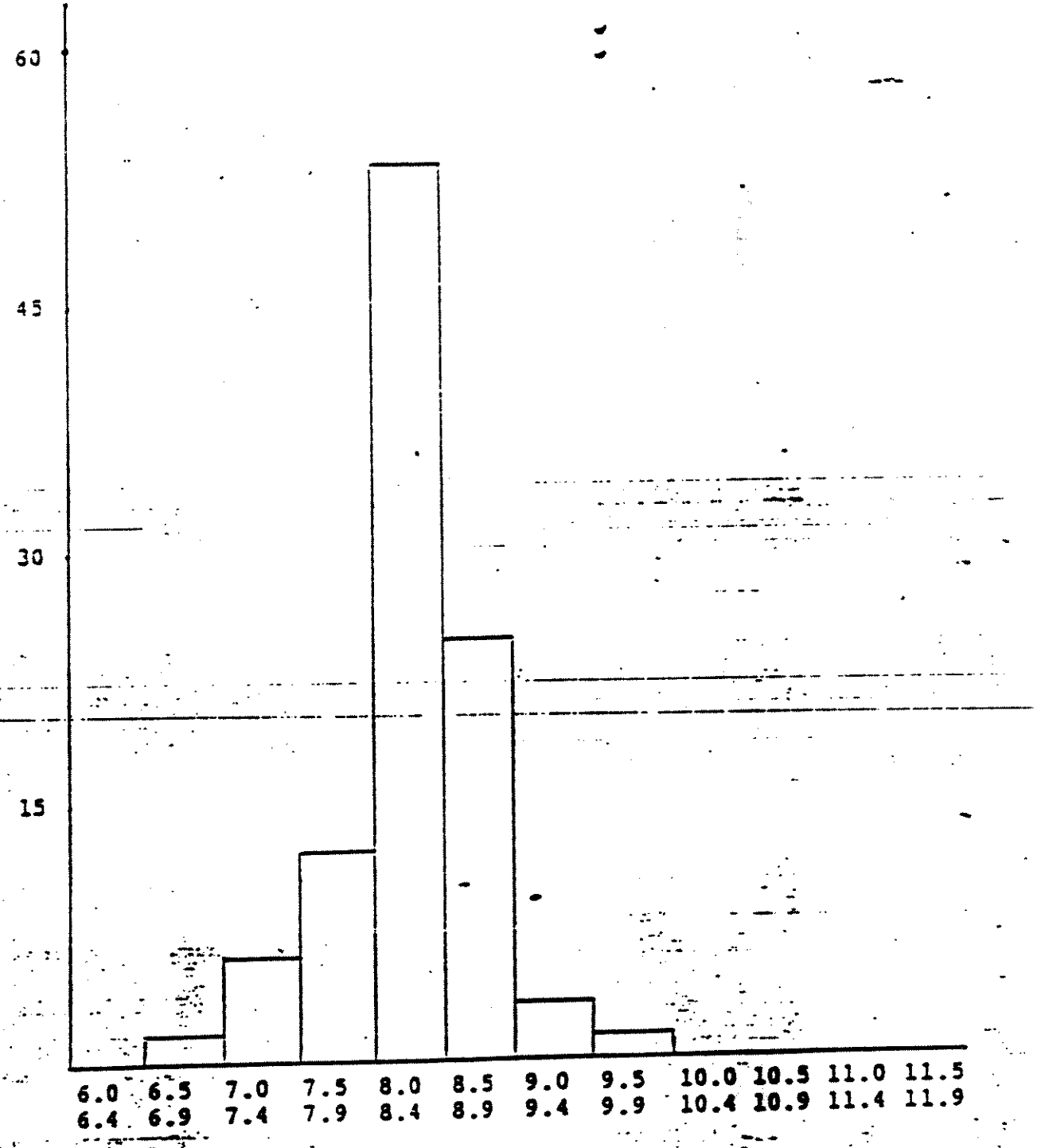


Figure 2. Georgetown Lake Kokanee Length-Frequency in January 1985 Angler Creel. N = 96

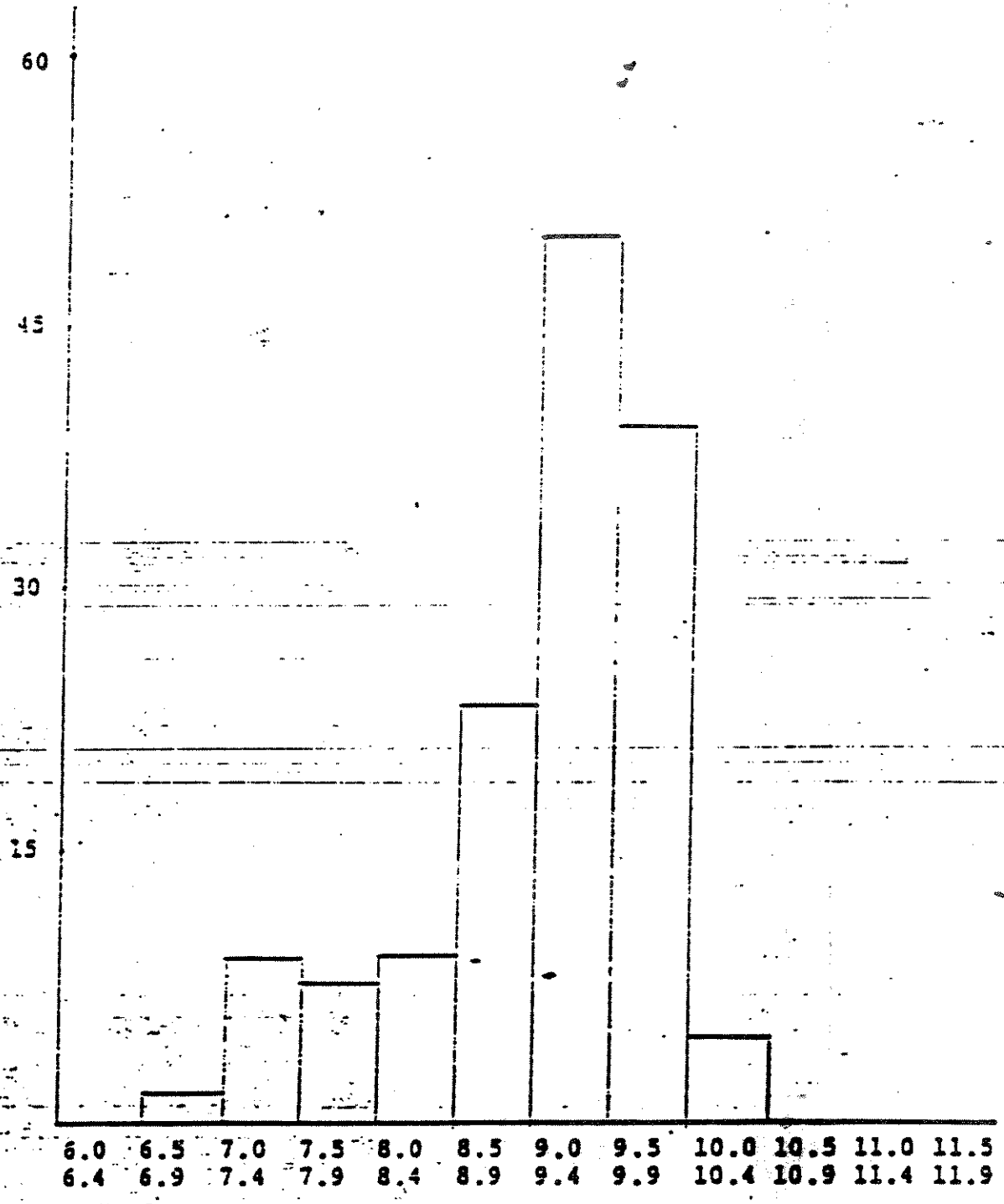


Figure 3. Georgetown Lake Kokanee Length-Frequency in January 1986 Angler Creel. N = 133

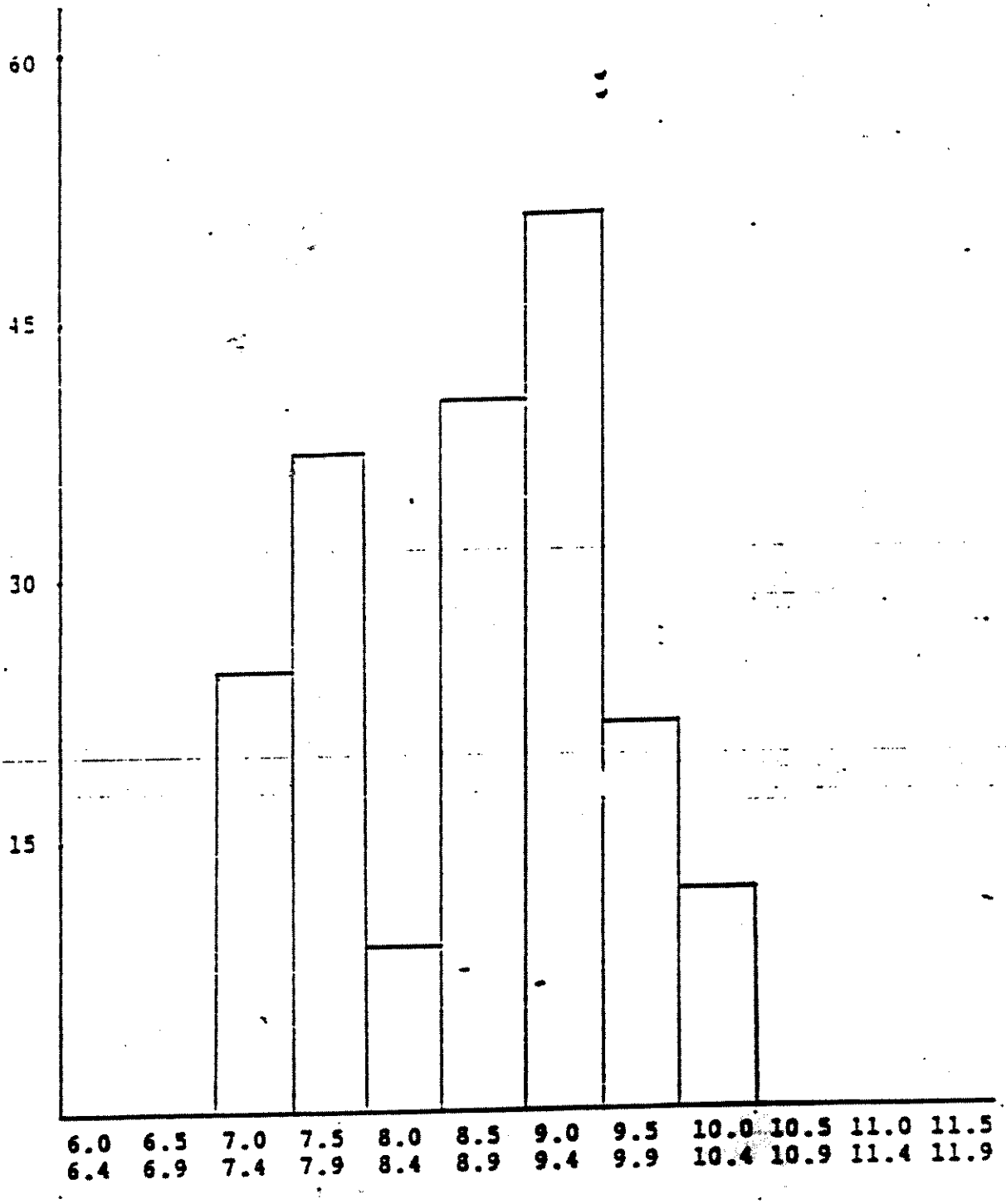


Figure 4. Georgetown Lake Kokanee Length-Frequency in January 1987 Angler Creel. N = 187.

