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REGION 4

MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS
FISHERIES DIVISION

JOB PROGRESS REPORT

STATE: MONTANA PROJECT TITLE: STATEWIDE FISHERIES INVESTIGATIONS

PROJECT NO.: F-46-R-6 STUDY TITLE: SURVEY AND INVENTORY OF COLDWATER LAKES

JOB NUMBER: II-b

JOB TITLE: WEST CENTRAL MONTANA COLDWATER LAKE INVESTIGATIONS

PROJECT PERIOD: JULY 1, 1992 THROUGH JUNE 30, 1993

ABSTRACT

Kokanee salmon caught by antlers in January, 1993, were 10.1 inches in average total length. Two and 3 year old kokanee were 8.7 and 10.2 inches average total length. These are the largest average sizes achieved in 15 years.

Brook trout average size in the January angler creel was the largest recorded in the eight years of record (13.4 inches). Brook trout constituted 15% of the trout catch, slightly higher than the average. Regulation changes proposed for 1994-95 should materially improve the brook trout fishery.

Rainbow trout average length in the January, 1993, angler creel declined to 12.2 inches. This is the smallest average length since 1986 and 1.7 inches smaller than the greatest average size observed (1991). The causes for the size decline are not clear but probably include low survival of Eagle Lake rainbow stocked in 1988 and 1989 as well as increased harvest pressure.

Despite extremely low winter water levels, under ice oxygen was adequate and no winterkill was observed.

OBJECTIVES AND DEGREE OF ATTAINMENT

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

   January caught rainbow trout averaged 12.2 inches in length. This is a .4 inch reduction in average length from January 11992 and 1.7 inches less than the January 1991 average. Average size reduction appears to be the result of stocking failures in 1988 and 1989 Eagle Lake rainbows. Increased angling pressure may also be a factor.

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 1992-93.

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 1992-93.

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

   Kokanee average size increased to 10.1 inches in average length. Two year old kokanee averaged 8.7 inches, one half inch greater than the largest size observed in the last 15 years. Three year old kokanee averaged 10.2 inches, a length increase of one half inch over the previous 15 year high. Abnormally low lake levels in winter 92-93 may reduce kokanee numbers and increase size in future years.

PROCEDURES

Georgetown Lake management monitoring in 1992-93 consisted of an intensive creel sampling during the January ice fishery. This data collection has been made annually since 1984-85 with small modifications. Fish are weighed, total length measured, and a few vertebrae excised from rainbow trout for examination in the laboratory for the presence of tetracycline markings. Tetracycline marks resulting from the addition of tetracycline to the hatchery diet are used to distinguish among the rainbow strains planted in Georgetown. Beginning with the 1993 stockings, Eagle Lake rainbow receive a single mark, Arlee rainbow receive 2 marks and 3 marks are placed on Kamloops rainbow.

Spawning runs of rainbows have been monitored by examination, fin clip sampling for electrophoretic analysis, and length of weight measurements. This effort utilized electrofishing for fish collection and in 1993 was reduced to a minimum due to expanded awareness of the potential for electrofishing injury to eggs and adults.

RESULTS AND DISCUSSION

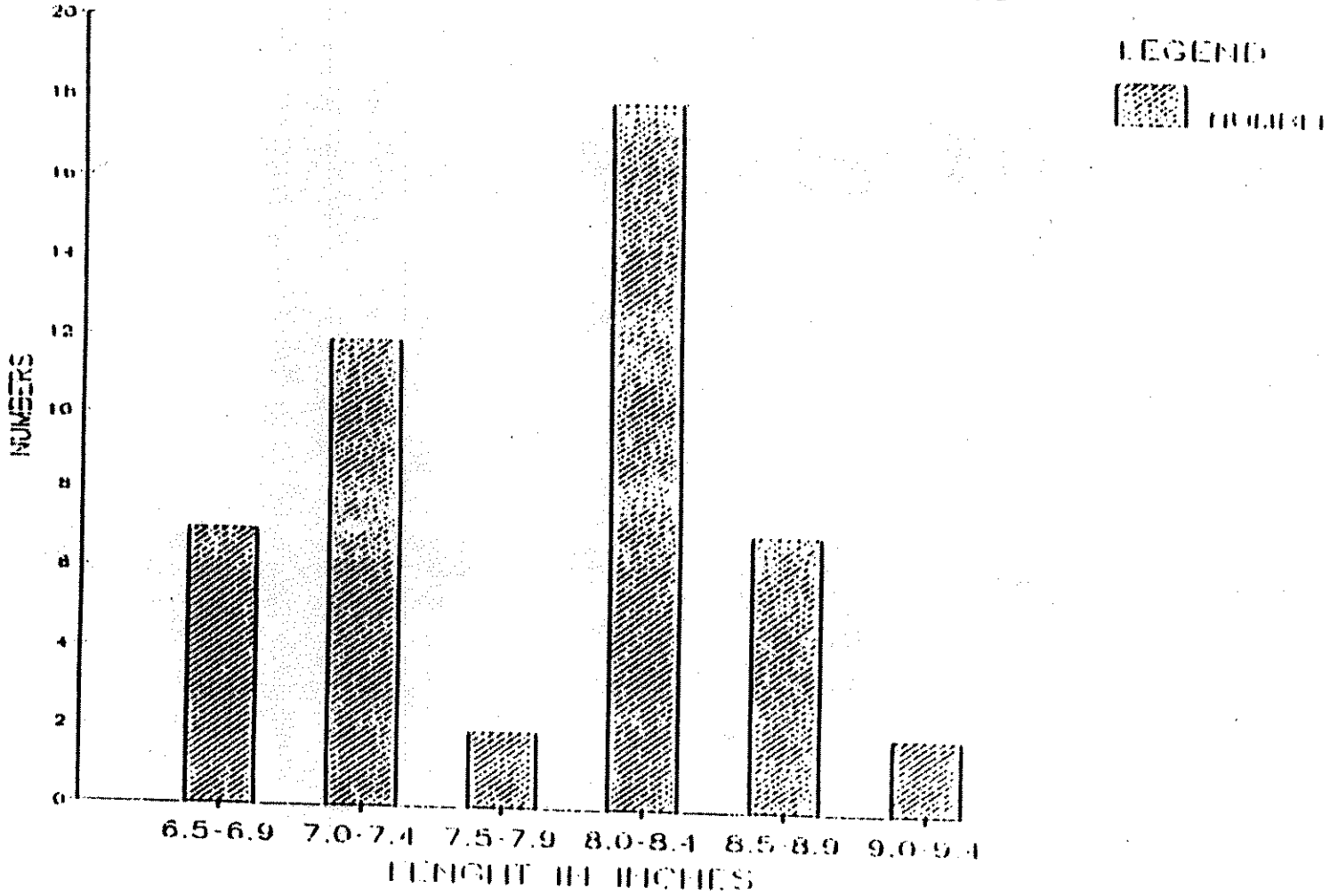
Kokanee Salmon

Catches of kokanee salmon in the January 1993 ice fishery were composed of larger average size fish than any year since 1977 (Table 1). Average kokanee in January 1993 was 10.1 inches. Average length of 2+ and 3+ kokanee were 0.5 inches greater than any year since 1979 (Table 2). Growth from 2+ to 3+ ages was 2.2 inches, also the greatest increase recorded. While no accurate method of assessing kokanee numbers in the lake is available, it appears that the increased growth observed in 1993 sampled fish reflects a reduction in kokanee density and, therefore, an increase in forage availability per individual. It is possible that reduced competition for food resources due to lower rainbow trout numbers may also have been a factor in greater kokanee size in 1993. Histograms of January angler caught kokanee lengths are shown in Figures 1-10, representing the years from 1984 to 1993.

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	92-93					
Sample Number	208	207	208					
Average Length	8.7	8.9	10.1					

