MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS
FISHERIES DIVISION

JOB PROGRESS REPORT

STATE: MONTANA PROJECT TITLE: STATEWIDE FISHERIES INVESTIGATIONS

PROJECT NO.: F-46-R-2 STUDY TITLE: SURVEY AND INVENTORY OF COLDWATER LAKES

JOB NUMBER: II-b

JOB TITLE: WEST CENTRAL MONTANA COLDWATER LAKE INVESTIGATIONS

PROJECT PERIOD: JULY 1, 1988 THROUGH JUNE 30, 1989

ABSTRACT

Kokanee salmon average lengths were 9.4 inches and 8.8 inches in 1988 and 1989, respectively.

Rainbow trout average lengths were 12.8 inches in January 1988 and 13.4 inches in January 1989. The 1989 length represents a 3.6 inch average length increase since regulations were changed in 1985. Arlee, Eagle Lake, and Kamloops average sizes in 1988 and 1989 were similar. January rainbow catch composition in 1988 and 1989 was less than 5% Kamloops, about 55% Arlee and 40% Eagle Lake. Growth of September 1986 Eagle Lake was about 7 inches in the first 16 months and 3 inches in the following 12 months. Large numbers of spawning rainbows entered tributaries in spring 1989. Ninety-two were examined including 2 Kamloops. Spawners averaged over 17 inches in length, 38% were 18 inches, and 13 percent exceeded 20 inches. A sample of 10 fish sacrificed and sampled for tetracycline marks contained 7 Eagle Lake rainbows. Dissolved oxygen levels declined to less than 5 ppm at 1 m depth below the ice in April, 1989.

OBJECTIVES AND DEGREE OF ATTAINMENT

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

   Since the change in management strategy in Georgetown in 1985 average size of winter caught rainbow has increased from 9.8 to 13.4 inches. Progress toward meeting this objective has been good and ultimate achievement of the goal seems likely.

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

   Mountain lake work was not done in FY89. Work was done in early FY90 and will be reported in the next report period.

3. Develop mountain lake management plans for ecological units

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

Mountain lake management plans will be completed as our data base improves. None have been completed to date.

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

This objective is directed toward our low elevation lakes in the Clearwater River drainage. We have changed stocking programs on a trial basis on certain lakes and will be monitoring those lakes next year to measure changes in trout population densities.

5. Increase yellow perch mean size to 9 inches.

High population densities of yellow perch is one of the problems in the Clearwater Lakes. These populationss are linked to the trout populations on objective 5. We will report on any progress in increasing the size of yellow perch when we report on trout population densities in the next report period.

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

Average size of winter caught kokanee remains well below the ten inch average. The trend in average lengths since 1985 is upward but is difficult to ascertain due to varying percentages of 2+ and 3+ kokanee in the catch. Increasing predation on kokanee by piscivorous rainbow trout may contribute to increased salmon size in future years.

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, 1/2 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 the Georgetown Lake fishery has been rapid since regulations and stocking regime were changed in 1985. Monitoring of angler harvested fish in the ice fishery has been accomplished for most years since the winter of 1966-67.

Kokanee Salmon

Kokanee salmon have provided the bulk of the winter catch. Efforts to reduce salmon numbers and increase average size have thus far been ineffective. Kokanee average lengths are shown in Table 1 for most years from 1966-67 to 1988-89. Average length in 87-88 was 9.4 inches, the greatest since 1976-77. In 88-89 average length decreased to 8.8 inches. Figures 1-6 are length frequency plots of Georgetown kokanee from January 1984 to January 1989. The data from January 1989 (Figure 6) are of interest since this is the first occasion in which bimodelity of the plot includes a one inch rather than a one half inch hiatus. Table 2 displays average second to third year growth of kokanee for 8 of the years since 1979. Growth has varied from 0.9 to 2.2 inches. It appears that some increase in growth may have occurred during recent years.

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	
Sample Number	No	46	96	133	187	384	403	
Average Length	data	7.8	8.2	9.1	8.6	9.4	8.8	

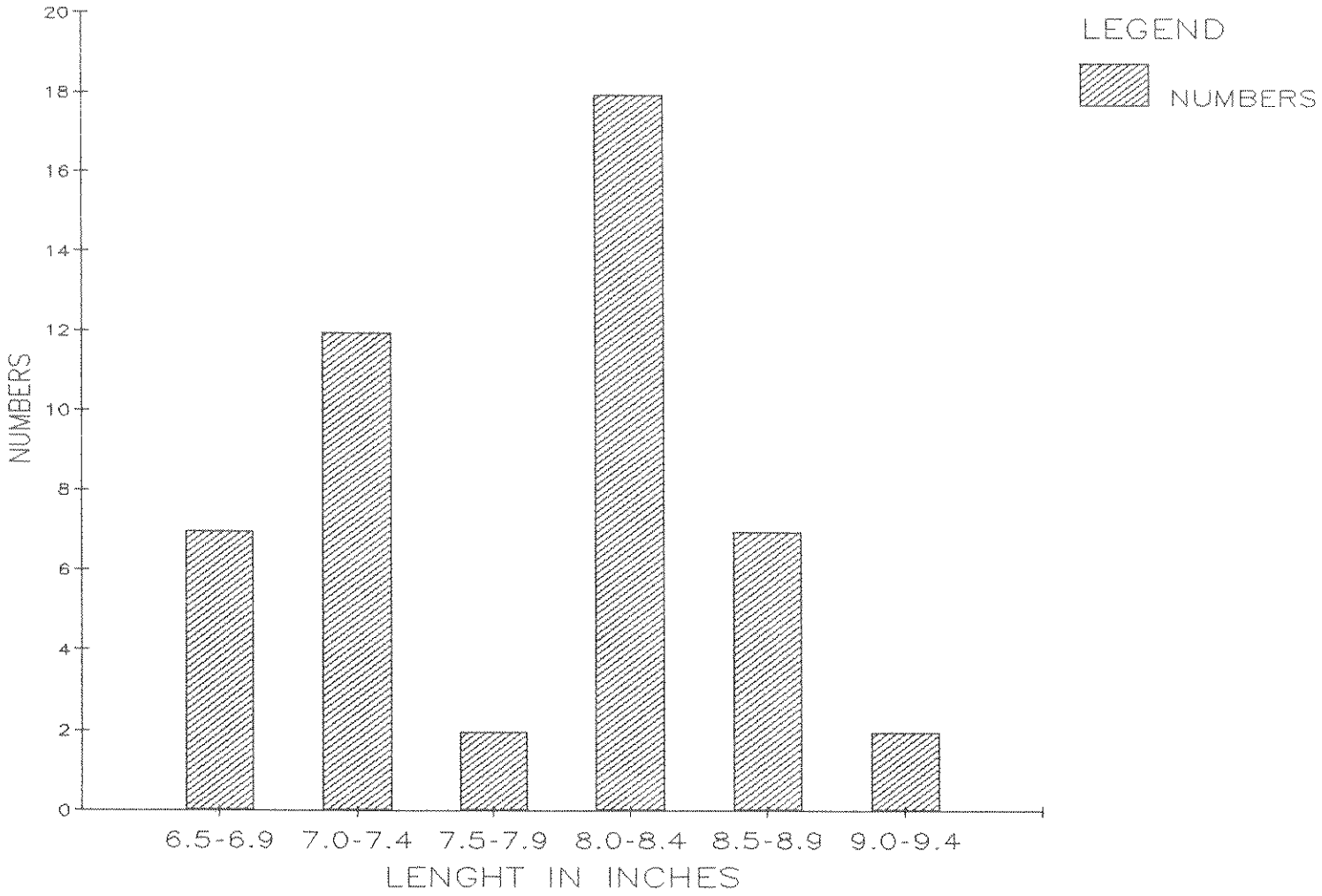
Table 2. Georgetown Lake Kokanee 2nd to 3rd Year Growth Increment in January Angler Creel Sample

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

Brook Trout

Brook trout are an important, highly esteemed component of the Georgetown Lake fishery. Brook trout are self-sustaining in the lake and utilize both tributary streams and springs in the lake for reproduction. Sportsmen's concern for the welfare of the brook trout fishery prompted evaluation of available data in 1989. Table 3 contains available information on brook trout size and relative abundance in the angler catch. Average length seems to be increasing slightly. Number of brook trout caught in comparison to rainbow seems to be relatively stable in recent years with about a 10 rainbow to 1 brook trout proportion. Large brook trout in excess of 3 pounds are taken occasionally and an esteemed, if uncommon, component of the catch. Although the data are limited, it appears that both number and average size of Georgetown brook trout are stable or increasing.

