Volume 033
Article 11

IDAHO

FISH & GAME DEPARTMENT

Joseph C. Greenley, Director

SNAKE RIVER FISHERIES INVESTIGATIONS'

Job Performance Report

Project F-63-R-4

Job No. IV. Survey of Fish Populations and Water Quality in the Boise River from its Mouth Upstream to Barber Dam

Period Covered: 1 March 1974 to 28 February 1975

by

Harry R. Gibson
Senior Fishery Research Biologist

May, 1975

TABLE OF CONTENTS

LIST OF TABLES

Page

LIST OF FIGURES

LIST OF FIGURES (Continued)

LIST OF FIGURES (Continued)

Page

JOB PERFORMANCE REPORT

State of ____Idaho

Name: SNAKE RIVER FISHERIES INVESTIGATIONS

Project No. F-63-R-4

Title: Survey of Fish Populations and Water Quality in the Boise River from its Mouth Upstream to Barber Dam

Job No. IV

Period Covered: 1 March 1974 to 28 February 1975

ABSTRACT:

We used electrofishing equipment to assess fish species distribution and relative abundance in the Boise River from Barber Dam downstream to the confluence with the Snake River.

This 94.6 km (58.8 mi) river section contains at least 24 fish species. Game fish total 13 species of which principal species of catchable size are mountain whitefish, largemouth and smallmouth bass, rainbow trout (hatchery and wild) and channel catfish. Catchable size game fish comprised 4.3% of the total sample (three sampling periods) or 73.6% of the game fish sample. Nongame fish composed 94.1% of our sample with shiners, chiselmouth and suckers appearing most frequently in our electrofishing catch.

Mountain whitefish was the only game fish found in all sections of the study river, although most abundant in the Barber Dam to Eagle area. Wild and hatchery trout were captured predominately in the Barber Dam to Star area. Largemouth bass, black crappie and bluegill were found mainly in the river sloughs. We captured smallmouth bass and channel catfish predominately from Notus to Fort Boise (at the mouth). The most abundant nongame fish species: shiners, suckers, chiselmouth, carp, squawfish and dace were captured in most parts of the river.

Minimum flow of less than 100 cfs and maximum of greater than 7,000 cfs occurred in January and May, respectively, at Boise. The maximum recorded water temperature of 26.1 C (79 F) was at Fort Boise during July, and the minimum of 0 C (32 F) at Barber in December.

Mountain whitefish stomach analysis indicate those from 150 to 249 mm (5.9-9.8 in) total length preferred immature Tendipedidae, Baetidae, Pyralidae and Simulidae in order of consumption. Whitefish of 250 to 299 mm (9.8-11.8 in) ingested less Tendipedidae but greater volumes of Pyralidae, Simulidae and nonfood items such as sand, sticks and leaves. Whitefish from 300 to 349 mm (11.8-13.7 in) began consuming less of those insects important to smaller fish, but consumed more Hydropsychidae and nonfood items.

Author:

Harry R. Gibson
Senior Fishery Research Biologist

RECOMMENDATIONS:

Encourage greater utilization of mountain whitefish. We found abundant whitefish populations in the Barber Dam to Eagle area. They compete with juvenile and adult trout, and it would probably be favorable to both species to crop the whitefish population.

Manage the Barber Dam to Star section of the Boise River as a cold water fishery, and the section from Star to the mouth as a warm water fishery. Water temperatures indicate these areas are most suited for this type of management.

Maintain and improve the slough areas by placement of brush piles to provide more cover for fish species. We found warm water fish species predominately in the sloughs.

Establish minimum and maximum flow requirements for the well being of aquatic life. Enforce these regulated flows.

OBJECTIVES:

To survey fish distribution and abundance, water quality conditions, map pollution sources and evaluate access areas to the important Snake River tributary--the Boise River (from its mouth upstream to Barber Dam).

INTRODUCTION:

The overall objective of the Snake River Fisheries Investigation is to make a physical and biological survey of the Snake River upstream from the Brownlee Reservoir flow line (Cobb Rapids). Because of its importance to the Snake River drainage system, we included the Boise River in our fisheries investigation program.

This report covers a fish population survey of the Boise River from the confluence with the Snake River, river km 629.7 (river mi 391.3), upstream 94.6 km (58.8 mi) to Barber Dam (Fig. 1). This watershed is characterized by river bottom land, terraces and low rolling hills. Water flow is regulated by discharge through Lucky Peak Dam, about 8 km (5 mi) upstream from Barber Dam and withdrawal through irrigation canals.

In some areas of the study river, encroachments on the channel by levees, farming activities, home construction and stream alteration have degraded the river aesthetically and biologically. Some encroachments combined with regulated water flows have resulted in sedimentary deposition in some areas and a resultant loss of fish habitat and spawning areas.

TECHNIQUES USED:

Fish populations

We achieved good success in using electrofishing equipment for collecting fish unharmed from the Snake River in 1973 (Gibson 1974). We used the same