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



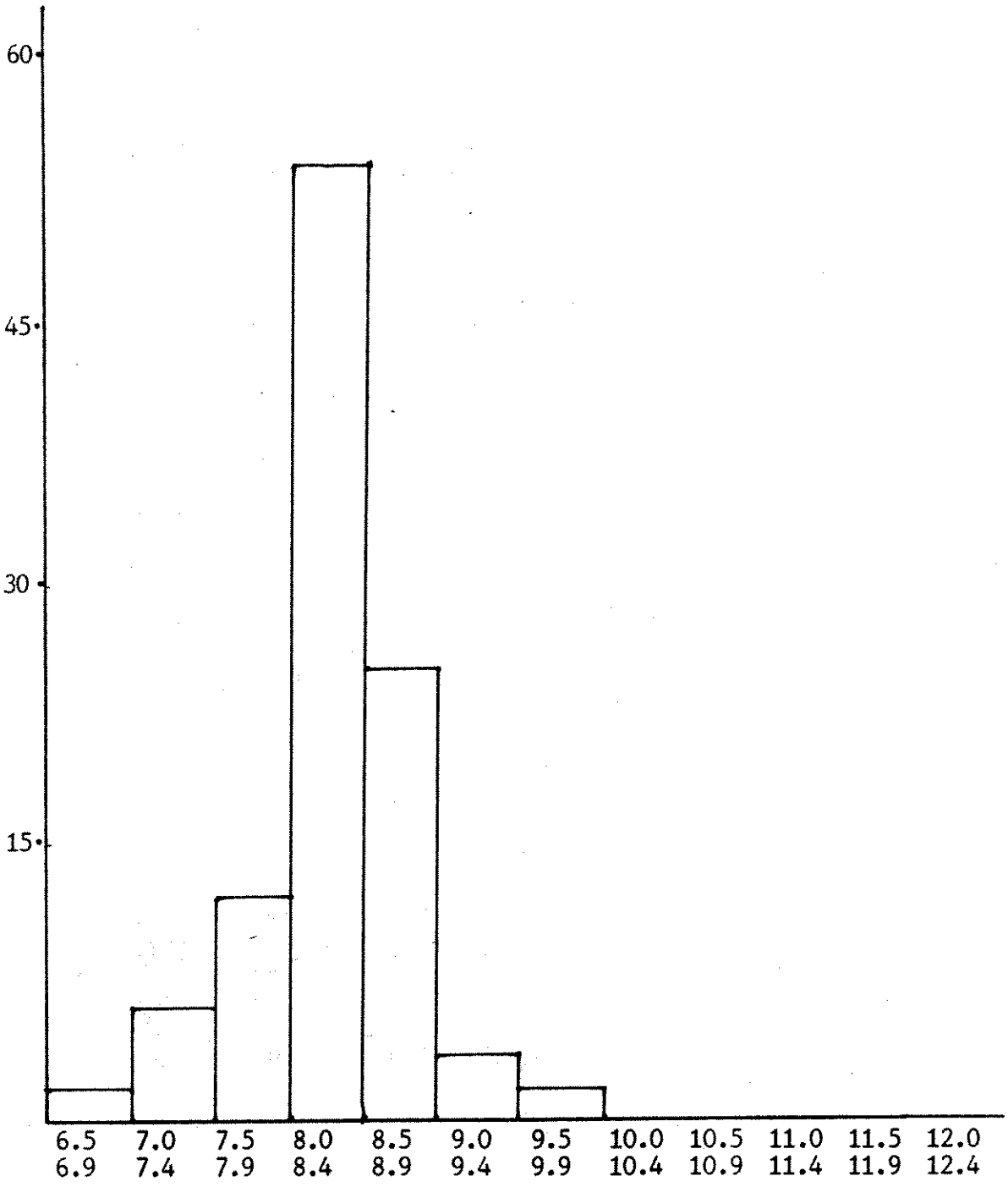


Figure 2. Georgetown Lake kokanee length-frequency in January 1985 creel N=96

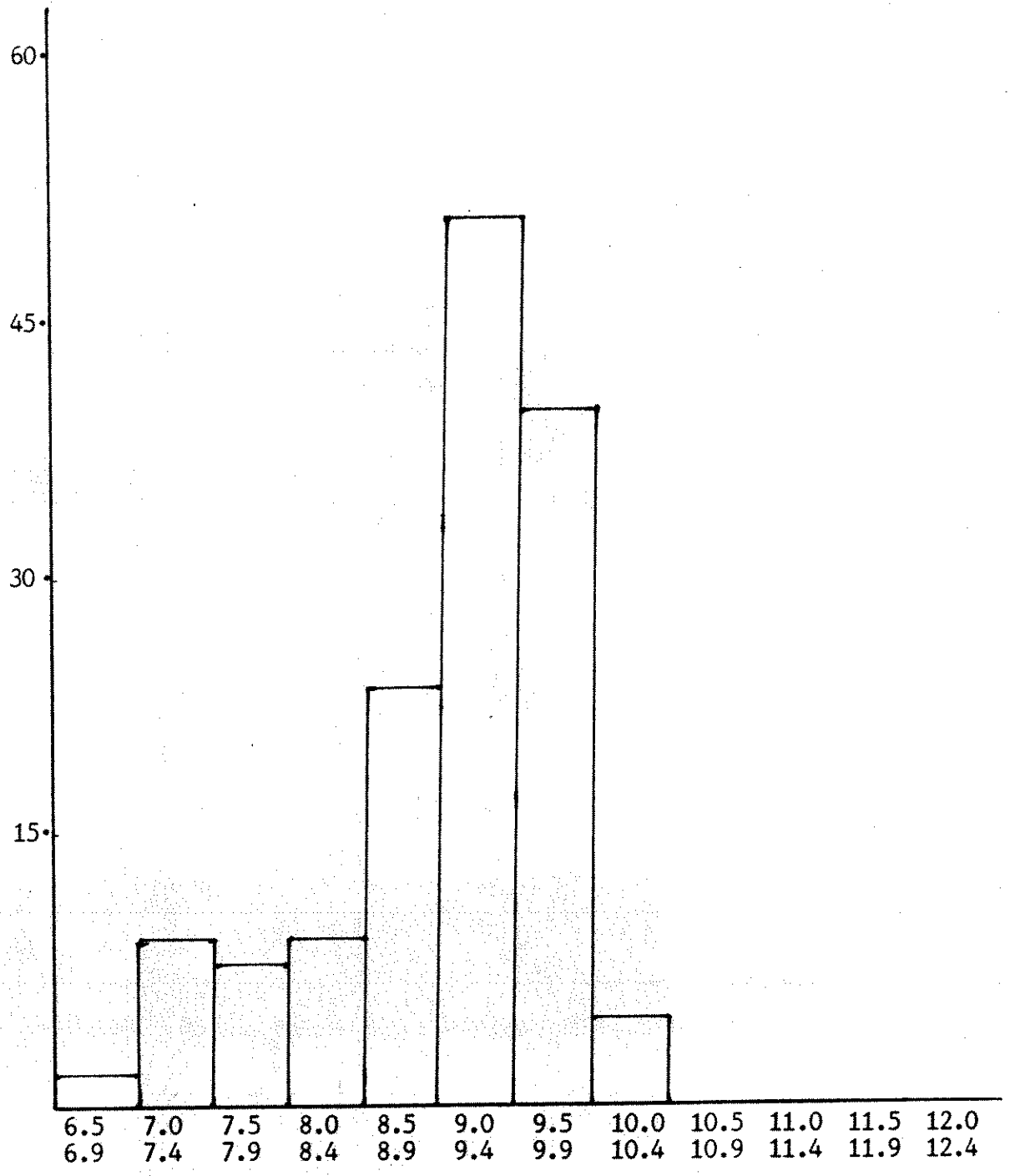


Figure 3. Georgetown Lake kokanee length-frequency in January 1986 creel
N=133

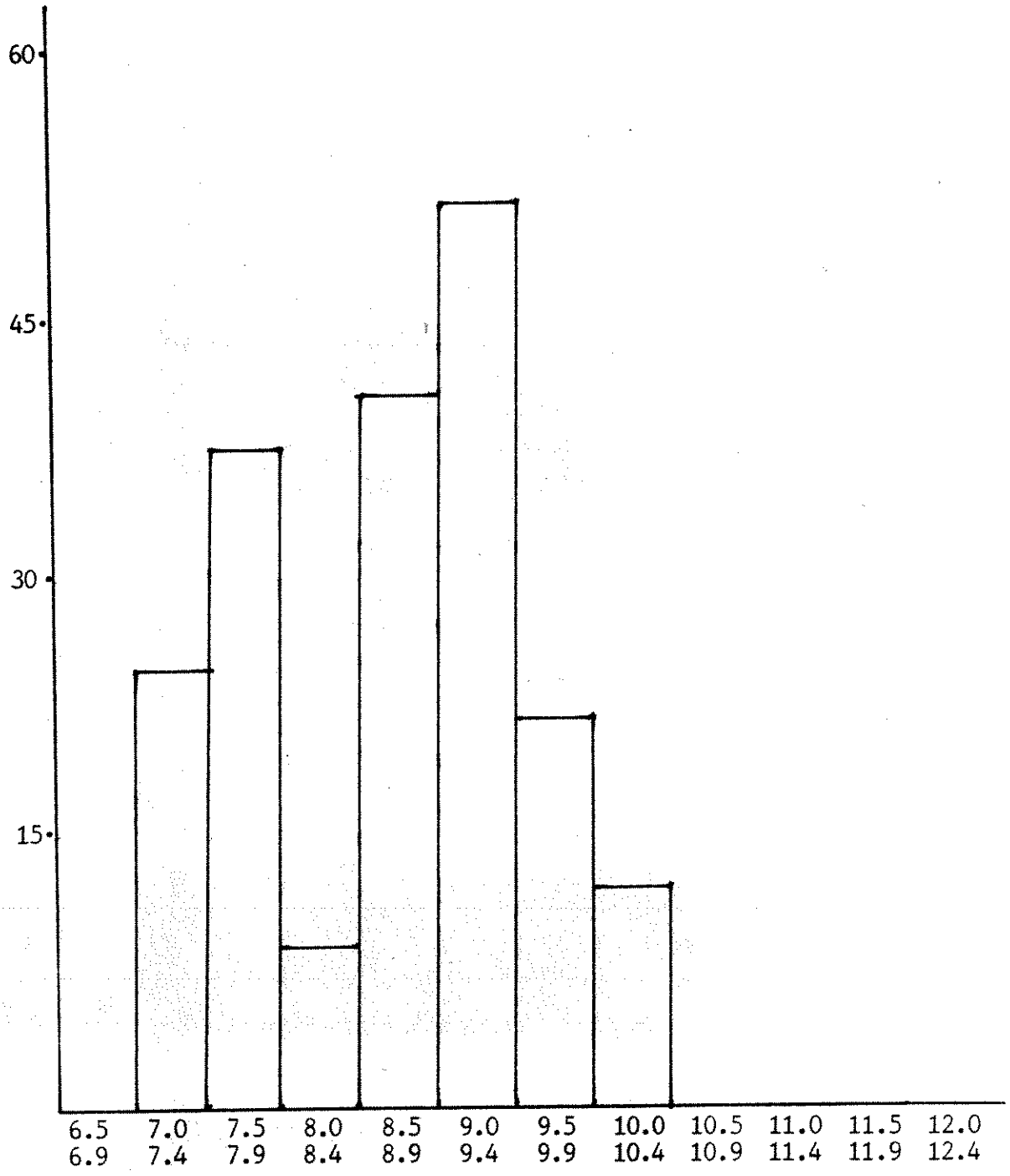


Figure 4. Georgetown Lake kokanee length-frequency in January 1987 creel
N=187

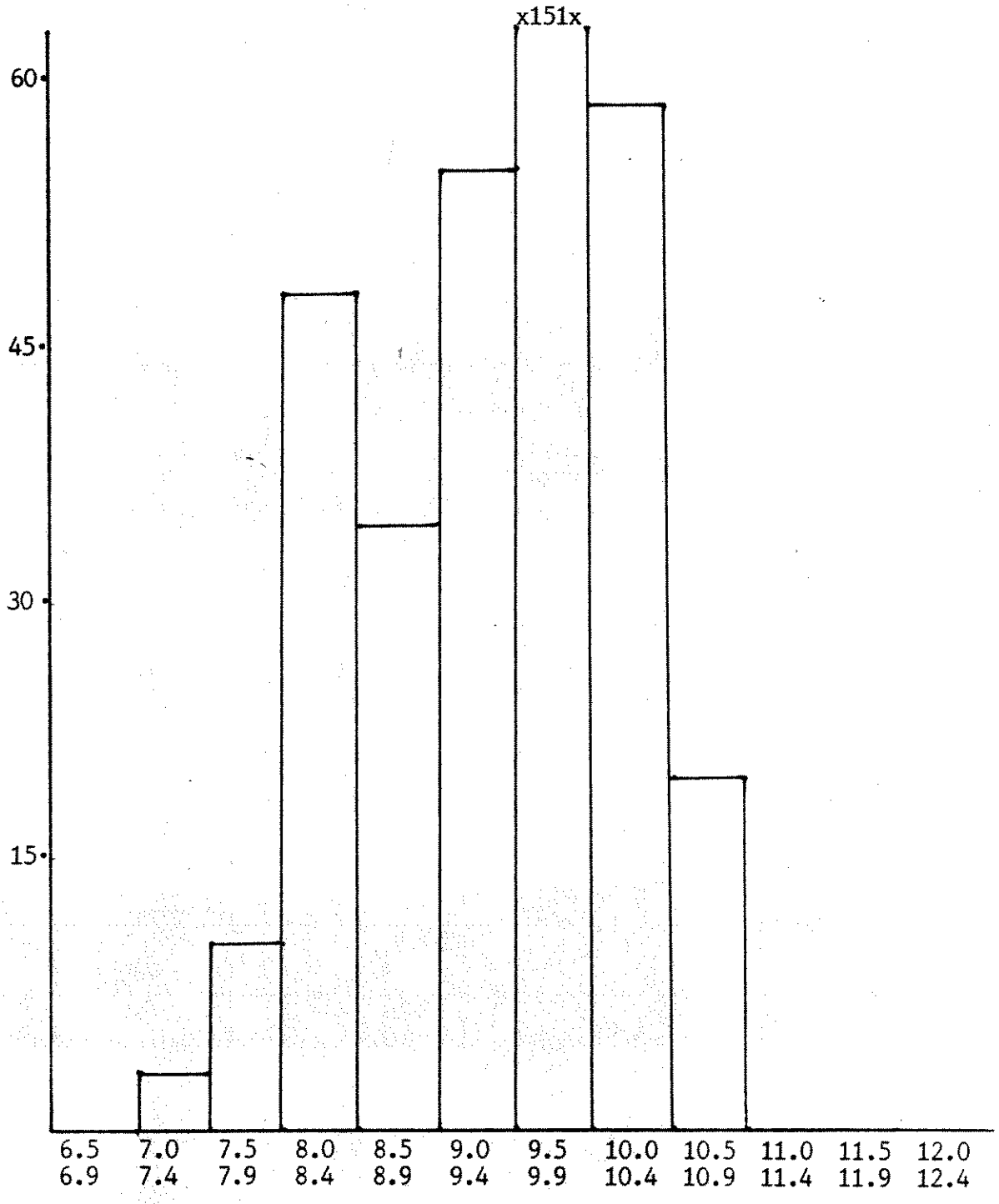


Figure 5. Georgetown Lake kokanee length-frequency in January 1988 creel
N=387

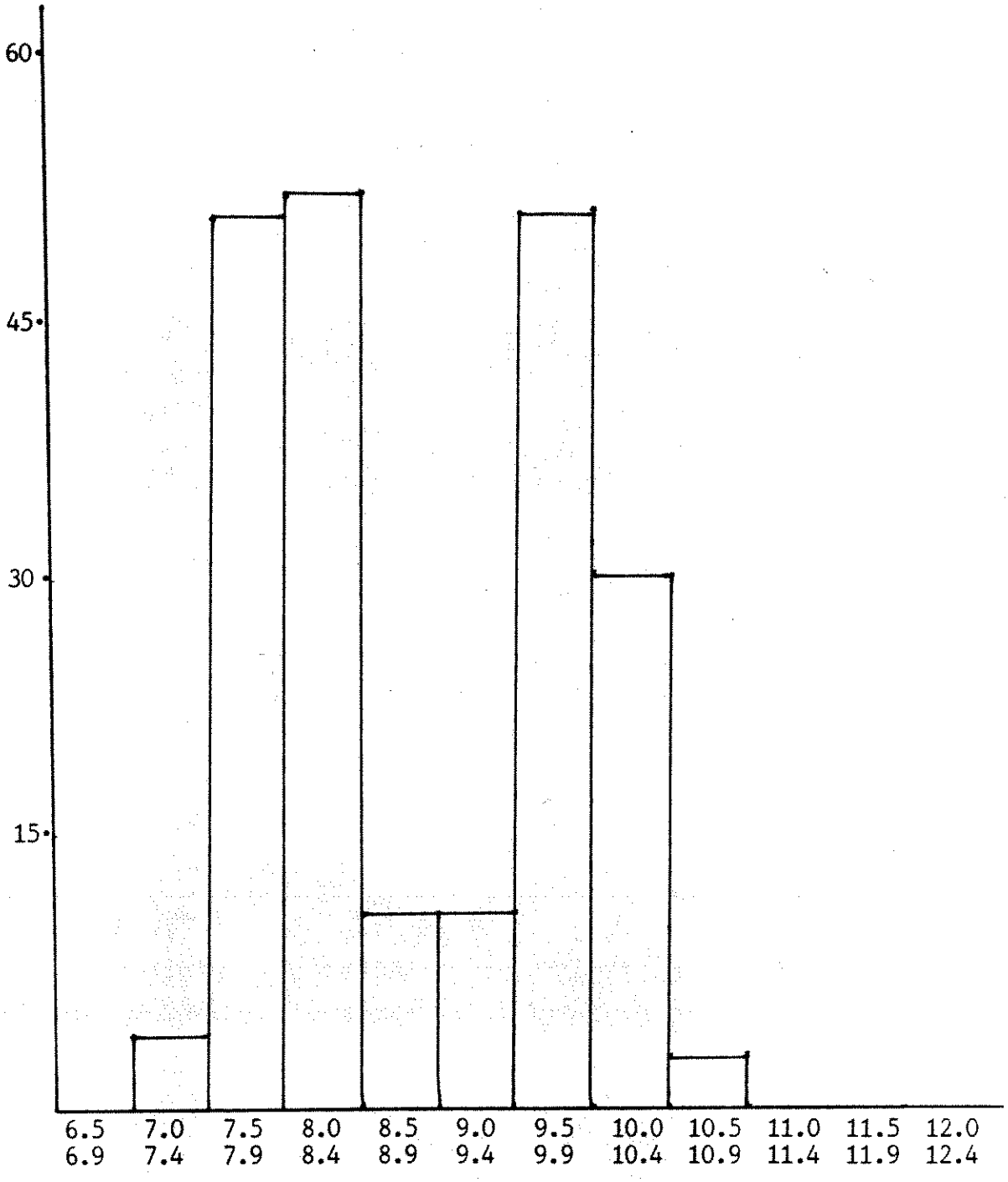


Figure 6. Georgetown Lake kokanee length-frequency in January 1989 creel N=200

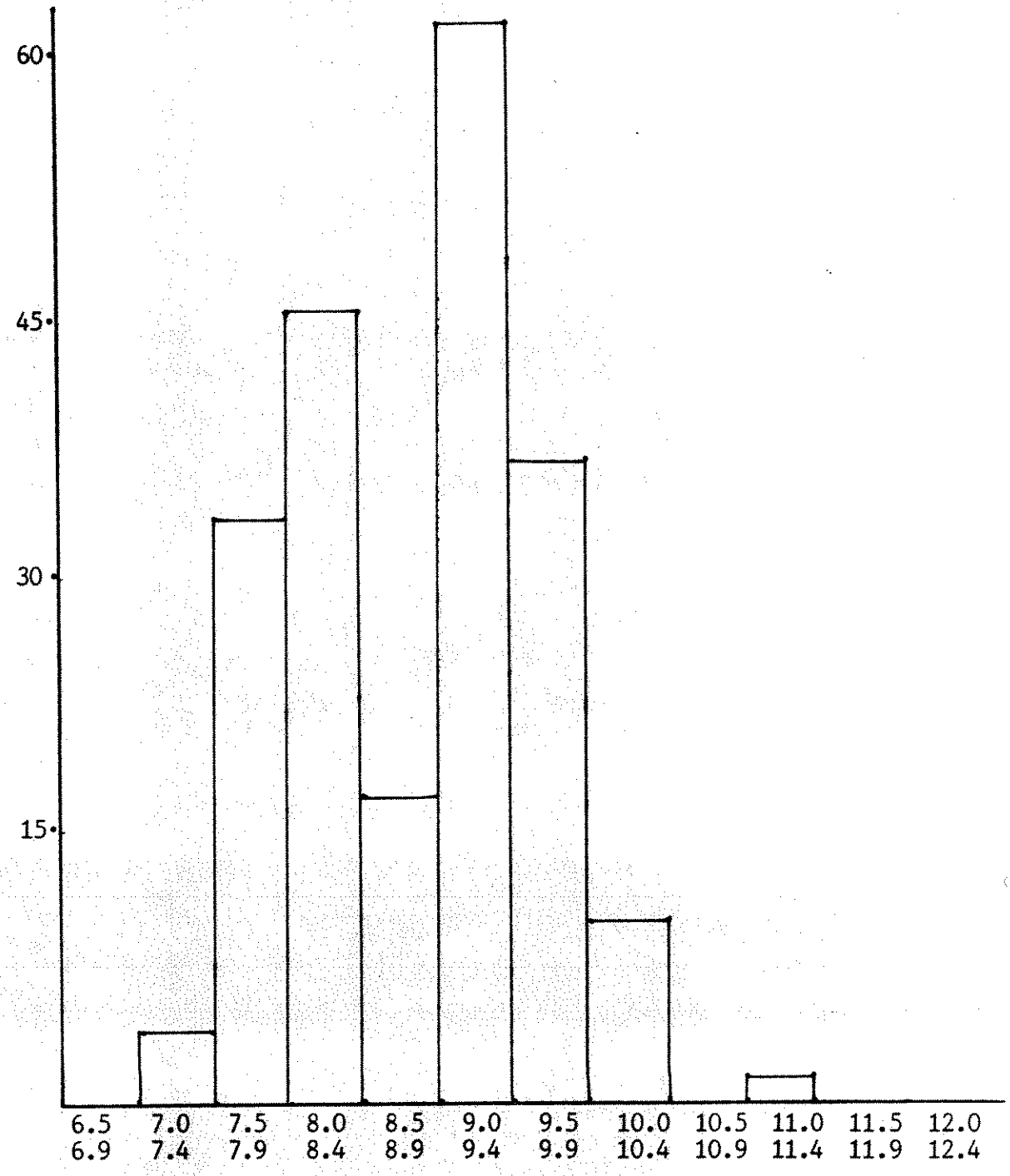


Figure 7. Georgetown Lake kokanee length-frequency in January 1990 creel
N=205

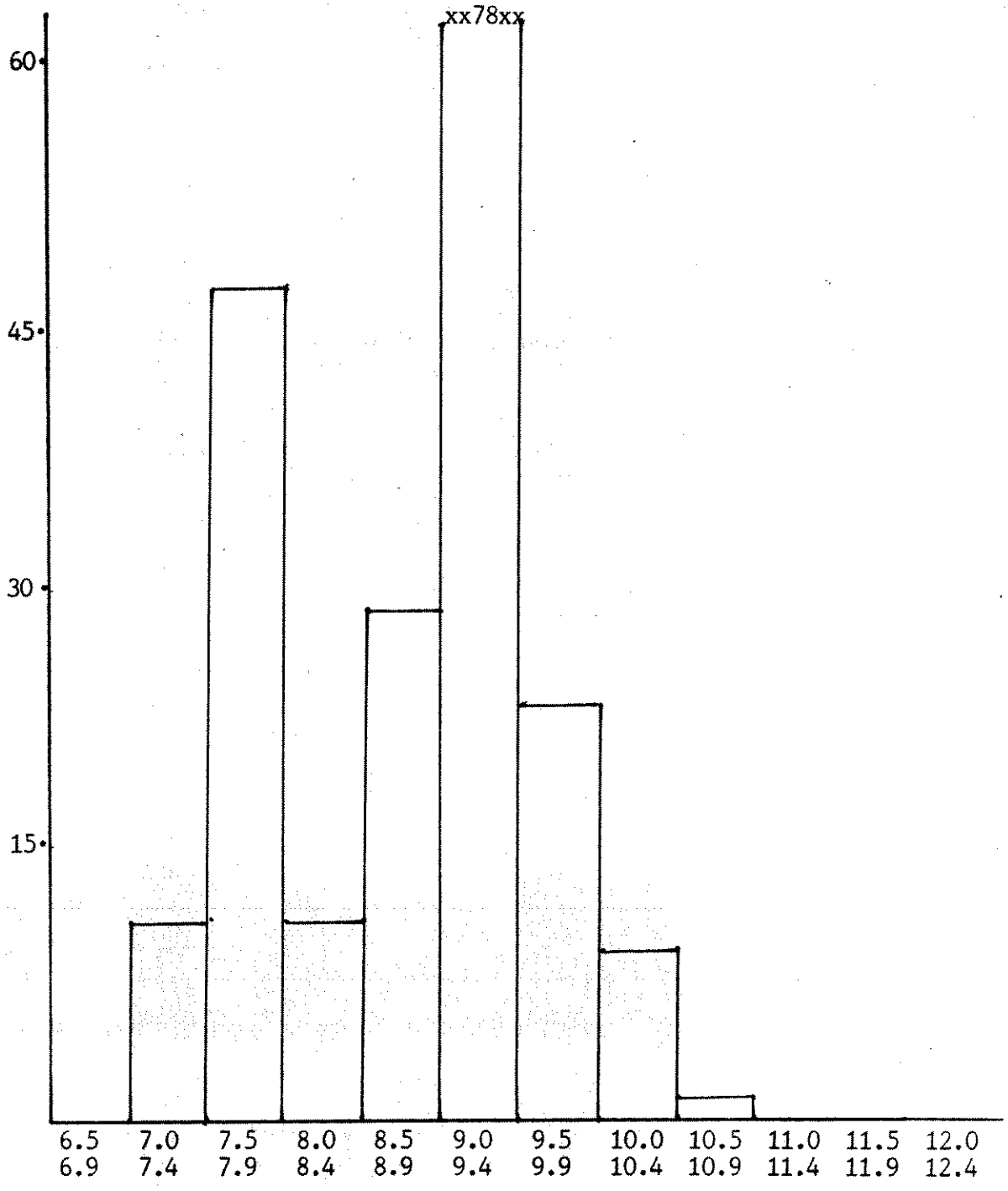


Figure 8. Georgetown Lake kokanee length-frequency in January 1991 creel
N=208

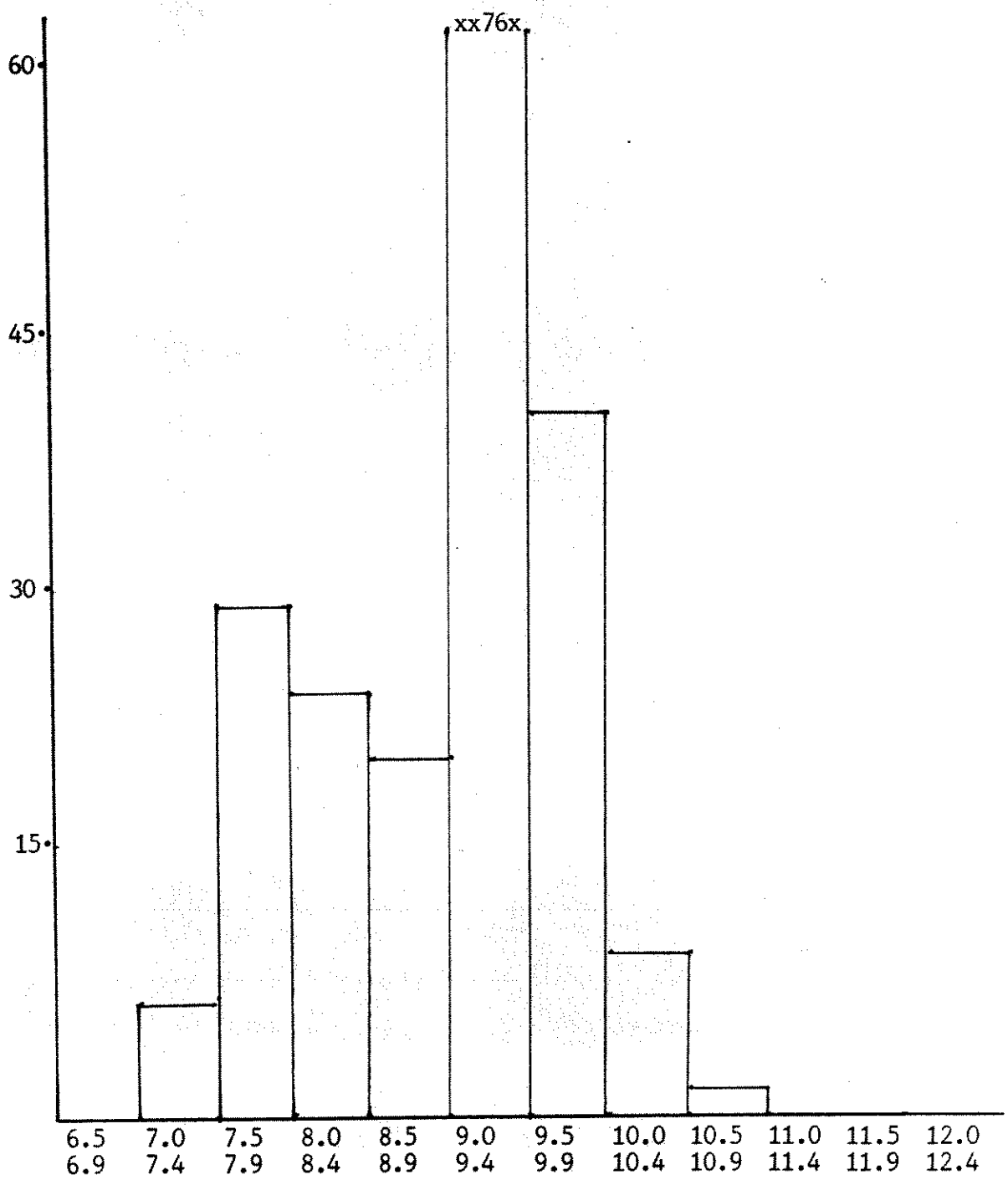


Figure 9. Georgetown Lake kokanee length-frequency in January 1992 creel
N=207

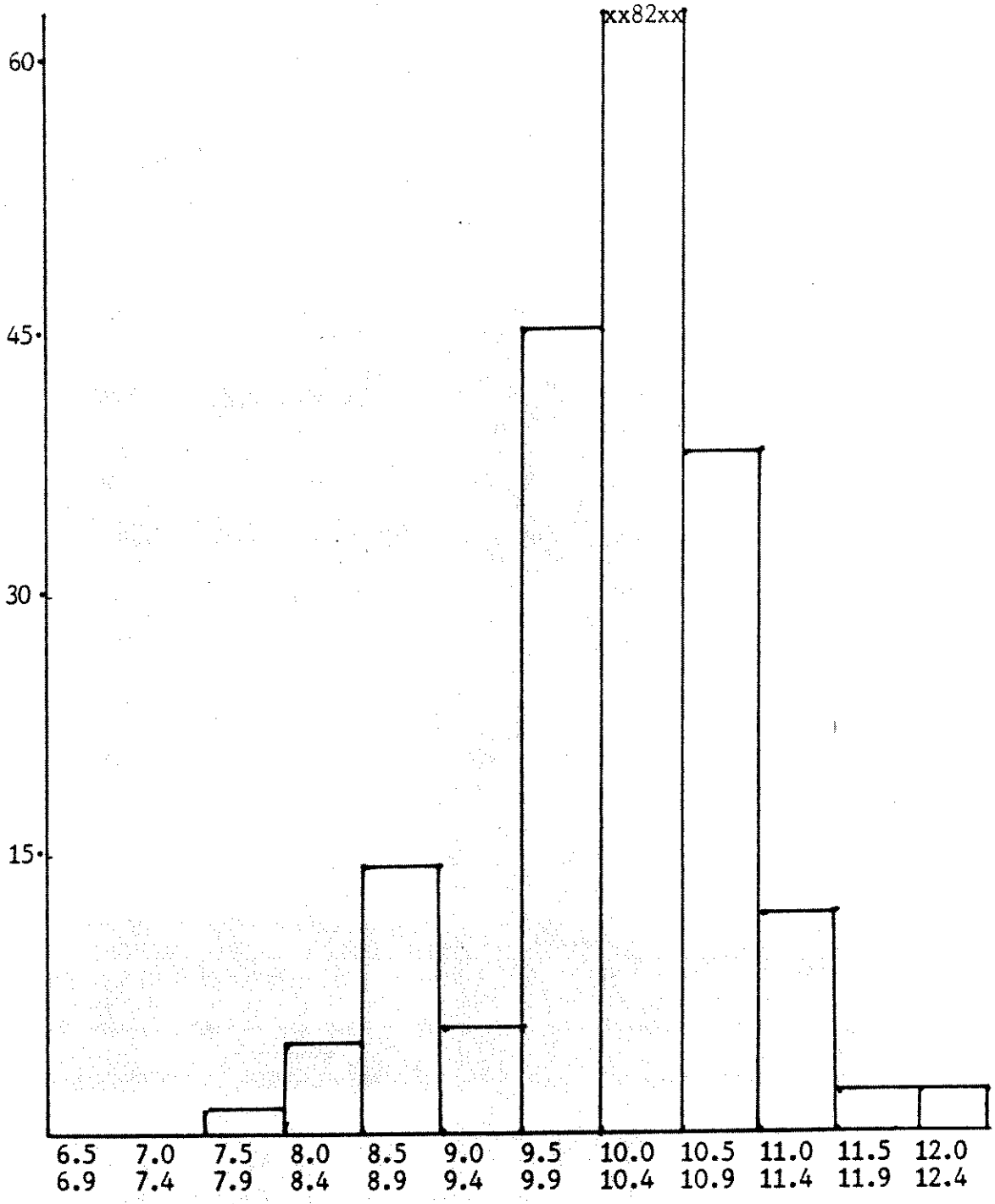


Figure 10. Georgetown Lake kokanee length-frequency in January 1993 creel
N=208

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	93
2+ ave. 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	8.7
3+ ave. length		8.7	8.3	8.8		8.4	9.3	9.2	9.7	9.5	9.3	9.3	9.4	10.2
ave. growth		0.9	1.4	1.6		1.5	2.1	1.7	2.2	1.3	1.4	1.4	1.7	2.2

Kokanee size as measured in 1993 showed 2+ fish to be exceptionally large in comparison to previous years. This suggests that these fish in 1994 catch may equal or exceed the average size of 3+ fish in 1993.

A snagging season for kokanee salmon has been in effect during fall and early winter (currently 15 September to 31 December) since 1965. The snag fishery in Georgetown has been criticized in recent years by some members of the angling community because of the presumed impact to spawning brook trout. Currently brook trout and kokanee salmon spawning areas overlap both physically and temporally in near shore springs. Anglers snagging for kokanee frequently snag brook trout. Taking brook trout by this means is illegal. A number of instances of illegal taking of brook trout by snagging have been prosecuted in recent years. Inadvertent snagging of brook trout and subsequent release clearly has some detrimental impact on fish so treated. To better assess the status of the kokanee snag fishery and possible adverse consequences for brook trout, a survey was designed and carried out during the fall of 1992.

A direct contact survey was chosen as the means of data collection. The survey was begun the last week of September and ended on the third week in November after the lake had frozen. The week was divided into week and weekend days since it was anticipated that angling activity would differ between these. It was arbitrarily decided to sample one weekend and two weekdays per week. Sample days were randomly selected within these periods. Survey periods generally extended from 8:00 a.m. to 5:00 p.m. with the goal of interviewing all snaggers active during that period. The vast majority of snagging effort was located near springs adjacent to shore on the east side of the lake near the pumphouse. Survey work was concentrated in this area. Data collected included angler, home location, hours fished, catch species and number and an estimate of annual snagging trips/angler. Data were summarized, extrapolated for the entire period of snagging and an estimate of total number of snaggers and catch for the season derived. Surveys were conducted by B. Sanborn, S. Gerdes, and S. Kujala of the Deer Lodge National Forest and G. Pierson of FWP.

Twenty-four days were sampled during the 55 day period, 8 weekend days, and 16 week days. No snaggers were observed until October 23. Snagging ended on November 20 when ice cover was complete. The snagging period included 29 days within the snagging period, 5 of 8 weekend days and 9 of 21 weekdays were surveyed.

Participation in the snag fishery was estimated to total 27 on weekends and 53 on week days for the 29 day snagging period or about 2.8 persons per day. Forty-five percent of snaggers interviewed were from Butte. The next highest category, 15%, were from out of state. Seven Montana communities comprised the remainder. Trip length averaged less than 1.5 hours. Few individuals made more than one snagging trip.

Kokanee snagged were estimated to total 1298 for the 29 day period. Average catch per person was slightly more than 16 kokanee and ranged from 0 to 64 fish taken.

Brook trout catch by snaggers was substantial, amounting to an estimated 266 fish. Of the brook trout taken by snaggers, about 30% were illegally retained while the remaining 70% were released. One must imagine that the number of illegally taken brook trout was higher since many people would have concealed these fish. One of five snagged fish was a brook trout.

In order to evaluate the kokanee snagging fishery at Georgetown, it is necessary to weigh the benefits in terms of angler opportunity, kokanee harvest and potential reduction in kokanee reproductive success and the negative consequences for brook trout.

Salmon snagging in Georgetown in 1992 appeared to be of relatively little interest to anglers with only 120 hours of activity estimated. The snag fishing has been in effect for an extended period and was at one time apparently rather popular but this was at a time when kokanee runs were present in Stuart Mill Creek. With the elimination of this spawning run in an attempt to control kokanee populations, interest in the snag fishery was declined. About thirteen hundred kokanee spawners were taken by anglers in 1992. While no data are available on total spawner numbers, it is apparent from the relatively stable size of kokanees that kokanee reproduction is in excess of available habitat. Thus, the presence or absence of 1300 spawners is probably of little significance to population density. If kokanee spawning were separated from brook trout concentrations, it would be of little consequence. The impact to brook trout remains the issue.