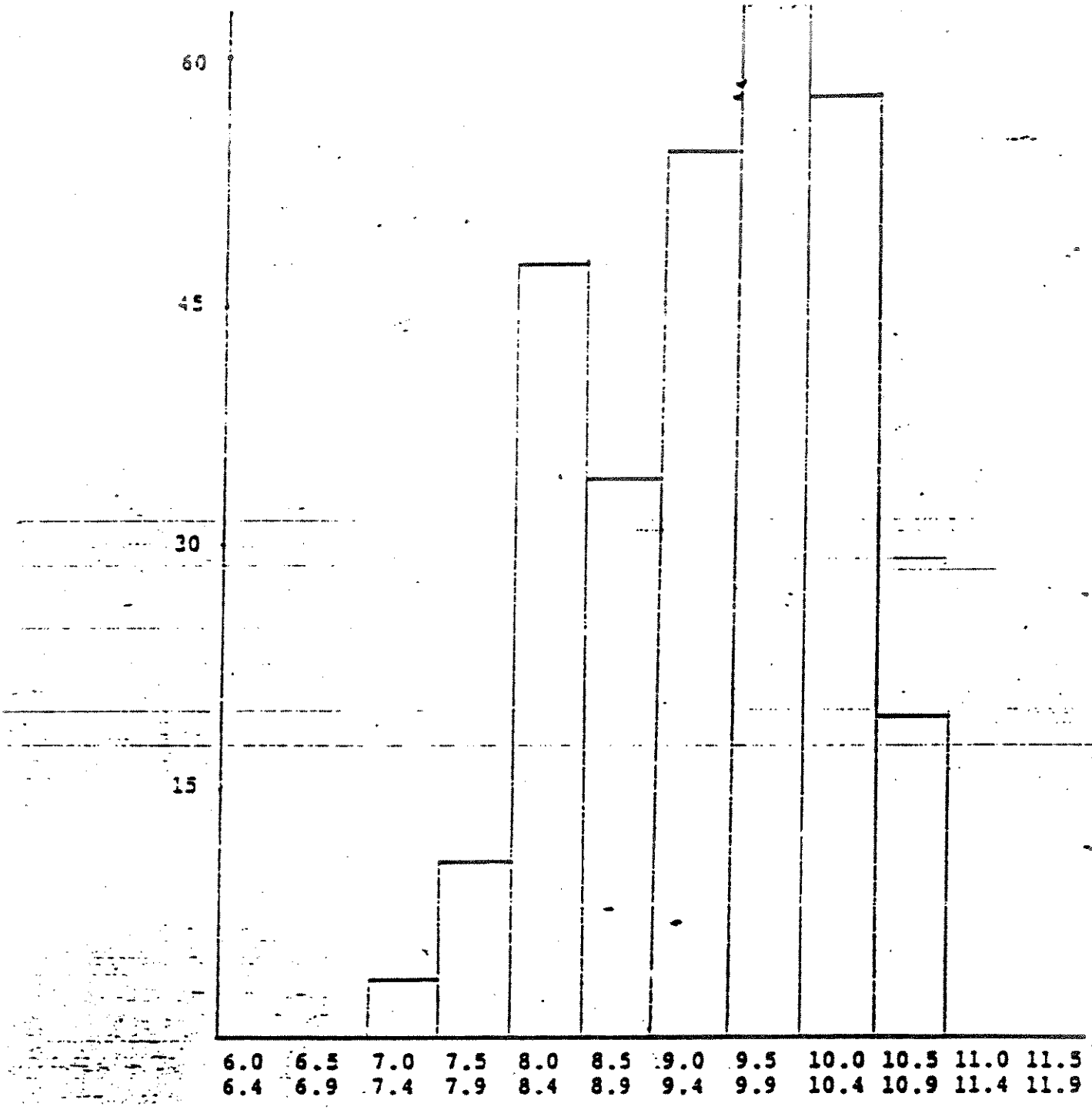


Figure 5. Georgetown Lake Kokanee Length-Frequency in January 1988 Angler Creel. N = 387.

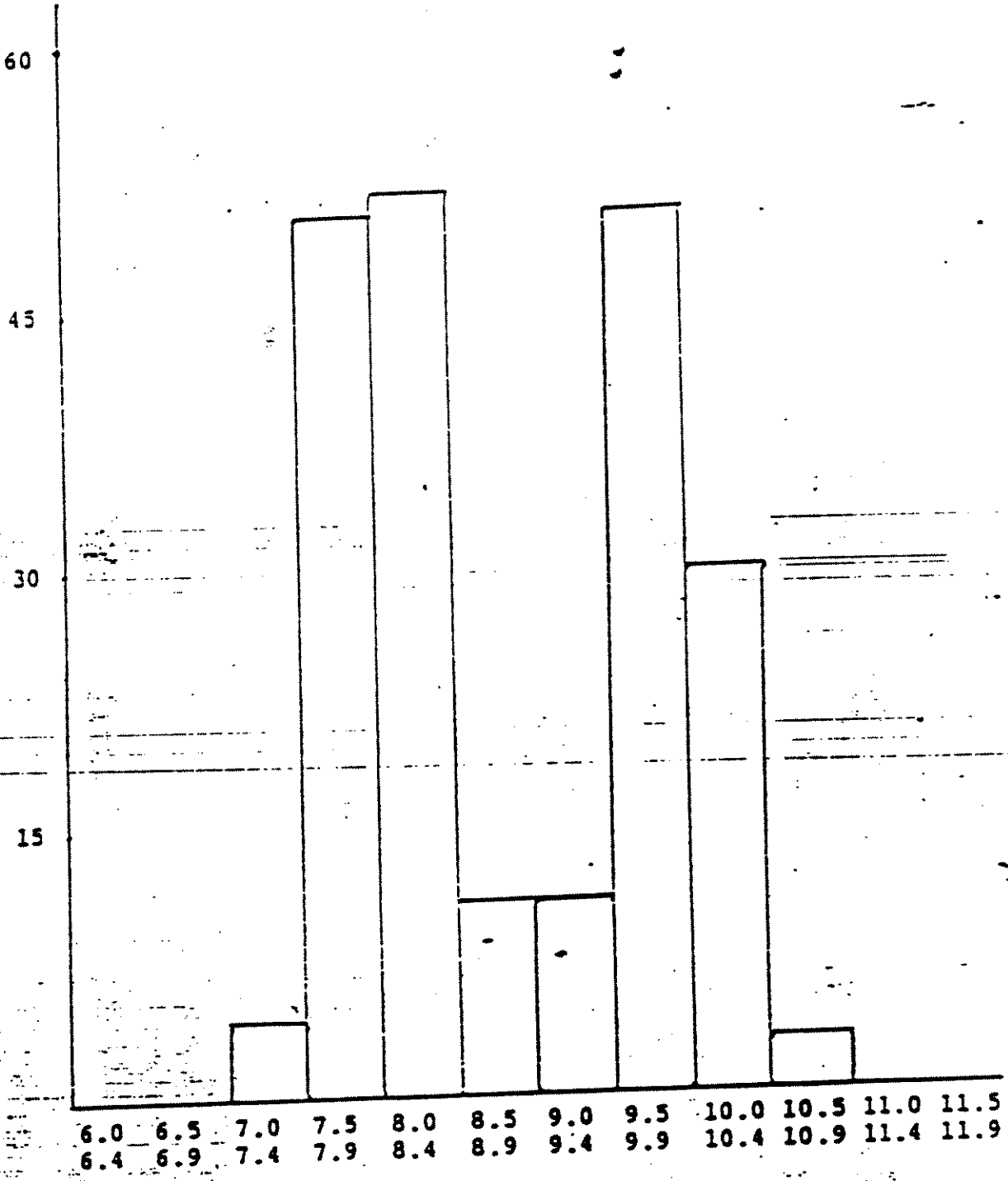


Figure 6. Georgetown Lake Kokanee Length-Frequency in January 1989 Angler Creel. N = 200.

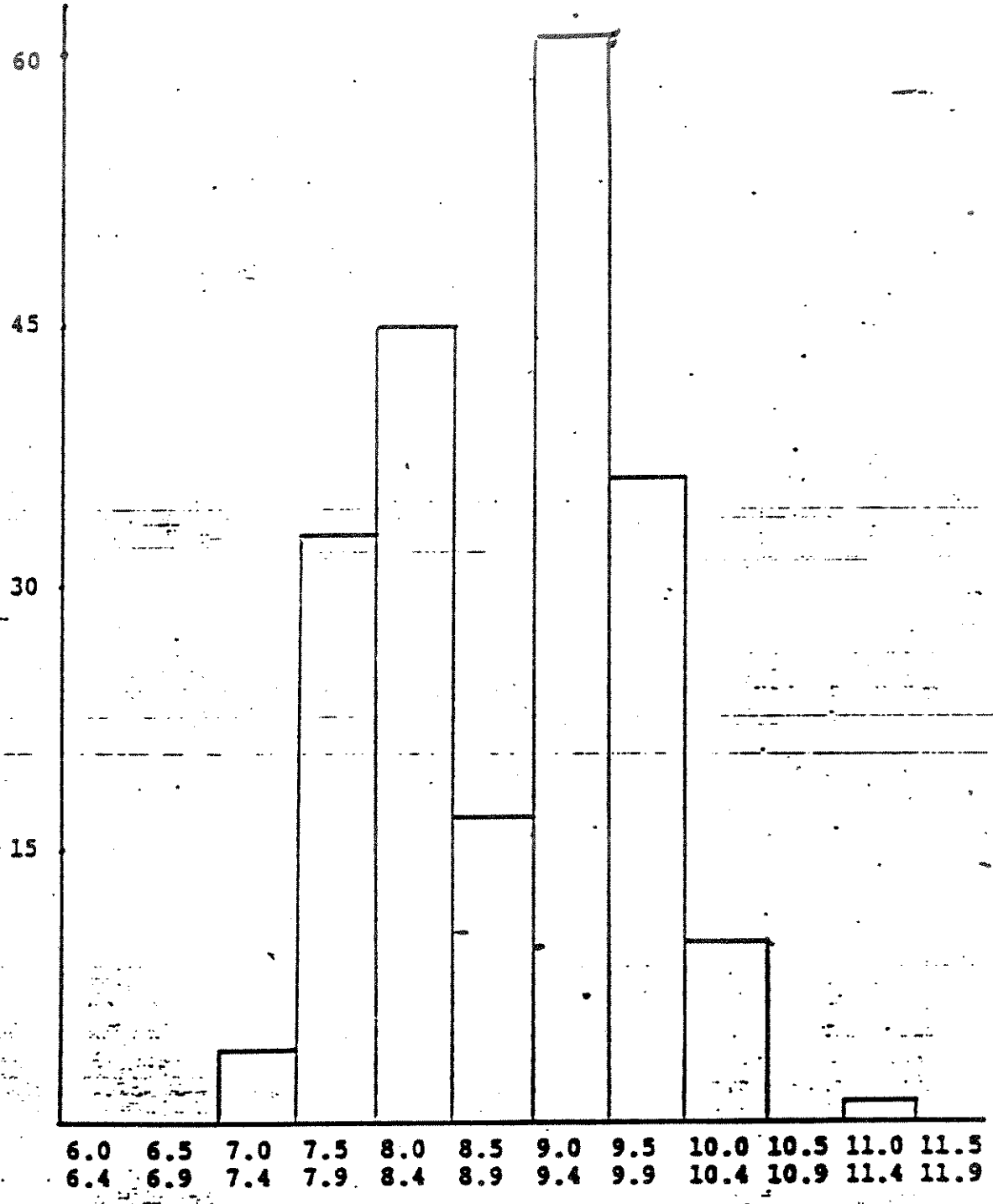


Figure 7. Georgetown Lake kokanee length-frequency in January 1990 angler creel N = 205

