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State of California
The Resources Agency
DEPARTMENT OF FISH AND GAME

STANDING STOCKS OF FISHES IN SECTIONS
OF INDIAN CREEK, PLUMAS COUNTY, 1978

By

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Bay-Delta Fishery Project
Contract Services Section
Information Report
79-2

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This report, which has been reviewed only by the Contract Services Supervisor, contains data that would not otherwise be available in a report format. The work was funded by the Department of Water Resources under W. A. 1600.

INTRODUCTION

In 1976, the Department of Water Resources (DWR) initiated an instream flow program. The purpose of this program is to identify streams that would benefit from flow enhancement, assess instream values and identify trade-offs required to enhance these streams. The Northern District of DWR selected Indian Creek below Antelope Reservoir (Figure 1) as one of the streams to study under this program. Initial flow studies by DWR indicated that flow augmentation could double trout habitat in the first 16 km of Indian Creek below the dam and increase habitat by 25% in lower reaches. As a result of this study, DWR and the Department of Fish and Game decided to reoperate Antelope Reservoir to increase flow releases to 0.6 cms year-round on a trial basis. These flows would be such that recreation at Antelope Reservoir would not be impaired.

The role of the Contract Services Section in this study is to monitor fish populations in selected sections of Indian Creek and assist DWR personnel in determining fishing effort and catch in the creek. This report describes sections of the creek we sampled, fish species we caught, and fish biomass at each station.

METHODS

Standing stocks of fishes were estimated at six stations in Indian Creek (Figure 1). Each station contained riffles and pools. Stations were selected to be near stations that had been sampled in previous studies. Markers were placed in trees along the stream to permanently establish station boundaries for future sampling. Each station was not necessarily