No estimated of brook trout spawner numbers are available. Brook trout spawning takes place in both nearshore springs and in Stuart Mill Creek and the North Fork of Flint Creek. Qualitative observations suggest that spring spawning brook trout are substantially larger than the creek spawners. This may reflect the small volumes of flow in the tributaries and the difficulty larger fish would encounter in ascending them. An estimated 266 brook trout were snagged during the survey period. Such a number is unlikely to be of consequence considering the large numbers of spawners observed in the streams and around the springs. The apparent increase of brook trout in the ice fishing also suggests that the brook trout population is increasing despite the impacts of the snag fishery. Thirty percent of snagged brook trout were illegally kept by fishermen. Many of those interviewed knew that keeping snagged trout was illegal. A few claimed to be unable to distinguish between brook trout and kokanee. The occasional citation written to individuals possessing large numbers of illegally snagged brook trout suggests that substantial numbers of brook trout are lost to legal anglers by poaching during the snagging period. It could be argued that these violations are soluble by a more frequent or intensive enforcement effort but the reality is that the snagging season overlaps fall hunting seasons, a period during which enforcement personnel are already maximally committed.

A final consideration is the perception of this activity by the public, both sporting and non-consumptive. Although there is no apparent biologically imperative consequences of the snag fishery, the public response to snagging of brook trout is heavily negative and the apparent freedom to violate statutes with little risk of arrest is seen as a failure of Fish, Wildlife and Parks in meeting management responsibilities.

Since the benefits of the snag fishery are limited and the negative aspects of some substance, proposed regulations for 1993-94 will eliminate the snag fishery.

An additional variable which may affect Georgetown kokanee populations was an extremely low lake level during the 1992-93 winter season. Due to drafting of the reservoir for work ont he water control structures, extremely low inflows and loss to irrigation demand, the reservoir entered the ice cover period some 2 feet lower than normal. These levels left a number of nearshore springs used by kokanee for spawning above the lake surface. This potential for reduction in reproductive success may manifest itself in the kokanee fishery in 1995-96 when the 1993 year class enters (1995) and would normally dominate (1996) the kokanee catch.

Brook Trout

Data generated from brook trout caught by ice anglers in January 1993 are displayed in Table 3. Average brook trout length was 13.4 inches. This exceeds the average length of angler caught fish in the preceding 8 years of record (12.1 inches) by 1.3 inches. maximum brook trout length observed was 16.9 inches total length. The rainbow to brook trout ratio in the creel was 5:1, brook trout comprised 15% of the trout catch. These data suggest that the brook trout population is stable or increasing slightly and that average size is slowly increasing.

Changes in kokanee salmon snagging regulations that have been proposed for implementation in March 1994 and beyond would, if adopted, be likely to have significant benefits for brook trout (see Kokanee Salmon section). Should these benefits materialize, some increase in brook trout numbers and average size may result.

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

	Summer		Winter								
	1979	1980	1980	1981	1987	1988	1989	1990	1991	1992	1993
Number Sampled											
Rainbow	88	774	141	730	244	303	221	305	302	300	301
Brook	4	124	11	123	18	57	23	47	45	75	56
Brook Trout Length											
Average	10.1	10.	11.8	11.1	12.1	12.1	12.2	12.0	13.1	12.7	13.4
Maximum					17.2	16.5	16.0	17.2	16.9	17.3	16.9
Rainbow to Brook Ratio	22:1	6:1	13:1	6:1	14:1	5:1	10:1	6:1	6:1	4:1	5:1
Brook Trout % of Catch	4	14	7	14	7	16	9	13	13	20	15

Rainbow Trout

Rainbow trout in Georgetown Lake angler creel in January, 1993, averaged 12.2 inches in total length (Table 4). This is the smallest average size since January, 1986 the year following a reduction in creel limit for the lake. It also 0.4 inches smaller than the average size in 1992. Length frequency histograms of Georgetown rainbows from January angler creels for the years 1986 to 1993 are presented in

Figures 11-18. Figures 17 and 18, representing lengths from 1992 and 1993, are remarkably similar and contrast sharply with Figure 16 from 1991. Figures 17 and 18 show a preponderance of the sample composed of younger and smaller fish while Figure 16 was dominated by older and larger rainbows. It was hypothesized in 1992 that the observed decrease in average size resulted from stocking failures of Eagle Lake rainbows in 1988 and 1989. The 1993 data cast some doubt on this hypothesis and if 1994 data are similar to 1993 and 1993, a reevaluation will be necessary. Another explanation for decline of average catch size and a greater proportion of younger fish in the creel may be expanded harvest. No data are available that accurately assess fishing pressure or harvest rates at Georgetown. However, if increased harvest rates have occurred in the last three years, changes in length frequency histograms similar to those observed in 1992 and 1993 would be expected. If 1994 data are similar to those from 1992 and 1993, a change in management will be required if previous angling quality is to be regained. Options could include reduction in mortality by reducing creel limits, increase in stocking rate to compensate for increased angling mortality or a combination of the two.

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	92-93					
Sample Number	302	300	301					
Average Length	13.9	12.6	12.2					

Table 5 presents rainbow strain performance and evaluation data for the years 1986-1993. All data are derived from January angler creeled fish. The 1993 catch was composed of 68.5% Arlee, 24.5% Eagle Lake and 7% Kamloops (Table 5). This composition is generally similar to previous years with the exception of 1991 when the first effects of Eagle Lake stocking failure were most dramatic.

Arlee rainbow have contributed the majority of the catch in all years since 1986 (Table 5). Arlee catch percentage has varied from 52 to 93%. The reliability of Arlee strain supply and performance has been a major asset in the Georgetown fishery. Length frequency histograms of Arlee rainbow catch are presented in Figures 19-26.

Eagle Lake rainbow have performed well in Georgetown comprising 24-44% of the catch with the exception of 1991 when they made up only 3% (Table 5). Average size of Eagle Lake in 1993 was 13.0 inches up 1.4 inches from 1992 but 2 inches below the average of 15 inches in 1990. Eagle Lake length frequency histograms for the years 1986-1993 are presented in Figures 27-34.

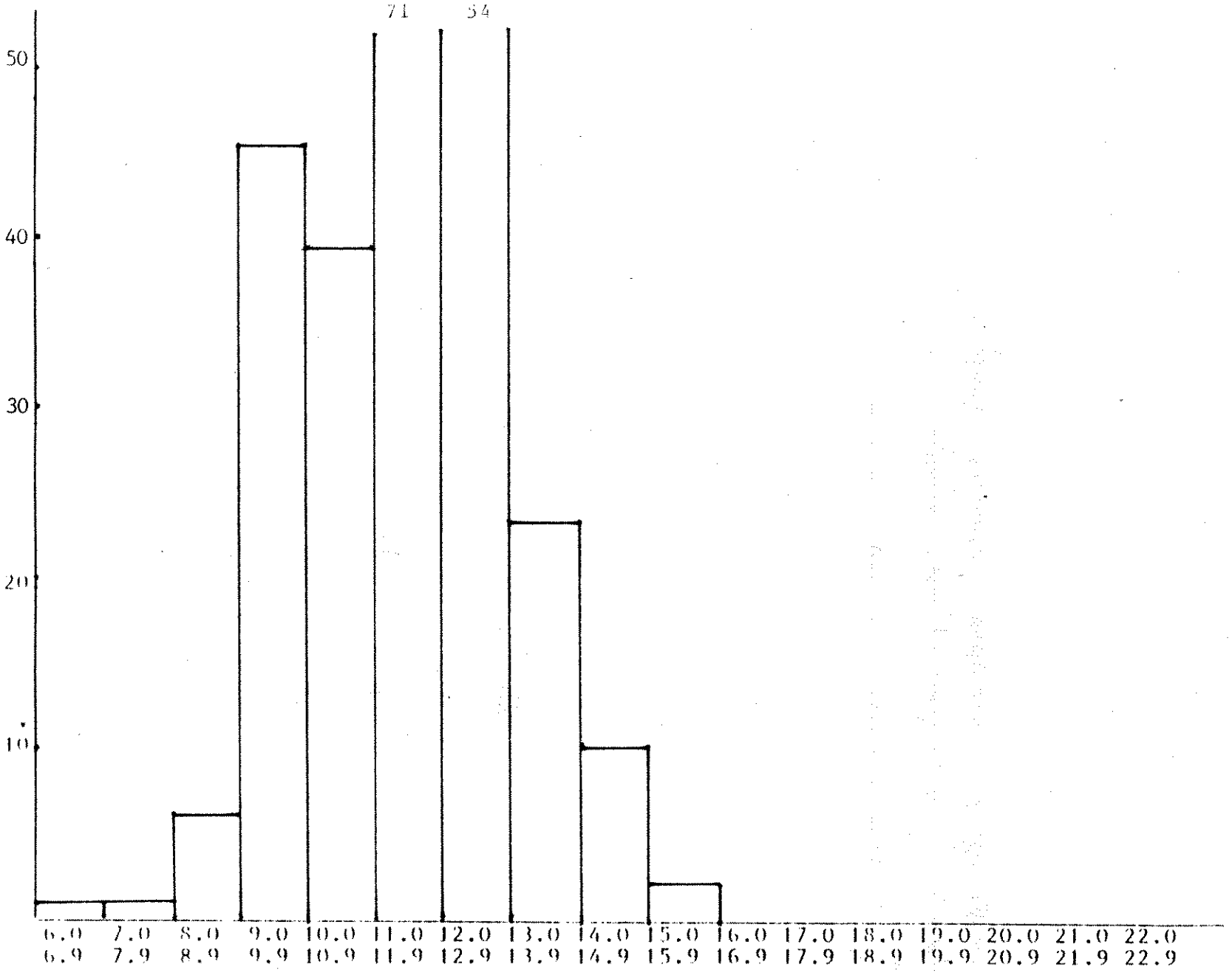


Figure 11. Length Frequency of Georgetown Lake Rainbow, January, 1986 N = 252.

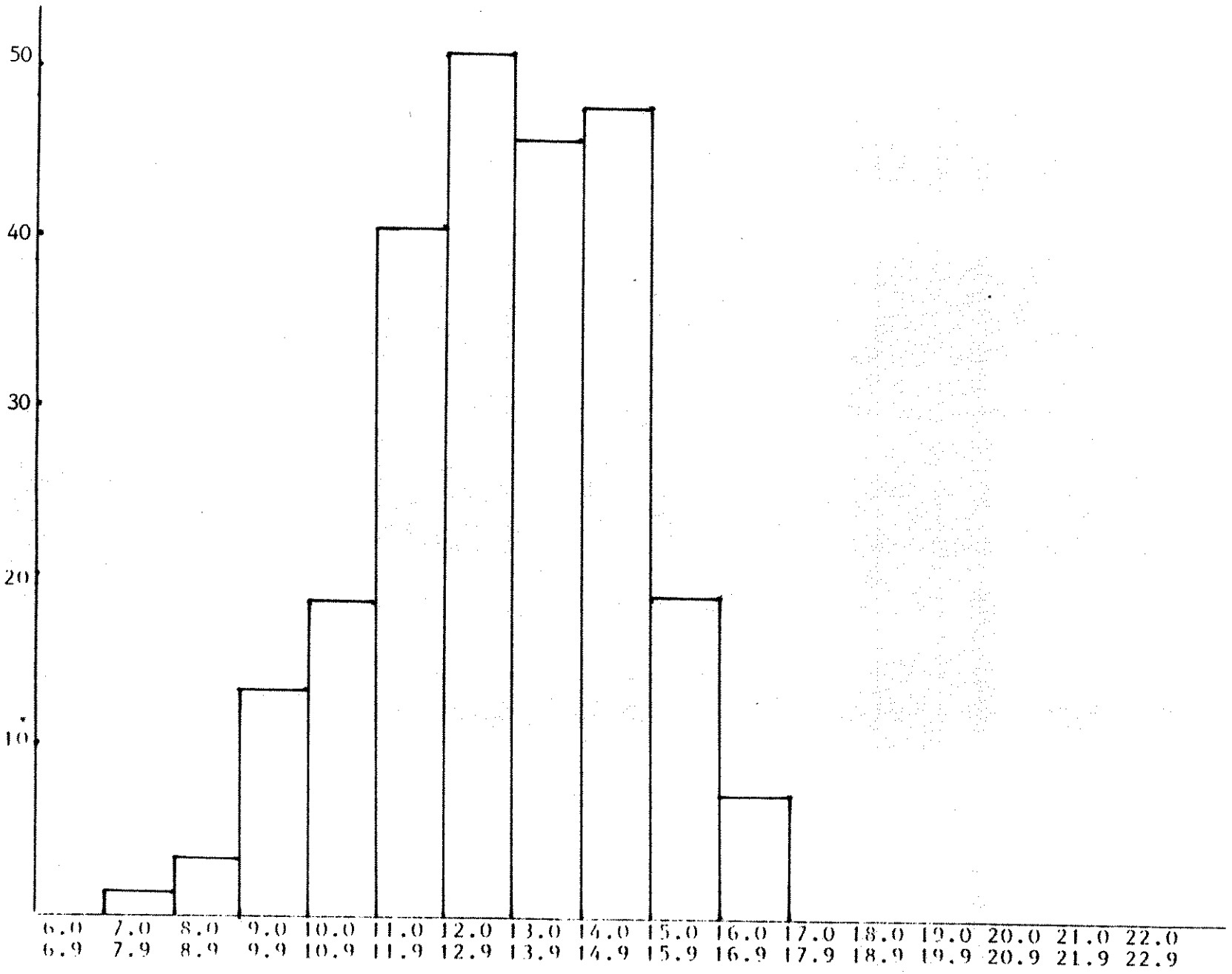


Figure 12. Length Frequency of Georgetown Lake Rainbow, January, 1987. N = 241.