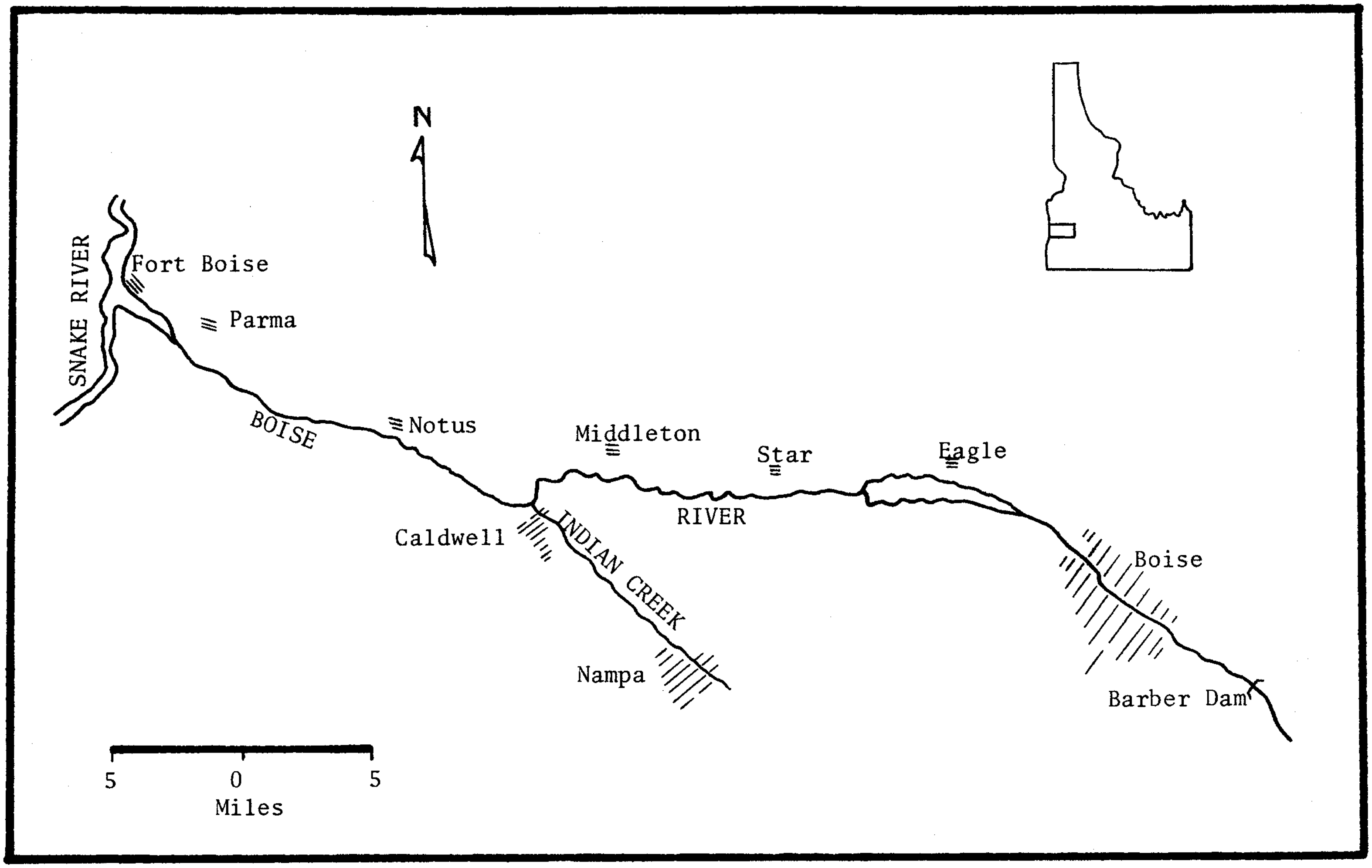


Figure 1. Boise River study area from Barber Dam downstream to the confluence with the Snake River at Fort Boise, 1974.

type of electrogear in the Boise River: a variable voltage pulsator (0-600 watts DC) powered by a 2,000 watt portable generator. This equipment was mounted in either of two boats: a 4.9 m (16 ft) aluminum jet boat (Fig. 2) used in areas where a large boat could be launched and maneuvered freely in the river, or a 3.7 m (12 ft) car top boat (Fig. 3) used where boat ramps were absent and shallow riffle areas were frequent. A 10 hp motor with weed guard was mounted on the small boat. For positive control, we powered our boat upstream against the current while electrofishing. As the electro-apparatus was the same in both boats, I feel both electrofishing rigs were equally effective in capturing fish.

Our negative electrodes, two strips of aluminum, 3.3 m (11 ft) long, 15.2 cm (6 in) wide, were insulated and fixed to the bottom of either boat. The positive electrode was the bow capture net.

We obtained our greatest fish capturing efficiency with pulsed direct current for 2 to 5 seconds, and automatically switching to continuous direct current until we broke the circuit. Fish in an electrical field of pulsed direct current exhibit stronger galvanonarcosis (inability of fish to swim due to narcosis), and those in continuous direct current show more galvanotaxis (tendency to swim toward the positive electrode). Fish were stunned and unable to escape the electrical field and then attracted to the positive net.

We enumerated all captured fish by species, section and habitat type and measured fish total length to the nearest millimeter. Nongame fish greater than 30 cm (11.8 in) were enumerated but not taken aboard. All game fish species were weighed on a triple beam balance to obtain length-weight relationships.

I assessed the age of centrarchids and coregonids from scale samples and of channel catfish from the left pectoral spines removed from captured fish. We collected stomachs from a sample of mountain whitefish for food habit studies.

Fish condition factor indicates suitability of an environment or is used to compare fish between areas, or within the same area (between changes in time or environment). I calculated condition factors (K) for centrarchids, coregonids and channel catfish, etc., from the following formula:

$$K = \frac{10^5 W}{L^3}$$

W = Weight in grams
L = Total length in millimeters

Rounsefell and Everhart (1953) used standard length in this formula, but I used total length as most fish measurements taken by Idaho Department of Fish and Game personnel are total length. As fish grow older, they usually gain proportionately more in weight than in length so the value of K increases with age (Rounsefell and Everhart 1953). I assessed mean condition factors or fish age groups and time.

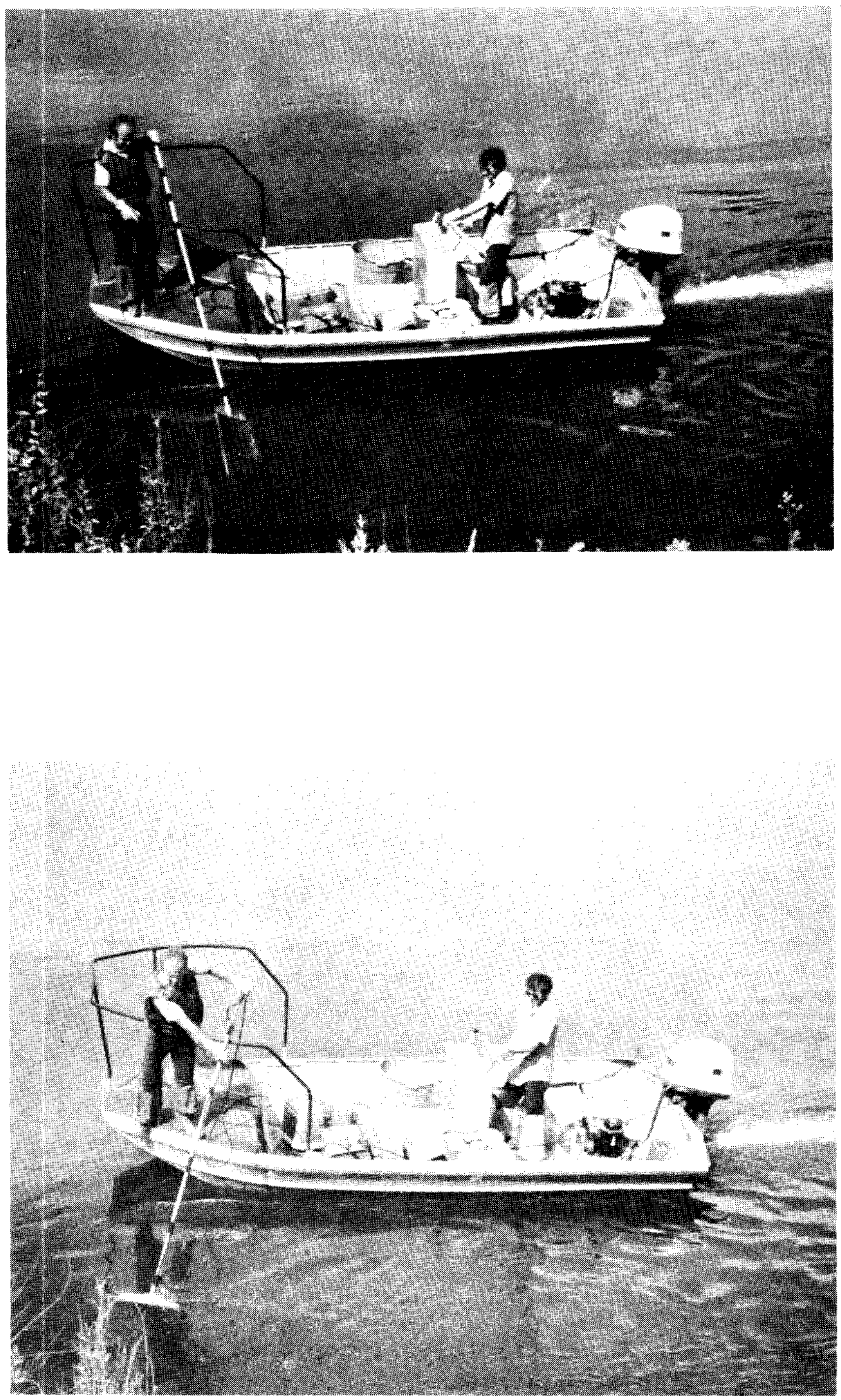


Figure 2. Electrofishing equipment mounted in 4.9 m (16 ft) jet boat.