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



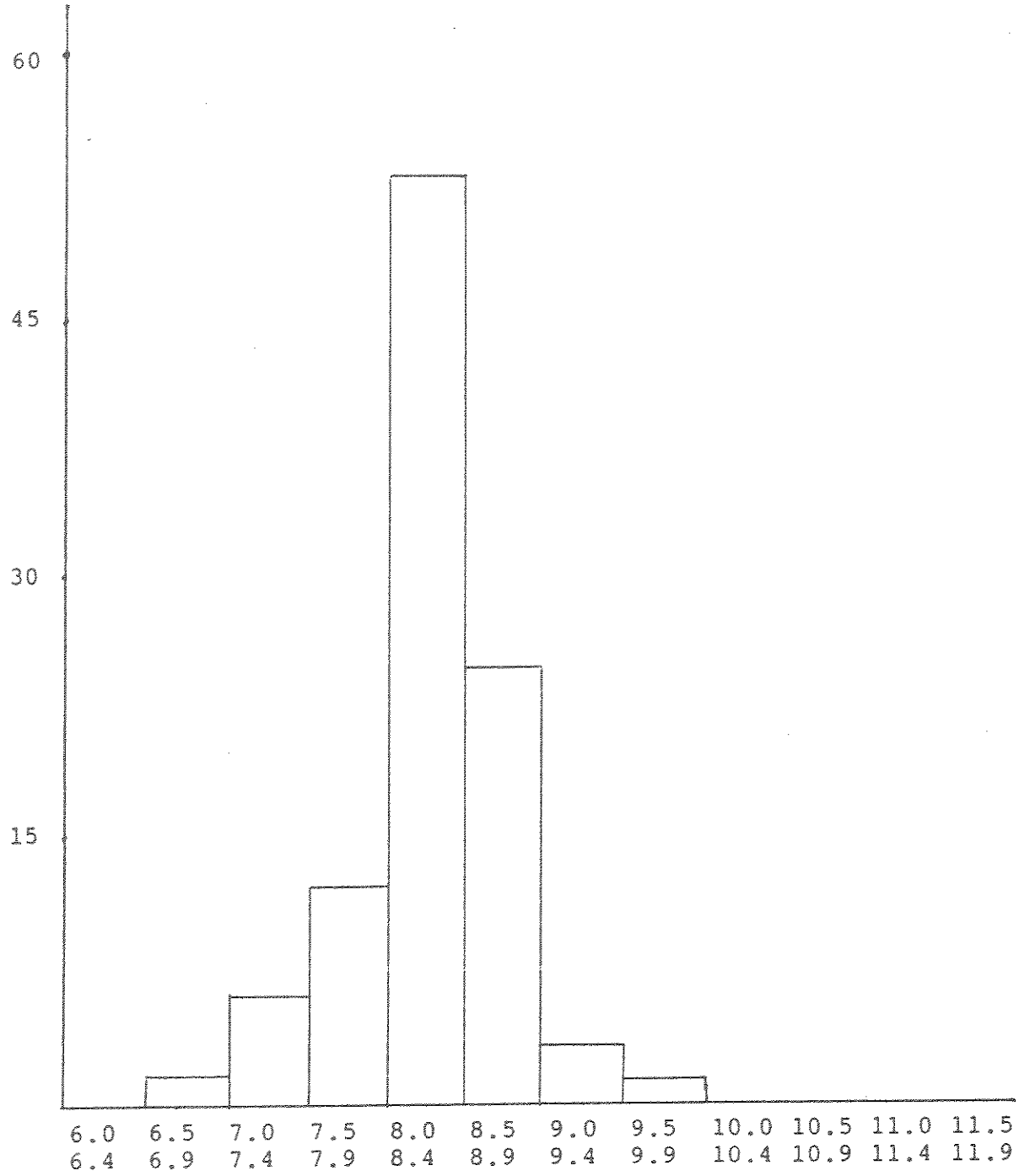


Figure 2. Georgetown Lake Kokanee Length-Frequency in January 1985 Angler Creel. N = 96

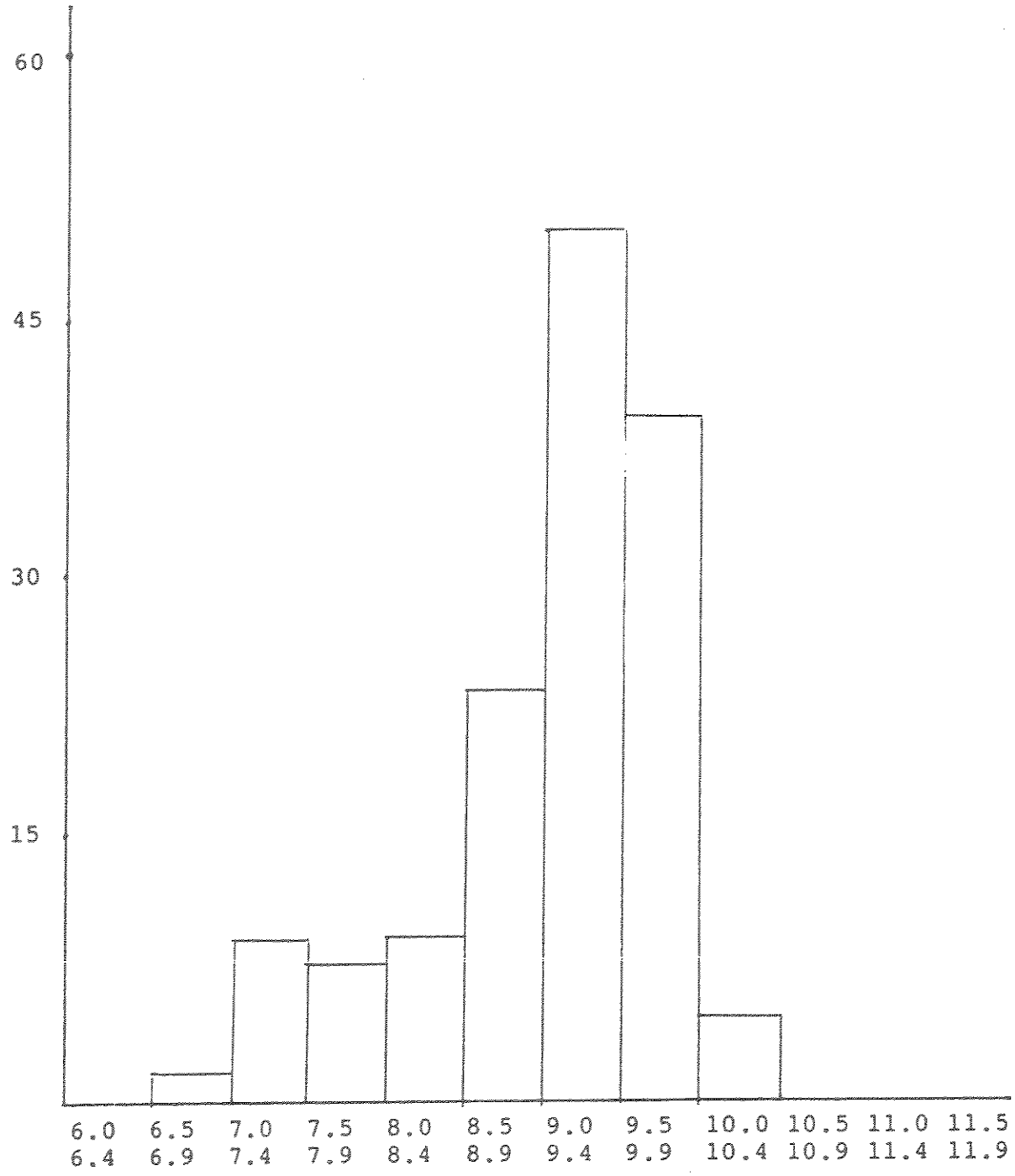


Figure 3. Georgetown Lake Kokanee Length-Frequency in January 1986 Angler Creel. N = 133