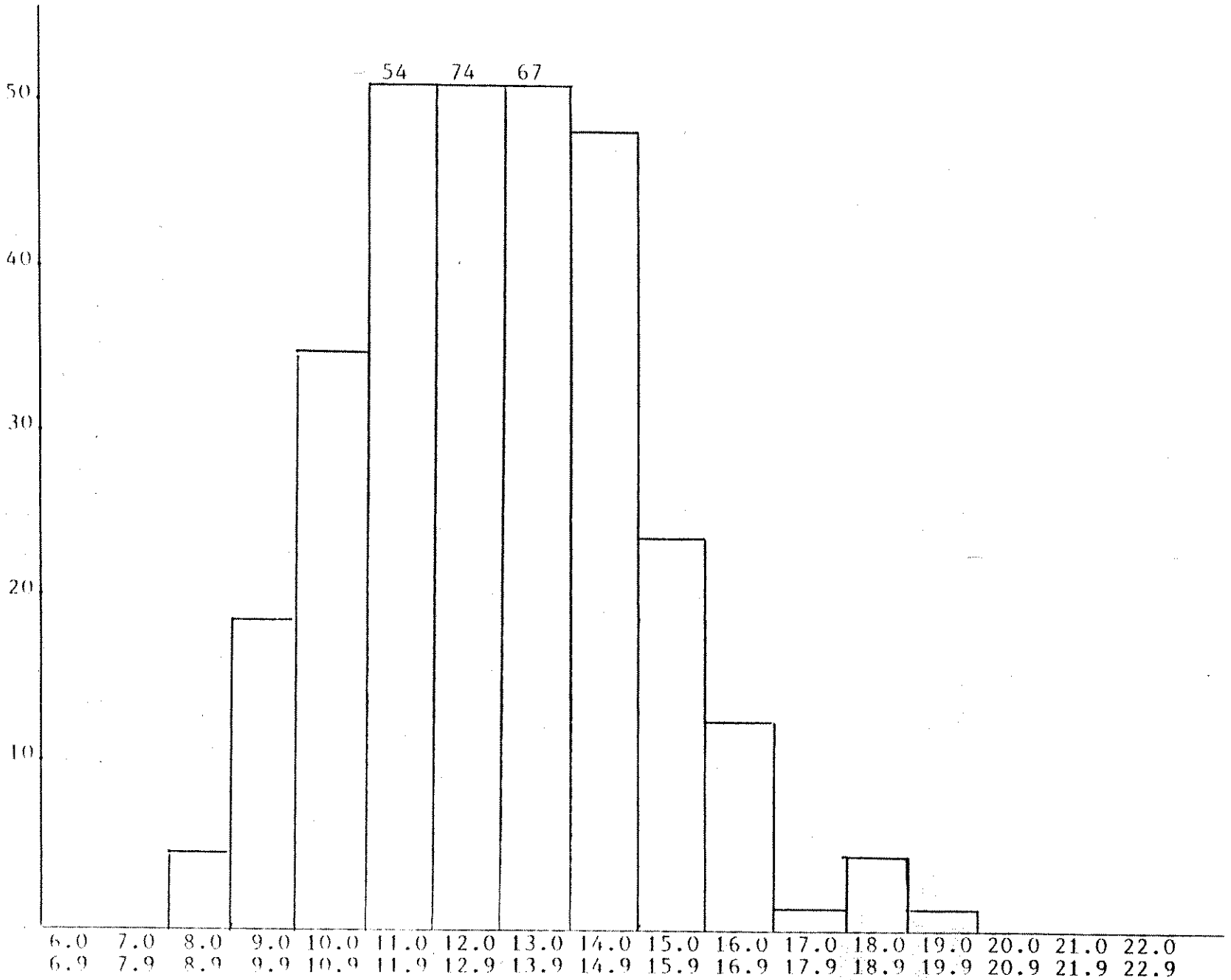


Figure 13. Length frequency of Georgetown Lake Rainbow January 1988 N=339

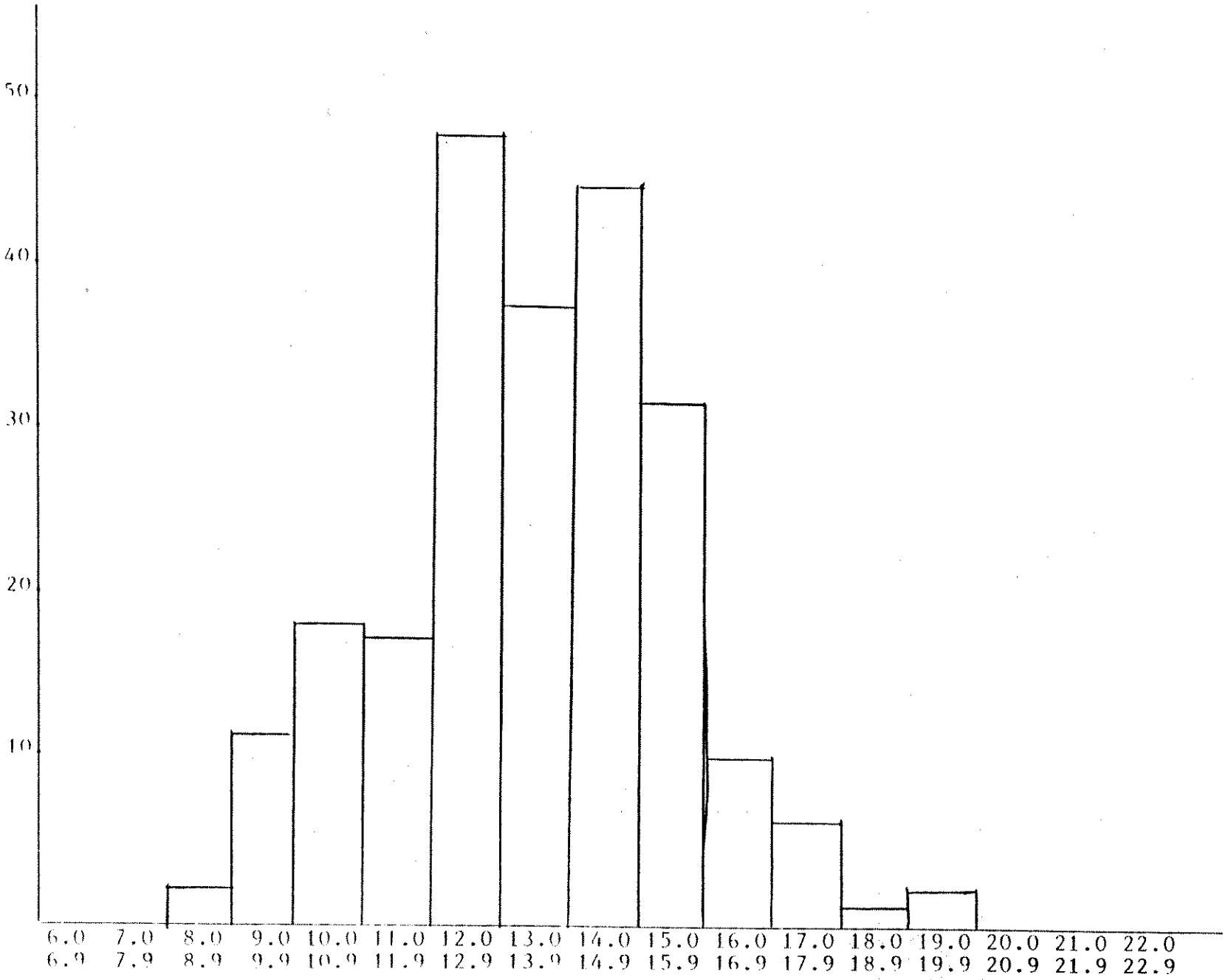


Figure 14. Length frequency of Georgetown Lake Rainbow January 1989 N=231

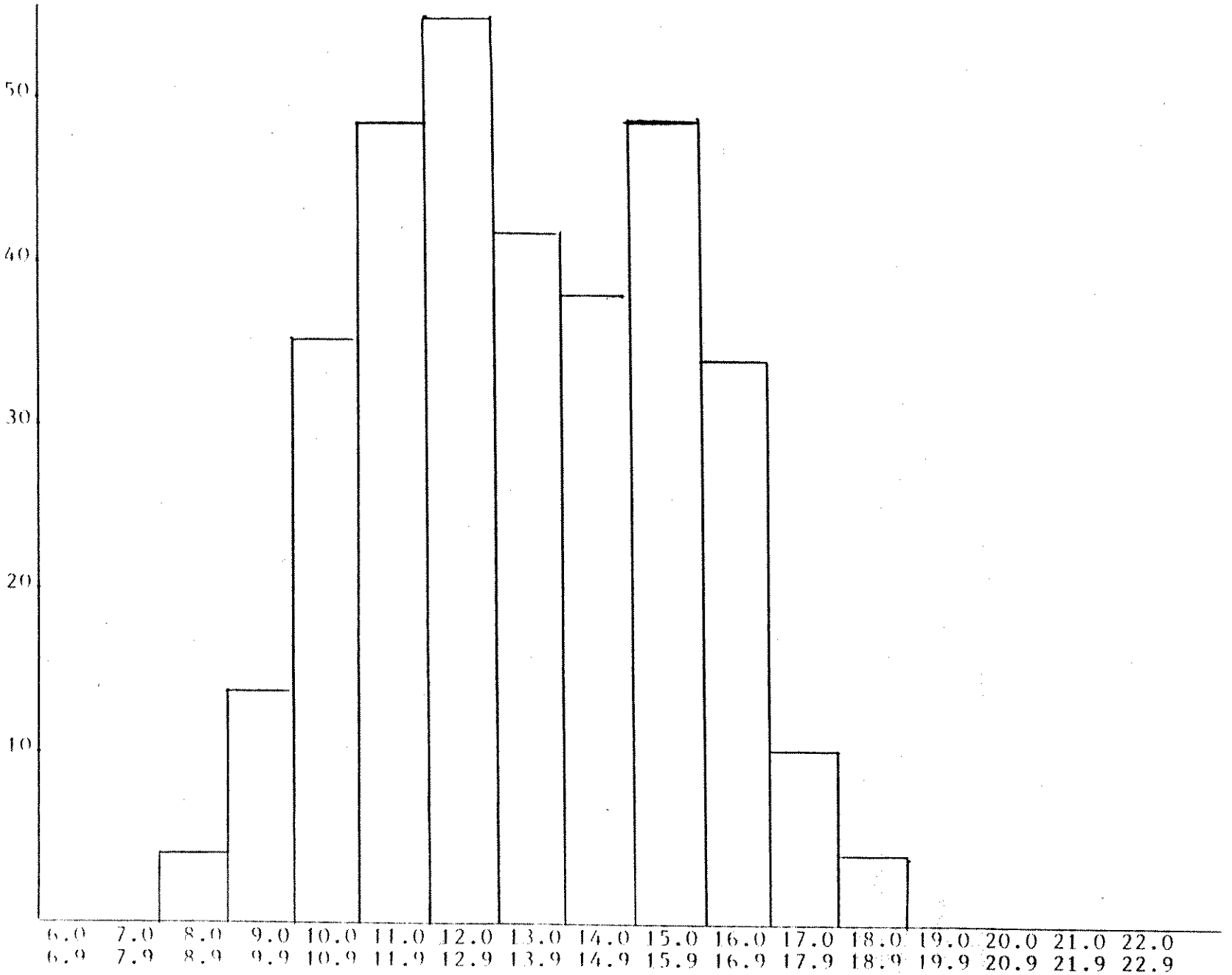


Figure 15. Length frequency of Georgetown Lake Rainbow January 1990 N=305

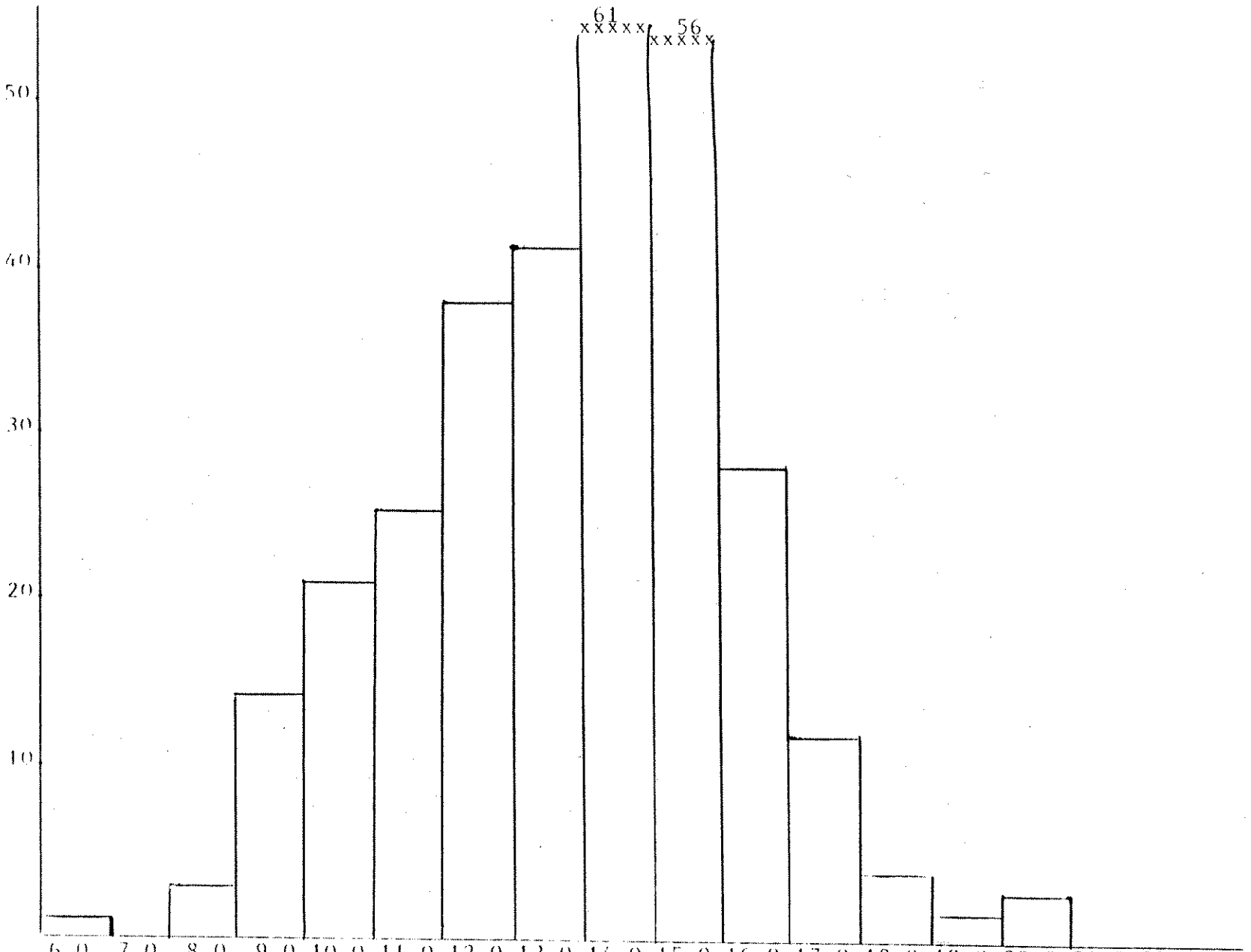


Figure 10. Length frequency of Georgetown Lake Rainbow January 1991 N302

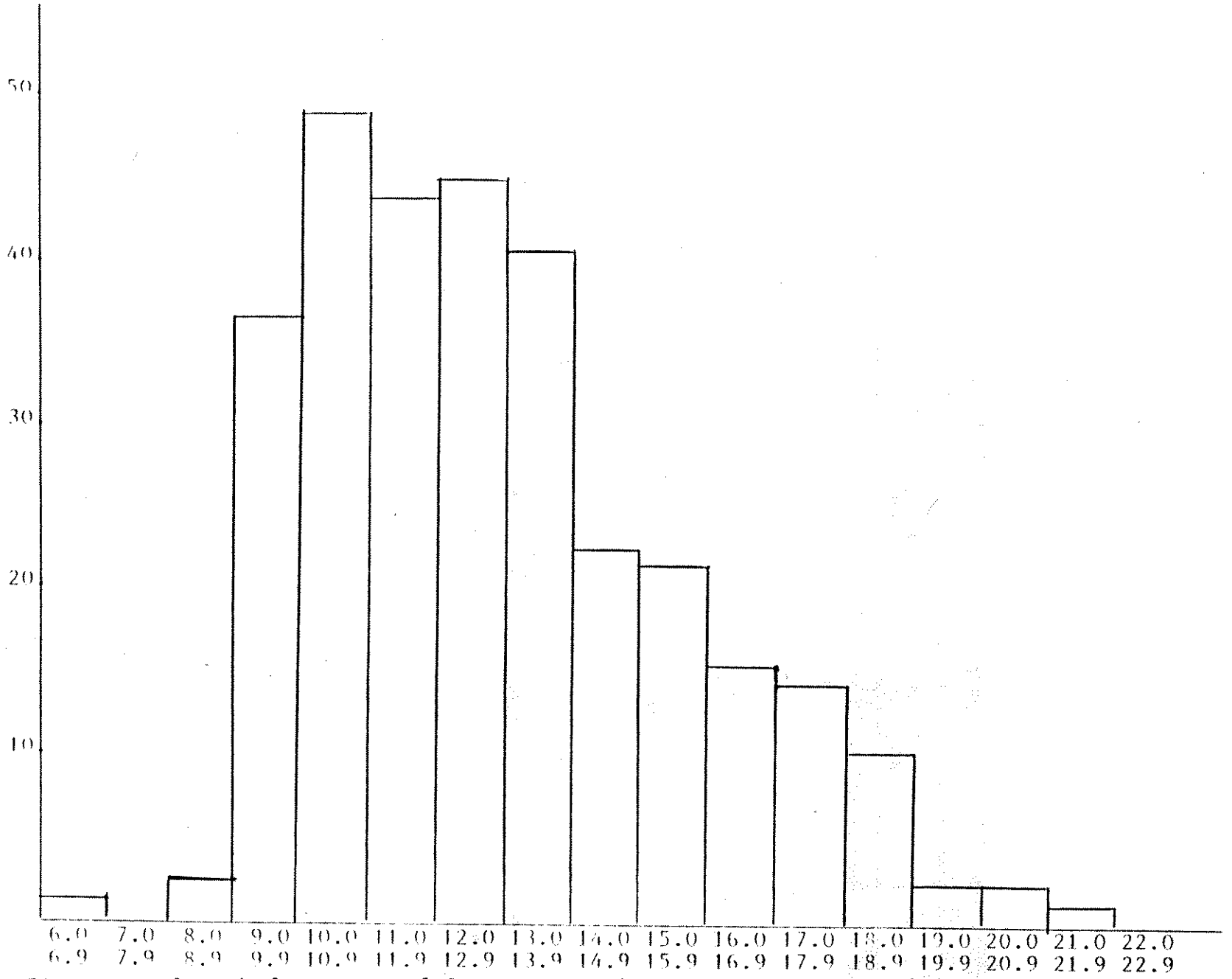


Figure 17. Length frequency of Georgetown Lake Rainbow January 1992 N=300

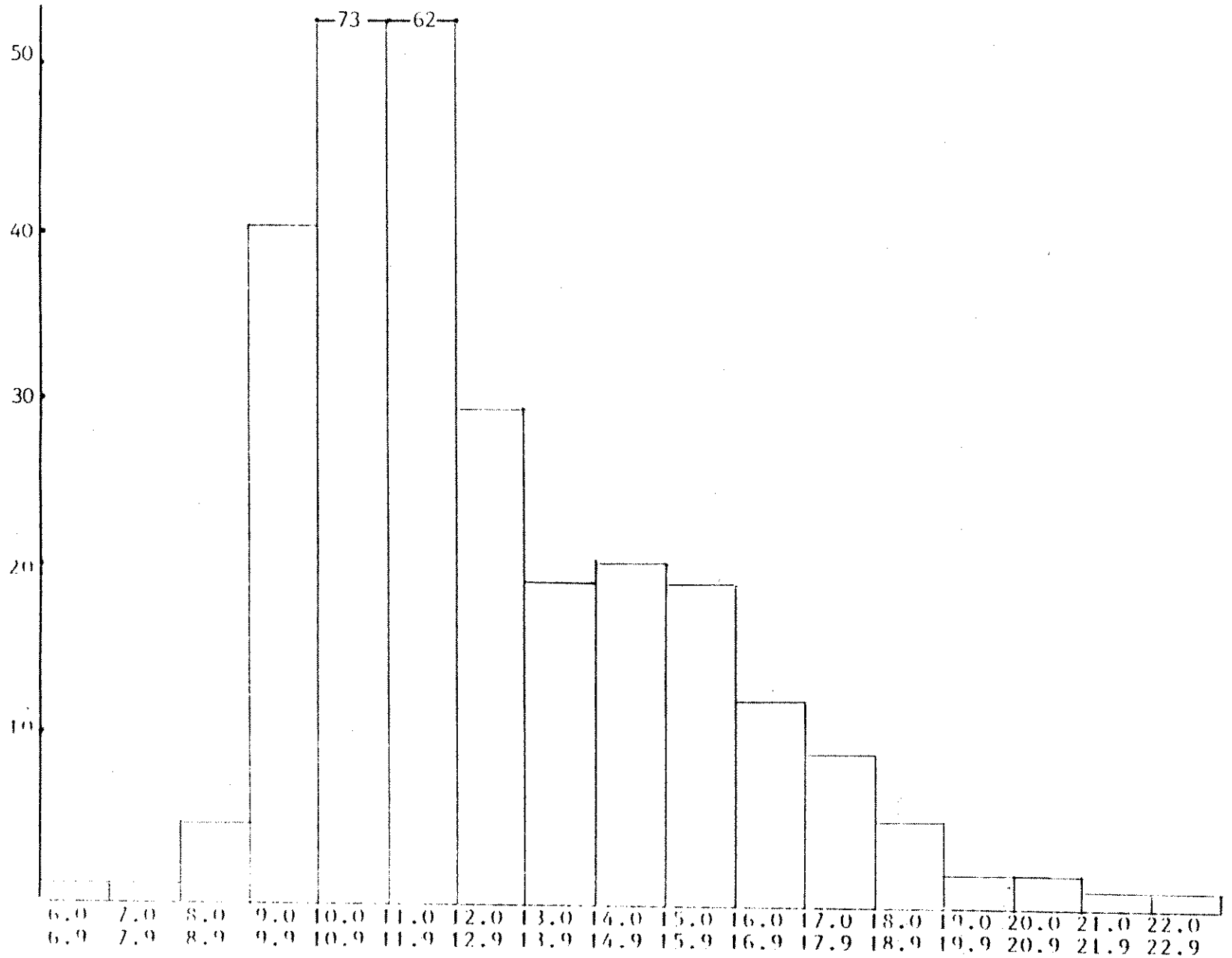


Figure 18. Length frequency of Georgetown Lake Rainbow January 1993 N-301

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
			1992-93	
Arlee	206	68.5	12.1	7.7-22.8
Eagle Lake	74	24.5	13.0	9.1-20.6
Kamloops	21	7	11.2	5.6-14.8
Total	301	100	12.2	5.6-22.8