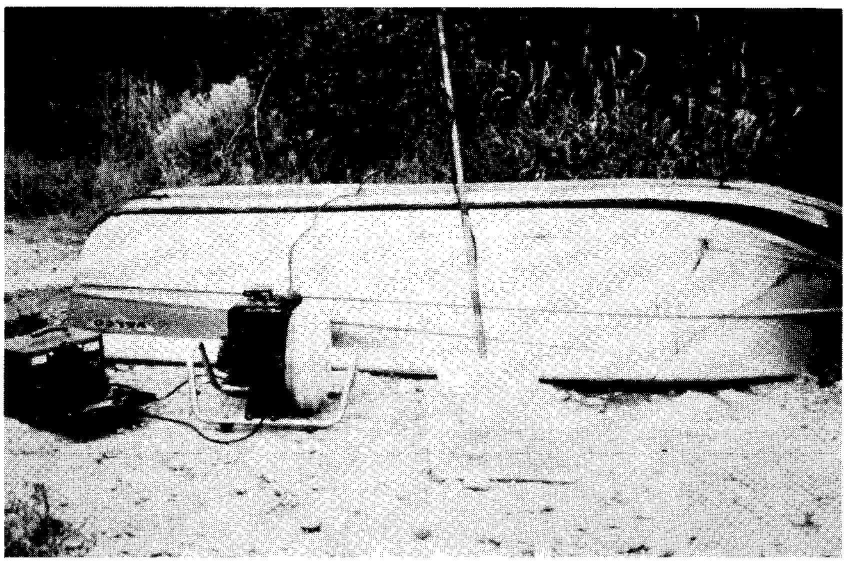


Figure 3. The 3.7 m (12 ft) car top boat and electrofishing equipment.

We collected fish population data from 31 areas in the study stream including the main river channel and slough section. In each area we sampled both shorelines, totaling 62 sections, 91.4 to 457.2 m (100 to 500 yd) in length. We electrofished seasonally, 29 January to 7 February, 11 July to 2 August and 21 October to 31 October 1974 to capture any species we missed during the other periods and to ascertain any fish migration. High water shortened our February period and eliminated our spring sampling. Our most intensive sampling was during the summer period.

Benthos samples

We collected benthos samples with a Surber sampler to ascertain aquatic benthos present and their abundance and distribution in the Boise River. Four or five samples (dependent on sample area size) were collected from substrates at riffle areas from each of the following sites: Barber and Strawberr Glenn in Boise, Star, Caldwell, Notus and Fort Boise. Each sample was .09 m^z (1 ft^2) and taken from water less than 30.5 cm (12 in) deep.

Water temperatures

I installed Moeller thermographs to record continuous Boise River water temperatures at Barber, Strawberry Glenn, Middleton and Fort Boise. My objective was to record maximum and minimum temperatures at each site, and to detect any difference in water temperature from Barber downstream to the Snake River. I could then ascertain if any area was suitable for the growth and well-being of different fish species.

FINDINGS:

Fish species and relative abundance

We captured 32,811 fish (seasonal catches combined) in approximately 19,948 lineal m (21,815 yd) of electrofishing at a catch rate of 827 fish per hour. Game fish comprised 5.8% of the Boise River sample at a rate of 48.3 fish per hour. Thirteen of the 24 species captured were game fish (Table 1). We captured a greater number of species in the Boise River than in the Snake River (16) from the Brownlee Reservoir flow line to the proposed Guffey Dam site (Gibson 1974).

Summer sampling period

The 11 July to 2 August electrosample was the most extensive and therefore the most representative of true species composition and abundance of the three sampling periods. We captured 6,041 fish (Fig. 4) from 10,392 m (11,365 yd) requiring 21 hours of electrosampling. Game fish comprised 8.5% of the summer sample at a catch rate of 24.6 fish per hour. Game fish composed 28.9% of the electrosample in the Snake River in 1973 (Gibson 1974).

Smallmouth bass totaled 46.2% of the game fish sample in the Snake (Gibson 1974), but was only 4.2% of game fish from the Boise River. Whitefish were the most abundant game fish species from the Boise, whereas they comprised only 6.2% of the game fish sample from the Snake River.

Table 1. Catch per hour and per 91.4 m (100 yd) section for the 25 species captured by electrofishing the Boise River from Barber Dam downstream to the confluence with the Snake River. Samples from January-February, July-August and October 1974 were combined.

Species		Fish/hr. electro-fishing	Fish/91.4 m (100 yd) elec-trofishing
Redside shiner	Richardsonius balteatus	452.9	82.4
Chiselmouth	Acrocheilus alutaceus	147.1	26.7
Bridgelip sucker	Catostomus columbianus)		
Largescale sucker	Catostomus macrocheilus)---	100.4*	18.3*
Mountain sucker	Pantosteus platyrhynchus)		
Carp	Cyprinus carpio	45.8	8.3
Mountain whitefish	Prosopium williamsoni	30.6	5.6
Dace	Rhinichthys sp.	13.7	2.5
Sculpin	Cottus sp.	10. 2	1.8
Northern squawfish	Ptychocheilus oregonensis	8.3	1.5
Blue gill	Lepomis macrochirus	4.4	0.8
Largemouth bass	Micropterus salmoides	4.3	0.8
Rainbow trout (hatchery)	Salmo gairdneri	1.4	0.3
Smallmouth bass	Micropterus dolomieui	1.1	0.2
Rainbow trout (wild)	Salmo gairdneri	1.0	0.17
Black crappie	Pomoxis nigromaculatus	0.7	0.13
Channel catfish	Ictalurus punctatus	0.6	0.10
Pumpkinseed	Lepomis gibbosus	0.6	0.10
Brown bullhead	Ictalurus nebulosus	0.4	0.08
Tui chub	Siphateles bicolor	0.2	0.04
Brown trout	Salmo trutta	0.1	0.02
Yellow perch	Perca flavescens	0.1	0.02
Warmouth	Lepomis gulosus	0.08	0.01
White catfish	Ictalurus catus	0.02	0.005
Tadpole madtom	Noturus gyrinus	0.02	0.005

*Most suckers were not taken aboard and we did not enumerate the three species separately.