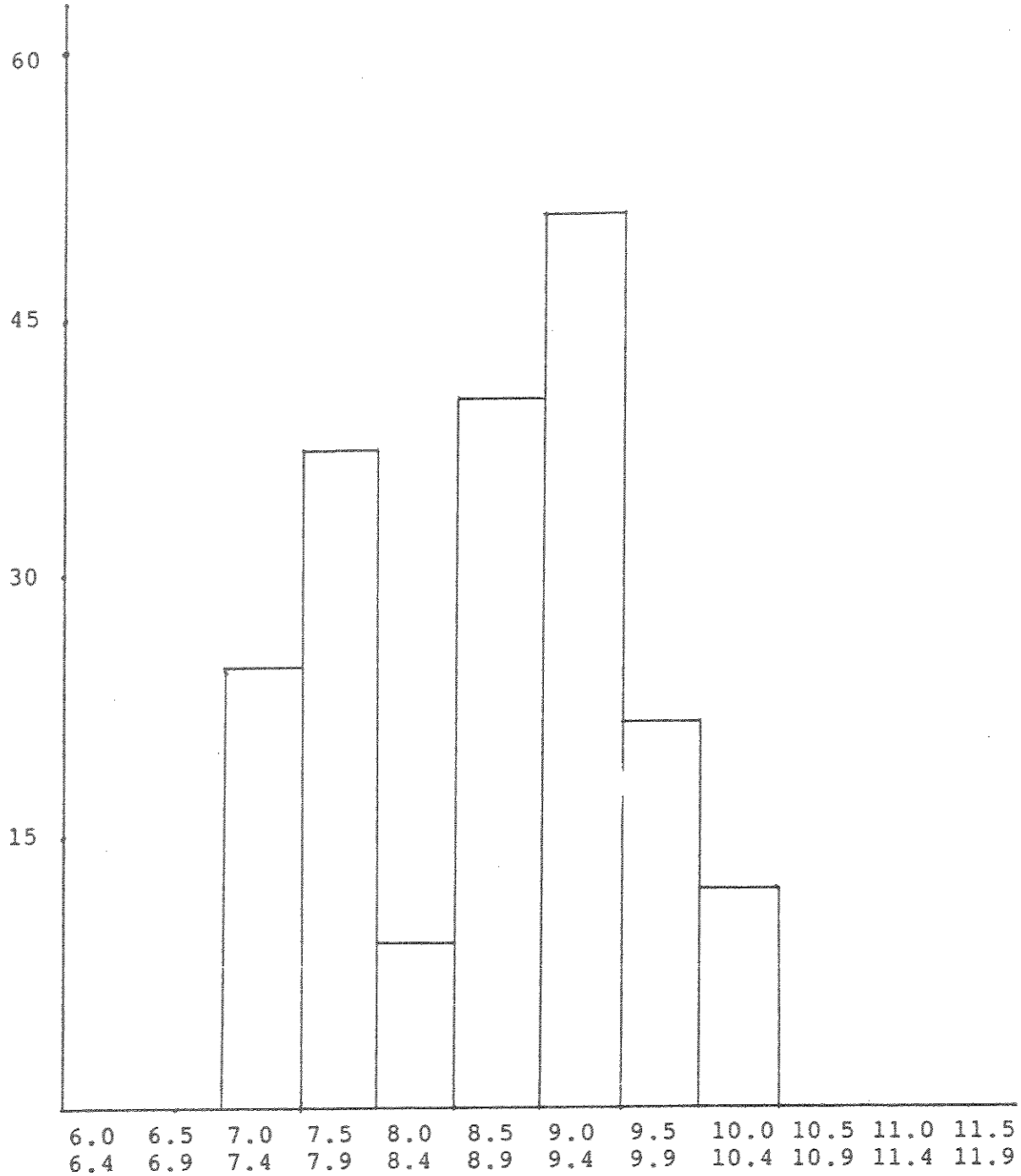


Figure 4. Georgetown Lake Kokanee Length-Frequency in January 1987 Angler Creel. N = 187.

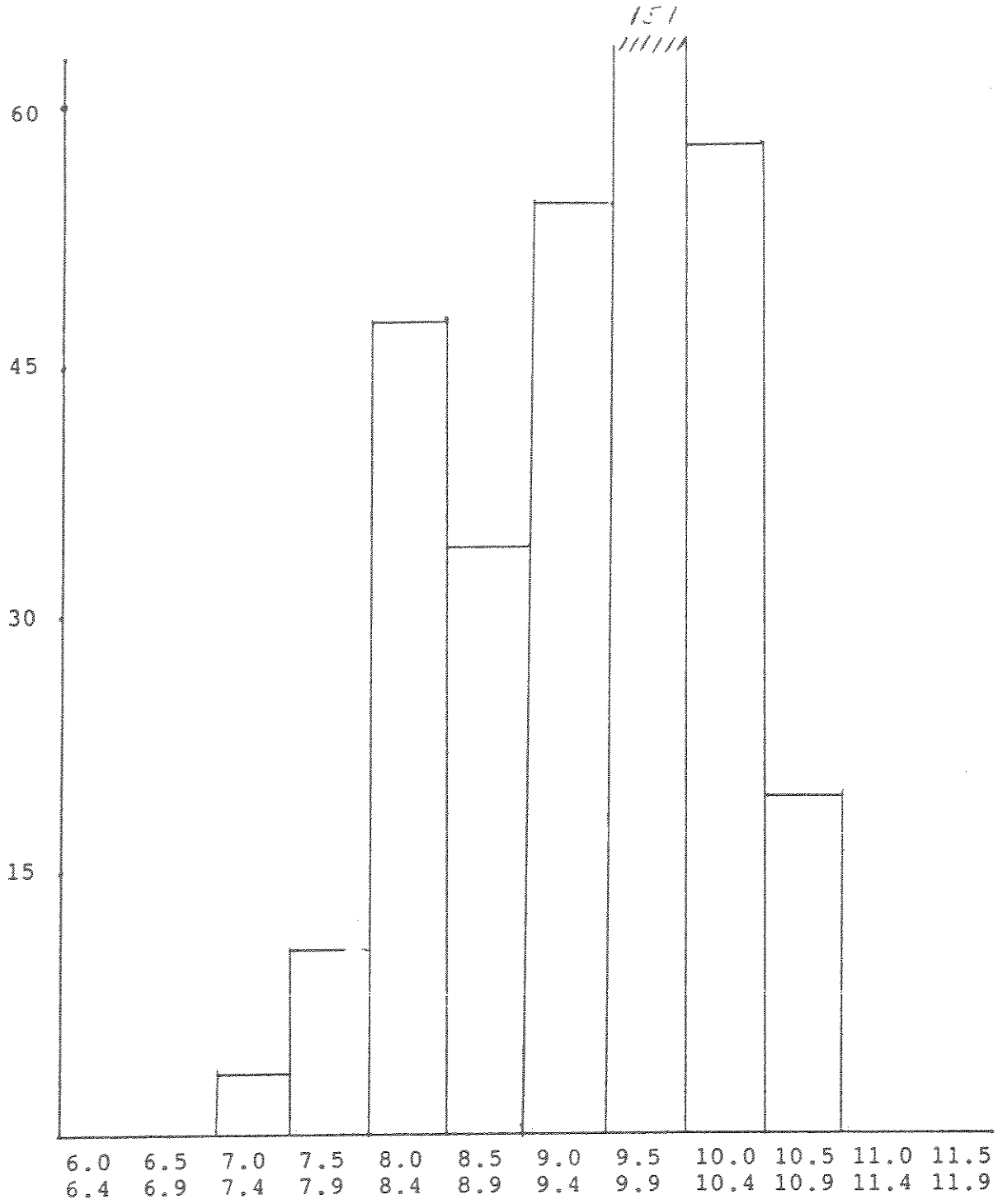


Figure 5. Georgetown Lake Kokanee Length-Frequency in January 1988 Angler Creel. N = 387.

