

STATUS OF THE MANZANITA LAKE TROUT FISHERY
LASSEN VOLCANIC NATIONAL PARK

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On October 24, 1978, the trout populations in Manzanita Lake were sampled using monofilament gill nets and electro-fishing. The Lassen Park staff had previously arranged with Walter D. Weidlein (Associate Fishery Biologist for the California Department of Fish and Game in Redding, CA) to supply the necessary equipment and expertise for the exercise. The purpose of the survey was to determine what effect the recent cessation of fish stocking had on the structure of rainbow trout (Salmo gairdneri) and brown trout (Salmo trutta) populations in the lake. Brown trout were last stocked in July 1974 and rainbow trout in July 1976. The exercise also served to familiarize some of the park staff with the sampling procedures and equipment.

Two gill nets were fished a total of three hours in mid-afternoon. To keep mortality at a minimum, the nets were inspected at intervals of 15 to 30 minutes. About halfway through the gill-netting period one of the nets was moved into deeper water near the center of the lake from its original location in the southwest arm. The other was kept at the same location near the Manzanita Creek inlet for the entire three hours. The total gill-netting effort yielded a single brown trout measuring 44.5cm fork length. Although this fish was severely tangled in the net, it survived and was later released in Reflection Lake.

When it became dark enough, the sampling procedure was changed from gill-netting to using the California Department of Fish and Game's electro-fishing boat. In order not to exceed the depth limitation of the electronic equipment, the boat was operated over the shallowest part of the lake (near shoreline) almost continuously for three hours. The shocking effort yielded 21 brown trout (size range 11.4 to 54.6cm) and 19 rainbow trout (size range 17.1 to 50.8cm). After taking length measurements and scale samples, the fish were kept in holding tanks until fully recovered and then returned to the lake. No mortality was noted on the day of the exercise nor the following day.

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Due to several shortcomings in the sampling procedure, it is not possible to precisely define current structure of the fish populations in the lake. The apparent low population density requires longer periods of gill net exposure for an adequate sample than the three hours used in this survey. Also, mesh size of the nets used varied from 20 to 75mm; the smallest openings being large enough for fingerling-sized fish to pass through without being caught. The electro-fishing also tended to favor taking the larger fish. Timing of the exercise coincided with spawning activity of the brown trout so the larger of this species would more likely be found congregating in shallow water, especially near the inlet. Also, the electrical frequency selected appeared to be more effective on the larger fish. There probably also was a tendency on the part of the net handler in retrieving fish to select the larger in a group of stunned fish because of greater visibility and a "fisherman's" desire for taking a larger fish. Finally, those segments of the populations occupying the deeper parts of the lake were not adequately sampled and could have contained some of the size classes not significantly represented in the sample.

Although those limitations preclude a precise definition of current population structure, a few comparisons of some population parameters are possible when data from this survey are compared with previous surveys.

The limited success in terms of numbers of fish taken per unit of effort (0.2 fish/hour for the gill-netting operation and 13.3 for electro-fishing) indicates a limited total population size for the lake. Results of previous gill-netting efforts in Manzanita Lake are available for comparison. Hubbell (1961) reported a catch/hour of 0.3 fish and West (1976) caught 1.5 fish per hour of effort. Catch success by both investigators was quite low. Compare, for example; Butte Lake, 8.4 fish/hour (Hubbell, 1960); Snag Lake, 3.3 fish/hour and Horseshoe Lake, 6.3 fish/hour (Everest, 1964). Weidlein (personal communication)

reports having much higher success using electro-fishing techniques in waters having high density fish populations. In-other-words, catch success using these sampling methods apparently is directly proportional to population density.

Even though the total population density may be low, the differences in gill net catch per unit of effort for the three surveys are small, so the data do not indicate any decrease in density since 1961.

To compare further this survey with West's (1976) and Hubbell's (1961) surveys, the data were tabulated (Tables 1,2 and 3) and regression curves were computed for rainbow trout (Figure 1) and for brown trout (Figure 2). Relative positions of the three curves for each species signify little except sample size. The 1961 curves are based on a sample of 264 fish (Table 3); for 1976, forty-one fish (Table 2); and for 1978, forty fish (Table 1). The inference here is that the 1961 sample, being larger, provided curves that more nearly approximated the true population structure at the time the survey was made. The same probably is not true for the 1976 and 1978 surveys.