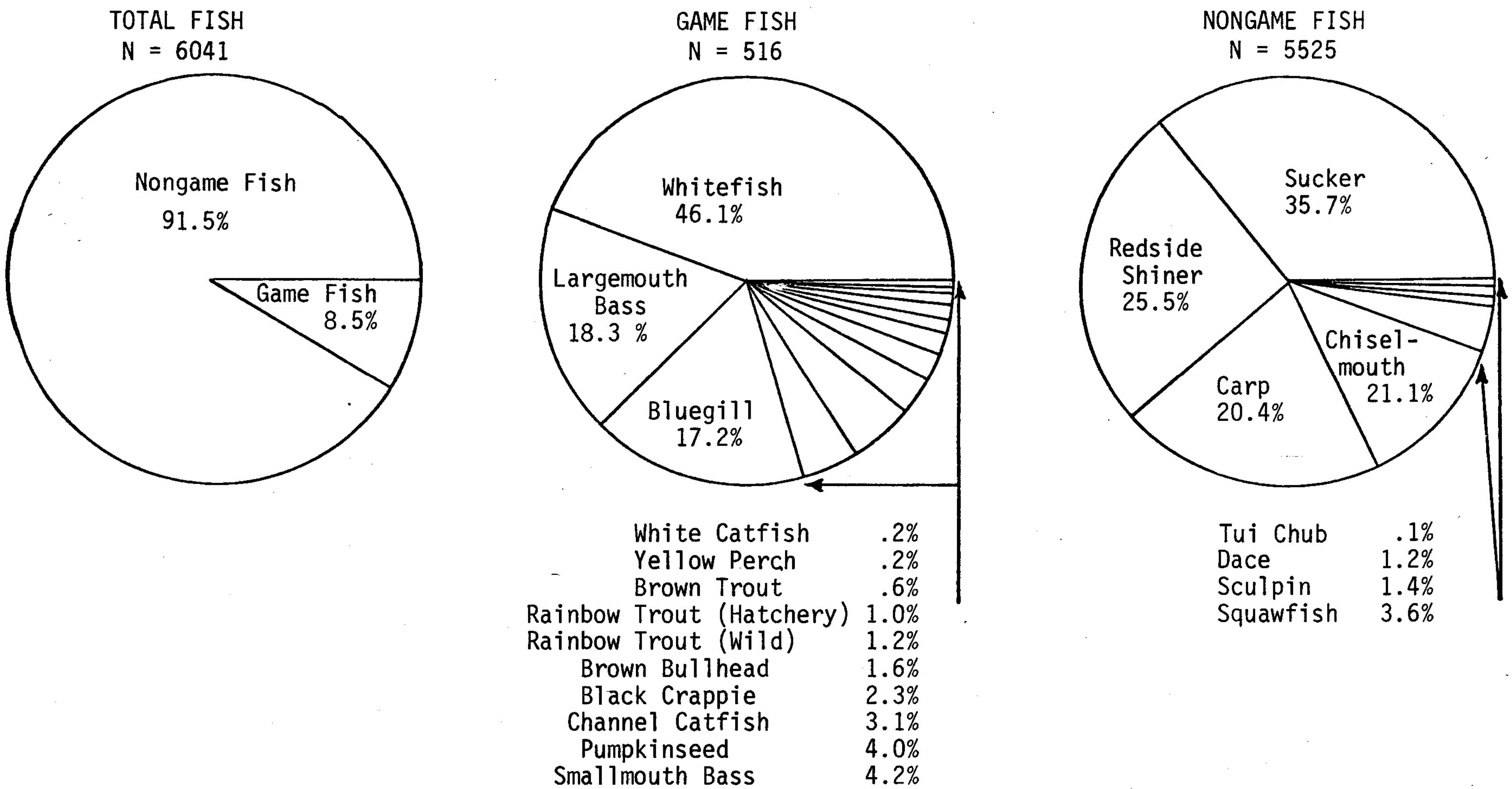


Figure 4. Percentage composition for total fish, game fish and nongame fish in electrofishing sample from the Boise River (mouth upstream to Barber Dam), 11 July to 2 August, 1974.

Suckers (35.7%), shiners (25.5%) and carp (20.4%) were the most numerous nongame fish species in the Boise River. Carp (54.2%) and suckers (34.7%) were the most common nongame fish species in the Snake River (Gibson 1974) while shiners were caught at the rate of only 1.6 fish per hour of electrofishing.

Fall sampling period

We sampled 17 areas in October 1974 requiring 13.8 hours to electrofish the 7,292 m (7,975 yd). To evaluate results of the fall sample, I compared these findings with the results of only these same 17 areas from the summer sampling period (Table 2).

Game fish comprised 3.0% of the total fall sample of 24,827 fish. The comparable summer sample was 3,872 fish composed of 7.9% game fish. Game fish doubled in catch rate in the fall period from the summer period, but nongame fish catch rate was six times more in the fall period. Although game fish numbers were greater in the October sample, they were a smaller percent of total fish because of the large number of nongame fish.

Three species increased significantly in our catch rates from summer to fall. Whitefish were twice as numerous in the fall than in the summer. We also captured more whitefish in November in the Weiser River than in August (Gibson 1975). I do not know if the increased catch rate results from a fall whitefish migration or if they are more susceptible to electrosampling during the colder fall temperatures.

Shiners and chiselmouth were 13 and 9 times, respectively, greater in the fall period than during the summer. Shiners are very abundant in Lucky Peak Reservoir, and they are washed into this study section of the Boise River when water is released through the dam.

White catfish (1) was the only game fish captured in the summer not found in the fall. We found warmouth in these areas only in the fall, and usually in sloughs away from the main river current. Channel catfish and pumpkinseed were the only species that decreased in numbers from the summer to the fall period.

Channel catfish in the Colorado River migrate downstream in the fall (McCammon 1956). Davis (1959) found that adults spend the day in deep holes or under some shelter. These channel catfish movements may account for the decrease in the number of catfish captured in the fall. We found a similar decrease in numbers of catfish during our fall sampling of the Payette (Reid 1975) and Weiser rivers (Gibson 1975).

Pumpkinseed require larger and denser masses of aquatic vegetation than do bluegill (Trautman 1957). In the colder water temperatures during fall, the pumpkinseed may have submerged deeper into their vegetative habitat in search of warmer temperatures and thus were more difficult to capture.

Winter sampling period

From 29 January to 13 February, we electrosampled 10 areas in the Boise

Table 2. Catch per hour and per 91.4 m (100 yd) section for fish species captured during October and July-August from 17 areas on the Boise River (mouth upstream to Barber Dam), 1974.

	Fall Sample		Summer Sample	
Species	Fish/hour electro-trofishing		Fish/hour electro-fishing	Fish/91.4 m (100 yd) elec-trofishing
Mountain whitefish	35.2	6.1	15.6	2.9
Bluegill	6.2	1.18	2.3	0.4
Largemouth bass	5.1	0.98	2.3	0.4
Rainbow trout (hatchery)	1.9	0.3	0.4	0.07
Smallmouth bass	1.4	0.25	1.0	0.2
Rainbow trout (wild)	1.2	0.2	0.3	0.06
Black crappie	1.1	0.2	0.5	0.09
Brown bullhead	0.7	0.1	0.3	0.06
Channel catfish	0.50	0.09	0.8	0.14
Perch	0.2	0.05	0.1	0.01
Warmouth	0.2	0.05	0.0	0.0
Pumpkinseed	0.1	0.04	0.8	0.15
Brown trout	0.1	0.04	0.2	0.03
White catfish	0.0	0.0	0.1	0.01
Totals (Game	53.9	9.37	24.7	4.49
Shiner	1170.4	202.8	87.2	15.8
Chiselmouth	367.3	63.6	40.3	7.3
Suckers	112.1	19.4	99.8	18.1
Carp	44.9	7.8	46.0	8.3
Squawfish	9.3	1.6	7.6	1.4
Dace	22.3	3.9	3.4	0.6
Sculpin	16.0	2.8	5.5	1.0
Tui chub	0.1	0.02	0.2	0.03
Madtom	0.07	0.01	0.0	0.0
Totals (Nongame fish)	1742.47	301.93	290.0	52.53

River covering a lineal distance of 2,263 m (2,475 yd) in 4.9 hours. We captured 1,943 fish of which 33.8% were game fish. The most abundant game fish, whitefish, comprised 93% of the game fish sample. Suckers (35.8%) and shiners (30.8%) were the most common nongame fish in our sample.

To evaluate species abundance and distribution in the winter sample, I compared the results of the winter sample to my data from the same 10 areas sampled during the summer (Table 3). The catch rate for game fish during the winter period was about five times greater than during the summer period. Nongame fish were only 35% greater in the winter sample than in the summer catch.

One difference in these seasonal samples was the increase in numbers of cold water fish (whitefish and rainbow trout) captured in the winter period. We did not find perch, brown tout, brown bullhead, bluegill, smallmouth bass, channel catfish and pumpkinseed in the winter sample. These species were captured in small numbers in the summer period, but in the winter water temperatures, less than 6 C (43 F), they were probably in deep holes or in heavy cover and therefore difficult to electrosample.