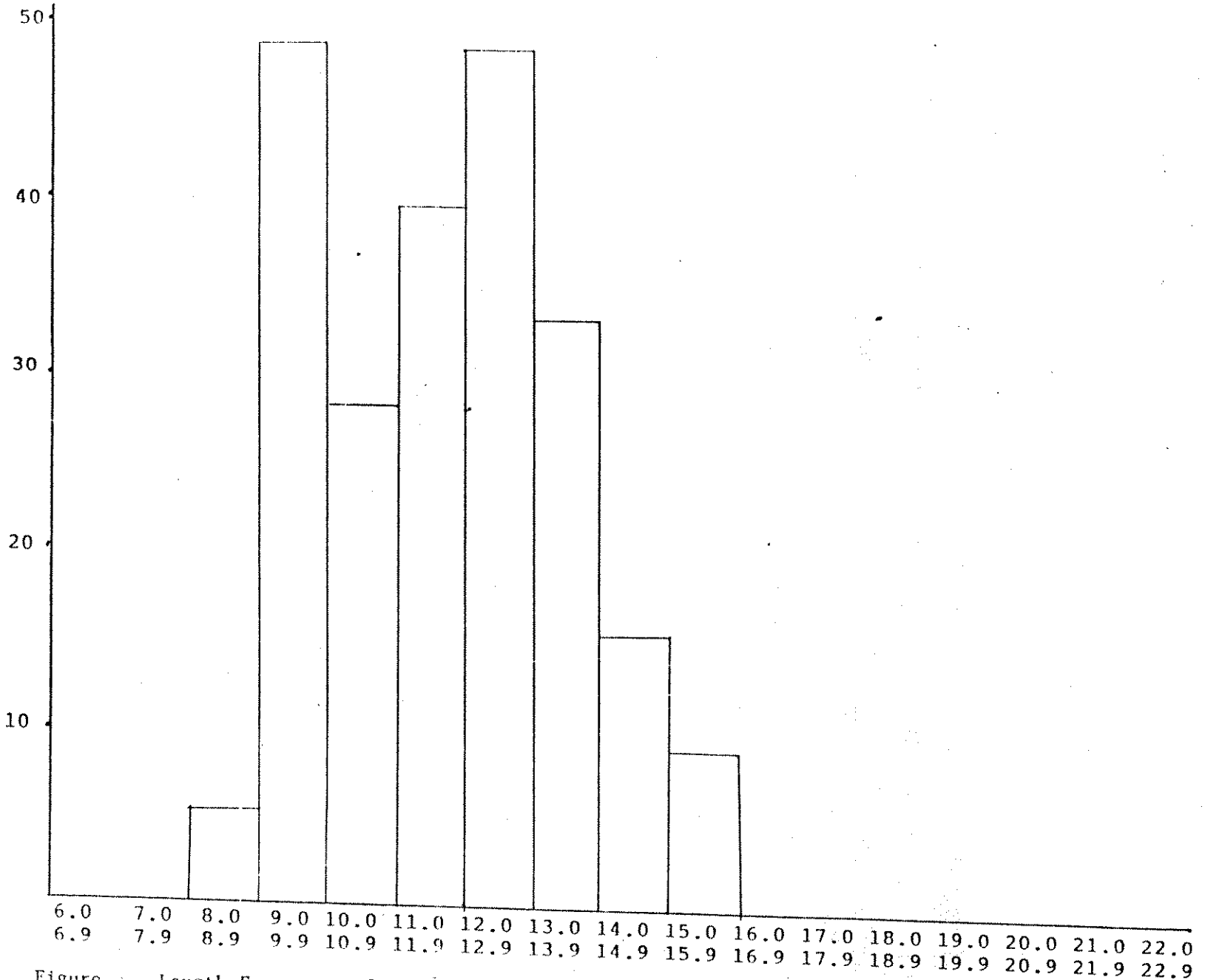


Figure 19. Length Frequency of Georgetown Arlee Rainbow, January 1986. N = 210

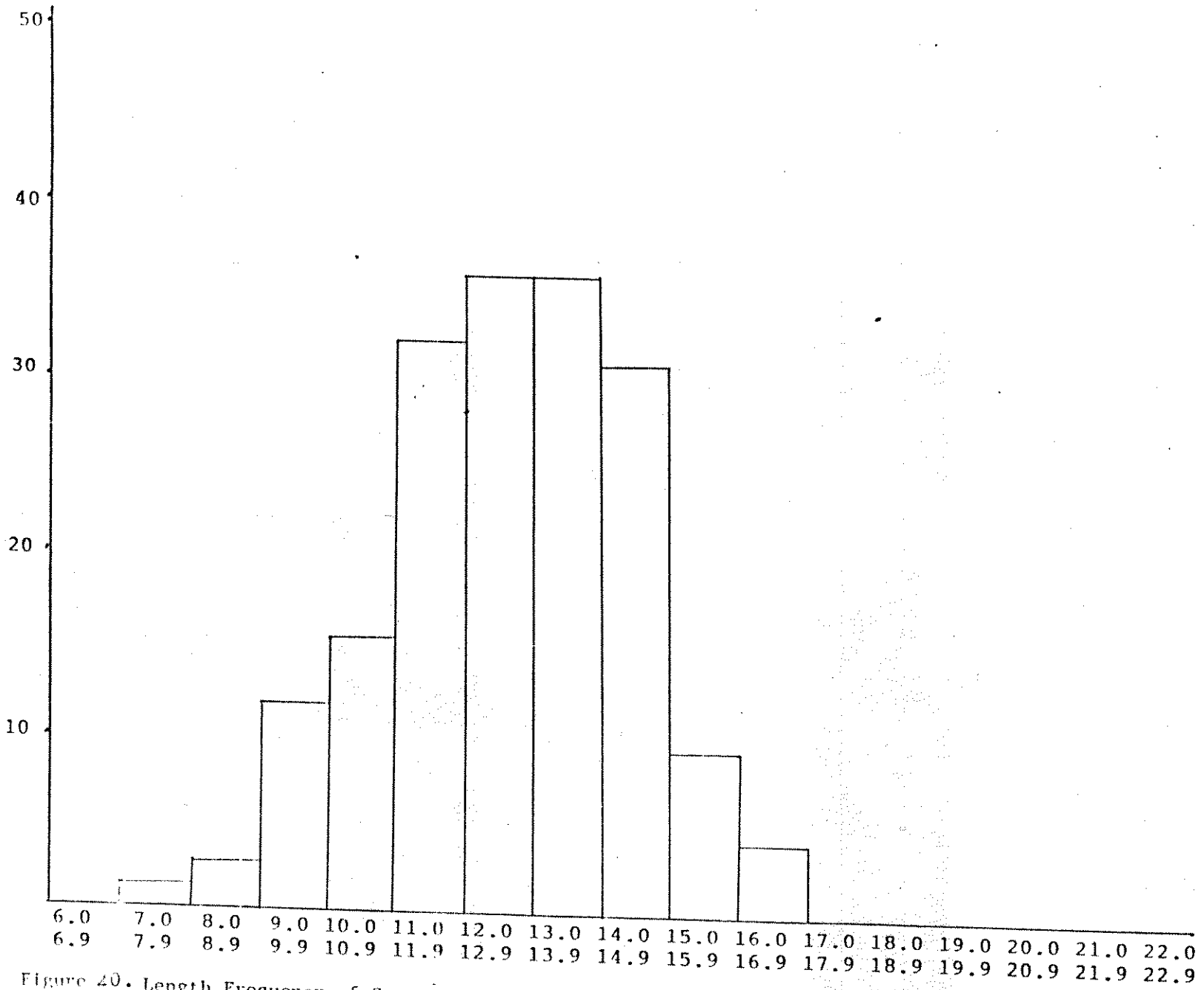


Figure 20. Length Frequency of Georgetown Arlee Rainbow. Winter 86-87. N = 169

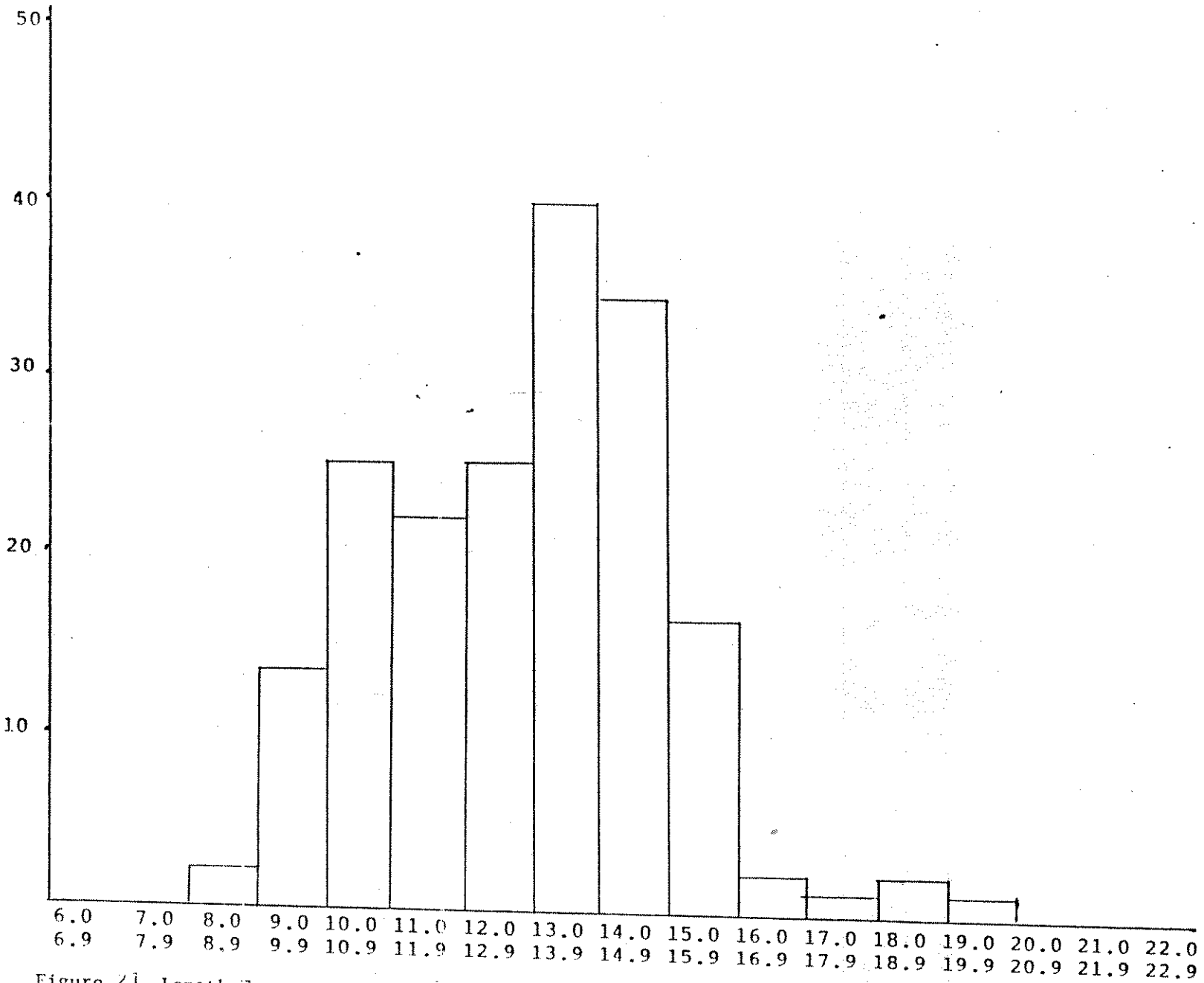


Figure 21 Length Frequency of Georgetown Arlee Rainbow. January 1988. N= 197

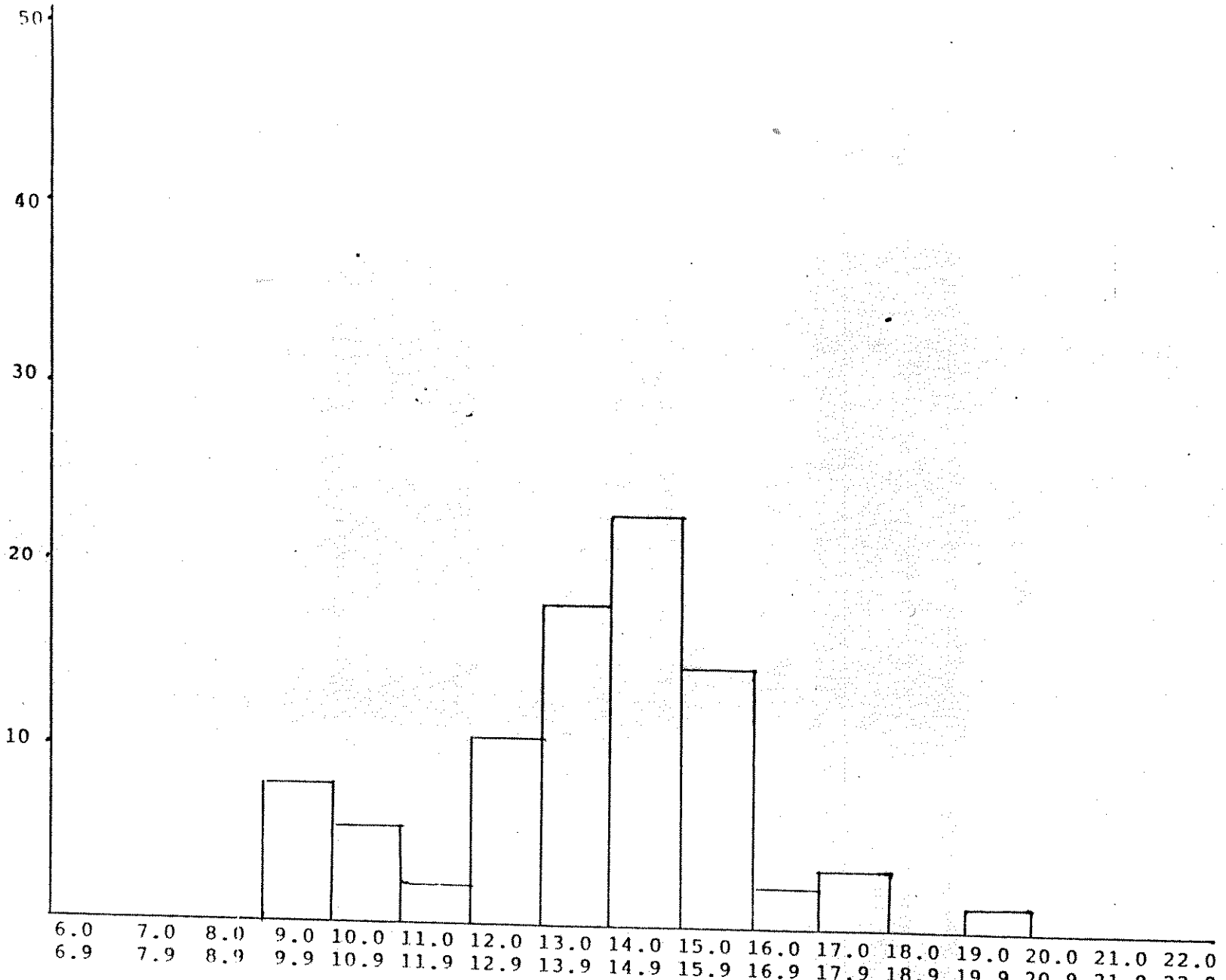


Figure 22 Length Frequency of Georgetown Arlee Rainbow, January 1989, N = 87

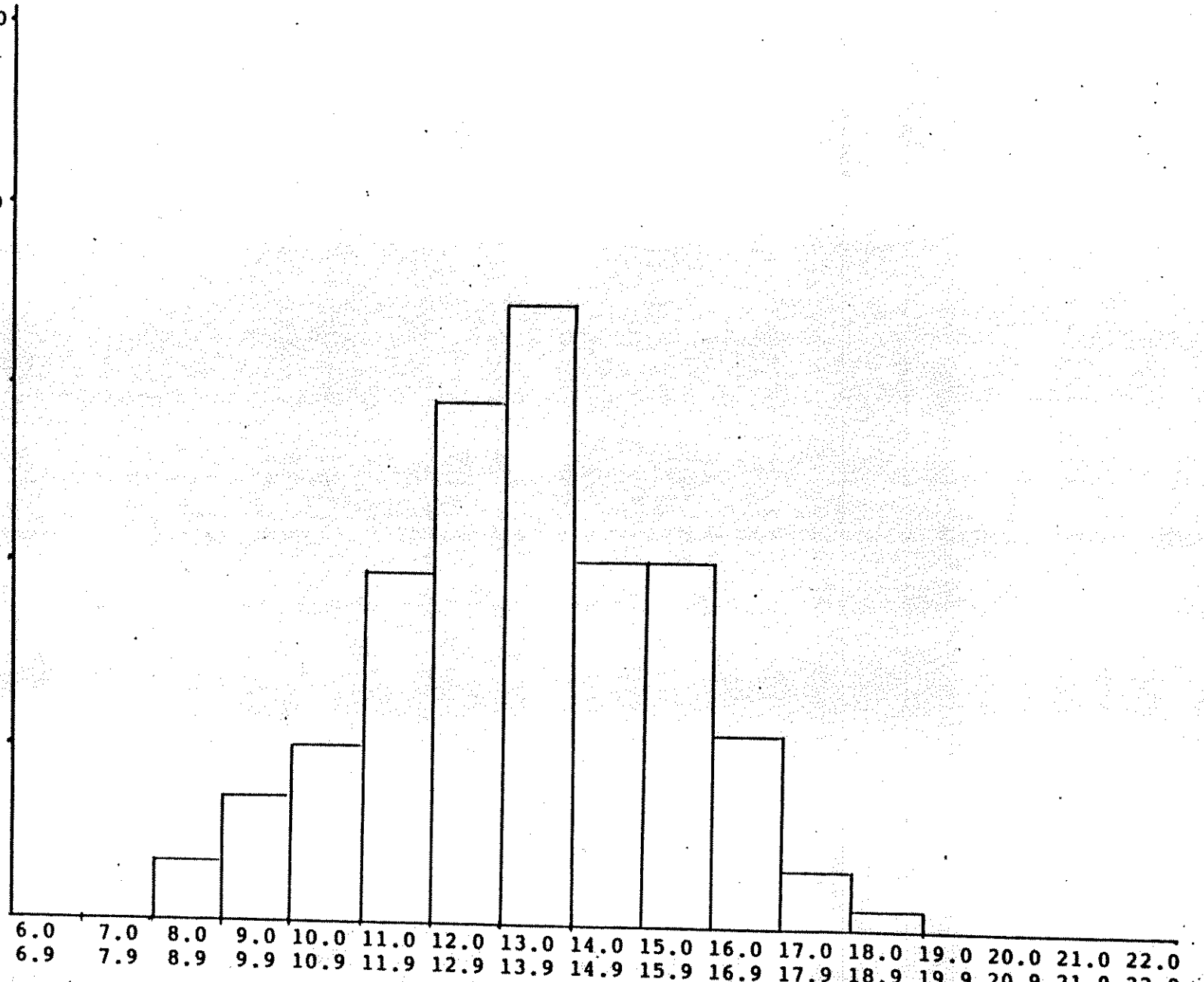