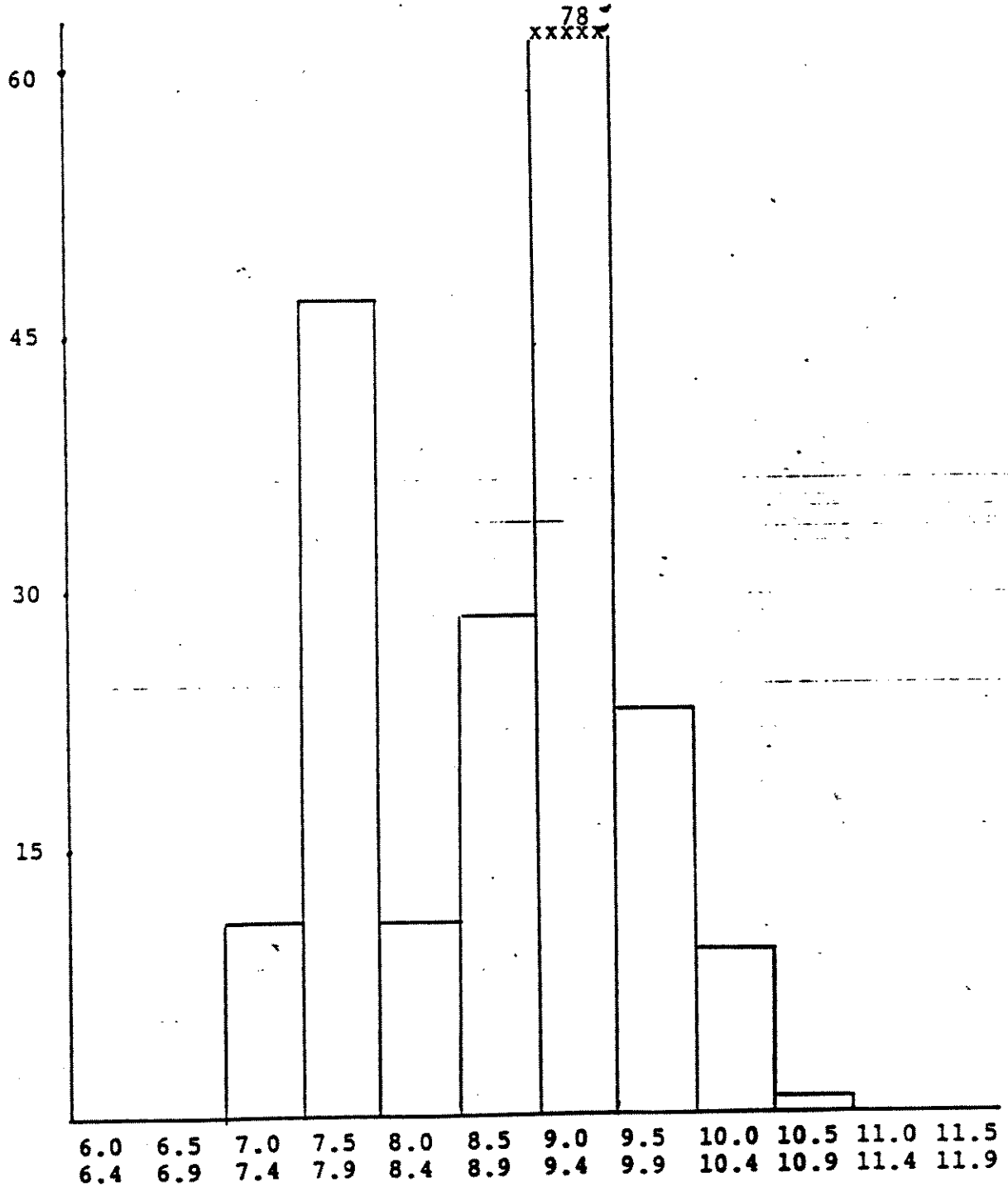


Figure 8. Georgetown Lake kokanee length-frequency in January 1991 angler creel. N=208.

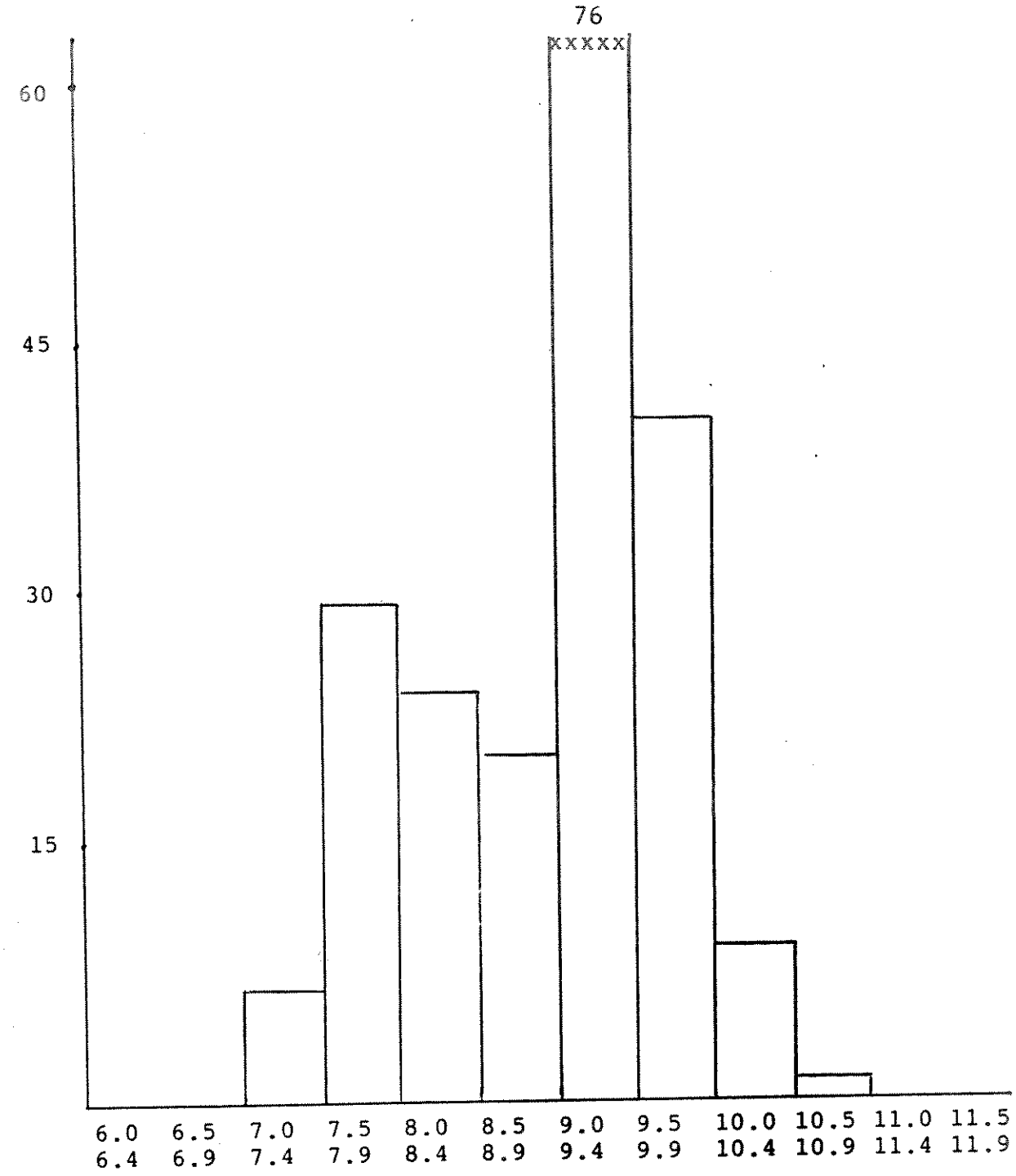


Figure 9. Georgetown Lake kokanee length-frequency in January 1992 creel. N=207

Brook Trout

Brook trout are a small but highly regarded fraction of the Georgetown fishery. Creel sample data for brook trout are show in Table 3. Brook trout sampled in 1992 averaged 12.7 in length with a maximum of 17.3 inches. This is a slight reduction over 1991 but still larger than any other previous year of record. Ratio of rainbow to brook trout reached 4:1 in 1992 and brook trout harvest equalled 20% of the total trout catch sampled. While these increases may reflect brook trout increases in abundance, it is more likely that they result from a reduction in rainbow numbers. Brook trout size and numbers appear to be in good condition in the lake.

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

	Summer		Winter							
	1979	1980	1980	1981	1987	1988	1989	1990	1991	1992
Number Sampled										
Rainbow	88	774	141	730	244	303	221	305	302	300
Brook	4	124	11	123	18	57	23	47	45	75
Brook Trout Length										
Average	10.1	10.	11.8	11.1	12.1	12.1	12.2	12.0	13.1	12.7
Maximum					17.2	16.5	16.0	17.2	16.9	17.3
Rainbow to Brook Ratio	22:1	6:1	13:1	6:1	14:1	5:1	10:1	6:1	6:1	4:1
Brook Trout % of Catch	4	14	7	14	7	16	9	13	13	20

Rainbow Trout

Rainbows are the most important trout in the Georgetown harvest in both numbers and poundage. Rapid increases in rainbow size followed regulation changes in 1985 (Table 4). This appears to have resulted from reduction in angling mortality and a consequent increase in life expectancy. The 1992 January harvest of rainbow trout averaged 12.6 inches. This is the smallest average rainbow length recorded since January 1986. The decline in average length results from the reduction in abundance of medium sized rainbows resulting from stocking failures of Eagle Lake rainbows planted in 1988, 1989, and perhaps 1990.

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
Year	90-91	91-92						
Sample Number	302	300						
Average Length	13.9	12.6						

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. Since data are collected in January, fish from a given Kamloops or Eagle Lake stocking are not likely to enter the datastream until 15 months after stocking.

The percent of each of the three strains with the January catch is presented in Table 5. Arlee rainbow dominated the catch in 1985-86 and 1986-87 at 70% of the harvest in both years (Fig. 10-16). The Arlee contribution declined in 1987-88 (63%), 1989 (52%) and 1989-90 (59%). In 1990-91 Arlee dominated the catch at 93% and declined to 67% of the 1991-92 catch. The increase in percent of catch contributed by Arlee stock is largely the result of decline in abundance of Eagle Lake rainbows (Fig. 17-23). Eagle Lake plants in 1988 and 1989 appear to have had minimal survival.

Eagle Lake rainbow performance has been discussed, in part, previously. Like Arlee rainbow, Eagle Lake sizes increased from 1986 through 1989 (Figures 17-20). In Table 5, it can be seen that Eagle Lake average size increased substantially in 1990 and 1991 (Figures 21 and 22). These increases result from the stocking failures of 1988 and 1989. Eagle Lake data from January 1993 are shown in Figure 23. It appears that 1990 stocked Eagle Lake are doing well and that in concert with a healthy 1991 plant the 1993 catch will return to a size distribution resembling