Species distribution

As our samples were limited during the fall and winter periods, I combined the three sampling periods for evaluation of distribution (Fig. 5). Mountain whitefish was the only game fish found in all study sections of the river (Fig. 6), although they were most abundant in the Barber Dam to Eagle area. We captured hatchery rainbow trout from Barber downstream to the Star-Caldwell vicinity, but we found wild rainbow trout downstream only to the Eagle-Star area. The upstream and downstream limits for brown trout were at Strawberry Glenn and Eagle.

We captured largemouth bass and black crappie from the mouth (Fort Boise) upstream to Fairview Bridge in Boise. I suspect these warm water fish in the Boise area escaped from the numerous ponds fronting the Boise River. The greatest number of largemouth bass and crappie were captured from Star downstream to the mouth.

Bluegill were captured from the mouth upriver to the Eagle area, but were found in greatest numbers from Star to the mouth. Although we found smallmouth bass from Star downriver, we captured the greatest number in the Parma-Fort Boise area. Bill Webb (Idaho Department of Fish and Game, oral communication) reported small populations of smallmouth bass in the Star to Middleton area in the past, but we captured few in that section. Channel catfish began appearing in our samples immediately downstream from Caldwell, but the largest populations were from Notus to Fort Boise.

The three warmouth captured were from Parma downstream to the mouth. We found perch at the Broadway Bridge site in Boise and from Caldwell to Fort Boise. A large perch population is reported upstream from Broadway Bridge, but logistics of sampling that area and time limitations prevented our verifying this population. We found brown bullheads at Glenwood Bridge in Boise and from Star downstream to the Snake River. Pumpkinseed were also captured sporadically from Star to Fort Boise.

Table 3. Catch per hour and per 91.4 m (100 yd) section for fish species captured during January-February and July-August from 10 areas on the Boise River (mouth upstream to Barber Dam), 1974.

Species	Winter Sample		Summer Sample	
	Fish/hour electro-fishing	Fish/91.4 m (100 yd) electrofishing	Fish/hour electro-fishing	Fish/91.4 m (100 yd) electrofishing
Mountain whitefish	124.3	24.8	18.0	3.2
Rainbow trout (hatchery)	4.9	0.97	0.4	0.07
Rainbow trout (wild)	3.1	0.6	0.6	0.10
Largemouth bass	1.4	0.06	2.2	0.4
Crappie	0.2	0.04	0.0	0.0
Perch	0.0	0.0	0.2	0.04
Brown trout	0.0	0.0	0.4	0.07
Brown bullhead	0.0	0.0	0.2	0.04
Bluegill	0.0	0.0	2.2	0.4
Smallmouth bass	0.0	0.0	0.6	0.10
Channel catfish	0.0	0.0	0.2	0.04
Pumpkinseed	0.0	0.0	2.0	0.4
Totals (Game fish)	133.9	26.5	27.0	4.8
Suckers	94.1	18.7	97.0	17.3
Shiners	81.0	16.0	87.4	15.5
Dace	33.8	6.7	4.9	0.9
Sculpin	21.0	4.2	13.3	2.4
Chiselmouth	18.6	3.7	23.2	4.1
Carp	13.9	2.7	34.4	6.1
Squawfish	0.2	0.04	6.3	1.1
Tui chub	0.0	0.0	0.39	0.07
Totals (Nongame fish)	262.6	52.0	266.9	47.5

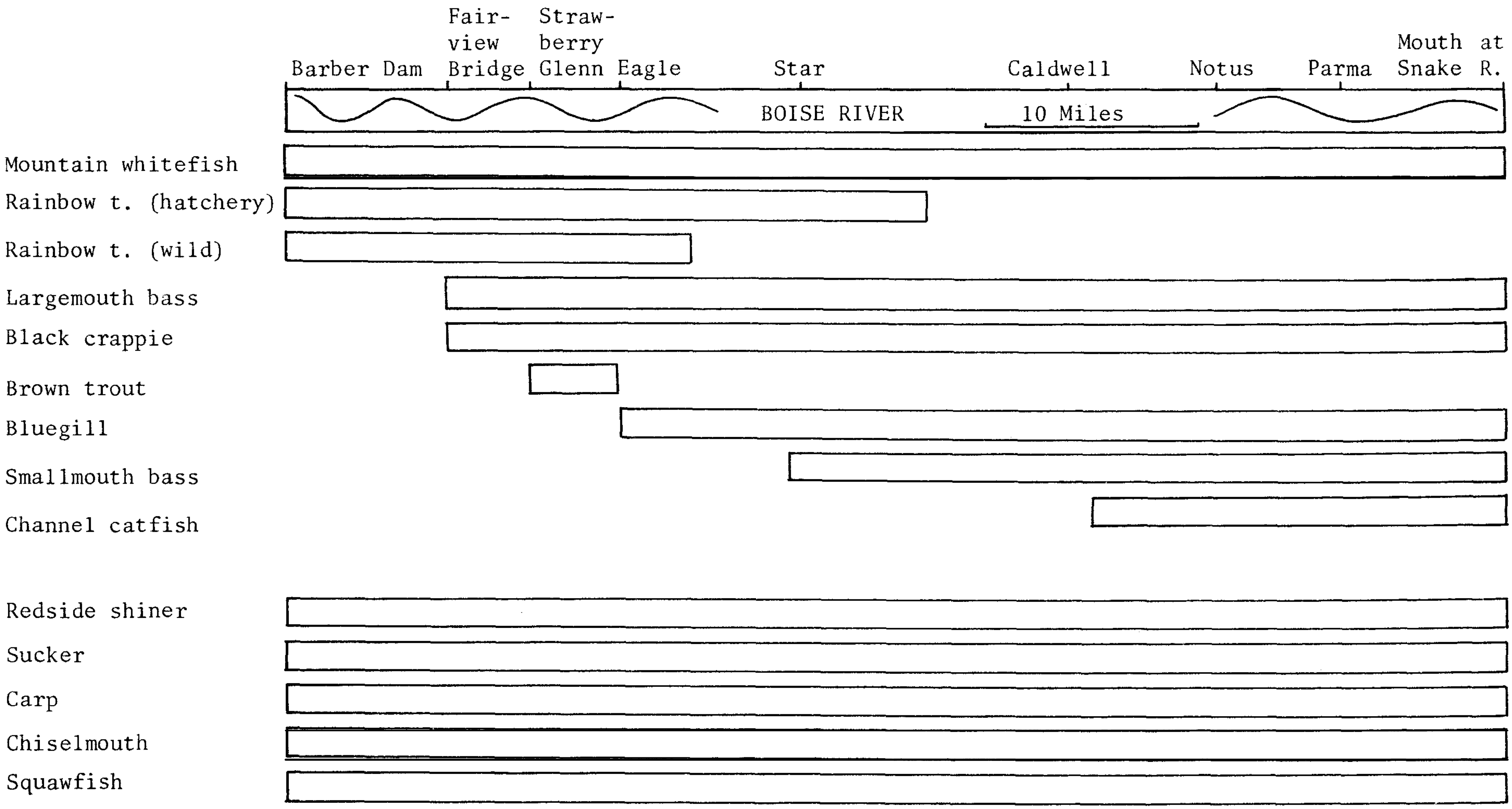


Figure 5. Distribution of 13 fish species in the Boise River from Barber Dam downstream to the mouth as determined by electrofishing during January-February, July-August and October, 1974.