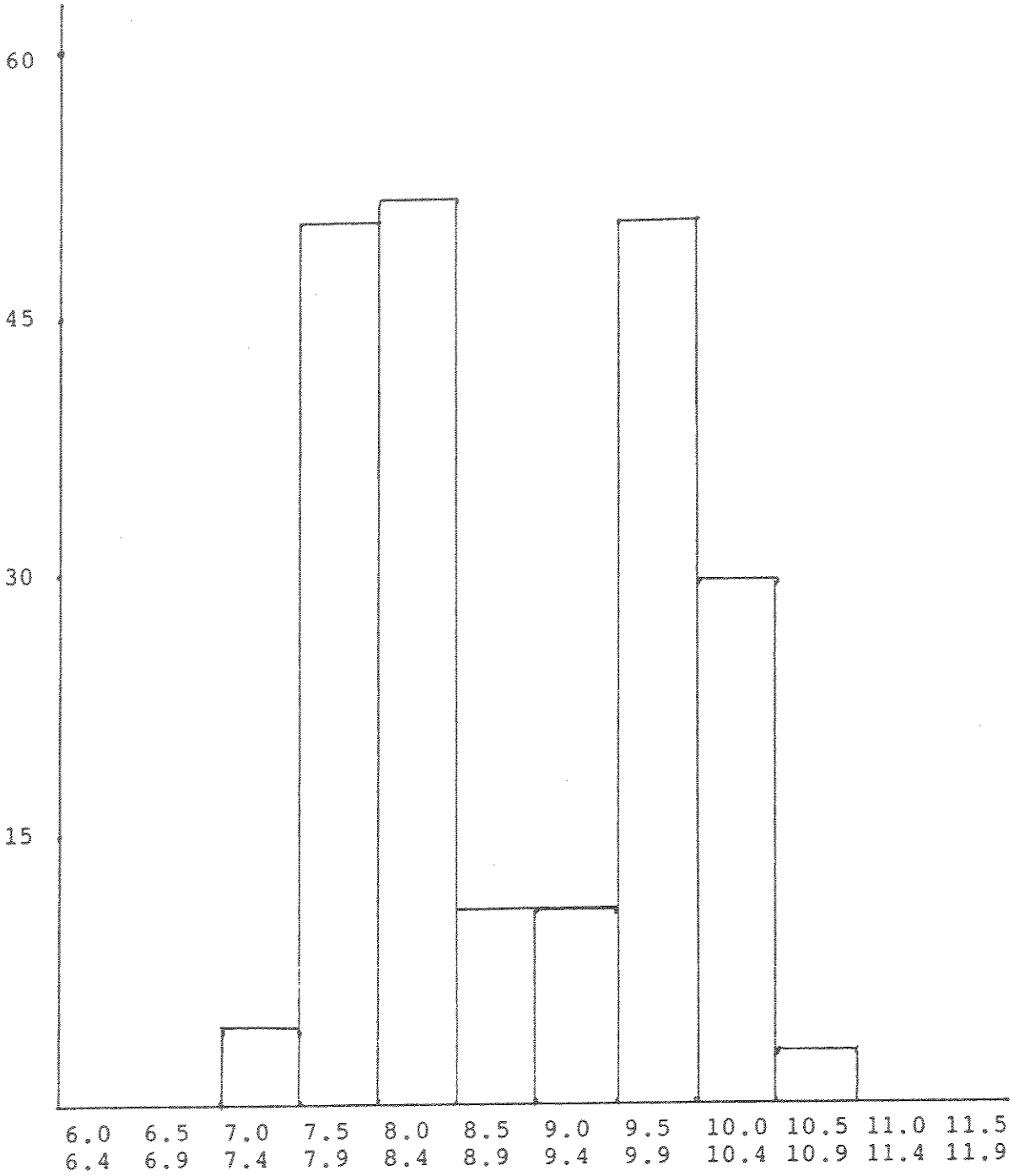


Figure 6. Georgetown Lake Kokanee Length-Frequency in January 1989 Angler Creel. N = 200.

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

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

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 reflects 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 four 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	
Sample Number	No	3	42	296	242	303	227	
Average Length	data	9.7	9.8	11.5	12.8	12.8	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 at 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 May. 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.

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

The percentages of catch figures in Table 5 are very similar to numbers of Arlee and Eagle Lake stocked. This suggests approximate equality in vulnerability to angling. Kamloops rainbow have not contributed significantly to the catch. The small size and late date of stocking are probably a major factor in the apparent poor Kamloops survival. Reduced vulnerability to angling of Kamloops as compared to Eagle Lake and Arlee may also reduce Kamloops contribution to the catch. Average size of creeled fish was remarkably similar in each years data. Whether

this will change with the development of older-larger classes of the nominally longer lived Eagle Lake and Arlee remains to be seen.

In the 1986 stocking of Eagle Lake, a double tetracycline mark was applied. This mark has remained distinct and has allowed the 1986 Eagle Lake plant to be followed in January creel samples in 1988 and 1989. These fish were too small to enter the fishery in January of 1987. Data from these fish is represented in Figure 15. In January 1988 sampled Eagle Lake of the 1986 stock averaged 12.5 inches and ranged from 10.8 to 14.0. In January of 1989 their average was 15.2 with a range from 12.9 to 17.6 inches in length. These figures represent a growth of about 7 inches during the first 16 months in the lake and an increase of about 3 inches in the following 12 months.

Length frequencies for Arlee in the years 1985-86 - 1988-89 are presented in Figures 7-10 and those for Eagle Lake in Figures 11-14. Perhaps most interesting is the gradual shift to large sizes as older age classes of both strains are developed.

Kamloops stocking appears to have been relatively unsuccessful when compared to Arlee and Eagle Lake. To evaluate this apparent failure, Kamloops rainbows were held in the hatchery for slightly over one year and uniquely marked by both adipose clipping and tetracycline treatment. Twenty-nine thousand of these fish were stocked in June 1989 at an average size of 8.3 inches. Their performance will be followed in succeeding years to determine whether they perform better than fall stocked fingerlings and whether the increased costs of production can be justified.

During the early spring of 1989 spawning rainbows were reported in tributaries to Georgetown. Investigation revealed large numbers of spawning rainbows to be present in the North Fork of Flint Creek and Stuart Mill Creek. Stuart Mill originates in a spring and only about 200 yards of stream are suitable for spawning. No count of spawners could be made but hundreds and possibly thousands of fish were involved. Spawners were also observed in large concentration near spring inflows within the lake.

On 24 May 1989 electrofishing samples were taken from both the North Fork of Flint Creek and Stuart Mill Creek. At that time spawning had been underway for several weeks and many fish showed fin erosion, a few fungus infection and most appeared to have lost weight. ninety-two fish were sampled, 35 fish from the North Fork of Flint Creek and 57 from Stuart Mill Creek. Fish from both streams averaged slightly over 17 inches and nearly 2 pounds. The largest fish was a male from the North Fork 25 inches long and 4.6 pounds. Thirty-eight percent of fish sampled were 18 inches or more in length and 13 percent exceeded 20 inches. Among the 92 spawners examined were 2 adipose clipped Kamloops, 17.4 and 18.0 inches long. Ten fish were sacrificed for vertebral examination for tetracycline marking. Three of the vertebral examinations were negative; no tetracycline marks were detected. These 3 fish were presumably Arlee, unmarked Kamloops, or representatives of the remnant self-sustaining rainbow population. The remaining 7 individuals all were tetracycline marked and therefore of the Eagle Lake strain. Two of the tetracycline marked fish bore double marks on the vertebrae indicating that they were from the 1986 stocking of Eagle Lake. The double marked fish were 14.3 and 15.0 inches in length, falling into the mid-range of the January 1989 sample (Figure 15) of the 1986 stocked Eagle Lake. Electrofishing will be used during the summer of 1989 to determine whether