Figure 23. Length Frequency of Scapolerus Arlee Rainbow Jan 1990 N= 174

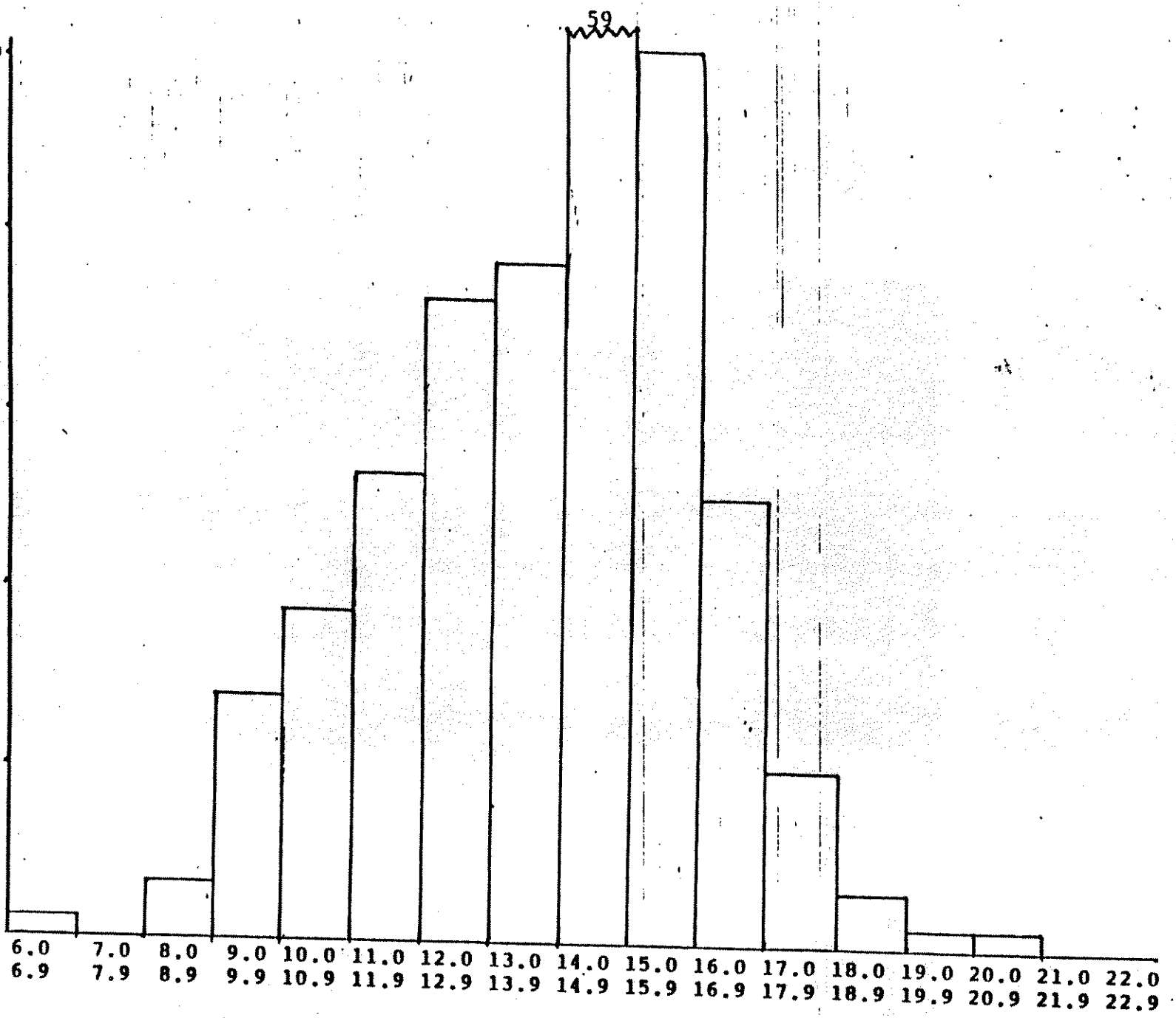


Figure 24 Length Frequency of Georgetown Arlee Rainbow, January 1991 N 282

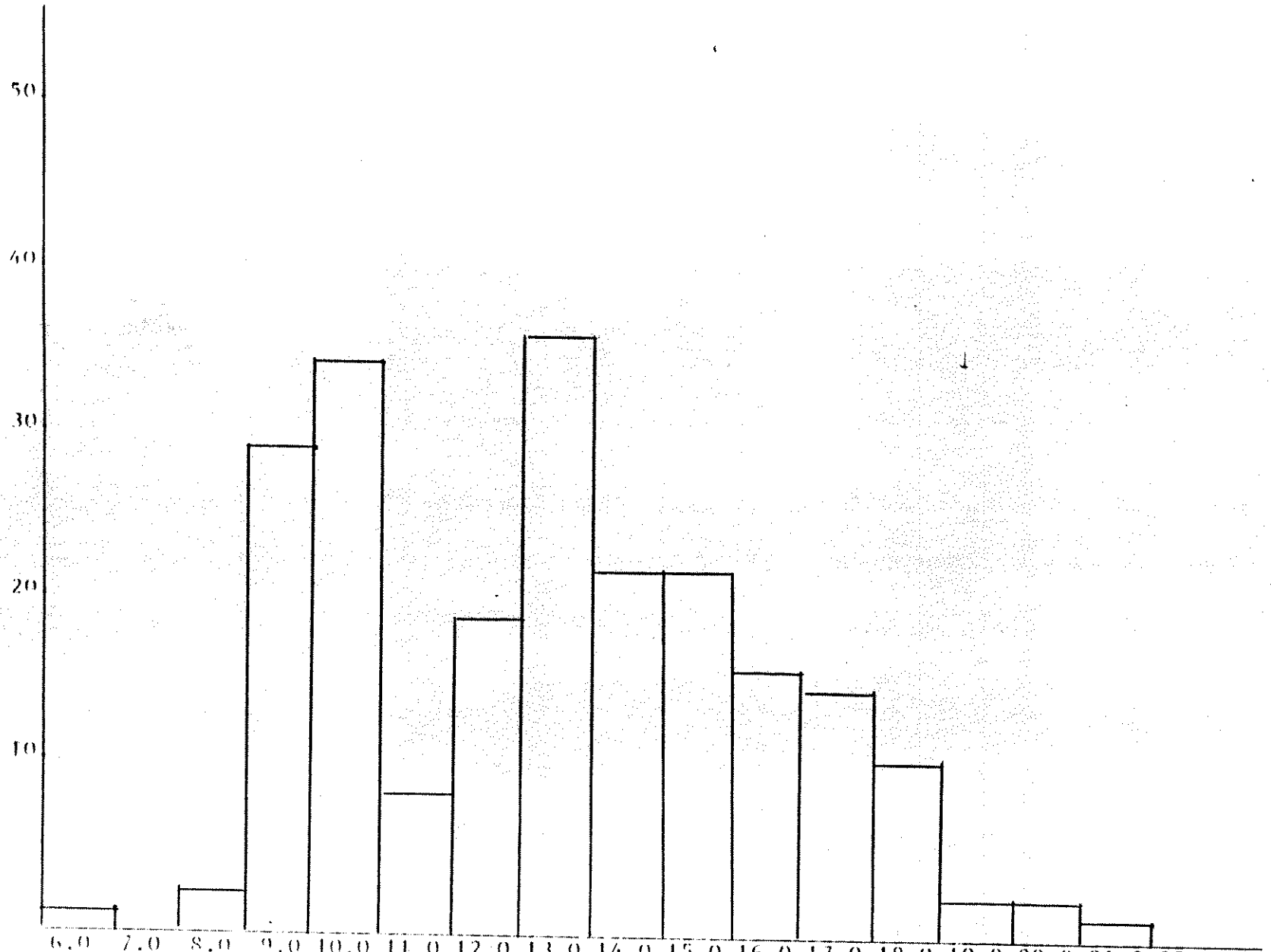


Figure 25. Length frequency of Georgetown Lake Arlee Rainbow, January 1992 N=208

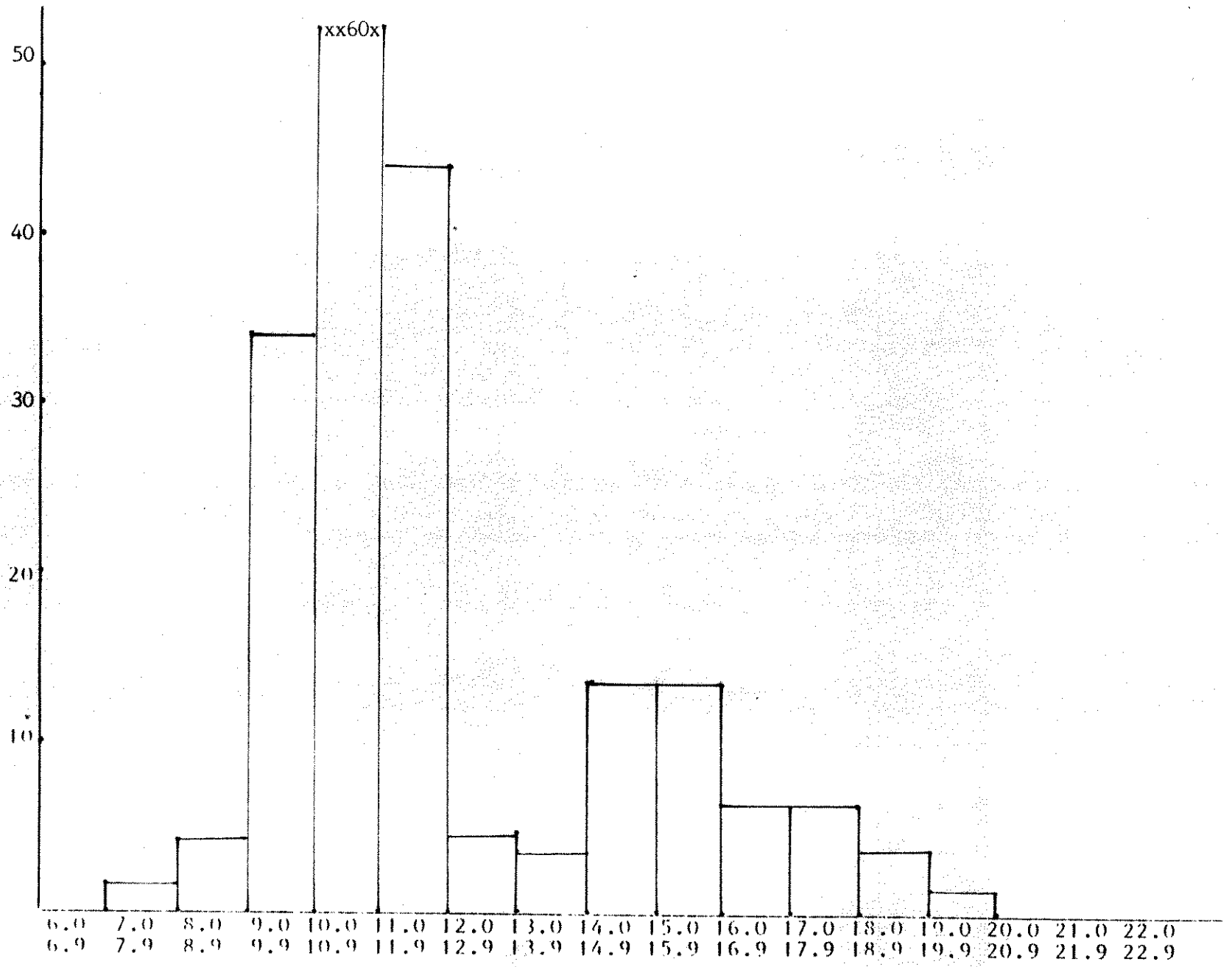


Figure 26. Length frequency of Georgetown Lake Arlee Rainbow, January 1993 N=206

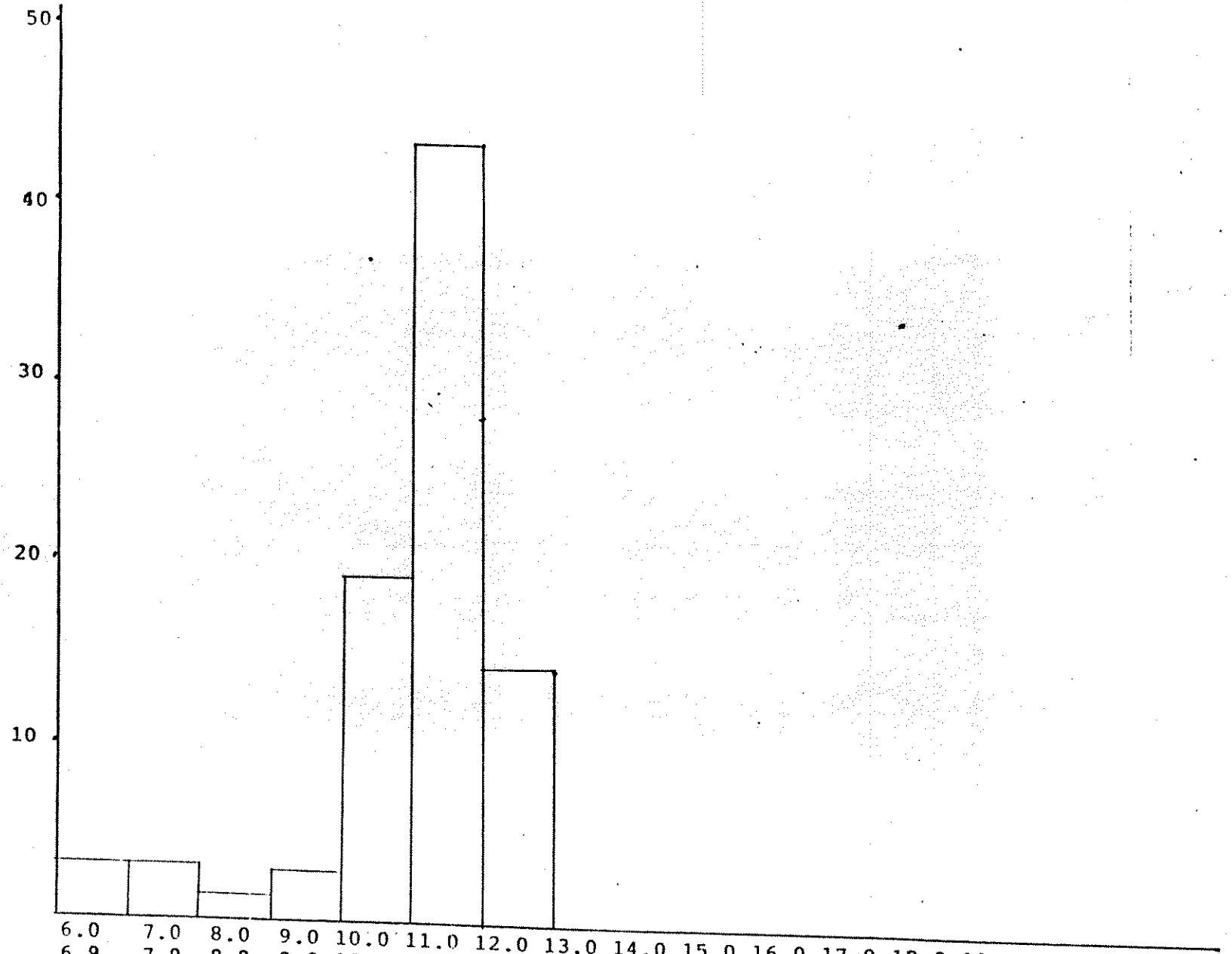


Figure 27 Length Frequency of Georgetown Eagle Lake Rainbow. January 1986. N = 84.