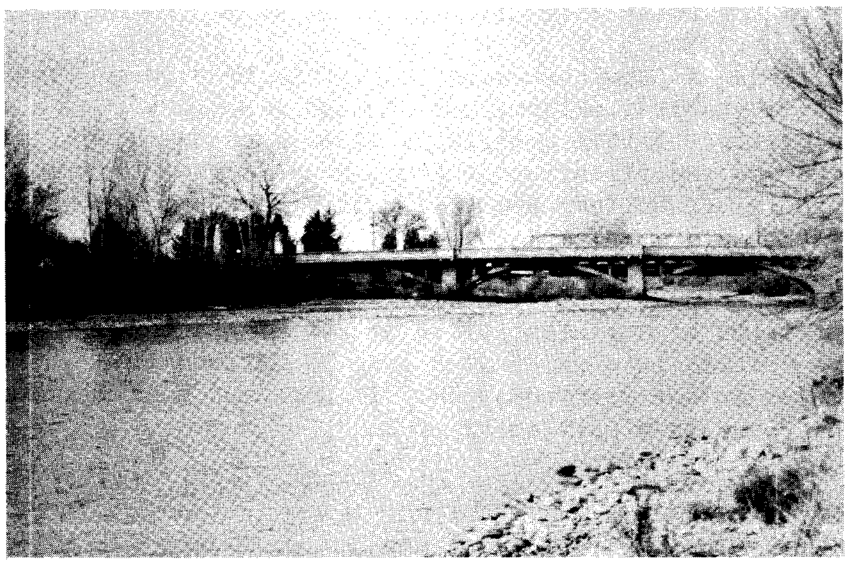


Figure 6. Habitat type water in the Boise River at Boise occupied by mountain whitefish, 1974.

The single white catfish captured was from a riffle 366 m (400 yd) upstream from the confluence with the Snake River. It is very likely this species migrated into the Boise from the Snake River.

We captured most game fish species in the main Boise River channel, but we found largemouth, bluegill, black crappie and pumpkinseed predominately in backwater sloughs. These sloughs are characterized by dead or slow moving water with abundant aquatic habitat of trees, bushes or other vegetative growth (Fig. 7). Depth is usually greater than .9 m (3 ft).

The most abundant nongame fish species, shiners, suckers, chiselmouth, carp, squawfish and dace were captured in most parts of the river. We collected sculpin only in the Boise area, but because this species is a bottom niche fish we may have missed capturing it in the deeper water below Boise. The single madtom was captured at Notus. We found the eight tui chubs sporadically in the Boise River from Star downstream to Notus.

Electrofishing is the best means of capturing a large sample of fish in their specific habitat without harm to the fish, but it may show some species selectivity. Bottom dwelling species such as channel catfish, sculpin and dace are difficult to capture because when stunned they sometimes remain near the river bottom, are difficult to see and are often swept away by the current.

My summary of species distribution in the Boise River is derived from species composition of our electrofishing catch. A failure to note the presence of a species in a particular area is derived from our lack of finding that species in our electrosample. It does not mean a specific species will never be found in a particular area.

Length data

Twelve game fish species caught during three sampling periods had individual fish of catchable size, 150 mm (6 in) or more, which totaled 73.4% of the captured game fish (Table 4). Whitefish, the most numerous game fish species, were measured as 87% catchables. Gibson (1975) found that 99% of the whitefish electrosample in the Snake River (below C. J. Strike Reservoir) were catchable size fish. Whitefish in our Boise River samples ranged from 70 to 410 mm (2.8-16.1 in) depending on the period of capture (Fig. 8 and 9). The most prominent whitefish size class of 220-310 mm (8.7-12.2 in) was taken in the January-February sampling period.

All of the hatchery rainbow trout were catchables (Fig. 10) and attained the maximum size of 350 mm (13.8 in) in our samples. Wild rainbow trout ranged from 110 to 390 mm (4.3-15.4 in) in total length. The five brown trout in our samples were in the 80 to 170 mm (3.1-6.7 in) size classes.

The smallest black crappie in our sample was 40 mm (1.6 in) and the largest was 250 mm (9.8 in) captured upstream from Parma. Yellow perch were in the 80 to 140 mm (3.1-5.5 in) size class and warmouth were 70 to 160 mm (2.8-6.3 in) in total length.

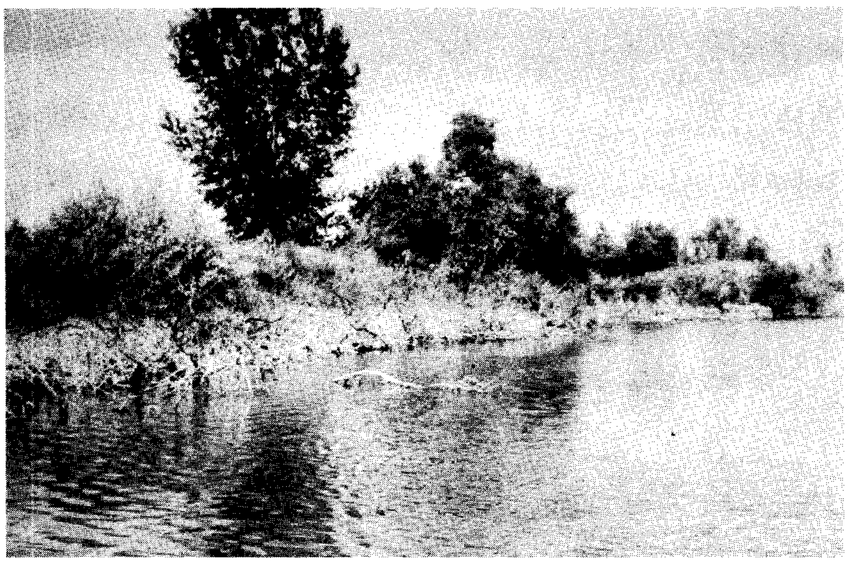


Figure 7. A Boise River slough, with brush and trees, important as cover for warm water fish species, 1974.

Table 4. Number of catchables, 150 mm (6 in) or more total length, and percent as catchables of 12 game fish species captured by electrofishing in the Boise River (Barber Dam downstream to Snake River), January-February, July-August and October, 1974.

Species	Number of catchables	Percent as catchables
Mountain whitefish	1,164	87
Largemouth bass	78	46
Rainbow trout (hatchery)	55	100
Rainbow trout (wild)	29	76
Channel catfish	23	100
Smallmouth bass	17	40
Black crappie	16	57
Brown bullhead	12	67
Bluegill	11	6
Brown trout	1	20
White catfish	1	100
Warmouth	1	33