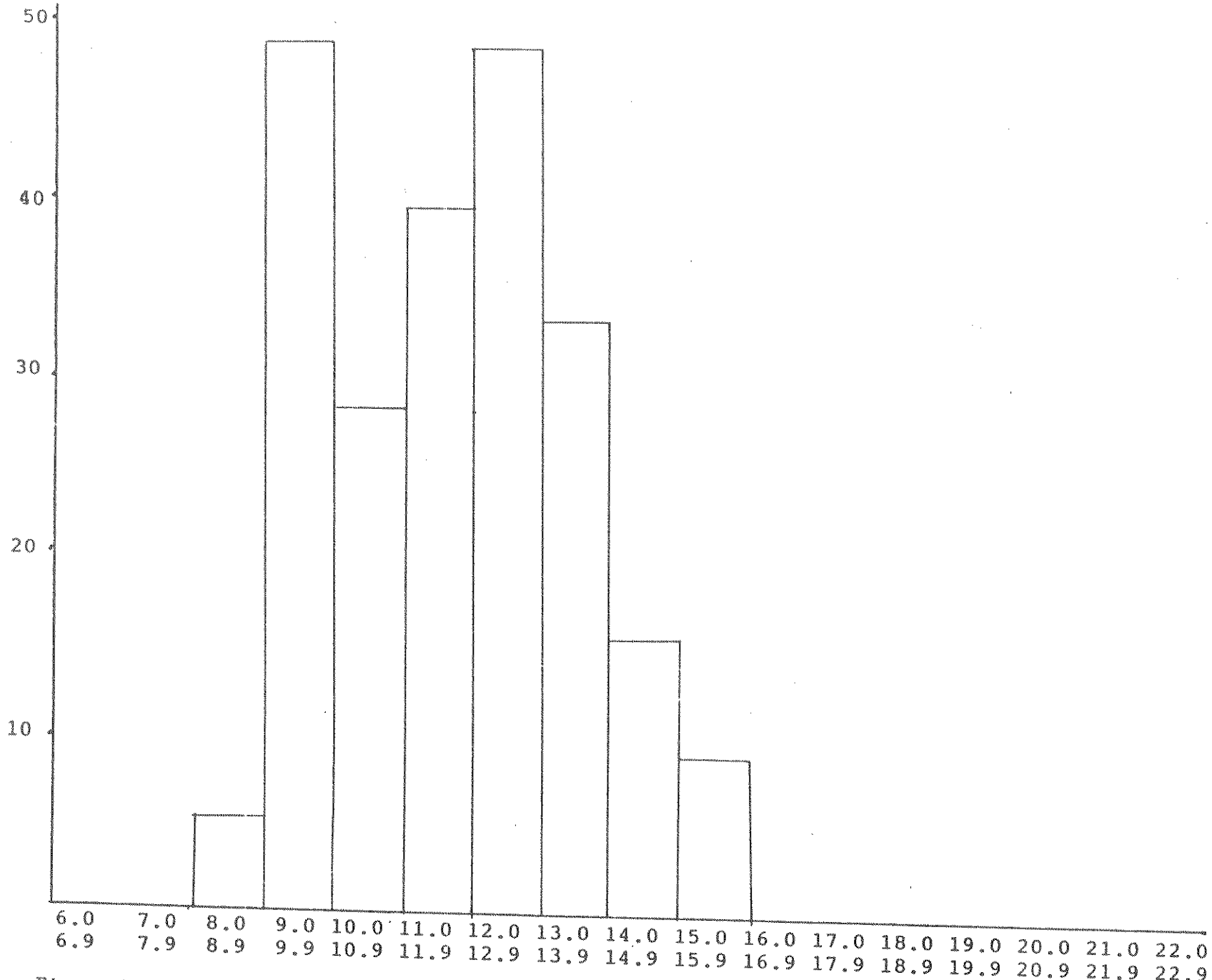


Figure 7. Length Frequency of Georgetown Arlee Rainbow. January 1986. N = 210

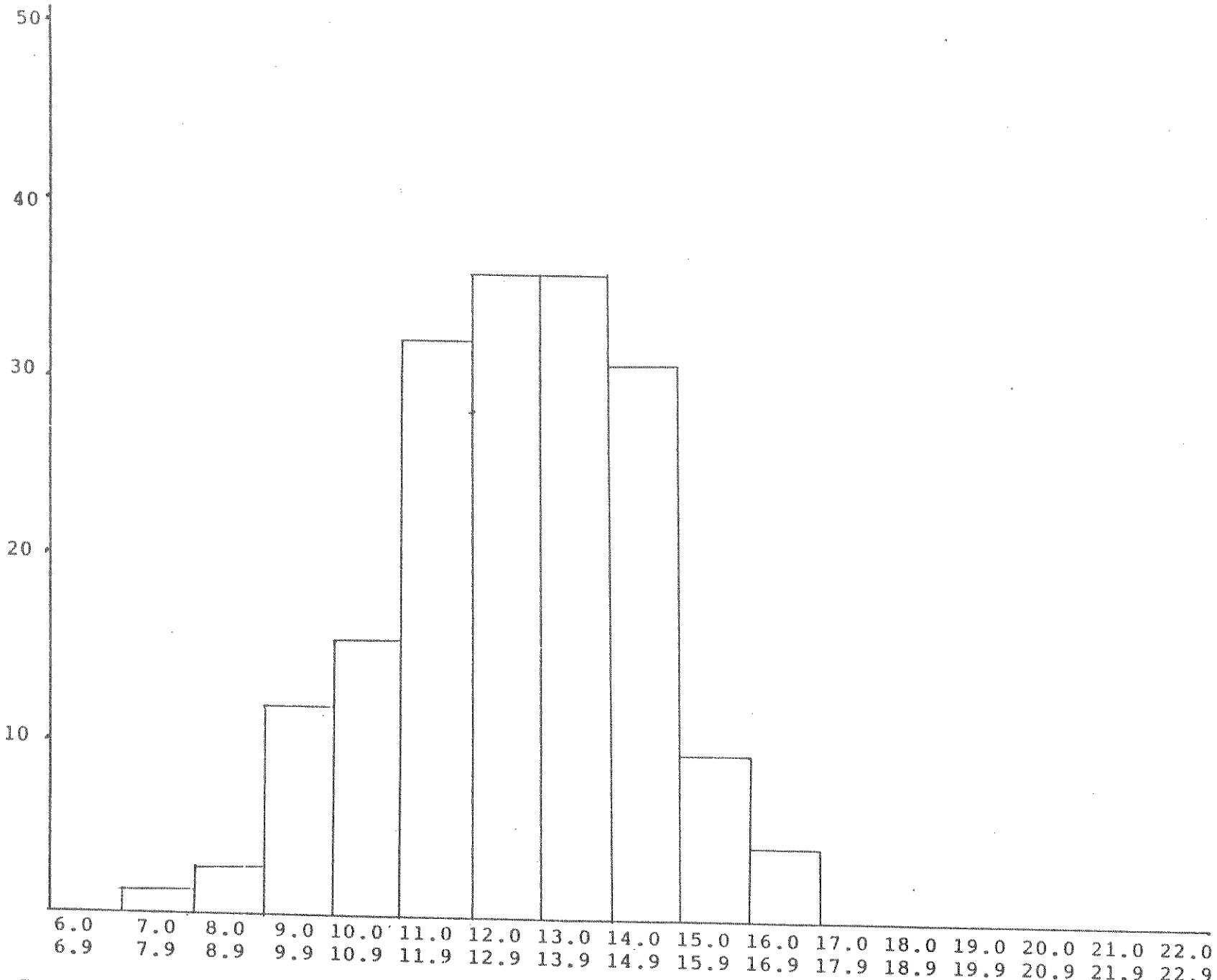


Figure 8. Length Frequency of Georgetown Arlee Rainbow. Winter 86-87. N = 169

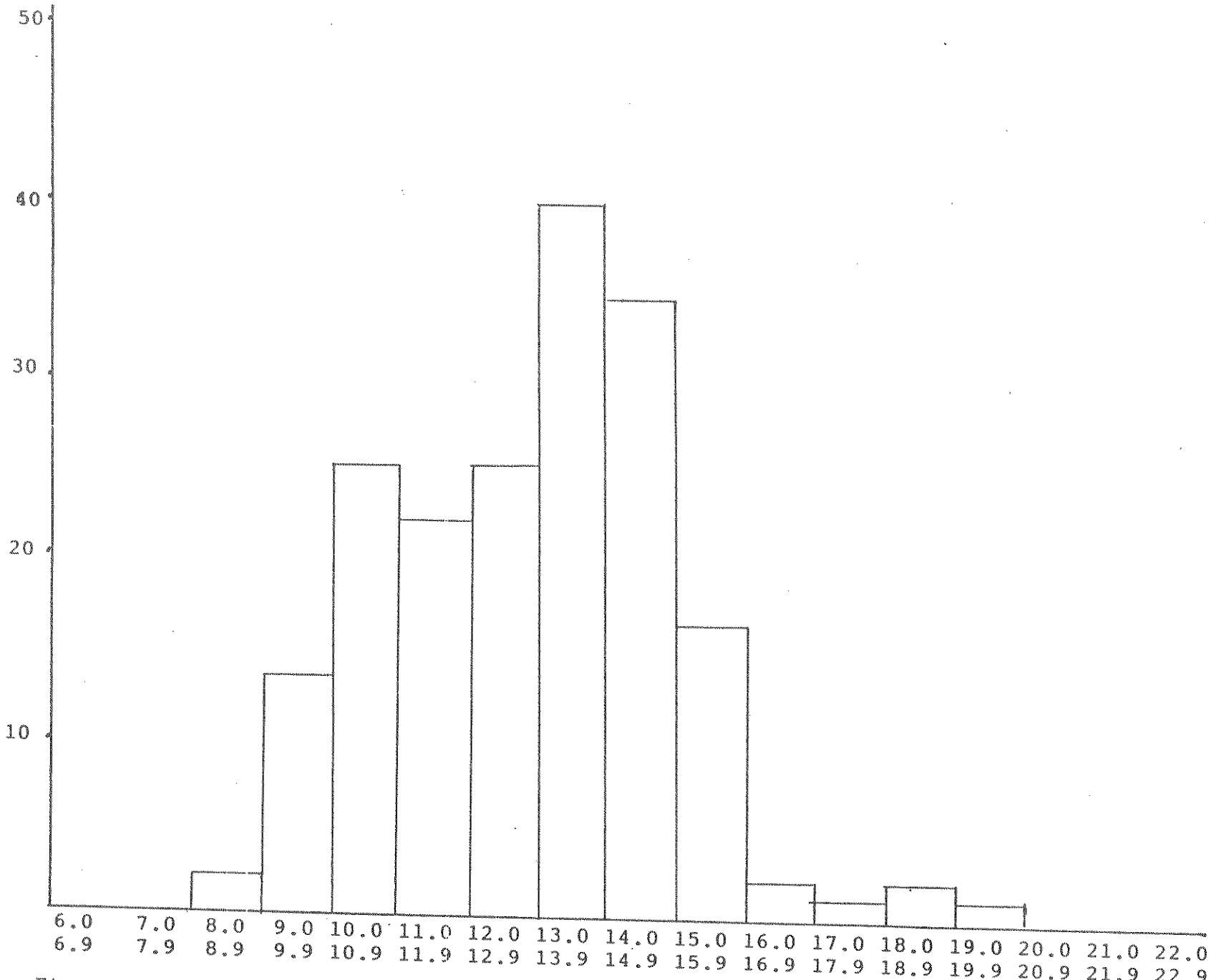