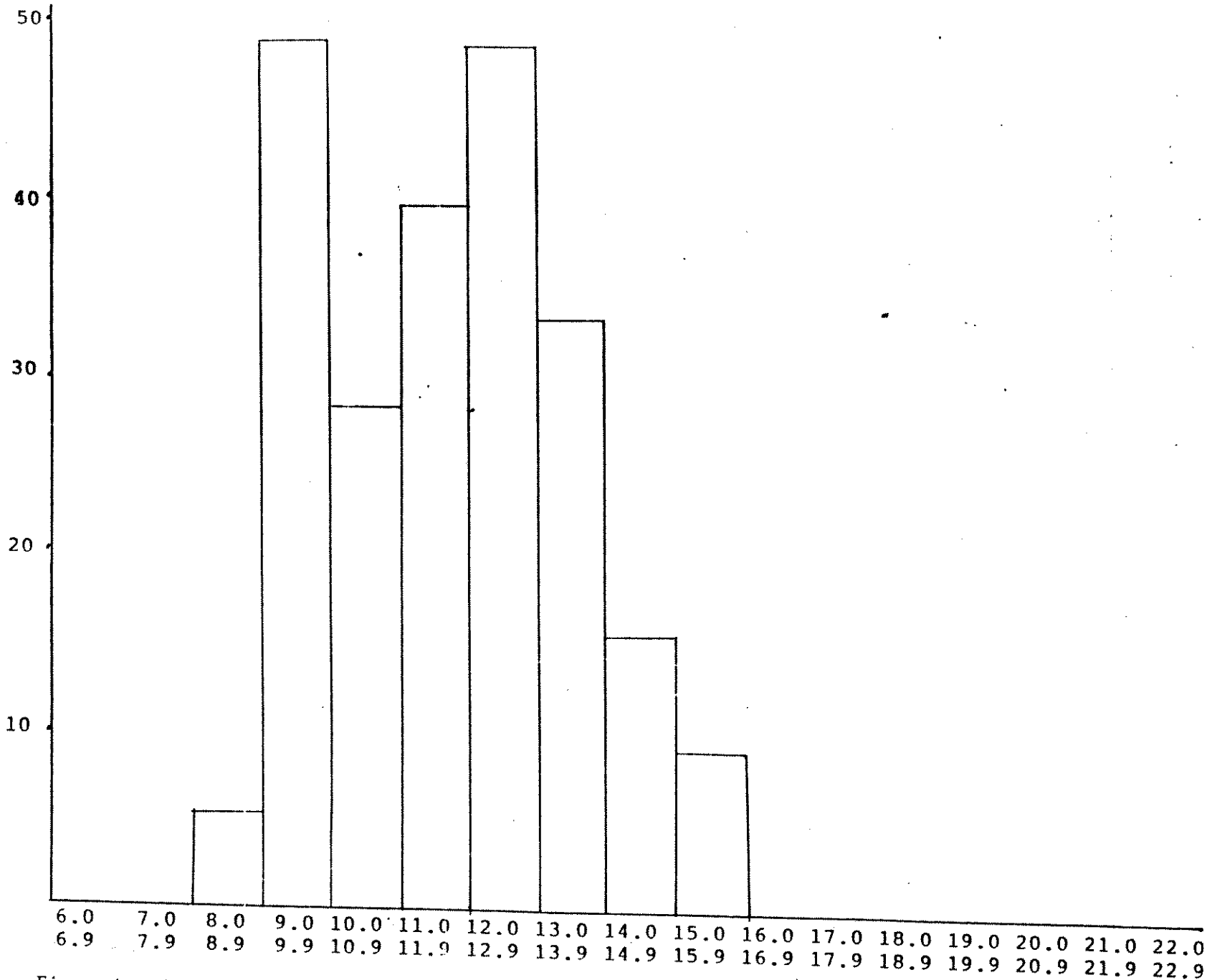


Figure 10. Length Frequency of Georgetown Arlee Rainbow. January 1986. N = 210

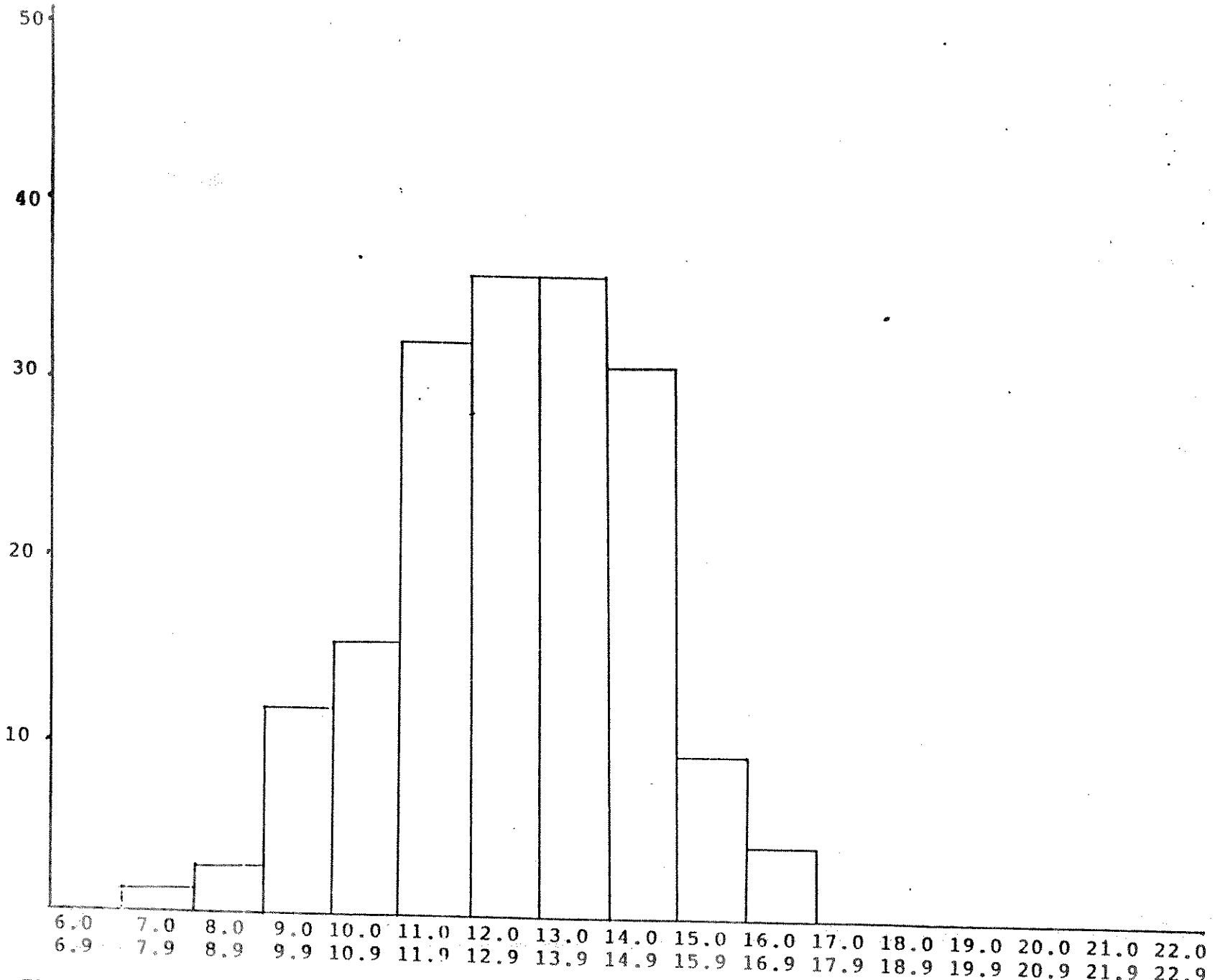


Figure 11. Length Frequency of Georgetown Artec Rainbow, January 1987 N = 169

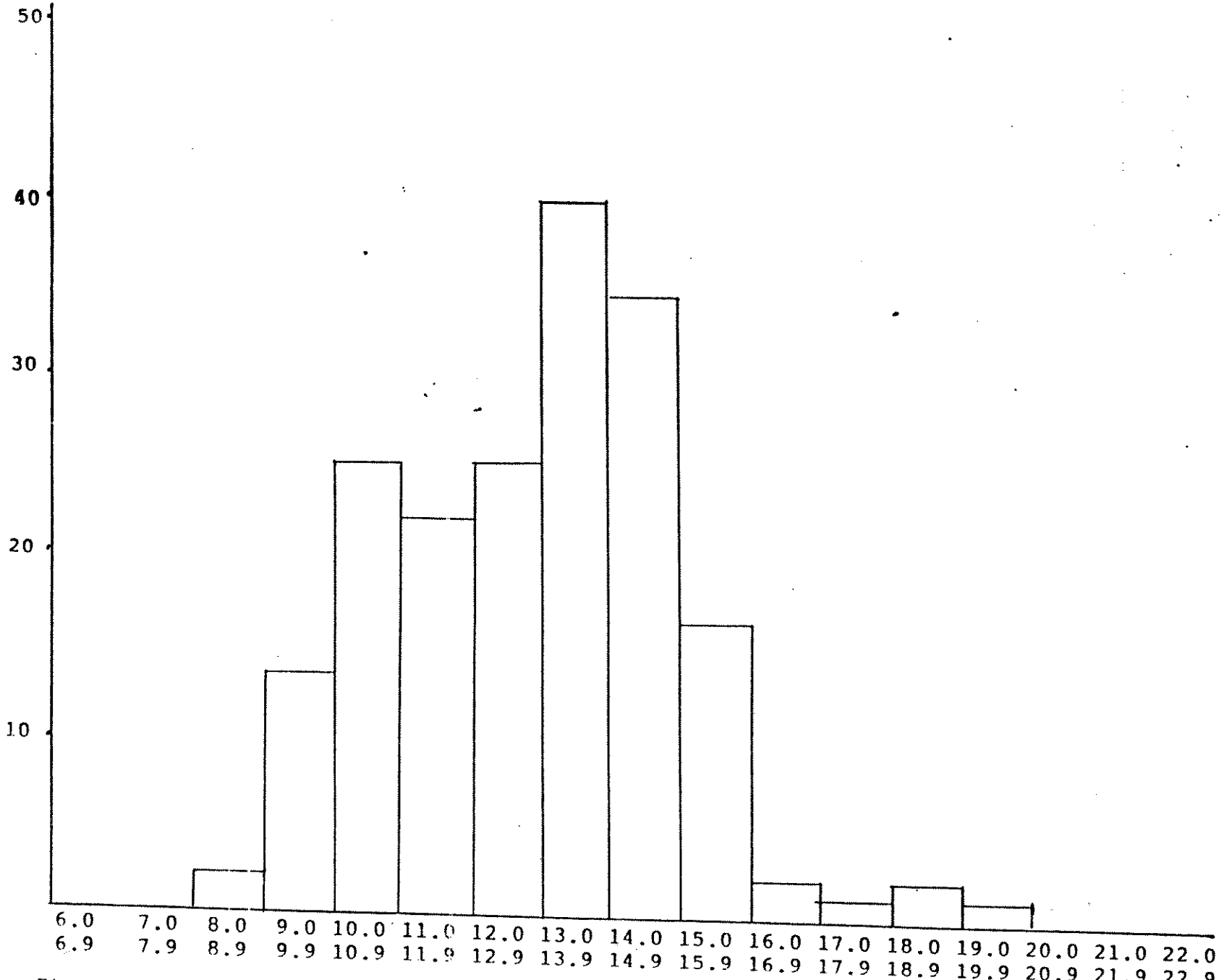


Figure 12. Length Frequency of Georgetown Arlee Rainbow. January 1988. N= 197

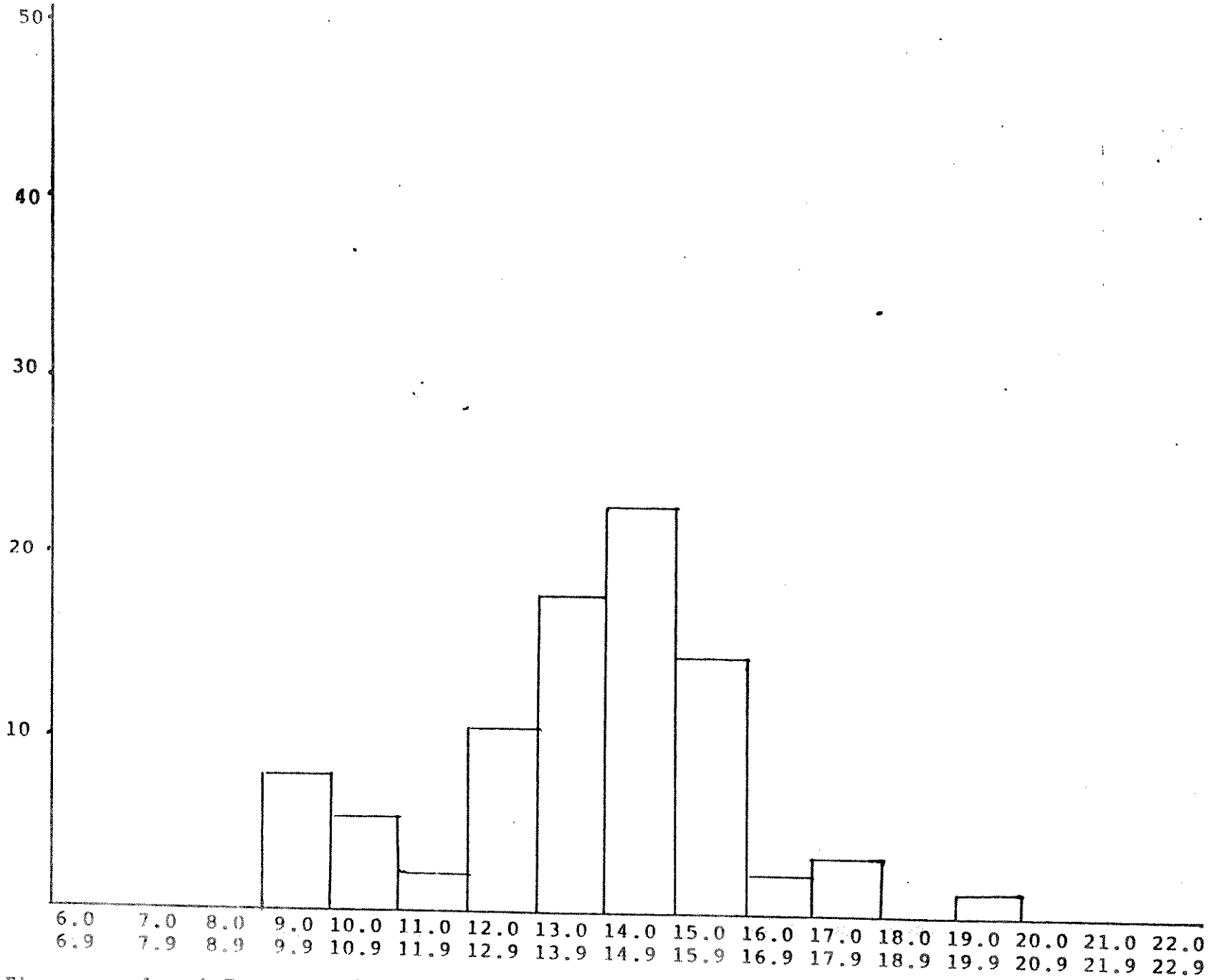
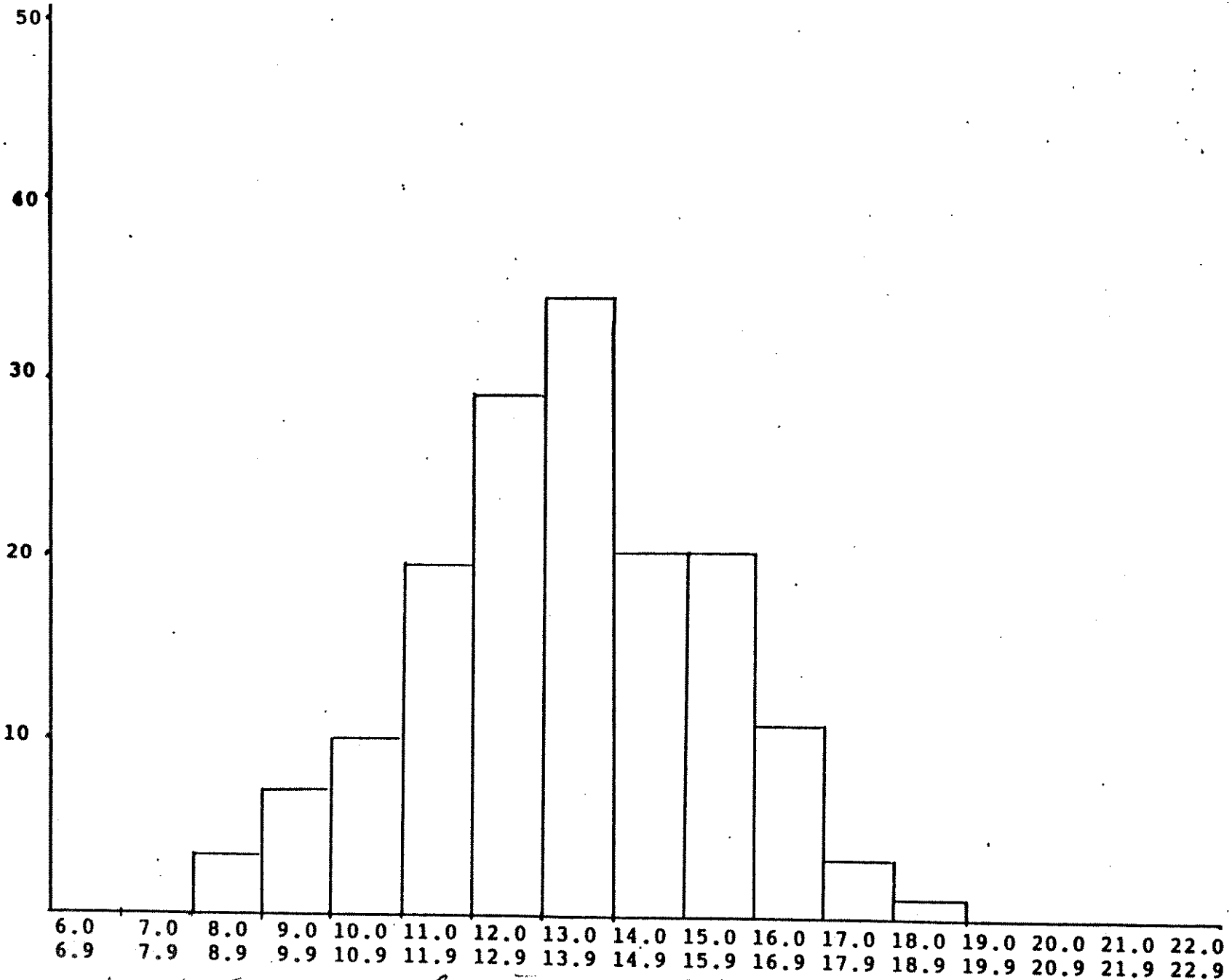