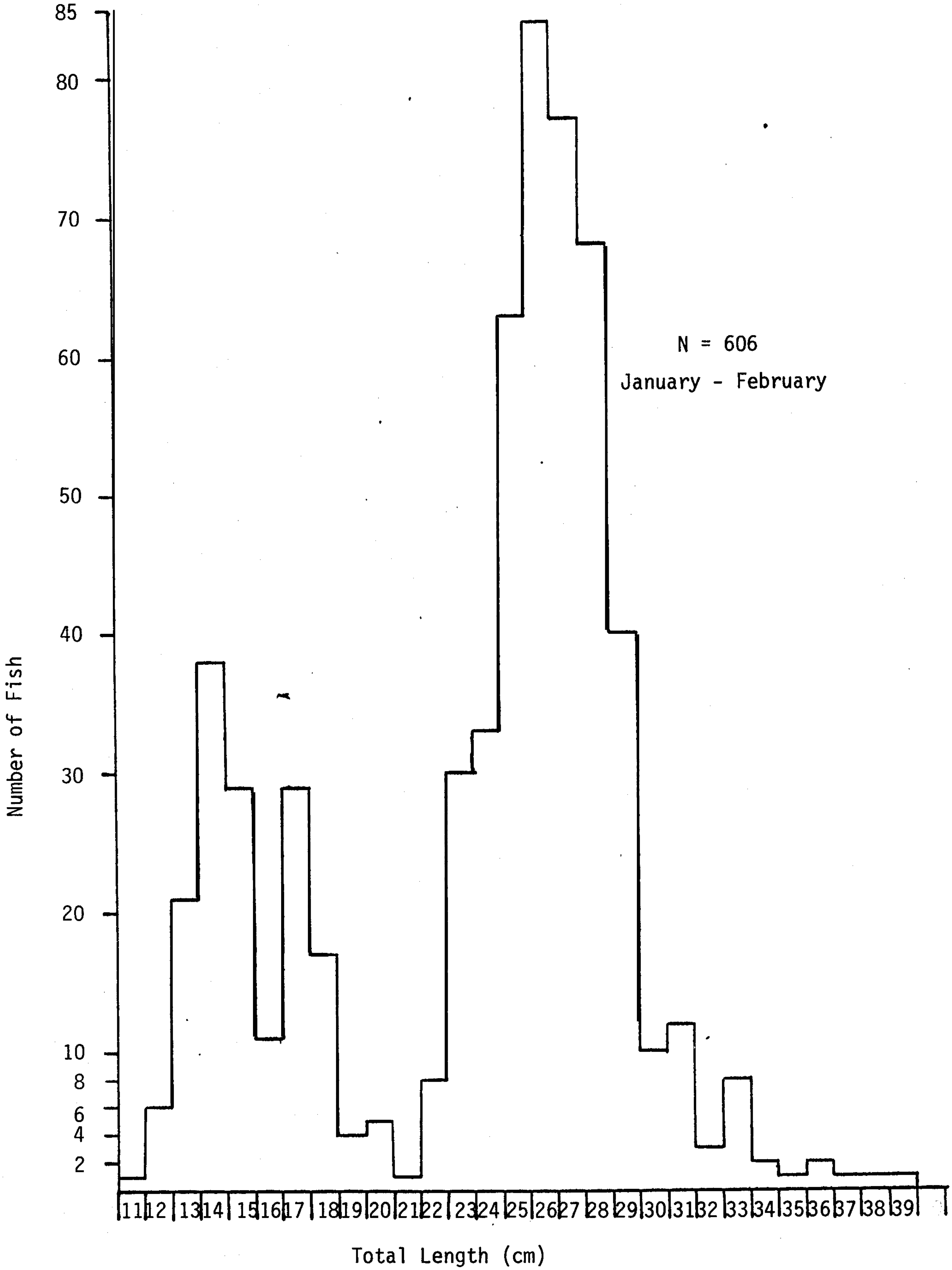


Figure 8. Length frequencies for mountain whitefish in the January-February electrofishing sample from the Boise River (Ft. Boise upstream to Barber Dam), 1974.

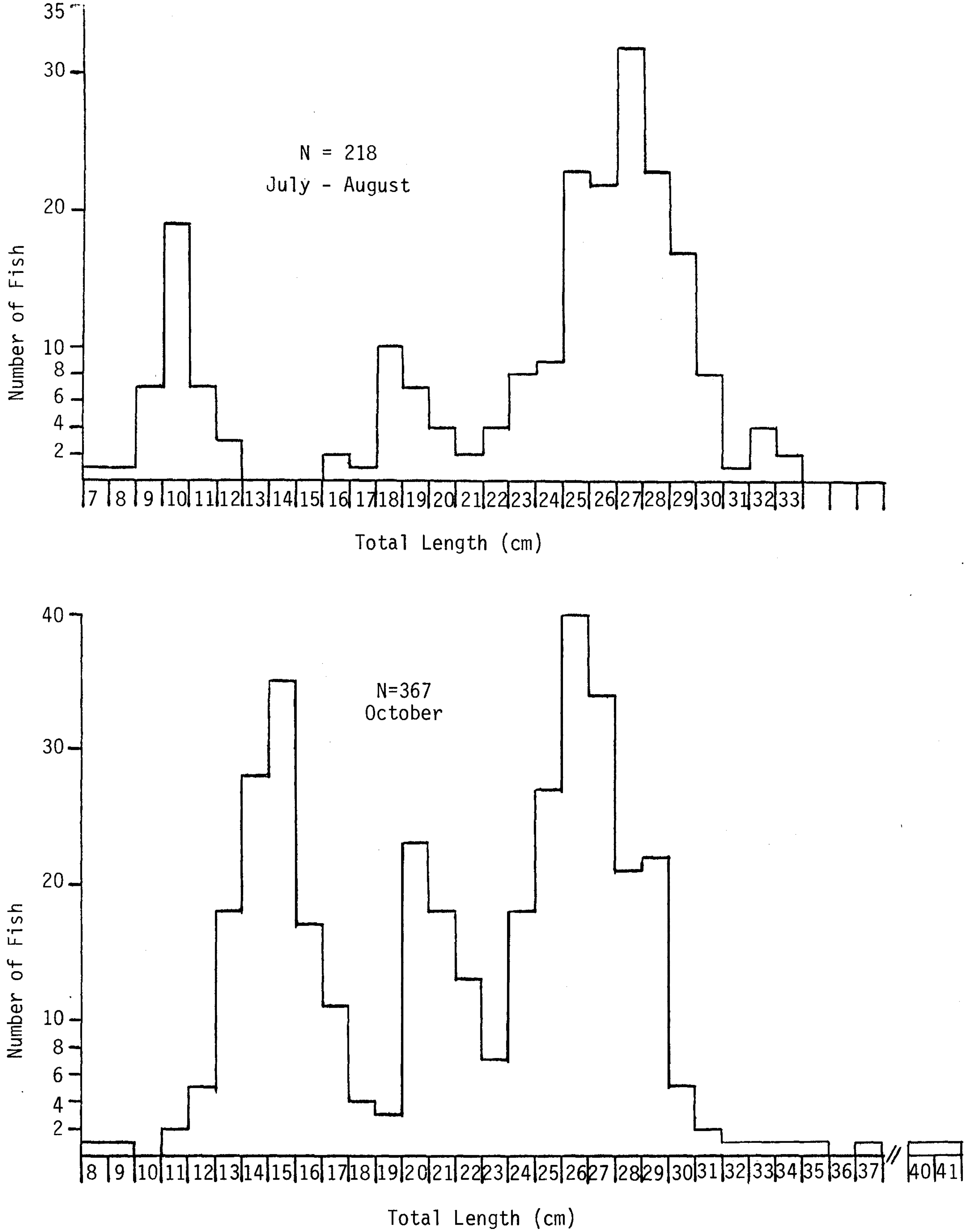


Figure 9. Length frequencies for mountain whitefish in the July-August and October samples from the Boise River (Ft. Boise upstream to Barber Dam), 1974.

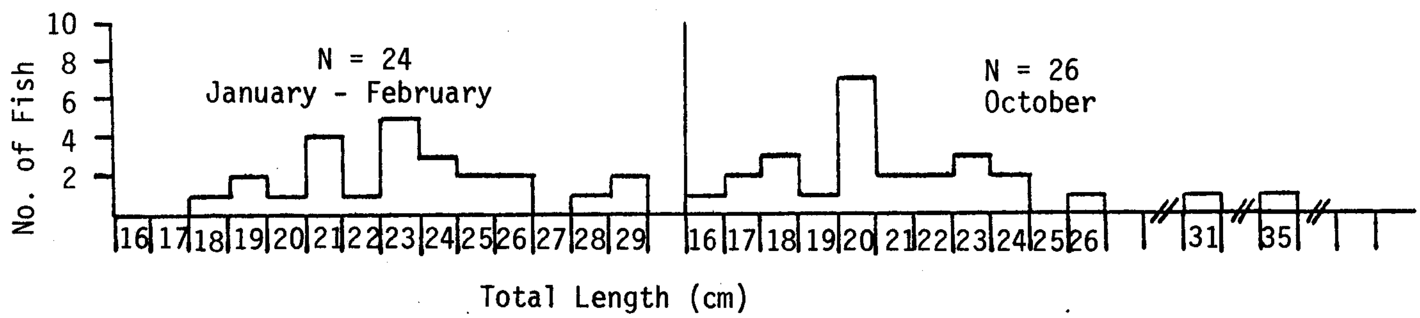


Figure 10. Length frequencies for hatchery rainbow trout in electrofishing samples from the Snake River (Ft. Boise upstream to Barber Dam) during two time periods, 1974.