Figure 9. Length Frequency of Georgetown Arlee Rainbow. January 1988. N= 197

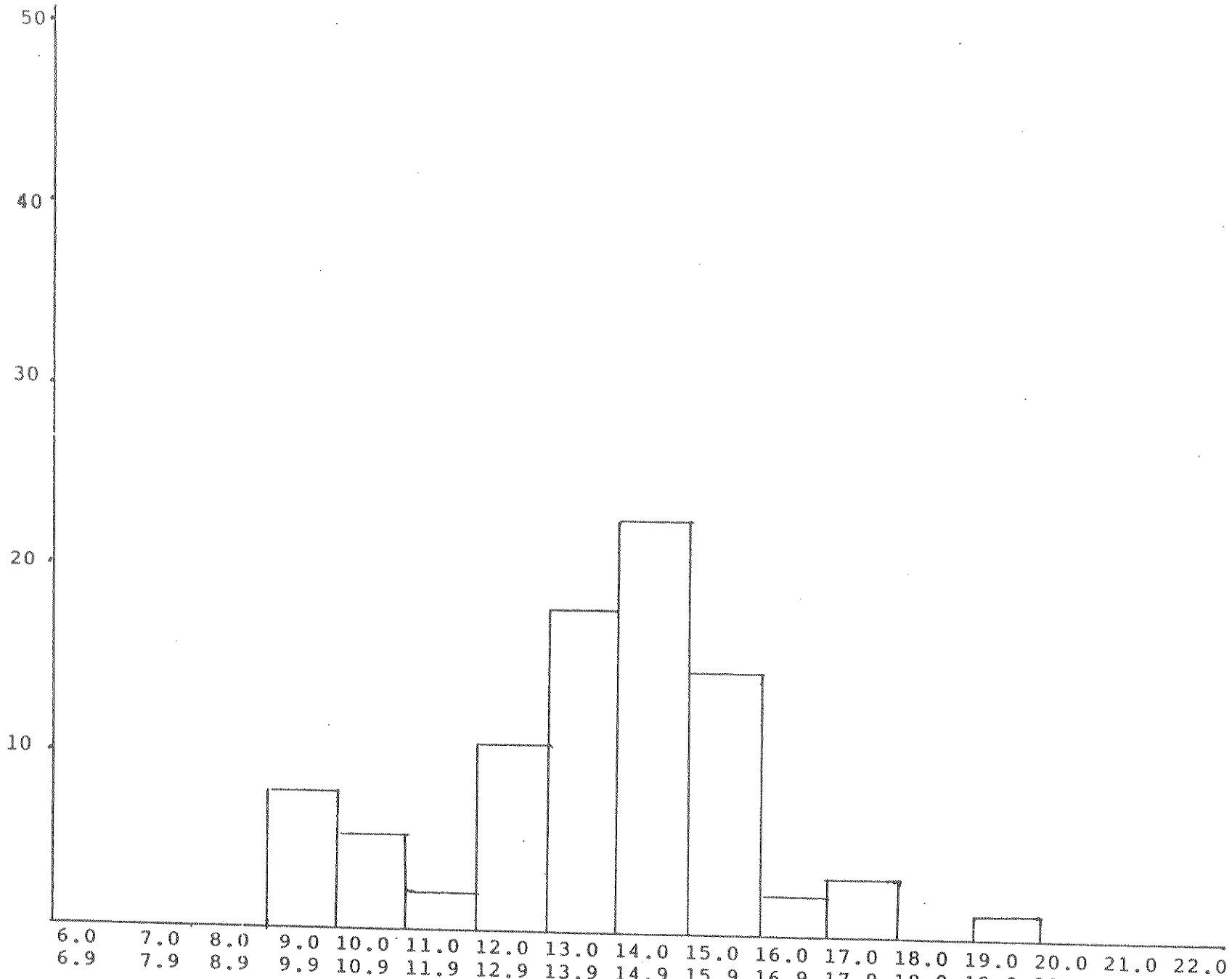


Figure 10. Length Frequency of Georgetown Arlee Rainbow. January 1989. N = 87

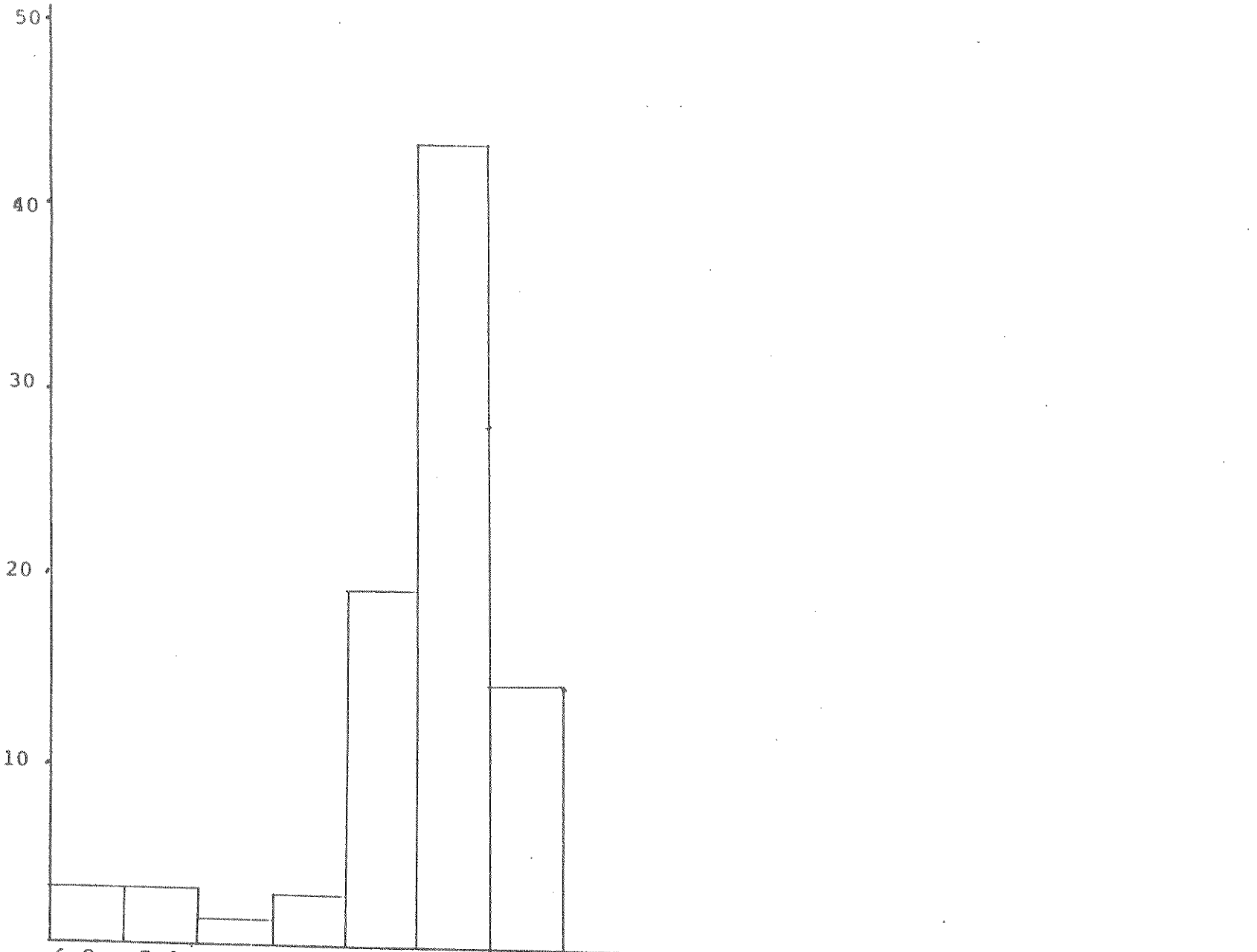


Figure 11. Length Frequency of Georgetown Eagle Lake Rainbow. January 1986. N = 84.