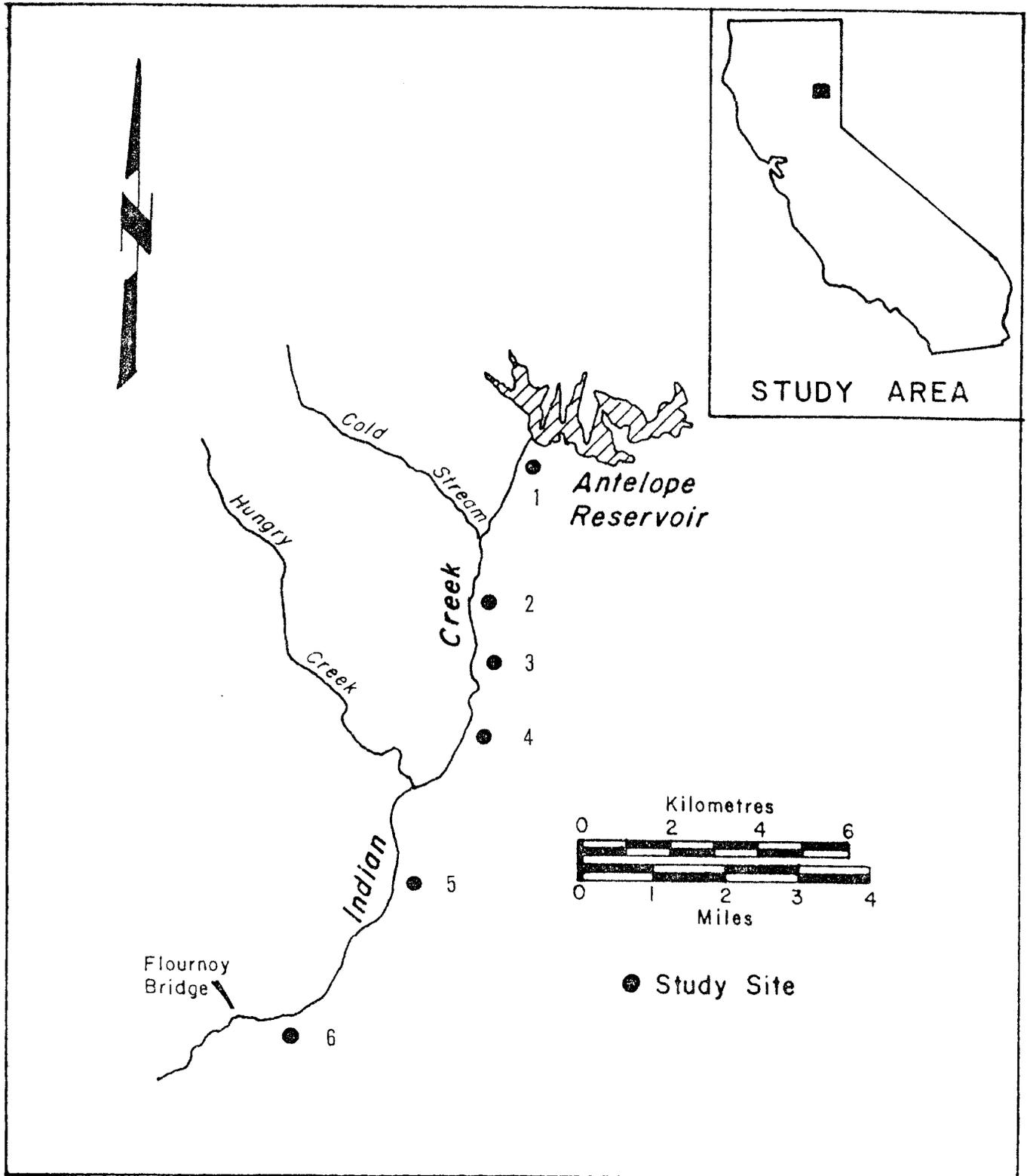


Figure 1. - Stations which were sampled to determine biomass of fishes in Indian Creek, Plumas County, October 1977.

representative of the stream reach in which it was located. Stations varied in length from 32 to 73 m. The length, average width, and average depth of each station was measured with a cloth tape. Fish were captured with a battery-powered backpack electroshocker in stream sections blocked by seines. Fish were removed from the net-enclosed section on each pass. Standing stock estimates were developed using the two-count method of Seber and LeCren (1967) or the multiple-pass method of Leslie and Davis (1939) with limits of confidence computed using a formula proposed by DeLury (1951).

The weight of each fish, except brown bullhead (Ictalurus nebulosus), was determined by displacement. Fork length of each fish, except brown bullhead, was measured to the nearest millimetre.

Scales were mounted dry between microscope slides and their images were projected on a table through a Bausch and Lomb microprojector at a magnification of 42X. Scale measurements for the calculation of growth were recorded to the nearest millimetre along the anterior radius of the anterior-posterior axis of the scale.

Geometric mean functional regressions were used to describe the body-scale and length-weight relationships (Ricker, 1975). Information on growth was developed using the von Bertalanffy growth function and a Walford graph (Walford, 1946). Estimation of true mean growth rate (G) was calculated using the methods of Ricker (1975).

RESULTS

Distribution

We caught brown trout (Salmo trutta), rainbow trout (Salmo gairdneri), brown bullhead, Lahontan redbside (Richardsonius egregius), golden shiner (Notemigonus crysoleucas), Sacramento sucker (Catostomus occidentalis), and

Sacramento squawfish (Ptychocheilus grandis) in Indian Creek. Brown trout were caught at every station. We observed rainbow trout throughout the creek, although we did not catch them at each station. We caught brown bullheads, Lahontan redbside, and golden shiners near Antelope Reservoir, but not at downstream sections. We caught Sacramento squawfish and Sacramento suckers only at the lowest section of the sampling area (Table 1).

Standing Crop

Brown trout were the most common game fish caught and biomass averaged 5.8 g/m² at six stations (Table 2). Rainbow trout averaged 0.7 g/m² in three stations (Table 3). Brown trout large enough to catch (127 mm FL) averaged 5.3 g/m² (97 fish/ha) and rainbow trout large enough to catch averaged 0.7 g/m² (12 fish/ha).

Sacramento sucker was the most common non-salmonid fish caught. We calculated a biomass of 4.9 g/m² for our lowest station. Sacramento squawfish biomass was 0.02 g/m² in the same station. Brown bullhead biomass was 0.4 g/m² in our station nearest the dam. Lahontan redbside biomass was 0.1 g/m² and golden shiner biomass was 0.01 g/m² in the same station. We did not catch non-salmonid fishes in other stations (Table 4).

Age and Growth

The formula $L = 4.495 + 3.207 S$ describes the relationship between the fork length (L) and enlarged scale radius (S) of 122 brown trout. The coefficient of correlation (r) is 0.96. The formula was $L = 44.610 + 2.801 S$ for 24 rainbow trout. The value for r is 0.92.

Growth as measured for the population and for the mean of individual growth rates was faster for age 1+ brown trout than for age 2+ fish (Table 5). We did not compute growth for rainbow trout.