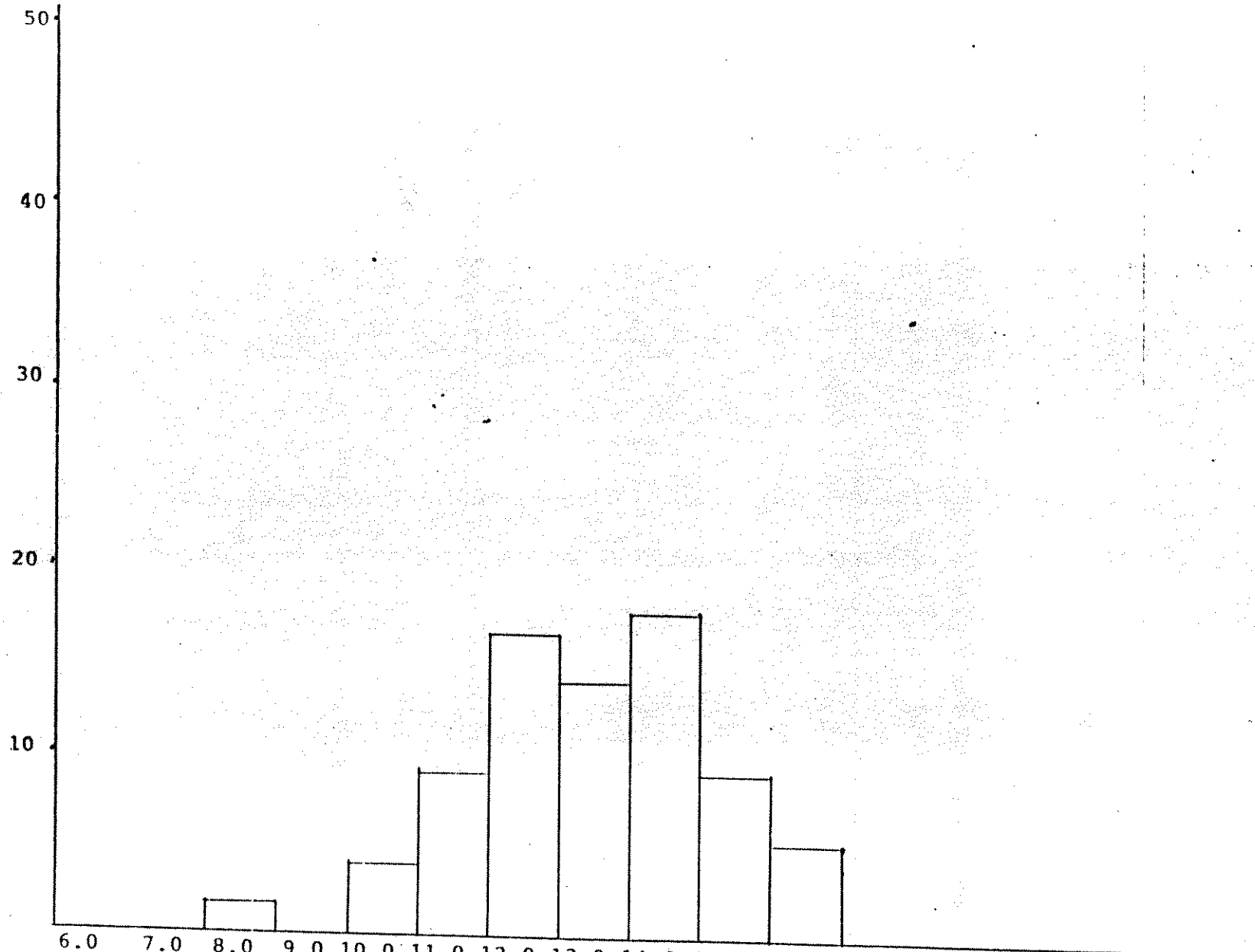


Figure 28 Length Frequency of Georgetown Eagle Lake Rainbow. January 1987. N = 70

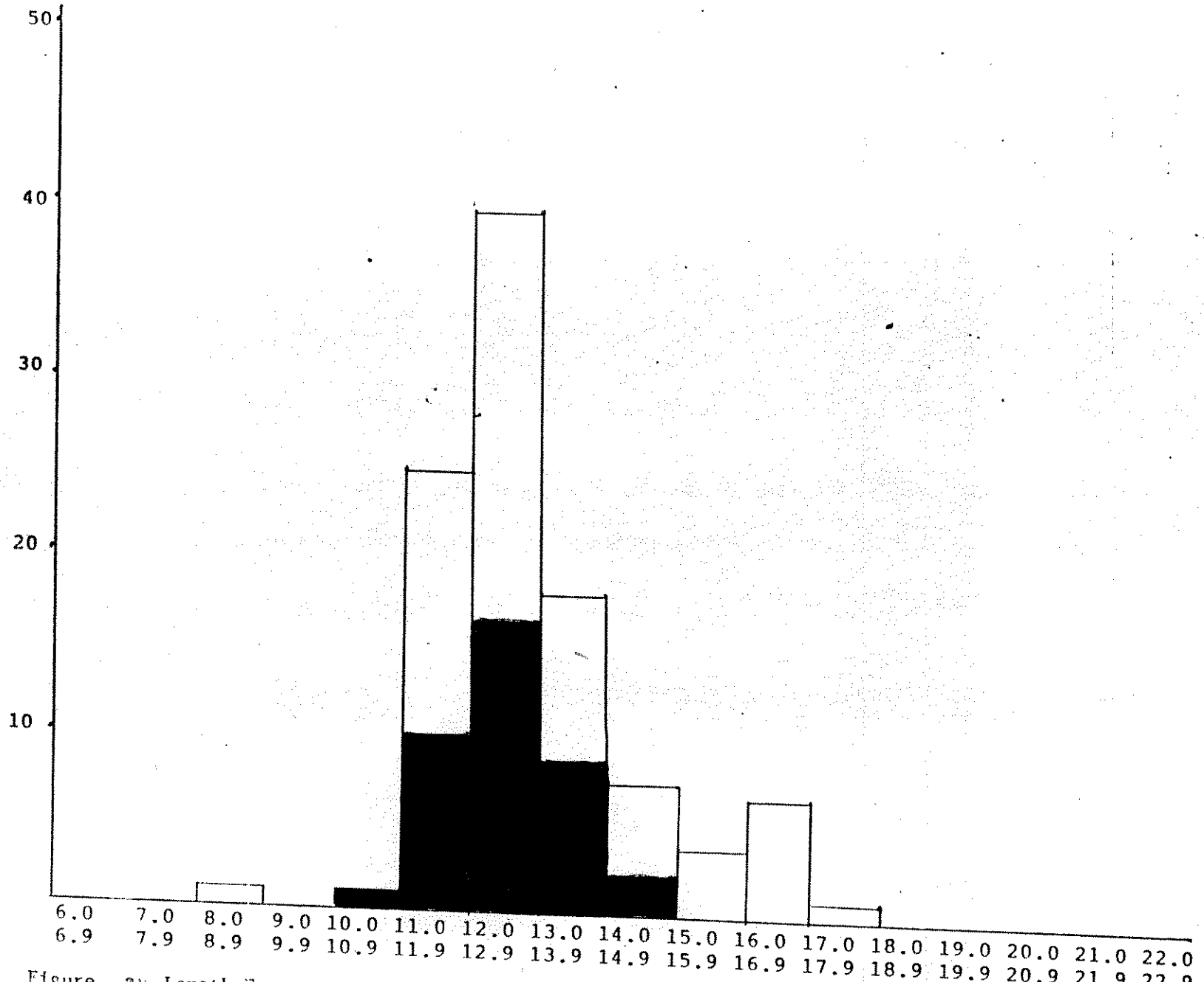


Figure 29 Length Frequency of Georgetown Eagle Lake Rainbow. January 1988. N = 106

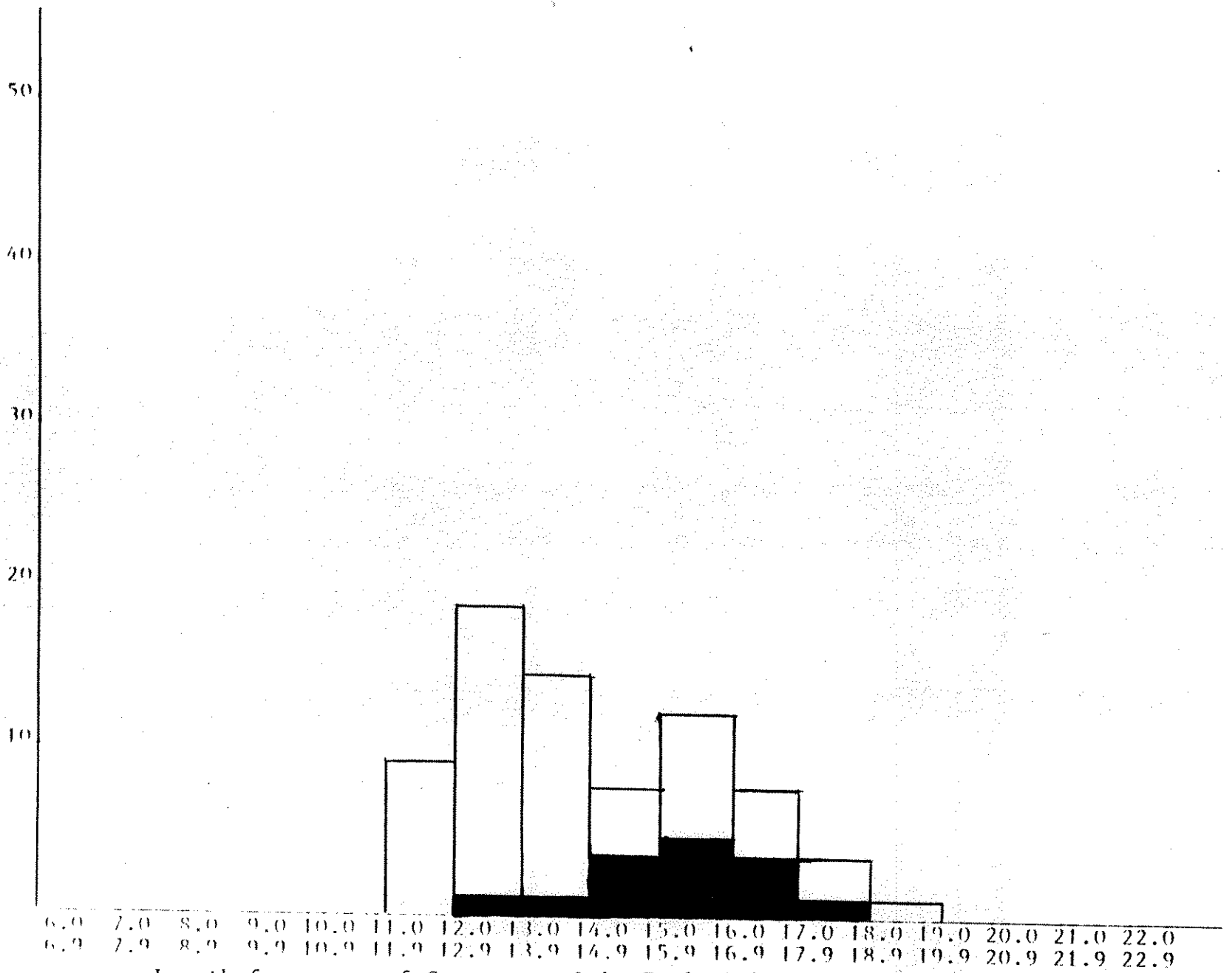


Figure 30. Length frequency of Georgetown Lake Eagle Lake Rainbown, January 1989. N=71
Shaded area is 1986 Plant, N=13

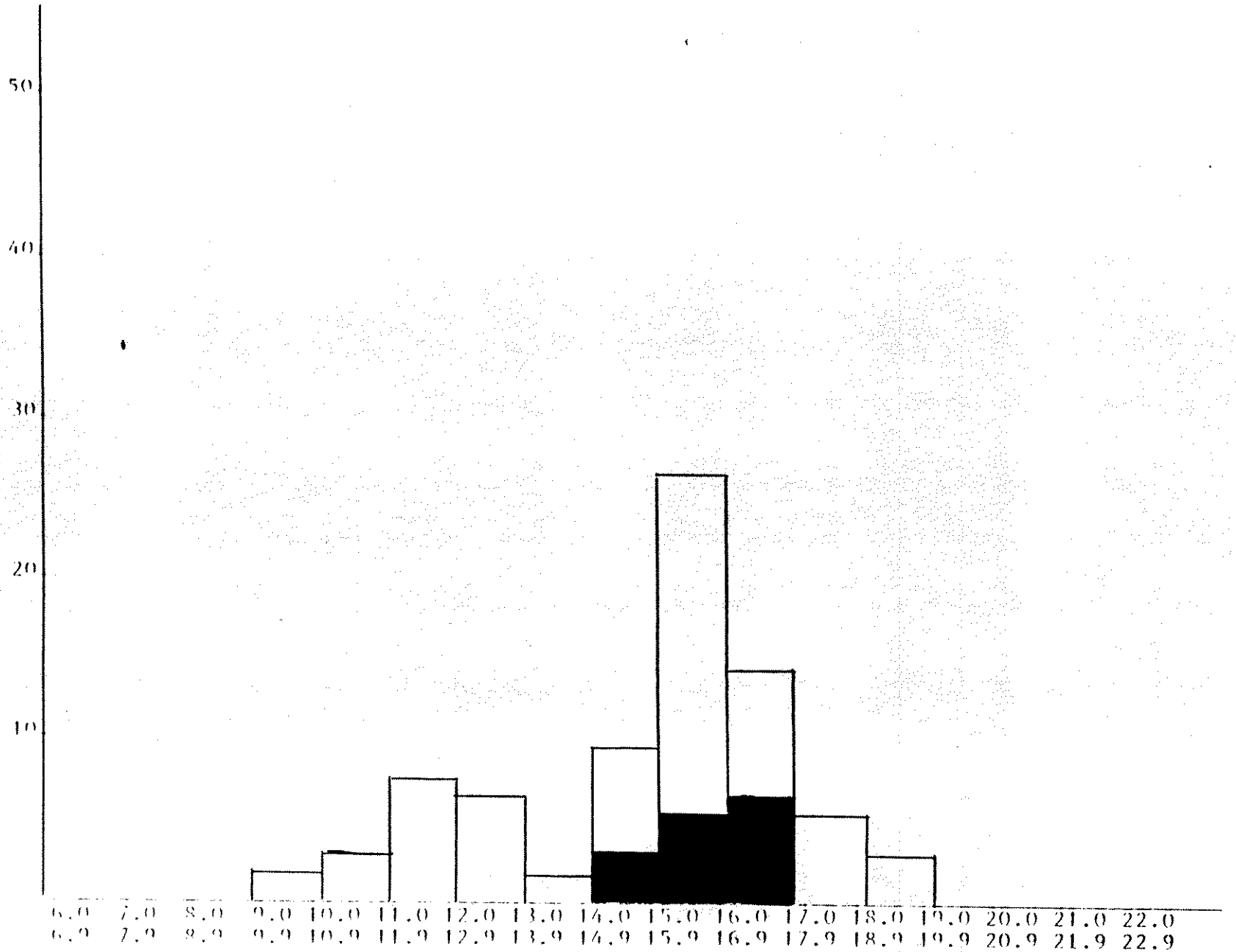


Figure 31. Length frequency of Georgetown Lake Eagle Lake Rainbow, January 1990 N=80
Shaded area is 1986 Plant, N=14

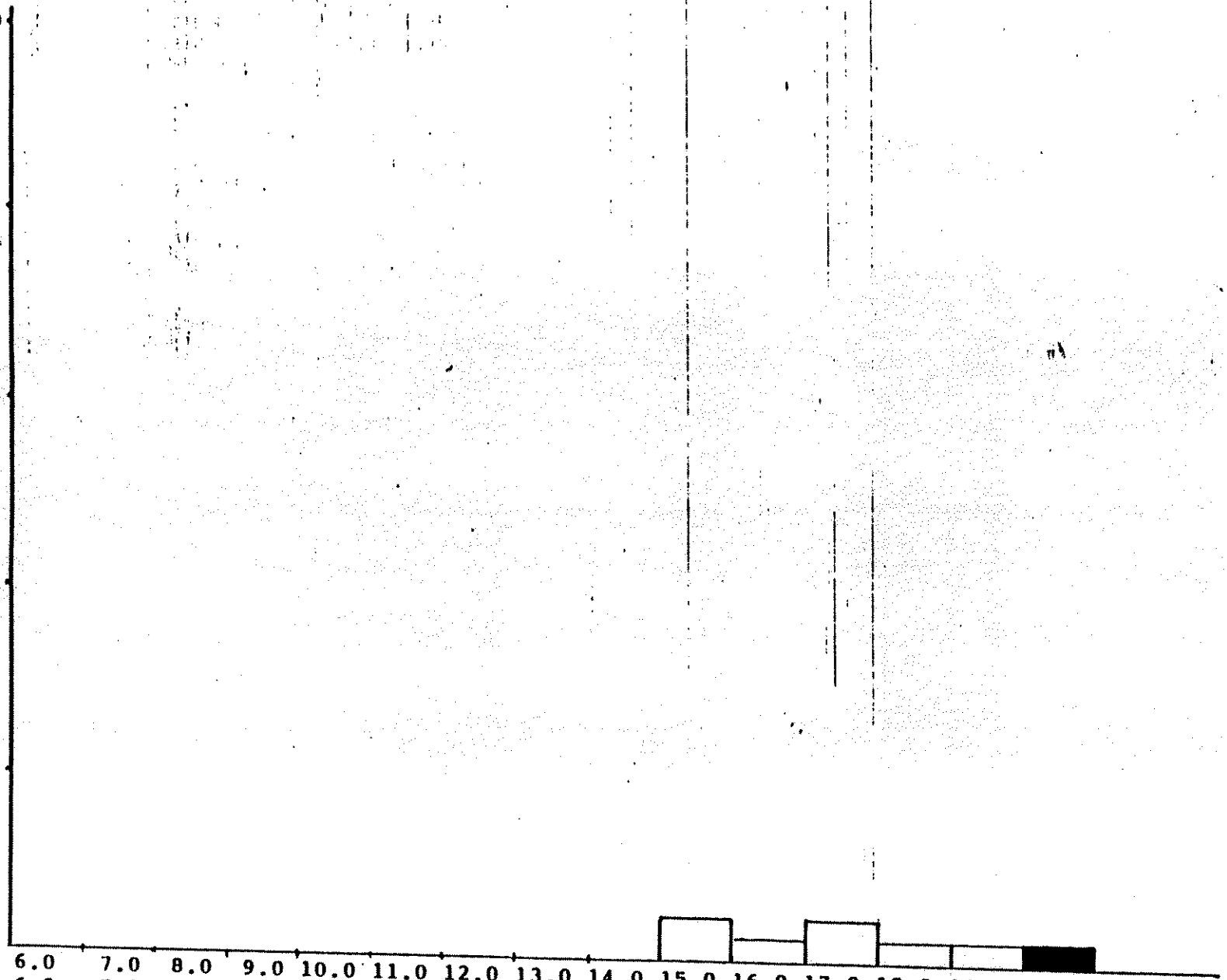


Figure 32 Length frequency of Georgetown Eagle Lake Rainbow. N-8. Shaded area 1986 plant. N-1 January 1991