Figure 13. Length Frequency of Georgetown Arlee Rainbow. January 1989. N = 87



igure 14. Length Frequency of Sacramento Lake Rainbow Jan 1990 N= 174

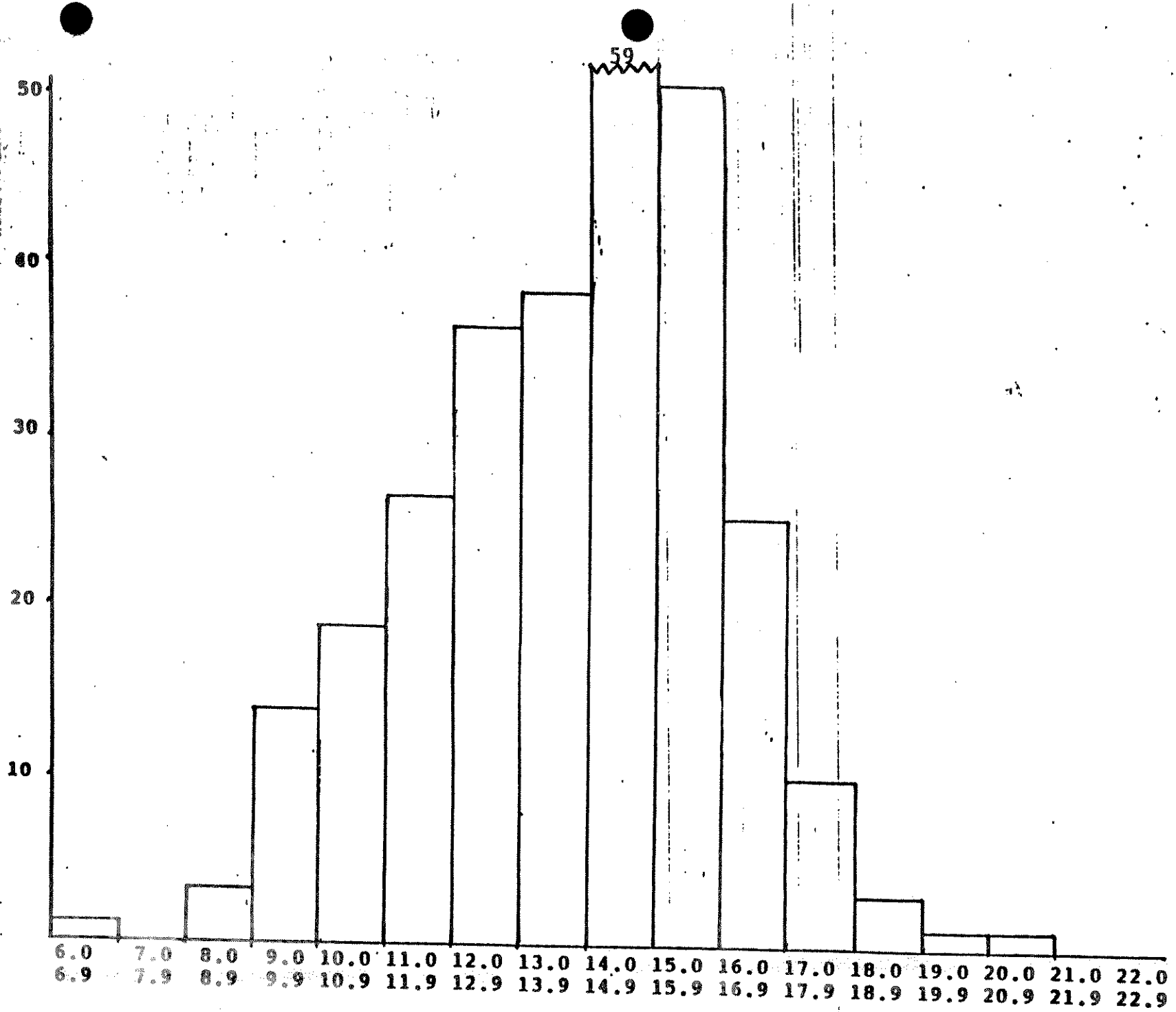


Figure 15. Length Frequency of Georgetown Arlee Rainbow, January 1991 N 282

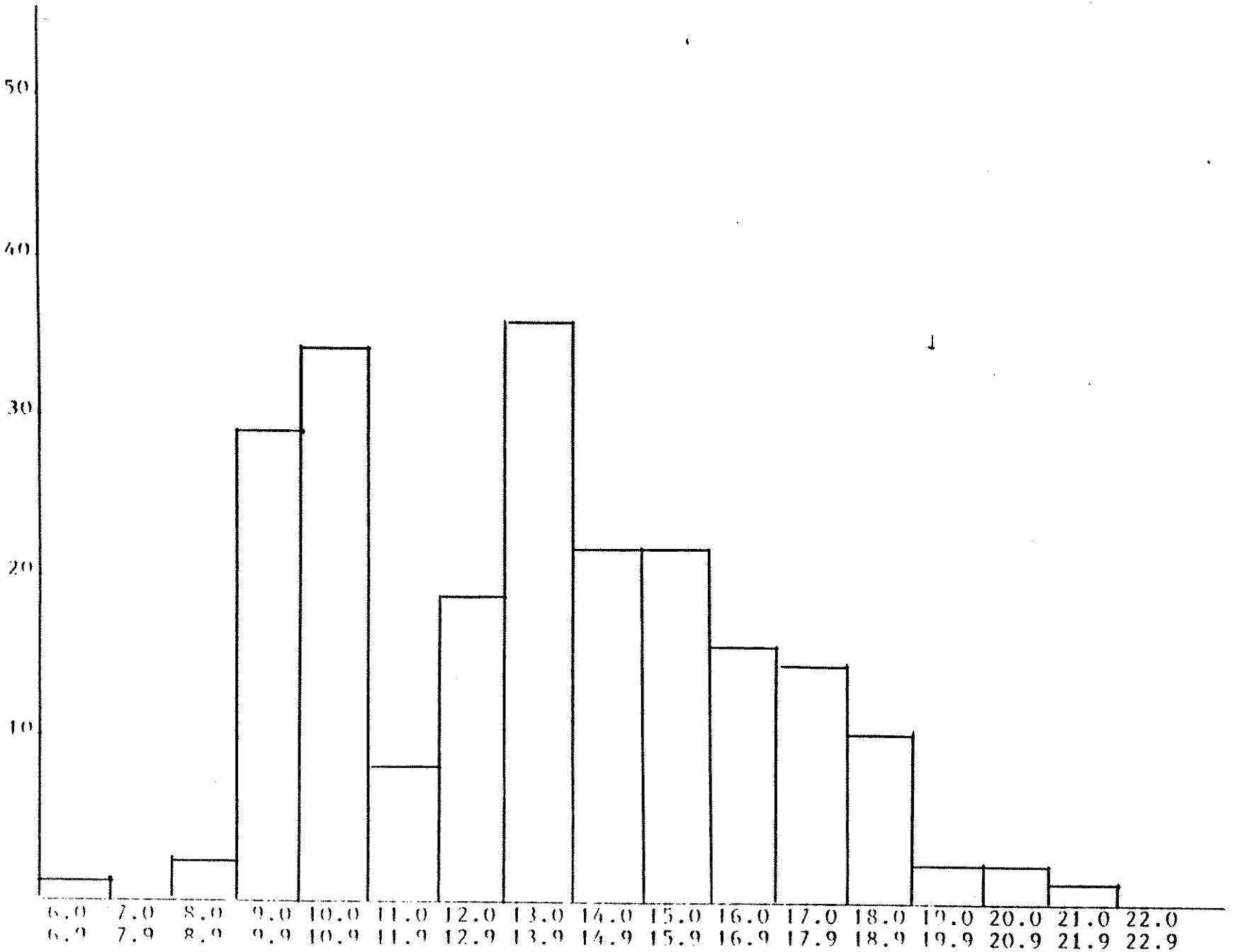


Figure 16. Length frequency of Georgetown Lake Arlee Rainbow, January 1992 N=208