TABLE 1
 DISTRIBUTION OF FISHES IN
 SECTIONS OF INDIAN CREEK,
 PLUMAS COUNTY, 1978

	<u>Station Number</u>					
	1	2	3	4	5	6
Distance below Antelope Dam (km)	0.6	3.9	5.3	6.8	12.3	21.0
Brown Trout	X	X	X	X	X	X
Rainbow Trout	X			X	X	X
Brown Bullhead	X					
Lahontan Redside	X					
Golden Shiner	X					
Sacramento Sucker						X
Sacramento Squawfish						X

TABLE 2

ESTIMATE OF BROWN TROUT STANDING CROP
IN INDIAN CREEK, PLUMAS COUNTY, 1978

Distance Below Antelope Dam (km)	Population Estimate	95 Percent Confidence Interval	Biomass g/m ²	Estimate of Catchable Trout (127 mm FL)	Biomass of Catchable Trout g/m ²
0.6	5	2-7	0.8	1	0.6
3.9	47	41-53	6.4	10	4.9
5.3	55	46-65	14.4	31	13.5
6.8	15	11-19	1.8	3	1.2
12.3	19	16-21	1.1	6	0.9
21.0	1	1-1	1.1	1	1.1

TABLE 3

ESTIMATES OF RAINBOW TROUT STANDING CROP
IN INDIAN CREEK, PLUMAS COUNTY, 1978

Distance Below Antelope Dam (km)	Population Estimate	95 Percent Confidence Interval	Biomass g/m ²	Estimate of Catchable Trout (127 mm FL)	Biomass of Catchable Trout g/m ²
0.6	1	1-1	0.7	1	0.7
6.8	1	1-1	0.1	1	0.1
12.3	12	4-20	0.2	1	0.2
21.0	14	10-19	1.9	6	1.6

TABLE 4

ESTIMATES OF STANDING CROPS OF NONGAME FISHES
IN INDIAN CREEK, PLUMAS COUNTY, 1978

Distance Below Antelope Dam (km)	Species	Population Estimate	95 Percent Confidence Interval	Biomass g/m ²
0.6	Brown Bullhead	17	10-24	0.4
0.6	Golden Shiner	1	1-1	0.01
0.6	Lahontan Redside	2	2-2	0.1
21.0	Sacramento Sucker	98	80-115	4.9
21.0	Sacramento Squawfish	1	1-1	0.02

TABLE 5

GROWTH RATES FOR BROWN TROUT
CAUGHT IN INDIAN CREEK, 1978

Age Interval	Population Growth			Mean Individual Growth		
	Length Interval mm	Difference Of Natural Logarithms	Instantaneous Growth Rate G _x	Length Interval mm	Difference of Natural Logarithms	Instantaneous Growth Rate G
1-2	89-188	0.748	2.220	107-188	0.588	1.722
2-3	188-258	0.317	0.941	203-258	0.240	0.846

The von Bertalanffy equation as estimated for the brown trout population is: $L_t = 456 (1 - e^{-0.301(t - 0.084)})$

where L_t = length at age t

We caught no brown trout older than 3+ years. Fish of this age averaged 258 mm in length, while 2+ fish averaged 189 mm, and 1+ fish averaged 96 mm (Table 6).

TABLE 6

CALCULATED FORK LENGTH IN MILLIMETRES OF BROWN TROUT
FROM INDIAN CREEK, PLUMAS COUNTY -- SEPTEMBER 1978

Age	No. of Fish	Length at Capture	Calculated Lengths at Successive Annuli		
			1	2	3
1	52	183	89		
2	34	245	107	188	
3	3	304	107	203	258
Number of Back-calculations			89	37	3
Weighted Means (mm)			96	189	258
Increments (mm)			96	93	69

Length and Weight

Age group 0+ brown trout represented 61% of the catch, while 1+ fish made up 24%, 2+ fish comprised 12% and 3+ fish represented 3% (Figure 2). In contrast, age 0+ rainbow trout comprised 43% of the catch while age 1+ through 3+ fish made up 38, 16, and 3%, respectively (Figure 3).

The relationship between length (L) and weight (W) of brown trout is:

$$\text{Log}_{10}W = -4.835 + 2.955 \text{Log}_{10}L$$

$$r = 0.996$$

$$N = 182 \text{ (Figure 4)}$$

The same relationship for rainbow trout is:

$$\text{Log}_{10}W = -4.905 + 2.989 \text{Log}_{10}L$$

$$r = 0.992$$

$$N = 40 \text{ (Figure 5)}$$

Coefficient of Condition

We calculated the coefficient of condition and 95% confidence limits for 173 brown trout and 47 rainbow trout (Table 7).

There is no significant difference between the coefficient of condition for any age group of rainbow or brown trout we tested, or for male or female brown trout ("+" test, 0.05 level).