Hubbell's sample not only was larger than either of the others, he also attempted to reduce bias against taking small size-class fish by supplementing the gill-netting with seining. No seining was done in the 1976 survey, so data from it are biased against fish less than about 10cm long, since they would readily pass through the smallest mesh openings in the gill nets. For the reasons stated previously, the 1978 survey data also are biased against the smaller size classes.

Size structure of a fish population generally is an indication of the productive and survival efficiency of that population. A stable or increasing population would contain many small individuals and few large ones. The reverse is true of a declining population; that is, a predominance of large fish. Based on these considerations, on the stocking history and on the biases discussed above, the curves in Figures 1 and 2 are interpreted as follows.

Little bias is apparent in the 1961 data, and the slope of the curves for these data are steep. This indicates that, even though Hubbell (1961, p.37) considered the lake to be understocked, both rainbow and brown trout populations were at least stable and possibly were expanding. (It should be noted here that the lake was, at the time of Hubbell's survey, being stocked on an annual or semi-annual schedule, so the extent that self-regeneration contributed to this condition is not known).

Considering the small sample size and the bias against fingerling-sized fish, the rainbow trout curve for 1976 (Figure 1) shows a good proportional relationship between the size classes. That is, there were relatively more smaller than larger fish; an indication of population stability. This conclusion is strengthened if it is considered that the taking of any fingerling-sized fish would have resulted in a steepened slope for the curve.

The brown trout curve for 1976 (Figure 2) is based on a very small sample (Table 2) so that any conclusions regarding population structure probably are invalid. However, since less than half as many brown trout as rainbow trout were captured, it appears that the brown trout population size has declined since 1961 and the rainbow trout are now the dominant species in the lake. The 1978 sample supports this conclusion also. Some bias toward the larger brown trout was expected because of their spawning activity, yet only two more brown trout were taken than rainbow trout.

The 1978 curves for both rainbow and brown trout show a predominance of large fish, which in a natural population is an indication of population decline. However, such a conclusion is not justified in this case because of the strong possibility that the sampling method favored selection of larger fish.

The fish populations in Manzanita Lake have been, and still are, complicated by scheduled stocking in the past. All fish captured in the three surveys can be related to the stocking records (Table 4) and so the extent that natural regeneration contributes to the population size or structure remains unknown.

It is therefore recommended that any surveys in the future include methods which will permit taking representative samples of the small size-class fish. It also would be advisable to fin-clip, or otherwise mark, all small fish captured so the extent that natural propagation contributes to the fishery can be determined regardless of whether or not future management includes fish stocking.

Table 1. Fish sampled by electro-fishing from Manzanita Lake
October 24, 1978

SIZE CLASS (cm)	MID- POINT	NUMBER OF FISH	
		RAINBOW TROUT	BROWN TROUT
10-14.9	12.5	0	1
15-19.9	17.5	2	0
20-24.9	22.5	2	0
25-29.9	27.5	3	0
30-34.9	32.5	2	1
35-39.9	37.5	2	2
40-44.9	42.5	6	5
45-49.9	47.5	1	7
50-54.9	52.5	1	5
		<u>19</u>	<u>21</u>

Table 2. Fish sampled by gillnetting from Manzanita Lake
(West, 1976)

SIZE CLASS (cm)	MID- POINT	NUMBER OF FISH	
		RAINBOW TROUT	BROWN TROUT
15-19.9	17.5	3	0
20-24.9	22.5	12	0
25-29.9	27.5	2	2
30-34.9	32.5	2	1
35-39.9	37.5	2	2
40-44.9	42.5	5	0
45-49.9	47.5	2	7
50-54.9	52.5	1	0
		<u>29</u>	<u>12</u>

Table 3. Fish sampled by gillnetting from Manzanita Lake
(Hubbell, 1961)

AGE GROUP	RAINBOW TROUT		BROWN TROUT	
	NUMBER	MEAN LENGTH (cm)	NUMBER	MEAN LENGTH (cm)
0	19	3.7	69	7.2
I	12	15.1	18	14.7
II	5	22.6	93	24.1
III	6	30.6	10	34.2
IV	4	41.1	7	42.9
V	1	57.0	19	50.4
VI			1	58.1
	47		217	

Table 4. Recent fish stocking in the Manzanita Creek system (Manzanita Creek, Manzanita Lake and Reflection Lake)