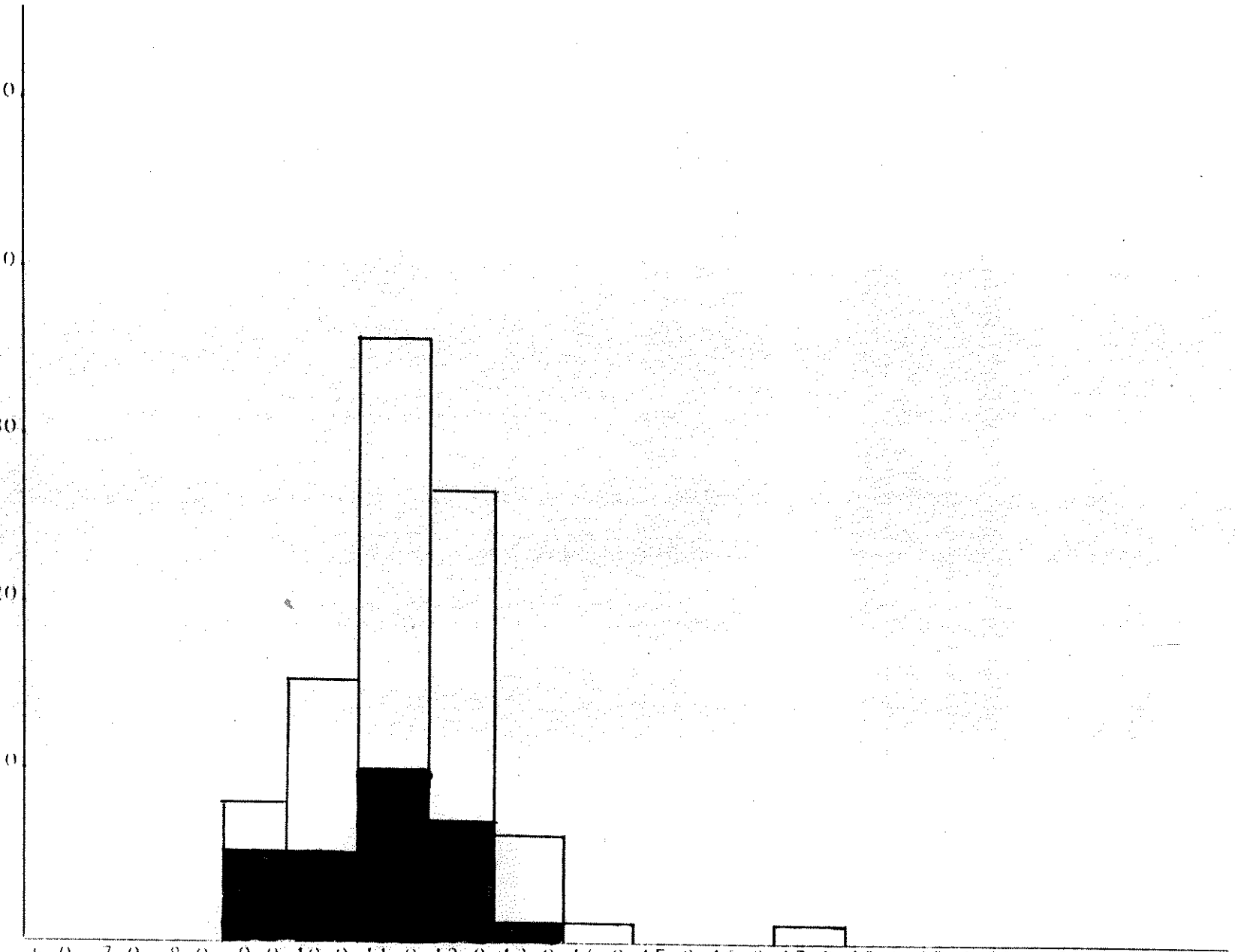


Figure 33. Length frequency of Georgetown Lake Eagle Lake Rainbow, January 1992 N=92
Shaded area is 1990 Plant

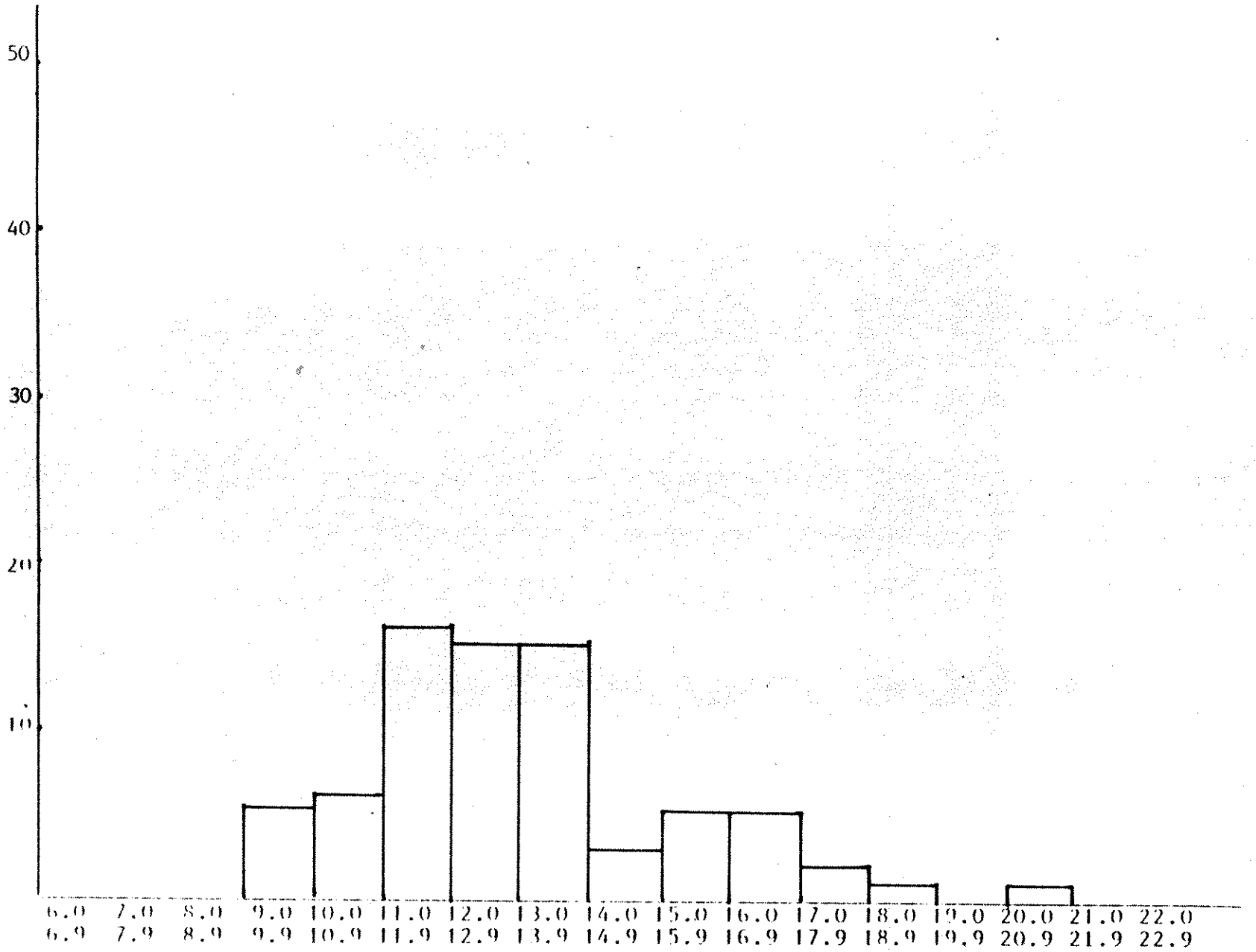


Figure 34. Length frequency of Georgetown Lake Eagle Lake Rainbow, January 1993 N=74

Kamloops rainbow accounted for 7% of the catch in January, 1993. Beginning in 1993, Kamloops were stocked in July at 6-9 inches instead of the September stocking of 3-4 inch fish. Number of Kamloops stocked was reduced from 60,000 to 30,000. It is expected that this change will result in substantially greater Kamloops numbers in the creel. Length histograms for Kamloops are presented in Figures 35-37.

Due to the potential injury to adult fish and fertilized eggs from electrofishing, data collection from spawning rainbows was significantly reduced in 1993. Eighteen spawning rainbows taken on 17 May 1993 in Stuart Mill Creek averaged 18.9 inches in total length and 2.75 pounds (Table 6). The largest rainbow handled was 23.7 inches and 4.7 pounds. Large numbers of spawners were present in spawning locations.

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	
Date 5/17/93					
Number	18	L 18.9			
Number Male	4				
Number Female	14				

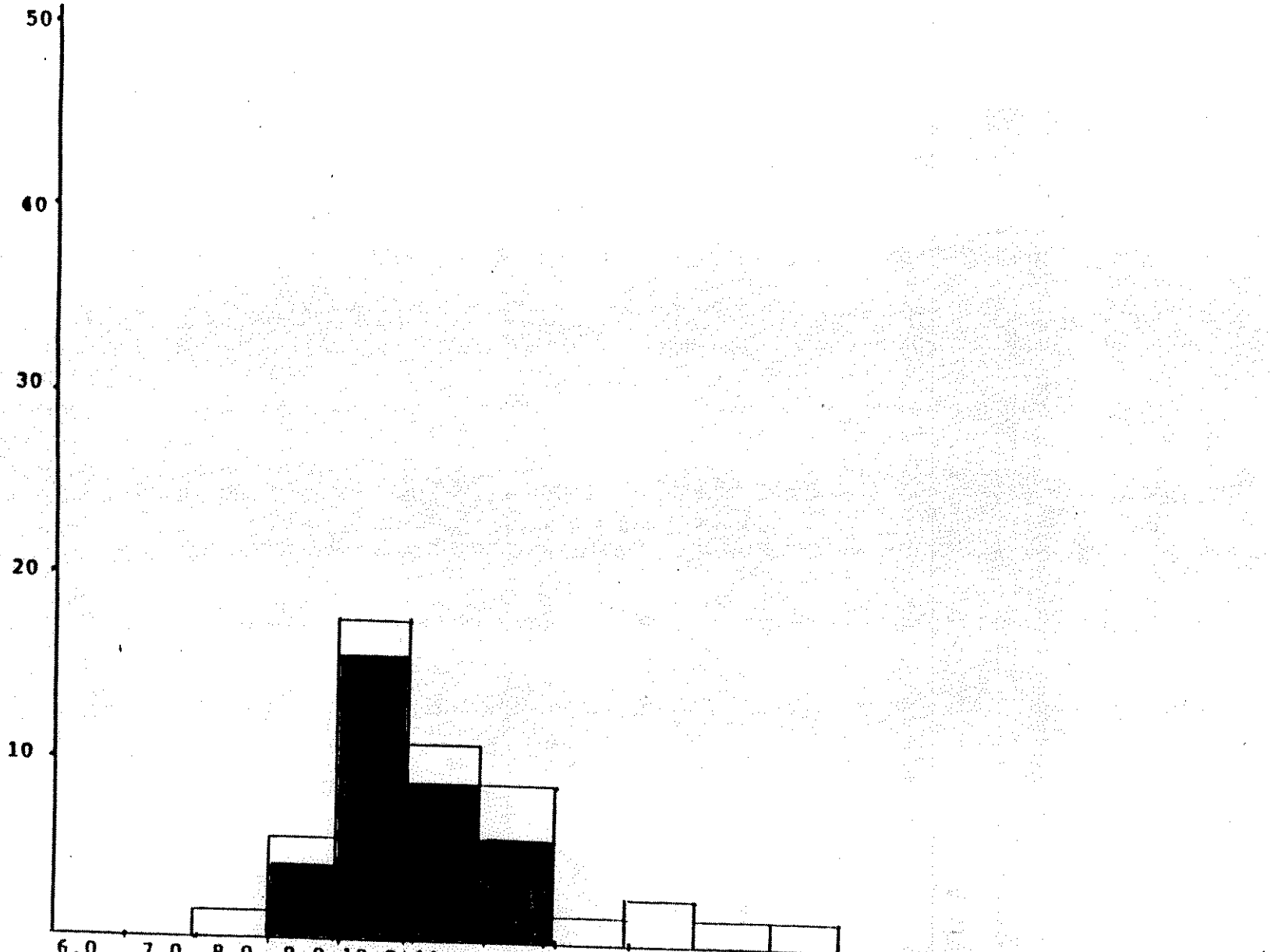


Figure 33 Length frequency of Georgetown Kamloops Rainbow, January 1990 N = 49
Shaded - June 1989 Plant N = 37

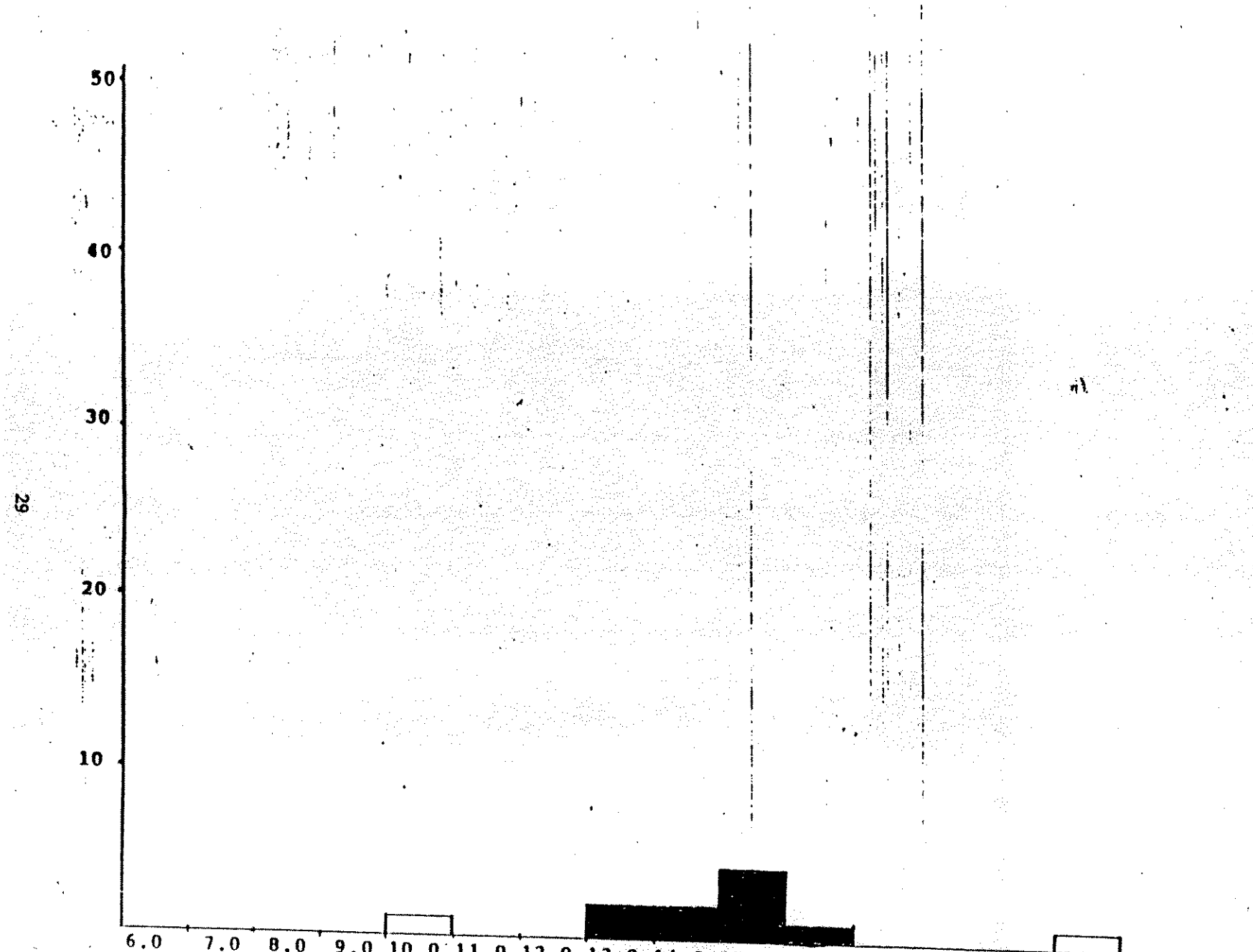


Figure 36 Length frequency of Georgetown Lake Kamloops Rainbow. January 1991. N-11. Shaded June 1989. Plant. N-9.

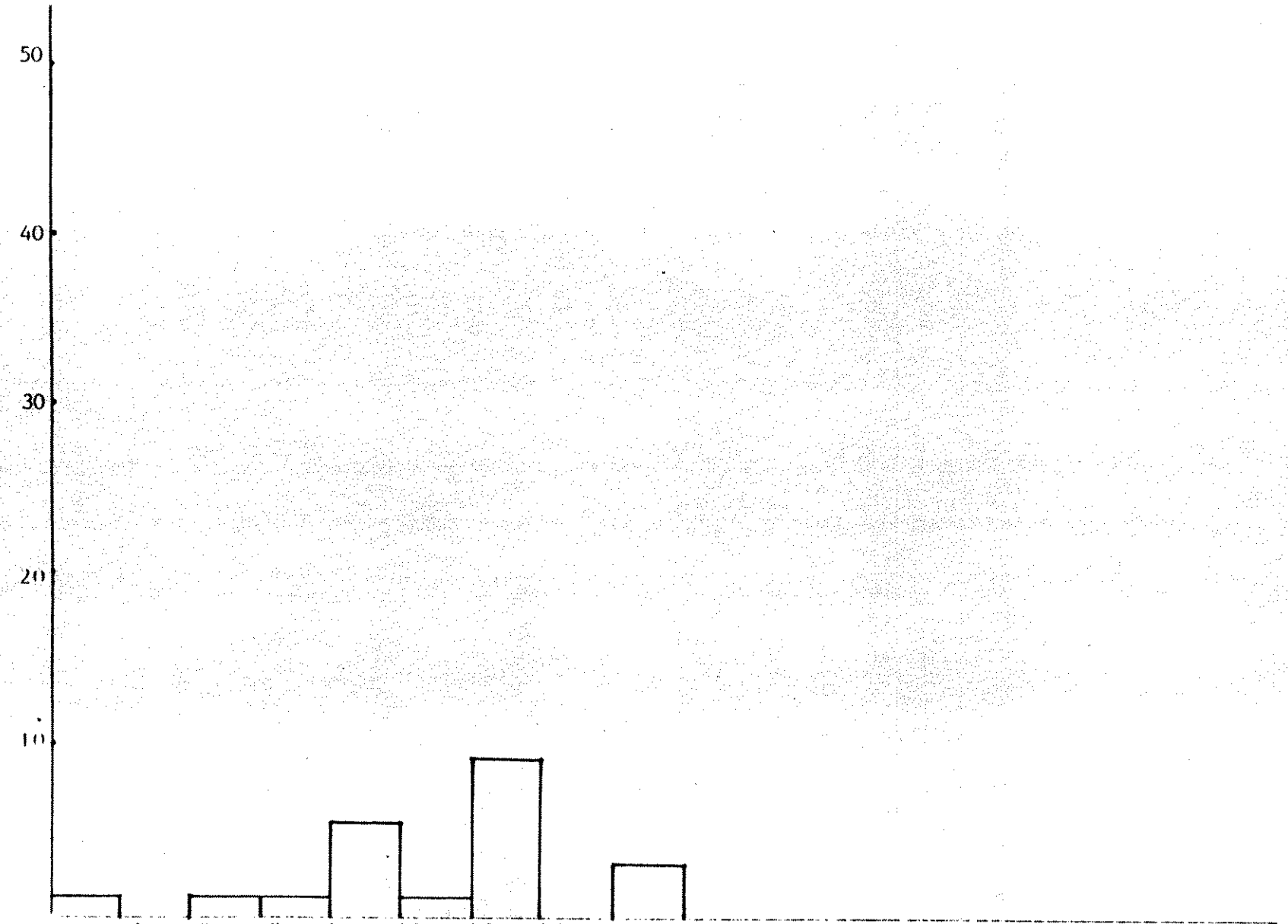


Figure 37. Length frequency of Georgetown Lake Kamloops Rainbow. January 1993 N=21

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

	Surface	1m	2m	3m	4m	5m
1992						
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
1993						
Dec. 92	11.0	11.0	9.9	7.1	4.4	1.9
January	10.5	10.5	8.1	3.5	2.8	2.5
February	8.4	4.8	2.5	.6	.4	.4
March	9.5	7.3	4.1	1.2	.8	.2

Georgetown water levels were unusually low throughout the majority of 1992 and early 1993. Considerable concern about potential trout winterkill existed. Oxygen concentrations under the ice remained within the normal range and no winterkill was experienced. Heavy rainfall in 1993 has raised the reservoir to full pool.

Waters Referred to:

Georgetown Lake
North Fork of Flint Creek
Stuart Mill Creek

Prepared by: Wayne F. Hadley

Date: August 1993

(F46R6.IIB)