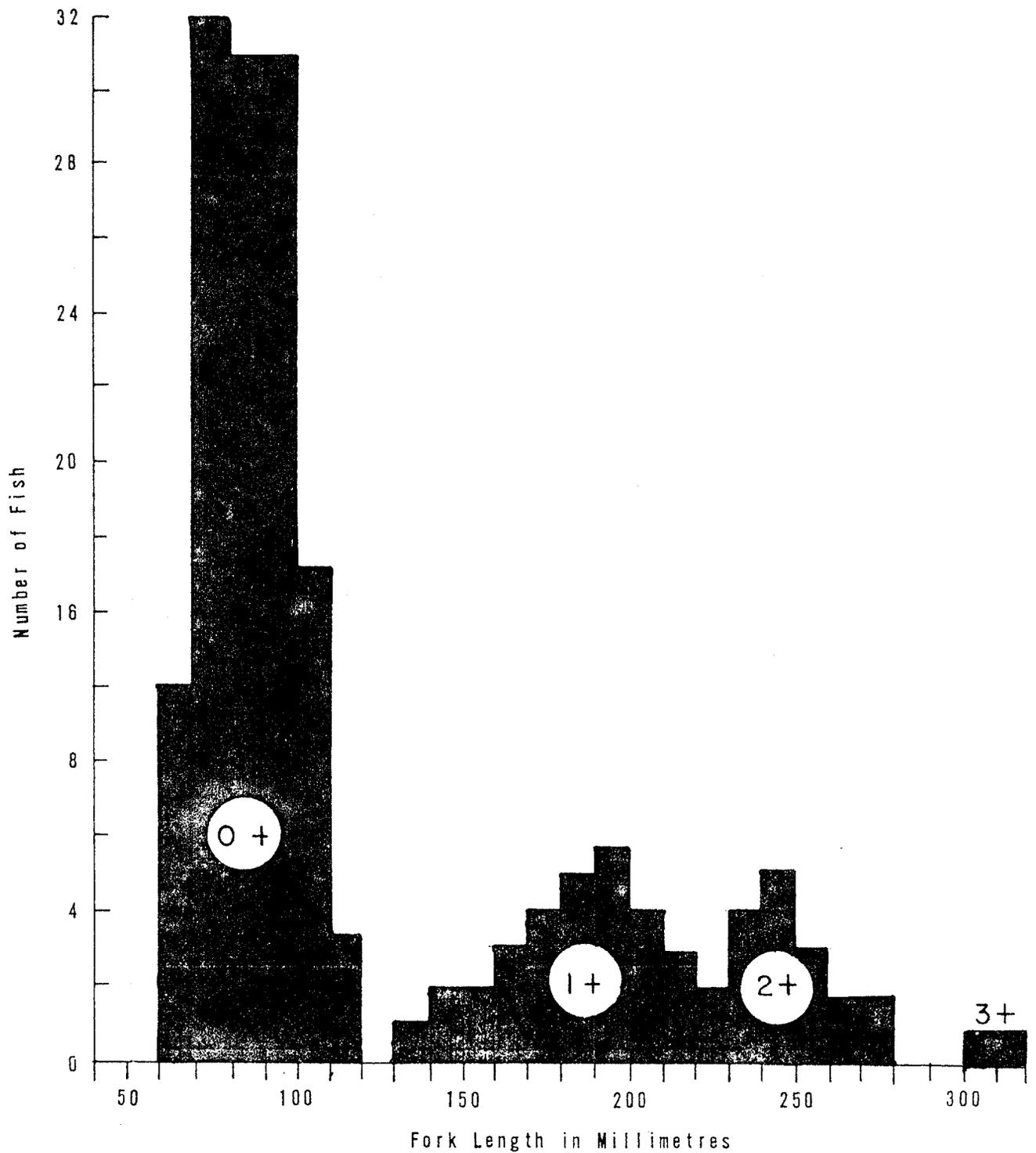


Figure 2. -Length, frequency of occurrence, and age of brown trout caught in sections of Indian Creek, Plumas County, 1978.