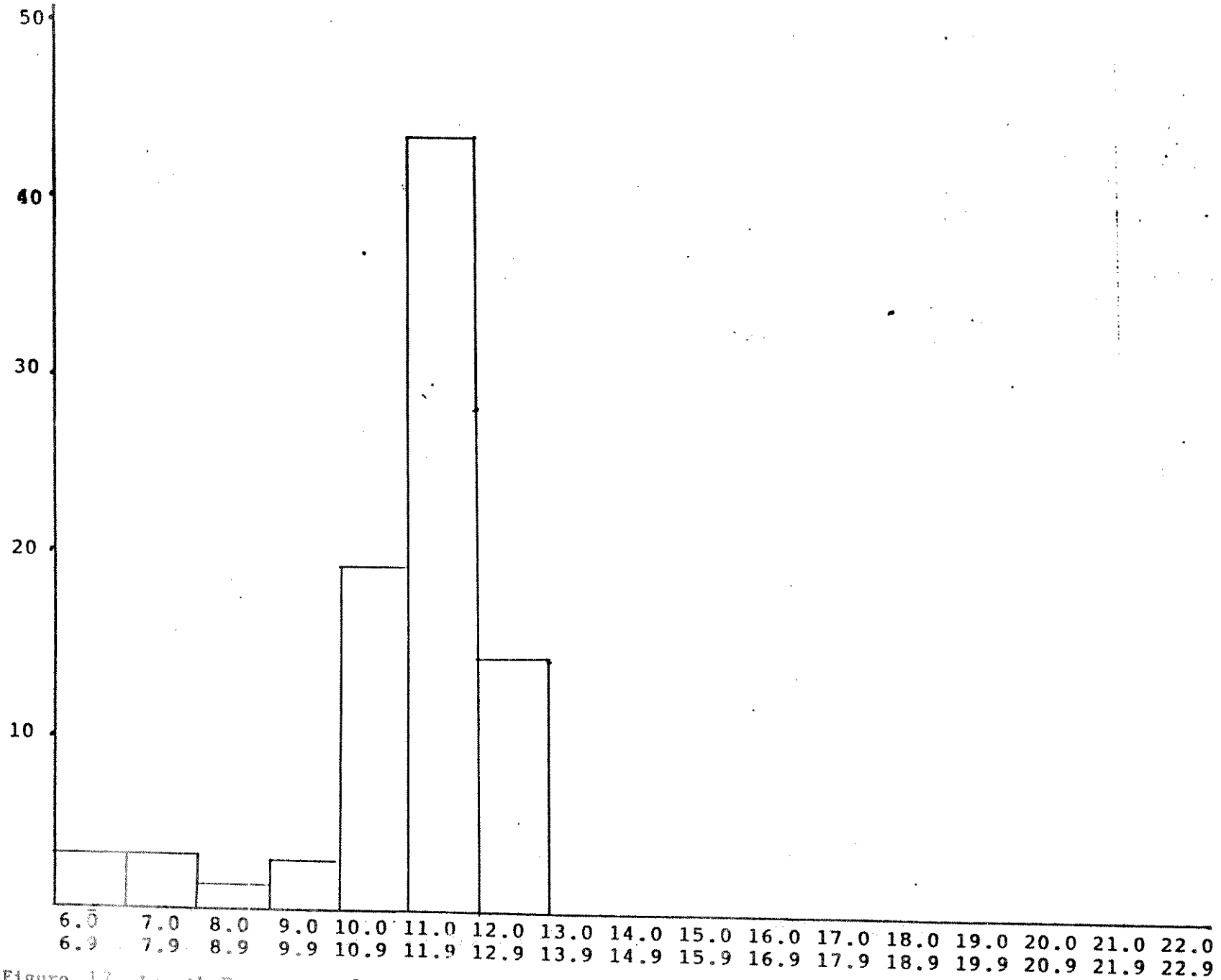


Figure 17. Length Frequency of Georgetown Eagle Lake Rainbow. January 1986. N = 84.

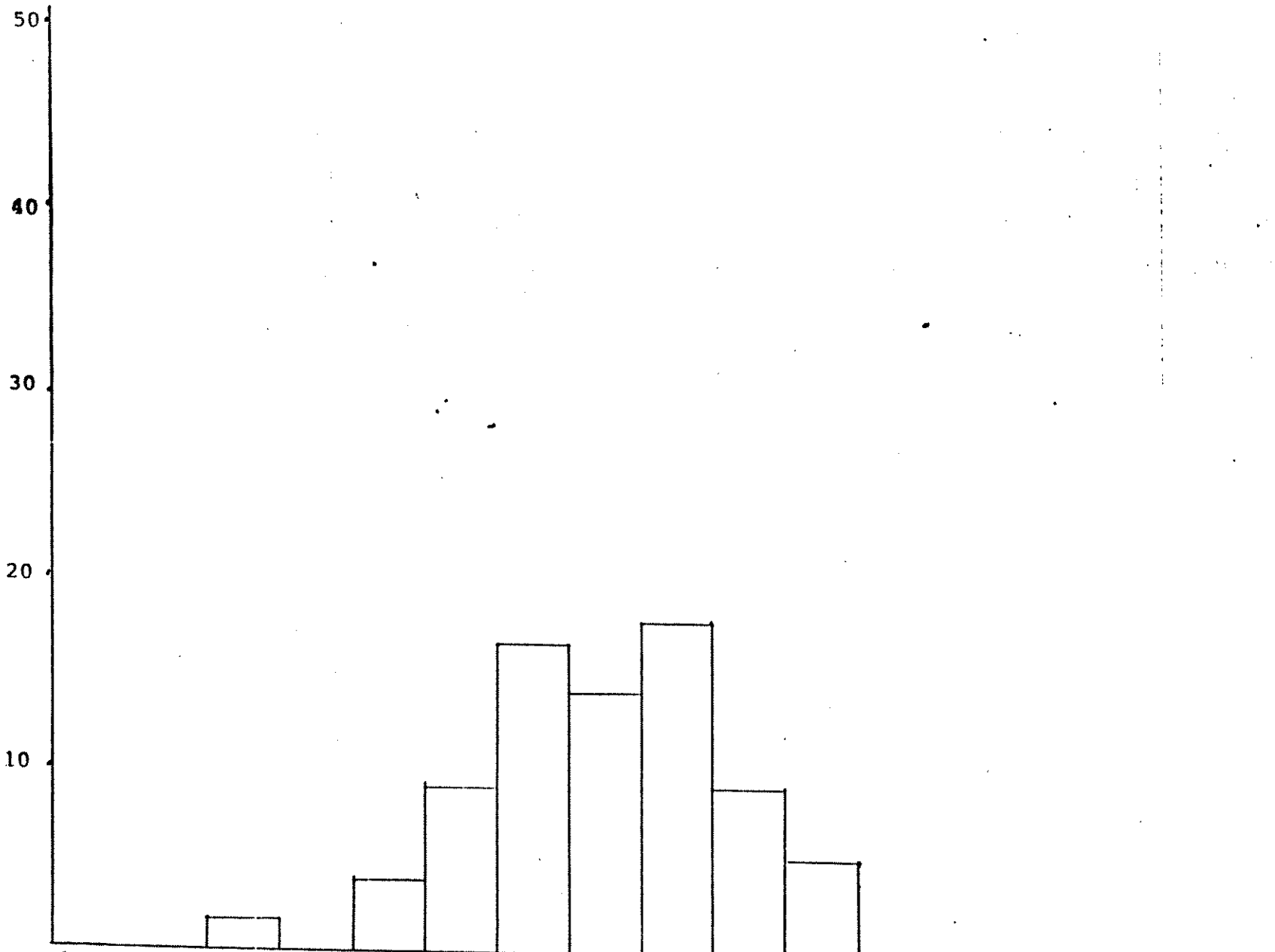


Figure 13. Length Frequency of Georgetown Eagle Lake Rainbow. January 1987. N = 70

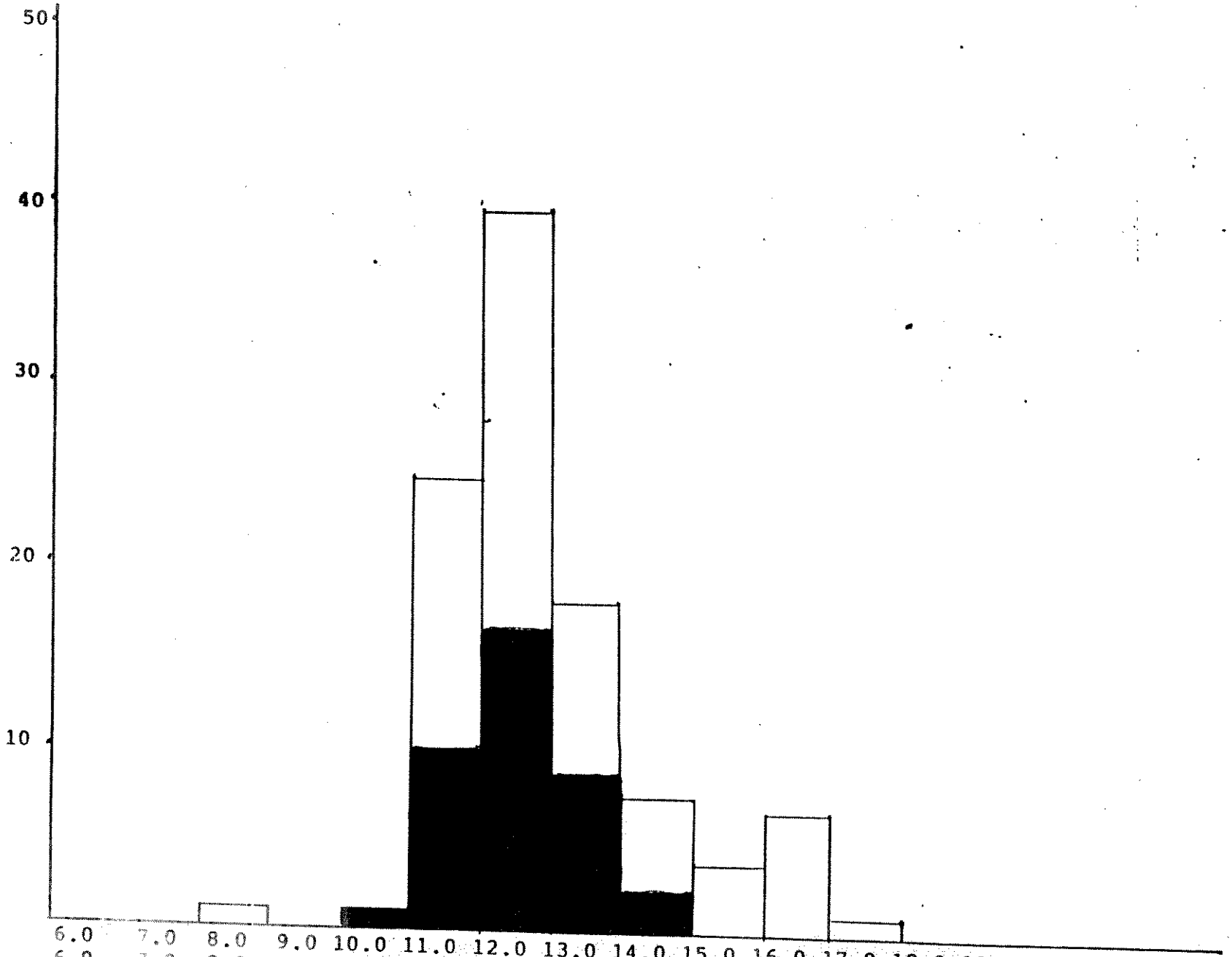


Figure [illegible]. Length Frequency of Georgetown Eagle Lake Rainbow. January 1988. N = 106