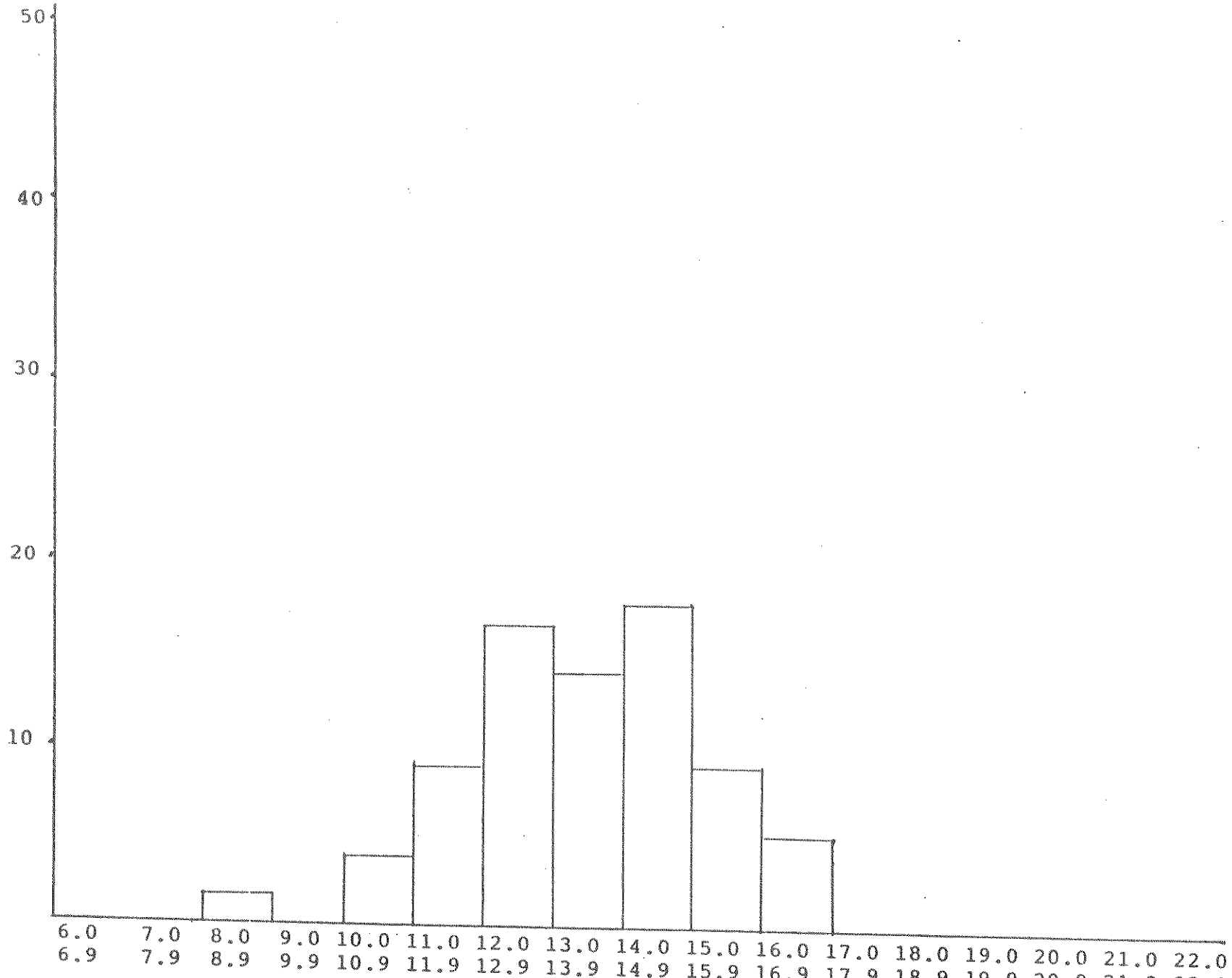


Figure 12. Length Frequency of Georgetown Eagle Lake Rainbow. January 1987. N = 70

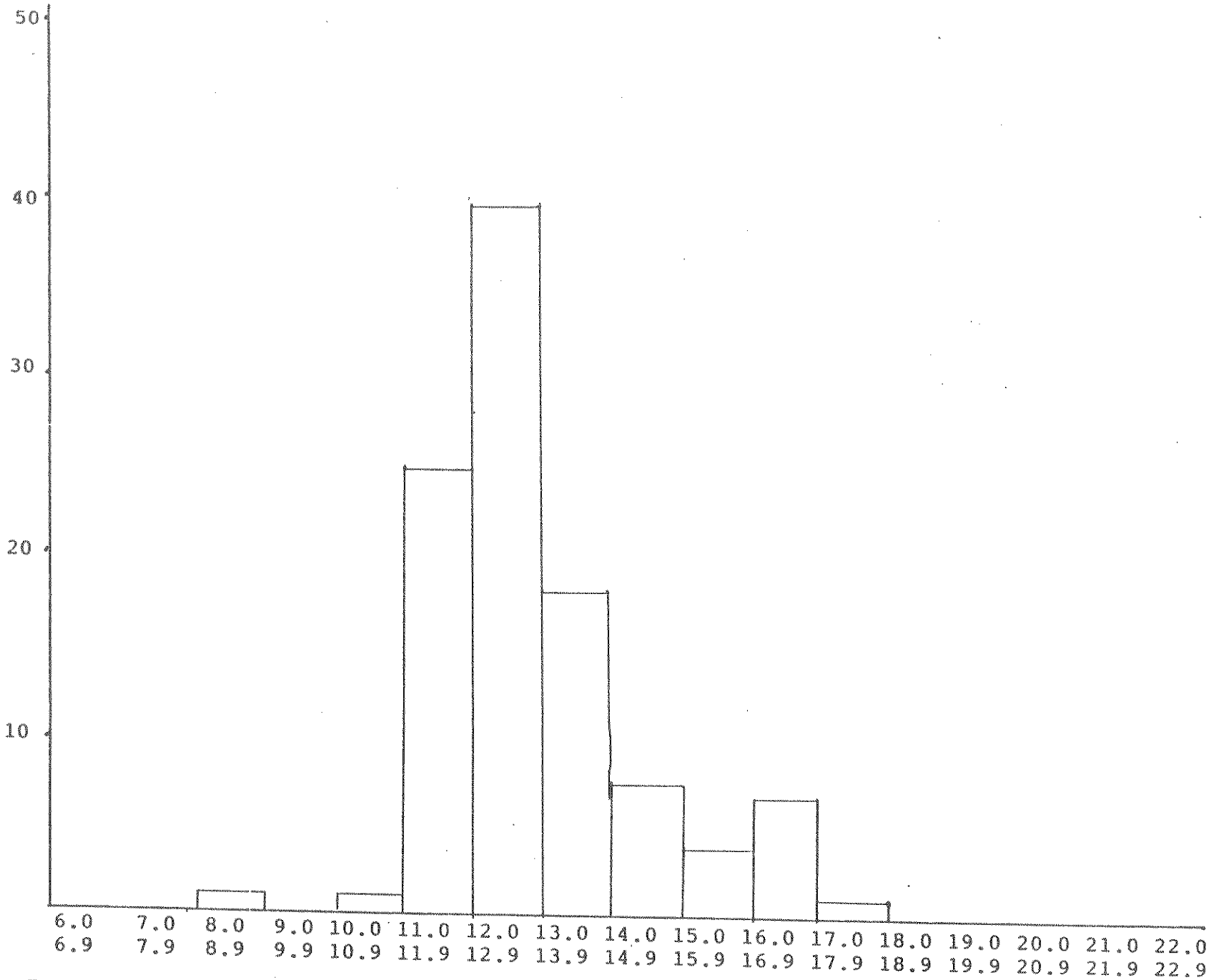


Figure 13. Length Frequency of Georgetown Eagle Lake Rainbow. January 1988. N - 106