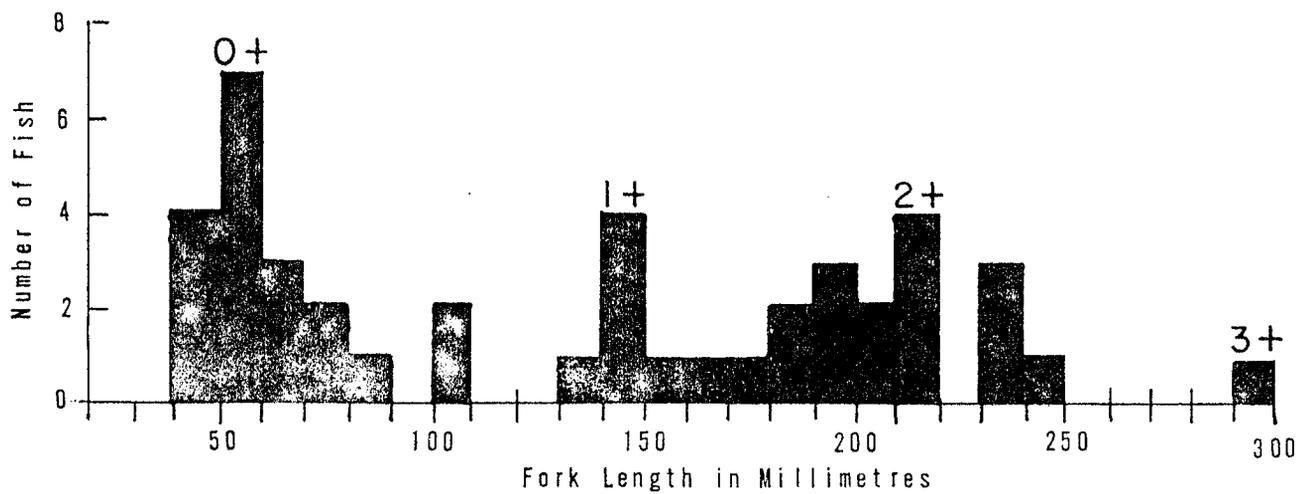


Figure 3. -Length, frequency of occurrence, and age of rainbow trout caught in sections of Indian Creek, Plumas County, 1978.