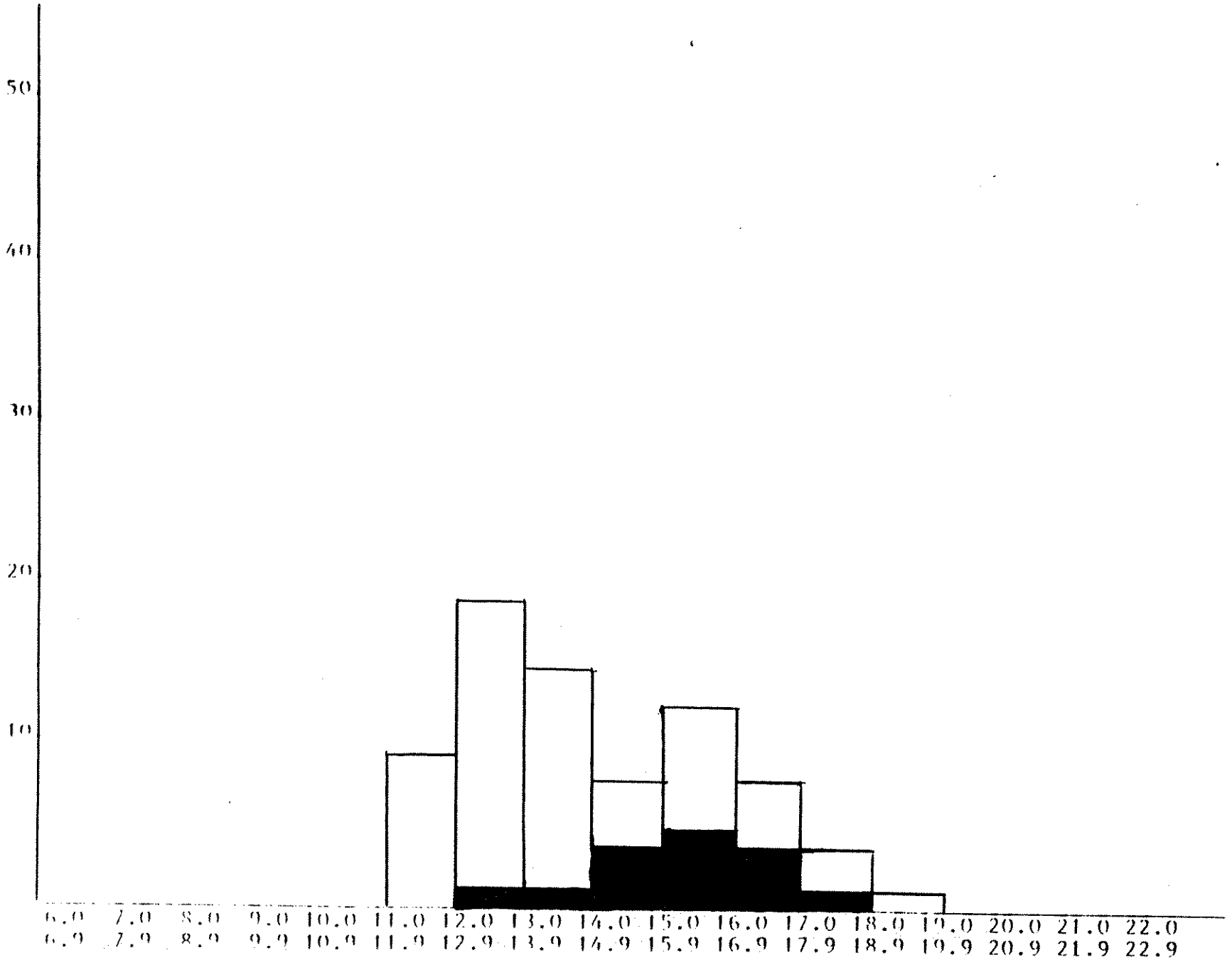
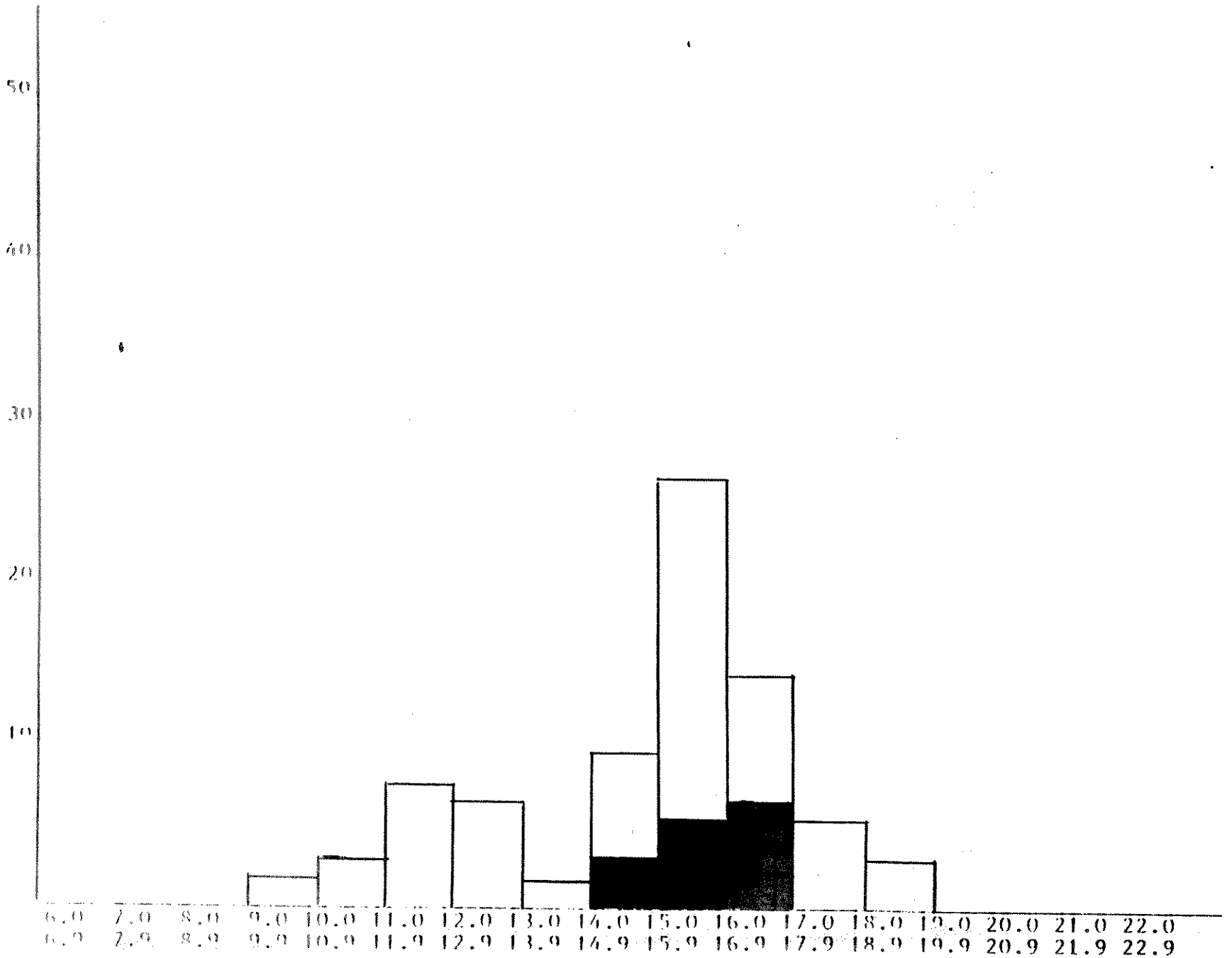


Figure 20. Length frequency of Georgetown Lake Eagle Lake Rainbown, January 1989. N=71
Shaded area is 1986 Plant, N=13



igure 21. Length frequency of Georgetown Lake Eagle Lake Rainbow, January 1990 N=80
Shaded area is 1986 Plant, N=14

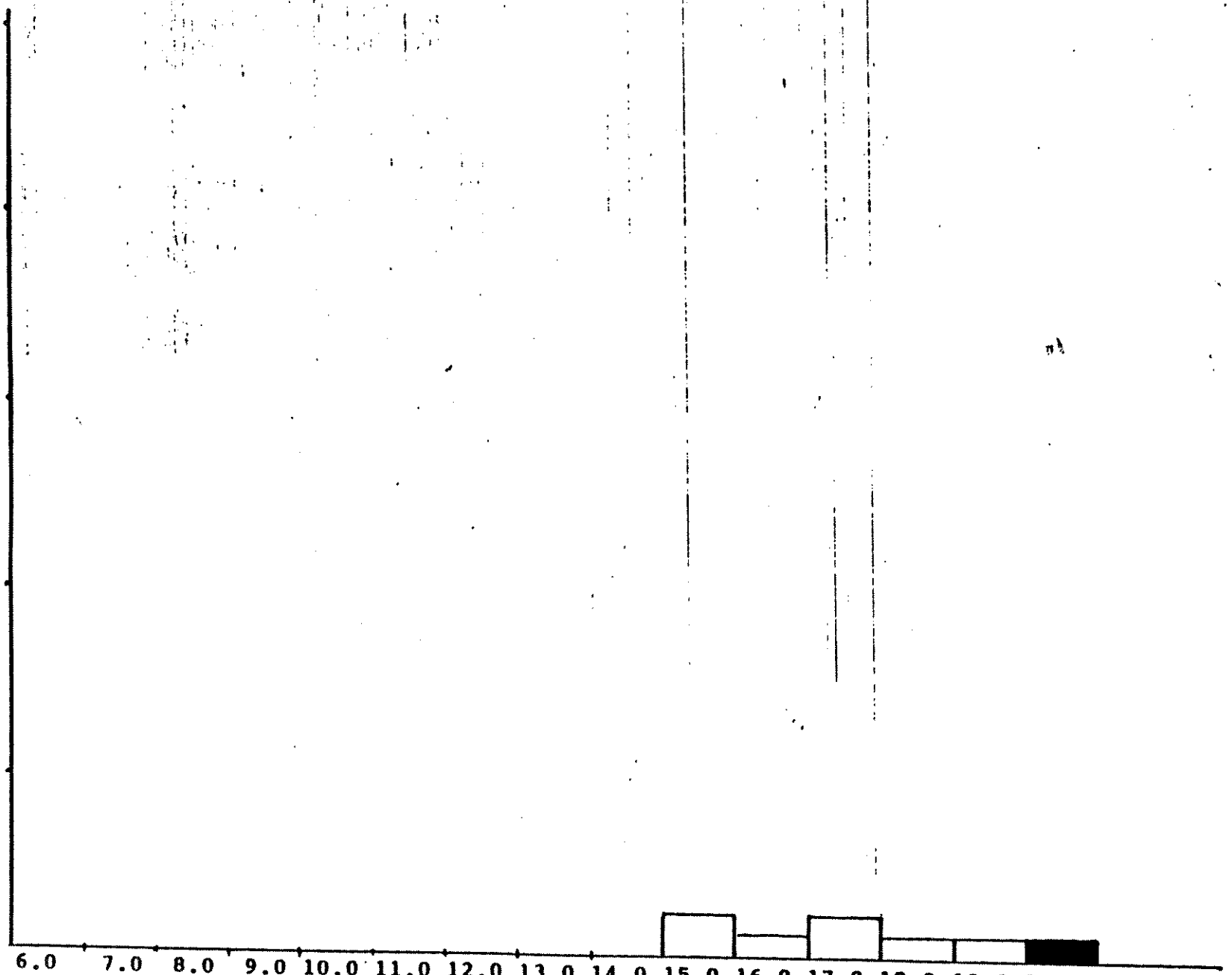


Figure 22. Length frequency of Georgetown Eagle Lake Rainbow. N-8. Shaded area 1986 plant. N-1 January 1991

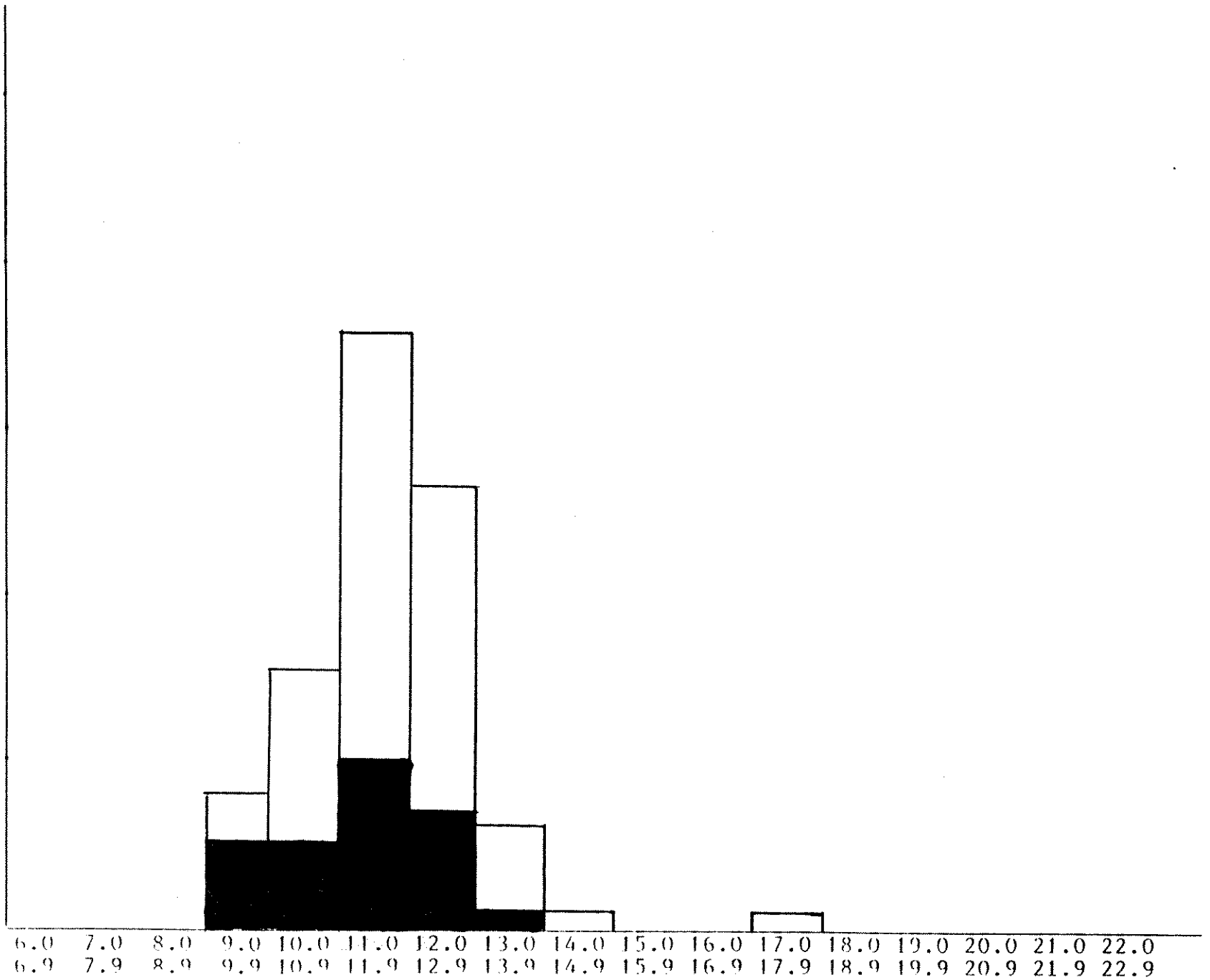


Figure 23. Length frequency of Georgetown Lake Eagle Lake Rainbow, January 1992 N=92
Shaded area is 1990 Plant

1989. In 1986, the Eagle Lake plant received a double tetracycline mark. Average lengths of the 1986 tetracycline marked Eagle Lake were 12.5 inches in 1988, 15.2 inches in 1989, 15.7 inches in 1990, and 20.8 inches in 1991. These constitute growth increments of 2.7 inches in 1988-1989, 0.5 inches in 1989-1990, and 5.1 inches in 1990-1991. Eagle Lake strain rainbows have achieved weights in excess of six pounds in Georgetown.