BROWN TROUT			RAINBOW TROUT		
DATE	AVERAGE SIZE	NUMBER	DATE	AVERAGE SIZE	NUMBER
7/70	4.1cm	5,184	7/70	8.9cm	5,016
7/71	12.7cm	5,440	7/71	9.5cm	5,040
7/72	5.3cm	5,200	8/72	31.8cm	200
8/73	5.3cm	4,416	6/73	10.2cm	5,000
7/74	4.8cm	5,040	7/74	6.6cm	3,072
			7/76	10.8cm	5,018
			9/78	35.5cm	150

Figure 1. Number of fish as a function of fish size for rainbow trout population samples from Manzanita Lake. Data from Hubbell (1961), West (1976) and electro-fishing October 24, 1978.

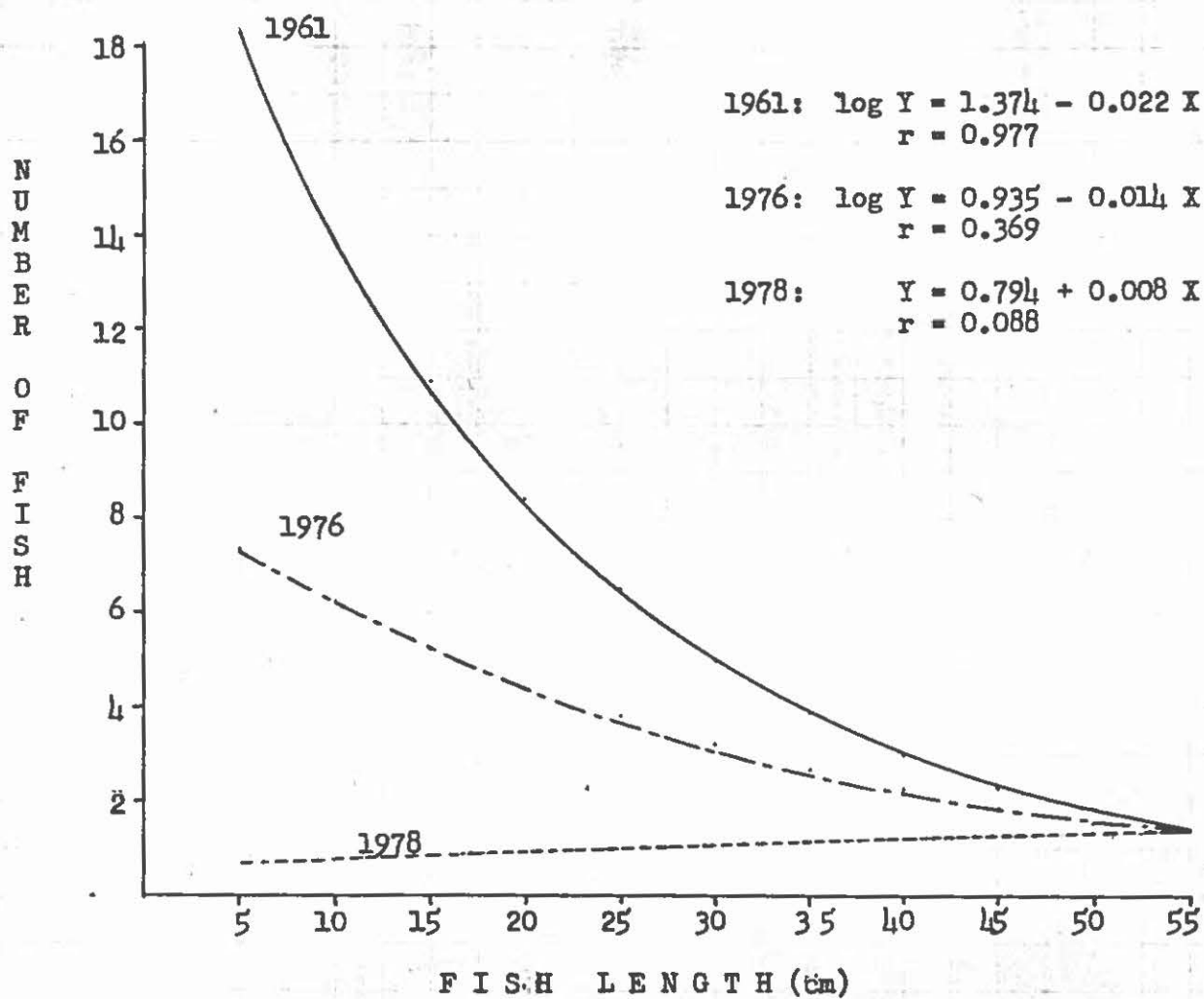
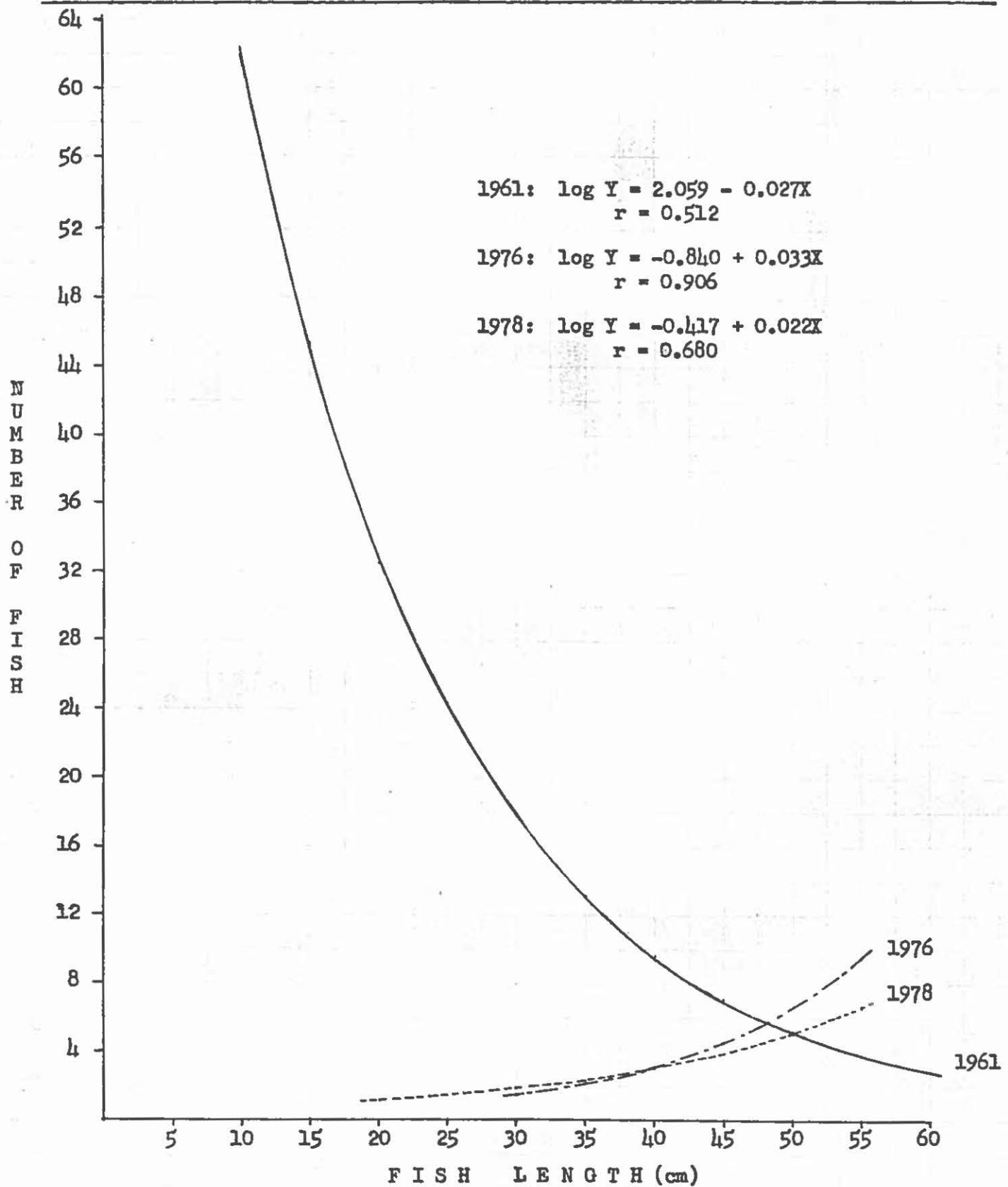


Figure 2. Number of fish as a function of fish length for brown trout population samples from Manzanita Lake. Data from Hubbell (1961), West (1976) and electro-fishing on October 24, 1978.



LITERATURE CITED

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