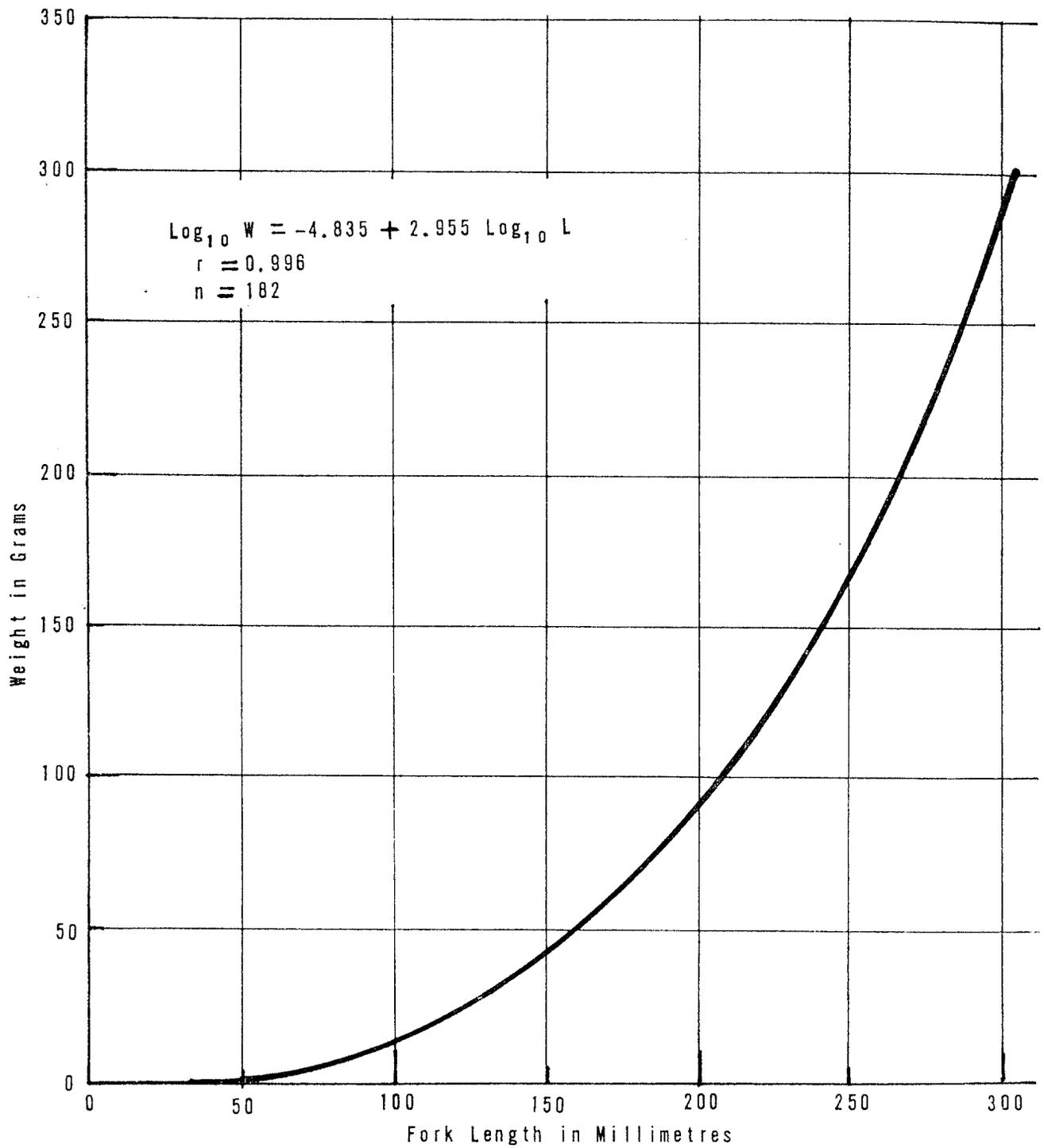


Figure 4. - The relationship between length and weight of brown trout caught in sections of Indian Creek, Plumas County, 1978.

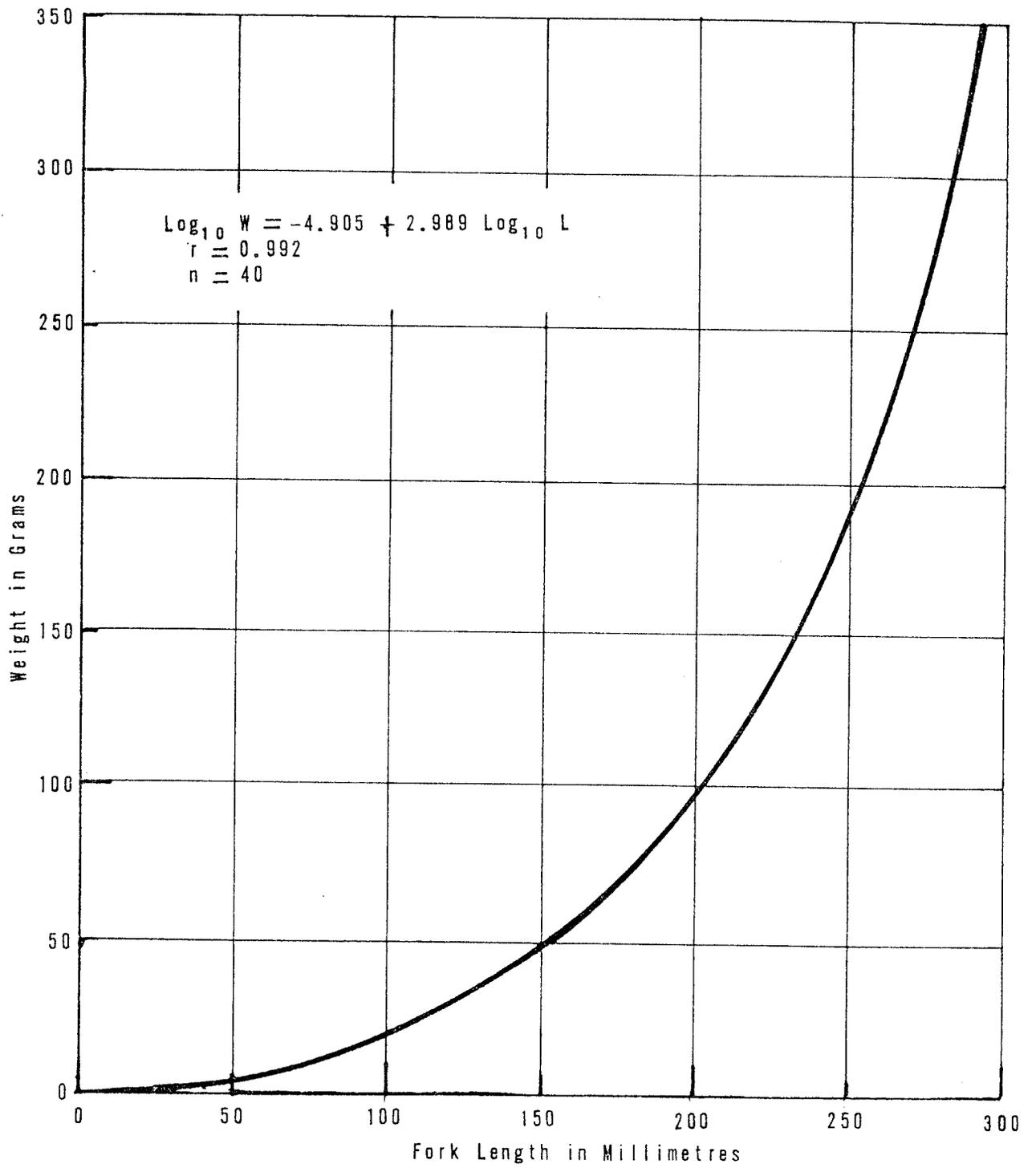


Figure 5. - The relationship between length and weight of rainbow trout caught in sections of Indian Creek, Plumas County, 1978.