Table 5. Georgetown Lake Rainbow Strain Evaluation, January Angler Creel 1986-91

	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
			1990-91	
Arlee	282	93	13.1	6.7-19.0
Eagle Lake	8	3	17.6	15.1-20.8
Kamloops	11	4	15.1	10.7-16.6
Total	301	100	13.8	6.7-20.8
			1991-92	
Arlee	208	67	13.0	6.2-21.4
Eagle Lake	92	33	11.6	9.1-17.3
Kamloops	0	0	0	0-0
Total	300	100	12.6	6.2-21.4

The Kamloops rainbows have not performed well, in the main, in Georgetown, Figures 24-25. Late stocking dates and apparent poor survival seem to be the contributing factors. A Kamloops taken in October 1989 reached a weight of 10.5 pounds and a length of 27 inches after four growing seasons. During the years 1985-1986 Kamloops contributed 1-4% of the January rainbow catch. In an effort to evaluate alternative stocking strategies, an experimental plant of 28,963 Kamloops was made in June 1989. These fish had been held an additional 9 months in the hatchery and averaged 8.3 inches long. Kamloops representation in the catch increased to 13% in January 1990 and 8% in 1991. The yearling Kamloops made up 76% of all Kamloops sampled in 1990 and 82% of those checked in 1991. The 1989 stocked Kamloops had grown 2.7 inches in average length in a 7 month period to reach 11 inches in January 1990 and grew 4.1 inches, average, in the following 12 months to January 1991 reaching an average length of 15.1 inches. No Kamloops were observed in the 1992 collections. The poor performance of fall stocked 4 inch Kamloops contrasted with the success of the 8 inch summer stocked fish as led to a recommendation that all Kamloops stocking in Georgetown be with 30,000 8 inch fish released in June. This will be the stocking program in use for Kamloops beginning in 1993.

The Georgetown fishing season opens with general stream trout season on the third Saturday in May. In 1991 ice out was somewhat later than normal and opening of fishing somewhat earlier. The result was large concentrations of spawning and prespawning rainbows in areas open to fishing. The accessibility of numbers of big fish resulted in major legal harvest, frequent violations of fishing regulations, and public concern about excessive and unethical harvest. Regulations were changed in 1992 so that areas of pre-spawner and spawner concentration were closed to fishing until the rainbows had dispersed.

Spawning runs in 1992 were sampled less intensively than in previous years to reduce potential for negative impacts from electrofishing. Forty-eight spawners were examined (Table 6). Average spawner size was more than an inch longer than in 1990 or 1991. It is likely that the increase reflects a reduction in abundance of younger Eagle Lake spawners. Twenty-four juvenile rainbows were taken from the North Fork of Flint Creek and sent to the University of Montana Genetics Laboratory for electrophoretic analysis. These fish appear to have 85% Eagle Lake, 6% Arlee, and 9% Kamloops inheritance.

dissolved oxygen concentrations remained at or above 5 ppm at 2 meters except in March (Figure 7). Winterkill remains a serious potential problem at Georgetown.

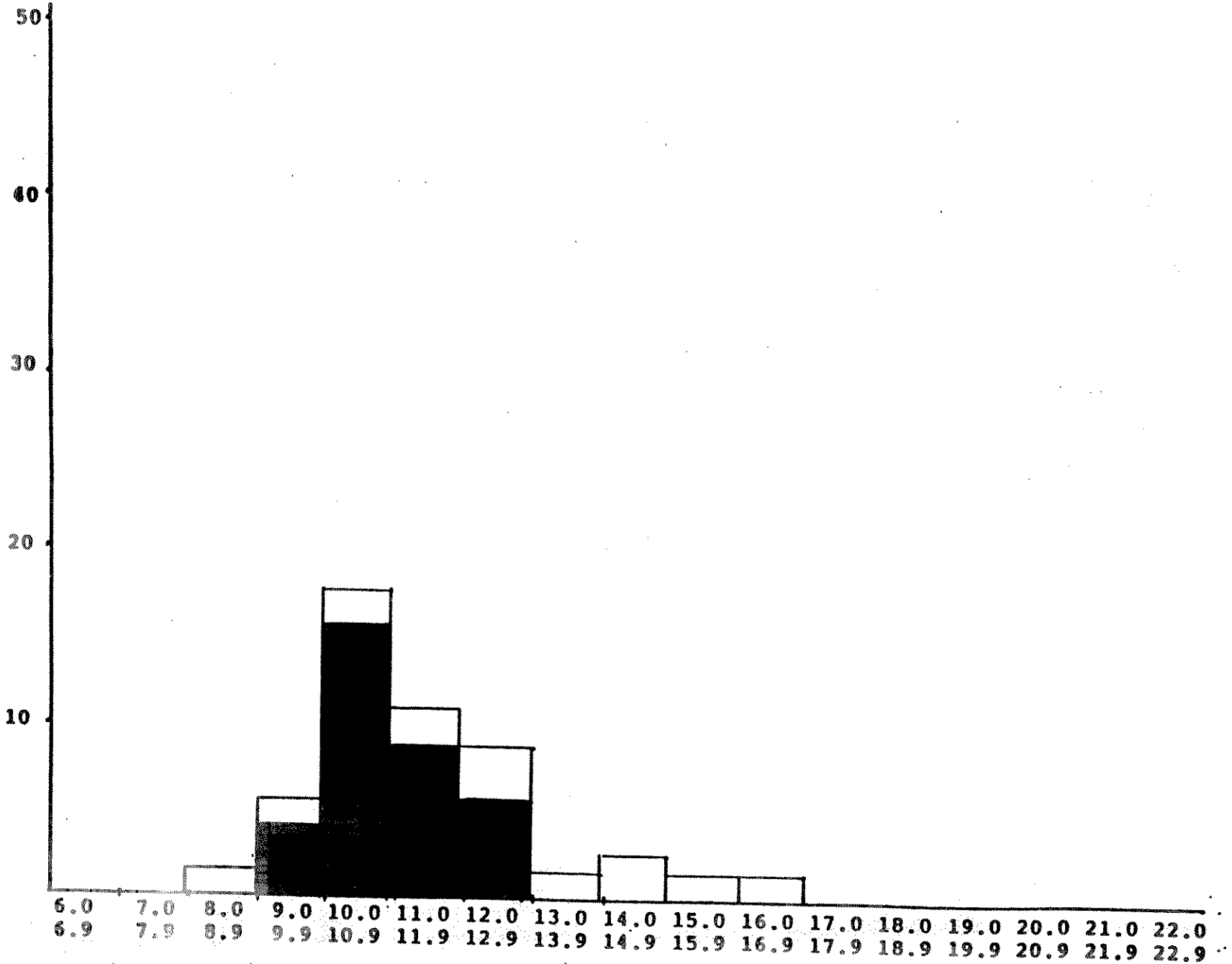


Figure 24. Length frequency of Georgetown Kamloops Rainbow, January 1990 N = 49
Shaded - June 1989 Plant N = 37

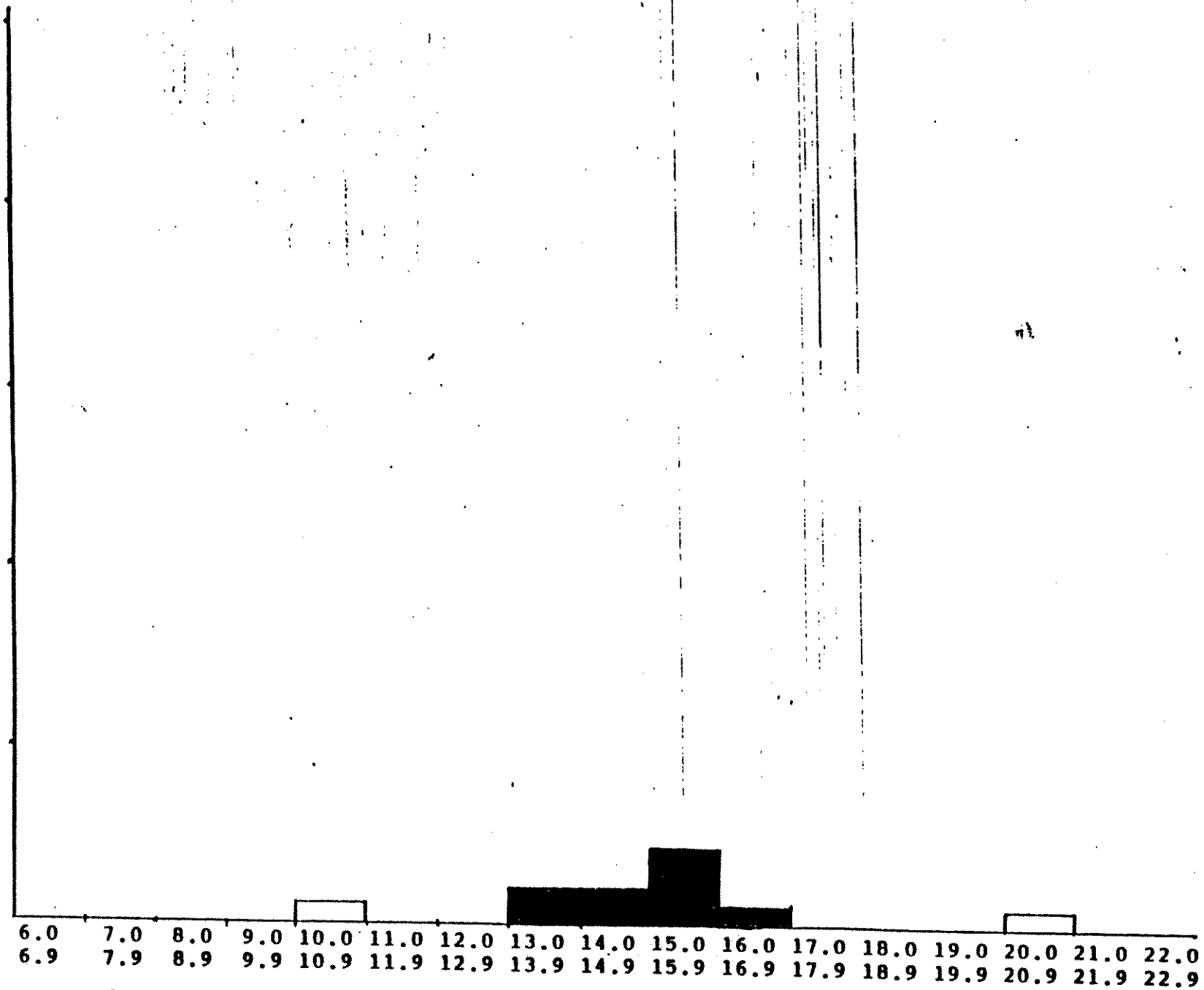


Figure 25. Length frequency of Georgetown Lake Kamloops Rainbow. January 1991. N-11. Shaded June 1989. Plant. N-9.

Table 6. Georgetown Lake Tributaries Spawning Rainbow.

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	
Date 5/24/91			Date 4/17/92		
Number	96	L 17.6	Number	48	L 18.8
Number Male	34		Number Male	24	
Number Female	62		Number Female	24	
Number Hook Scarred	8		Number Hook Scarred	5	

Table 7. Georgetown Lake 1992 under ice dissolved oxygen concentration (ppm).

	Surface	1m	2m	3m	4m	5m
January	7	6.4	5.3	2.9	2.0	1.5
February	7.5	6	5	3	2	1.5
February	5.5	6.3	3.1	2.7	1.2	
March	7.5	7.5	5.9	4.1	1.7	.7

Waters Referred to:

Georgetown Lake
North Fork of Flint Creek
Stuart Mill Creek

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Date: August 1992