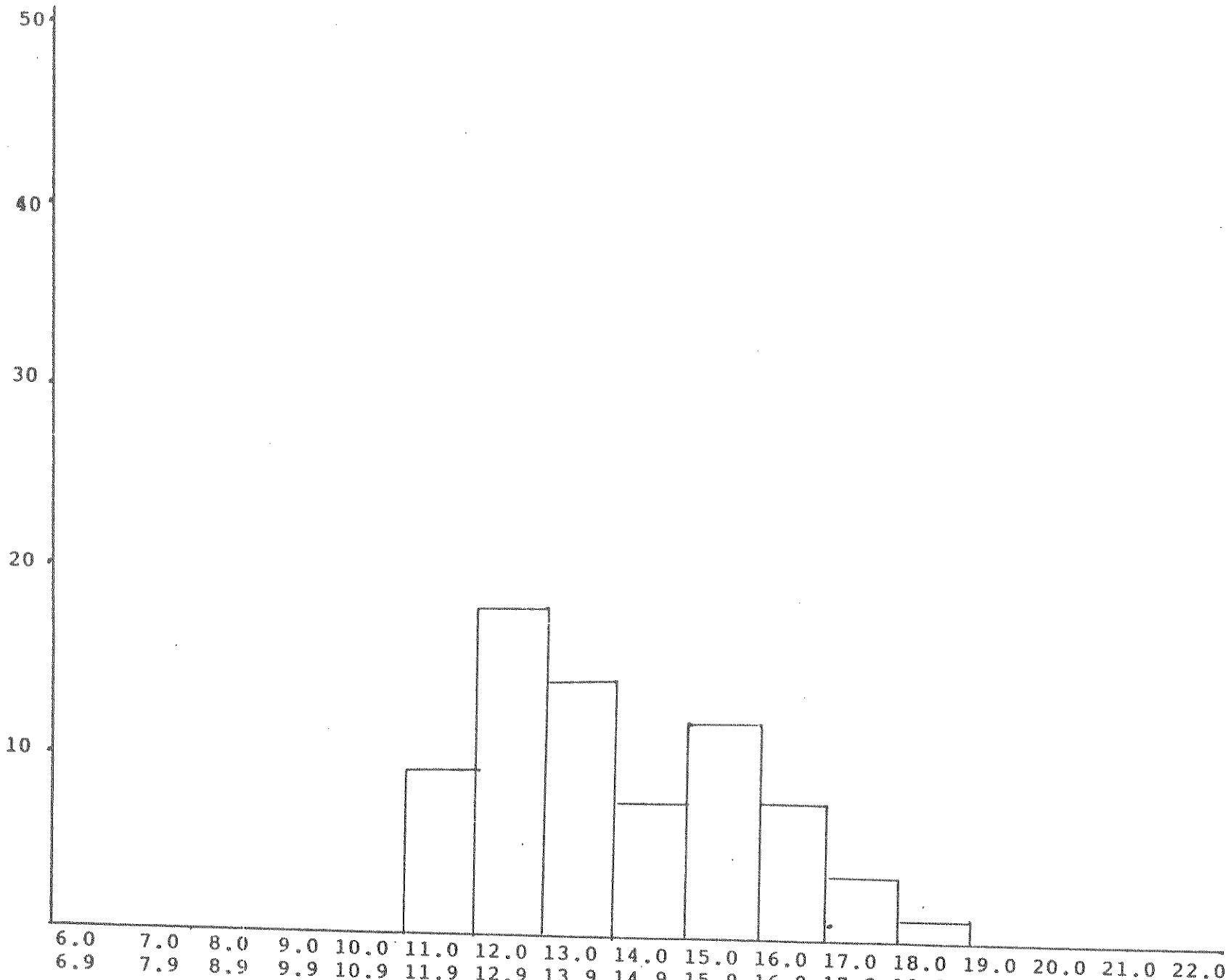


Figure 14. Length Frequency of Georgetown Eagle Lake Rainbow. January 1989. N = 71

rainbow fry are present in the spawning tributaries. The expected 1990 spawning run will be monitored.

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Oxygen concentrations (Table 6) were measured under the ice in January, February, March and April, 1989. The depth of 5 ppm oxygen concentration declined from 2+ meters beneath the ice in January to less than 1 meter in April. These data emphasize the severe deoxygenation process occuring during the winter and the importance of maintaining full pool levels throughout the period of ice cover.

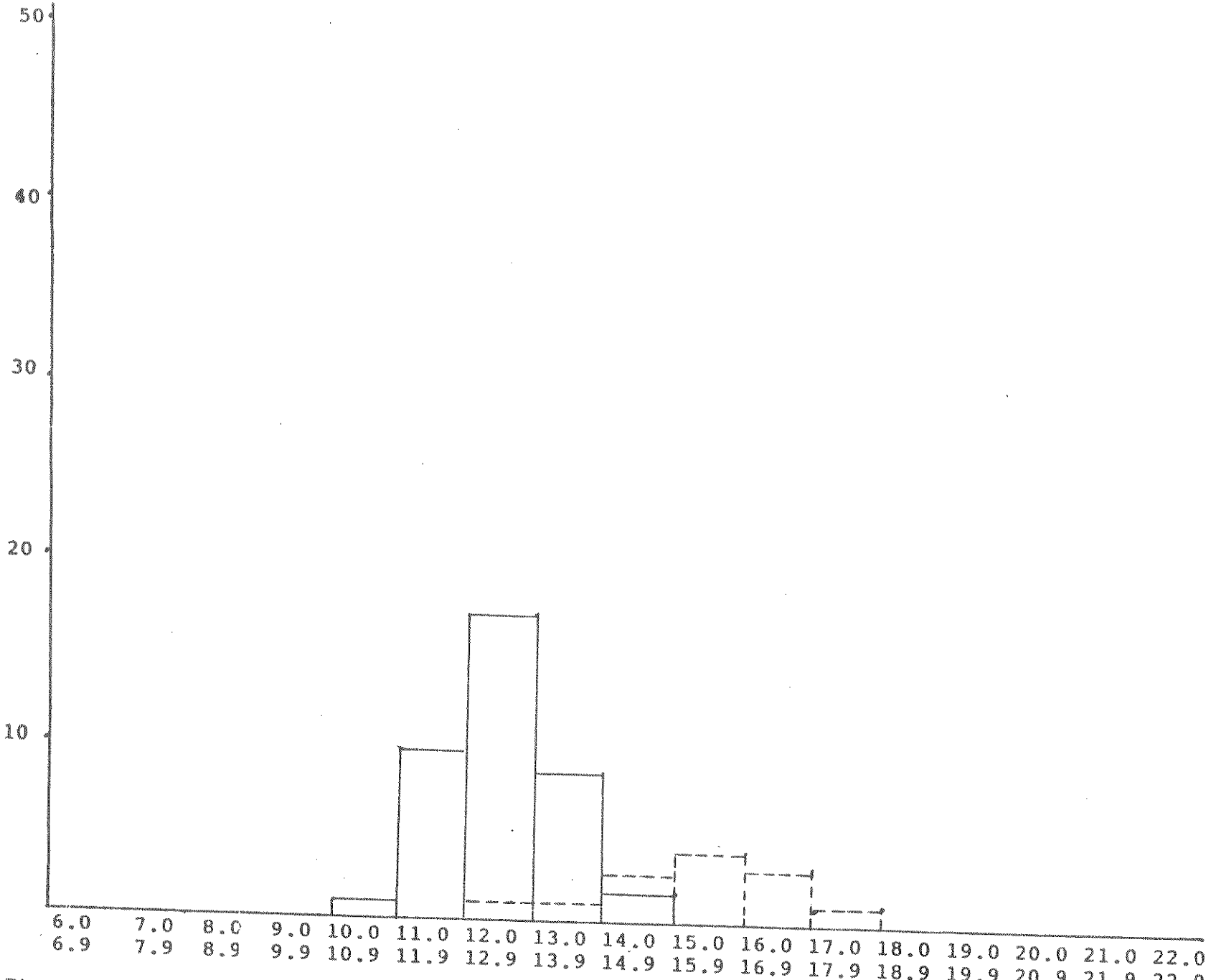

Figure 15. Length Frequency of 1986 Stocked Eagle Lake Rainbow in Georgetown.
Solid = January 1988 N = 39
Dash = January 1989 N = 12

Table 6. Georgetown Lake Under Ice Dissolved Oxygen Concentration (ppm), 1989.

	Surface	1m	2m	3m	4m	5m
January	13	10.6	5.8	4	1.4	.8
February	9.3	7.5	4.8	2.5	1.0	.3
March	7.1	5.4	3.8	1.8	1.2	.8
April	6.7	4.8	3.6	2.7	.9	1.0

Waters Referred to:

Georgetown Lake
North Fork of Flint Creek
Stuart Mill Creek

Prepared by: Wayne F. Hadley

Date: August 1989