TABLE 7
 CONDITION OF BROWN TROUT AND RAINBOW TROUT
 IN INDIAN CREEK, 1978

<u>Age Group</u>	<u>Number of Fish</u>	<u>Coefficient of Condition</u>	<u>95% Confidence Limits</u>
<u>Brown Trout</u>			
0+	82	1.191	± 0.272
1+	52	1.172	± 0.296
2+	34	1.138	± 0.150
3+	5	1.103	± 0.239
Combined	173	1.172	± 0.263
<u>Rainbow Trout</u>			
0+	16	1.243	± 0.657
1+	14	1.125	± 0.269
2+	6	1.155	± 0.227
Combined	36	1.188	± 0.478

LITERATURE CITED

- DeLury, D. B. 1951. On the planning of experiments for the estimation of fish populations. J. Fish. Res. Bd. Canada. 8:281-307.
- Hinton, Ralph. MS. Instream flow needs study, North Fork Feather River. California Department of Water Resources Memorandum.
- Leslie, P. H. and D. H. S. Davis. 1939. An attempt to determine the absolute number of rats in a given area. J. Animal Ecology. 8:94-113.
- Ricker, W. E. 1975. Computation and interpretation of biological statistics of fish populations. Fisheries Research Board of Canada, Bulletin 191, 382 pp.
- Seber, G. A. F. and E. D. LeCren. 1967. Estimating population parameters from catches large relative to the population. J. Animal Ecology. 36(3):631-643.
- Walford, L. A. 1946. A new graphic method of describing the growth of animals. Biol. Bull. 90(2):141-147.

APPENDIX 1

PERMANENT FISH POPULATION STATIONS
INDIAN CREEK, PLUMAS COUNTY
September 1978

APPENDIX I

PERMANENT FISH POPULATION STATIONS INDIAN CREEK, PLUMAS COUNTY September 1978

Station 1 - Located 0.6 km below Antelope Dam adjacent to picnic area near junction of Indian Creek Road and spur road leading to base of dam (NE $\frac{1}{4}$ of NE $\frac{1}{4}$, Section 27, T27N, R12E). The station extends 64 m upstream from a clump of six pine trees (RB) about 30 m upstream from the cattle guard on Indian Creek Road to a 13 cm-diameter pine (LB). Each end of the station is marked by 3.5 cm metal disks on small pines. The station consists of two small pools (55%) with riffle area (55%) in between and at each end. The station has a surface area of 542 m² and a volume of 165 m³ at 0.6 cms.

Station 2 - Located 13.8 km above Flourney Bridge, 1.9 km below Cold Stream, and about 3.9 km below Antelope Dam (SW $\frac{1}{4}$ of SW $\frac{1}{4}$, Section 34, T27N, R12E). The station extends 35 m from a 35.6 cm diameter alder (RB) downstream to a 10.2 cm-diameter pine (RB). Both are marked with metal disks which can be seen from the road. The station contains riffle (64%) and shallow pool (36%) areas. It has a surface area of 281 m² and a volume of 111 m³ at 0.6 cms.

Station 3 - Located 11.5 km above Flourney Bridge, 3.7 km above Hungry Creek, and about 5.3 km below Antelope Dam (NW $\frac{1}{4}$ of NW $\frac{1}{4}$, Section 10, T26N, R12E). The lower end of the station is about 29 m upstream from the upper end of a parking turnout. The station extends 42.7 m upstream from a 38 cm-diameter alder (RB) to a 28 cm-diameter pine (RB). Both are marked with metal disks which can be seen from the creek. The section contains a riffle area which enters a 0.9 m-deep pool followed by a riffle and a shallow pool. (Riffle area totals 39%, pool area 61%.) It has a surface area of 306 m² and a volume of 140 m³ at 0.6 cms.

Station 4 - Located 10.9 km above Flourney Bridge and about 6.8 km below Antelope Dam (NW $\frac{1}{2}$ of SW $\frac{1}{4}$, Section 10, T26N, R12E). Upper end of station is just downstream from a drainage ditch at the lower end of a parking turnout located 0.3 km above Babcock crossing. Station extends 34 m downstream to the end of a riffle just above a long shallow pool. The station could easily be extended in length up to about 91 m. It contains riffle (54%) and shallow pool (46%) areas with a small amount of undercut bank (RB). It is not marked with metal disks. The station has a surface area of 276 m² and a volume of 67 m³ at 0.6 cms.

Station 5 - Located at unimproved campground about 5.5 km upstream from Flourney Bridge and about 12.2 km below Antelope Dam (SW $\frac{1}{4}$ of SW $\frac{1}{4}$, Section 21, T26N, R12E). The station extends 72 m upstream from the

lower end of a riffle area with several grassy hummocks (Transect 3 of the fish habitat evaluation study). Metal disks on a small willow at the lower end (LB) and a large alder snag at the upper end (RB) mark the station. The station contains a riffle and shallow run area, a shallow pool with undercut bank (RB), and a riffle area. (Riffle area is 61%, pool area 39%.) It has a surface area of 714 m² and a volume of 174 m³ at 0.6 cms.

Station 6 - Located about 0.9 km upstream from Flournoy Bridge. Drive 0.3 km east of Flournoy Bridge and take paved spur road to right. Drive 0.6 km to gate in fence on right side of road. Follow trail from gate downstream 91 m along creek where alders on RB end and a steep riffle enters a pool. The lower end of the station is at the top of the steep riffle. The station extends 39 m upstream and is marked with metal disks on 10 cm-diameter alders (RB). The disks are hard to find because there are lots of alders along the right bank. The upper half of the station is a riffle and shallow pool, followed by a rocky run and a small pool in the lower half. (Riffle area totals 46%, pool area 54%.) The station has a surface area of 470 m² and a volume of 143 m³ at 0.6 cms.

APPENDIX 2

LENGTH AND WEIGHT OF BROWN TROUT
CAUGHT IN INDIAN CREEK
September 1978

LENGTH AND WEIGHT OF BROWN TROUT
CAUGHT IN INDIAN CREEK IN SEPTEMBER 1978

<u>Length</u> <u>mm</u>	<u>Weight</u> <u>-g-</u>	<u>Length</u> <u>mm</u>	<u>Weight</u> <u>-g-</u>	<u>Length</u> <u>mm</u>	<u>Weight</u> <u>-g-</u>
66	3-3	101	11-13	192	70-75
71	4	102	12	193	80
73	5	103	12-13-13	198	85-100
74	5-5-5	104	13-13	201	100
75	6-7-6	106	13-13	202	110
77	5-5	107	16	205	90
78	6	109	16	209	95-110
79	6-7	110	15	211	105
80	4-6-6	111	20	212	110
81	6-8-5	112	16	216	120
82	7-7-7-7-6-5	136	35-30	223	125
83	6-6-7-7	142	40-40	225	125-140
84	6-7-9	144	25	234	150
85	7-9	148	45	237	150
86	9-8	154	50	238	150-145
88	8-8-9-8	157	45	242	155
89	8-8	165	50-55	244	190-195-170
90	8	168	50	248	165
91	10-8	170	60-55	252	185
92	10-9-9-9	175	65	254	170-175
93	8-9-9-9	179	65	262	205
94	11-8	181	60	265	225
95	10-11-10	184	70	278	265
96	9-12-11	185	75	301	300
97	10-11-10-10	186	100	315	280
98	10-11	188	90		
99	12	189	75		
100	11-12-13	190	75		

APPENDIX 3
LENGTH AND WEIGHT OF RAINBOW TROUT
CAUGHT IN INDIAN CREEK
SEPTEMBER 1978

LENGTH AND WEIGHT OF RAINBOW TROUT
 CAUGHT IN INDIAN CREEK
 SEPTEMBER 1978

<u>Length</u> mm	<u>Weight</u> -g-	<u>Length</u> mm	<u>Weight</u> -g-
41	1	159	45
47	1	160	40
49	1	172	60
52	1	180	65
54	3	184	70
55	3	192	85
57	2-3	193	100
62	3	198	90
66	3-3	208	110
74	5	209	110
75	6	212	100
80	5	214	115
100	13	217	118
101	13	219	105
136	30	223	125
140	30	230	160
142	40	238	130
144	25	248	175
146	40	293	350

APPENDIX 4
METRIC CONVERSION FACTORS

APPENDIX 4

METRIC CONVERSION FACTORS

<u>Quantity</u>	<u>Metric Units</u>	<u>Divide by</u>	<u>English Units</u>
Length	millimetres (mm)	25.4	inches (in)
	centimetres (cm)	2.54	inches (in)
	metres (m)	0.3048	feet (ft)
	kilometres (km)	1.6093	miles (mi)
Area	square metres (m ²)	0.0929	square feet (ft ²)
Volume	cubic metres (m ³)	0.7646	cubic yards (yd ³)
Flow	cubic metres per second (cms)	0.0283	cubic feet per second (cfs)
Biomass	grams per square metre (g/m ²)	8.92	pounds per acre (lb/acre)