Largemouth (Fig. 11) and smallmouth (Fig. 12) bass ranged from 30 mm to 490 mm (1.2-19.3 in) and from 70 to 390 mm (2.8-15.4 in), respectively. All bluegill captured were less than 170 mm (6.7 in) and pumpkinseed less than 130 mm (5.1 in).

The 23 channel catfish captured were greater than 220 mm (8.7 in), the largest of 460 mm (18.1 in) total length was found about two miles below the Indian Creek inflow at Caldwell. Brown bullhead ranged from 80 to 230 mm (3.1-9.1 in).

Of captured carp, 95% were 300 mm (11.8 in) or longer, but 49% of suckers (Fig. 13, 14 and 15) and 72% of squawfish (Fig. 16) were less than 300 mm. Chiselmouth length was from 20-310 mm (.8-12.2 in) and 99.4% were 300 mm (11.8 in) or less (Fig. 17 and 18). Redside shiners (Fig. 19) were 20 to 150 mm (.8-5.9 in) in total length with the largest size class as 70 mm (2.8 in) (N=383) in the summer sample. Maximum sculpin length was 160 mm (6.3 in), but the majority were 30 to 110 mm (1.2-4.3 in) (Fig. 20). Dace were 20 to 110 mm (.8-4.3 in) in total length (Fig. 20). Maximum and minimum tui chub sizes were 240 and 50 mm (9.4 and 2.0 in), respectively. The single madtom was 150 mm (5.9 in).

Fish condition and age

I calculated condition factors for 583 fish I could definitely age from scales or spines. The K factor was then averaged for each species age group during the July-August or October electrofishing periods (Table 5).

The average condition factor (my calculation) was .966 for eight mountain whitefish, 117 to 416 mm (4.6-16.4 in) in total length, from the Logan River, Utah (Sigler 1951). Whitefish captured from the Snake River below C. J. Strike Dam, Idaho were similar in condition (Gibson 1975). Whitefish from the Boise River were in poorer condition than those above, and those captured during the summer were in better condition than the fall captured whitefish. Whitefish of 0+ were the most numerous age class in our whitefish sample.

The largemouth bass in our summer sample are in better condition or similar to those reported by Lynch et al (1953) for Two Buttes Reservoir, Colorado (K = 1.60, my calculation). However, the condition of the bass in our fall sample were in worse condition than those in our summer group.

Ritchie (1973) reported the following condition factors he averaged from other researchers' works: bluegill, 200 mm (7.9 in) total length, 2.23 and black crappie, 300 mm (11.8 in), 1.42. The K factors of bluegill in our summer and fall samples were generally less than Ritchie's factors, whereas those of crappie were higher than Ritchie's averages.

The condition factors of channel catfish from our fall sample are similar to those I reported for catfish from the Snake River, Idaho (avg. .92) during the same season in 1973 (Gibson 1974). But catfish in our summer sample were in worse condition than those caught during the same period in the Snake River (K = .87).

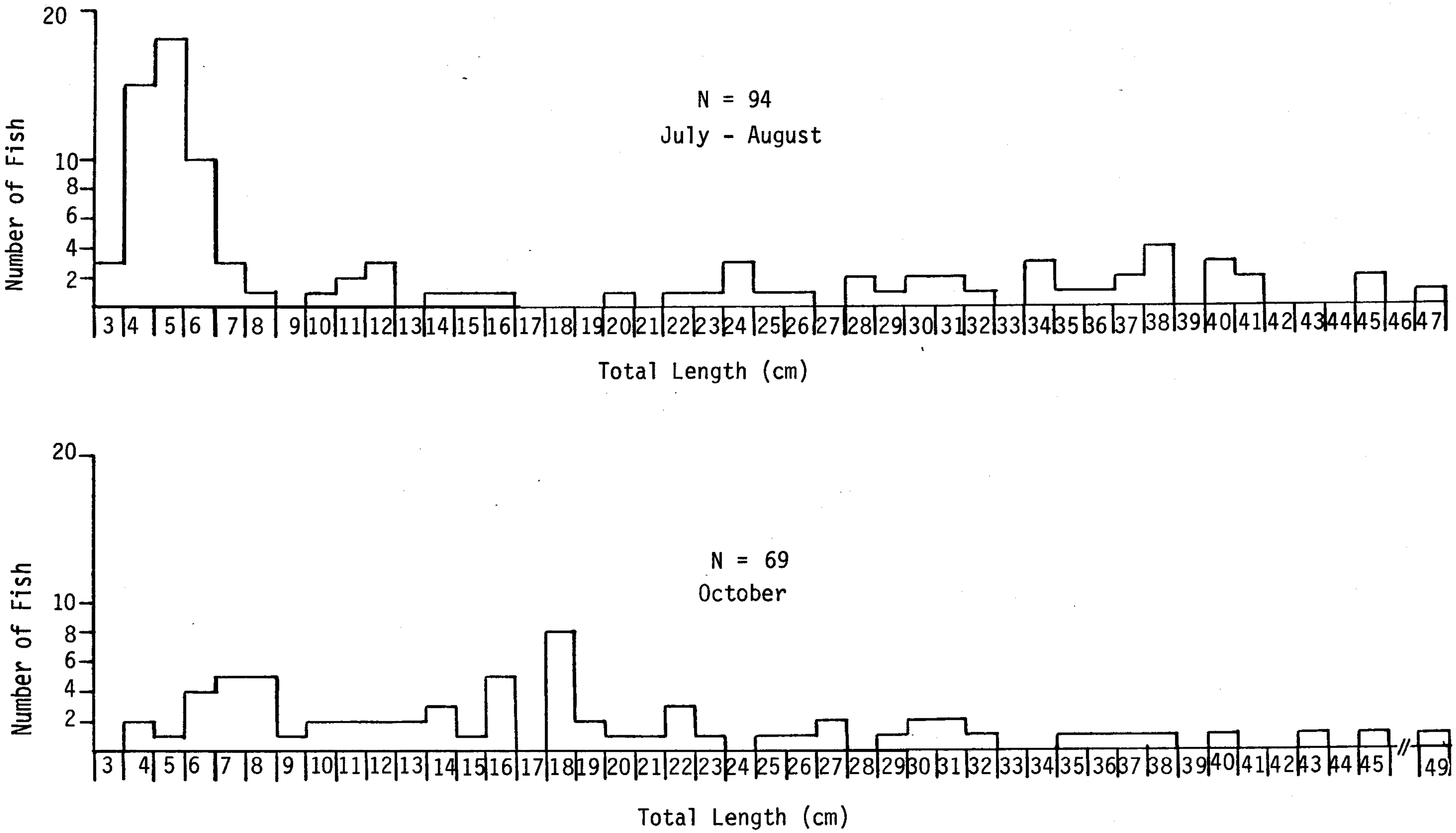


Figure 11. Length frequencies for largemouth bass in electrofishing samples from the Boise River (Ft. Boise upstream to Barber Dam) during two time periods, 1974.

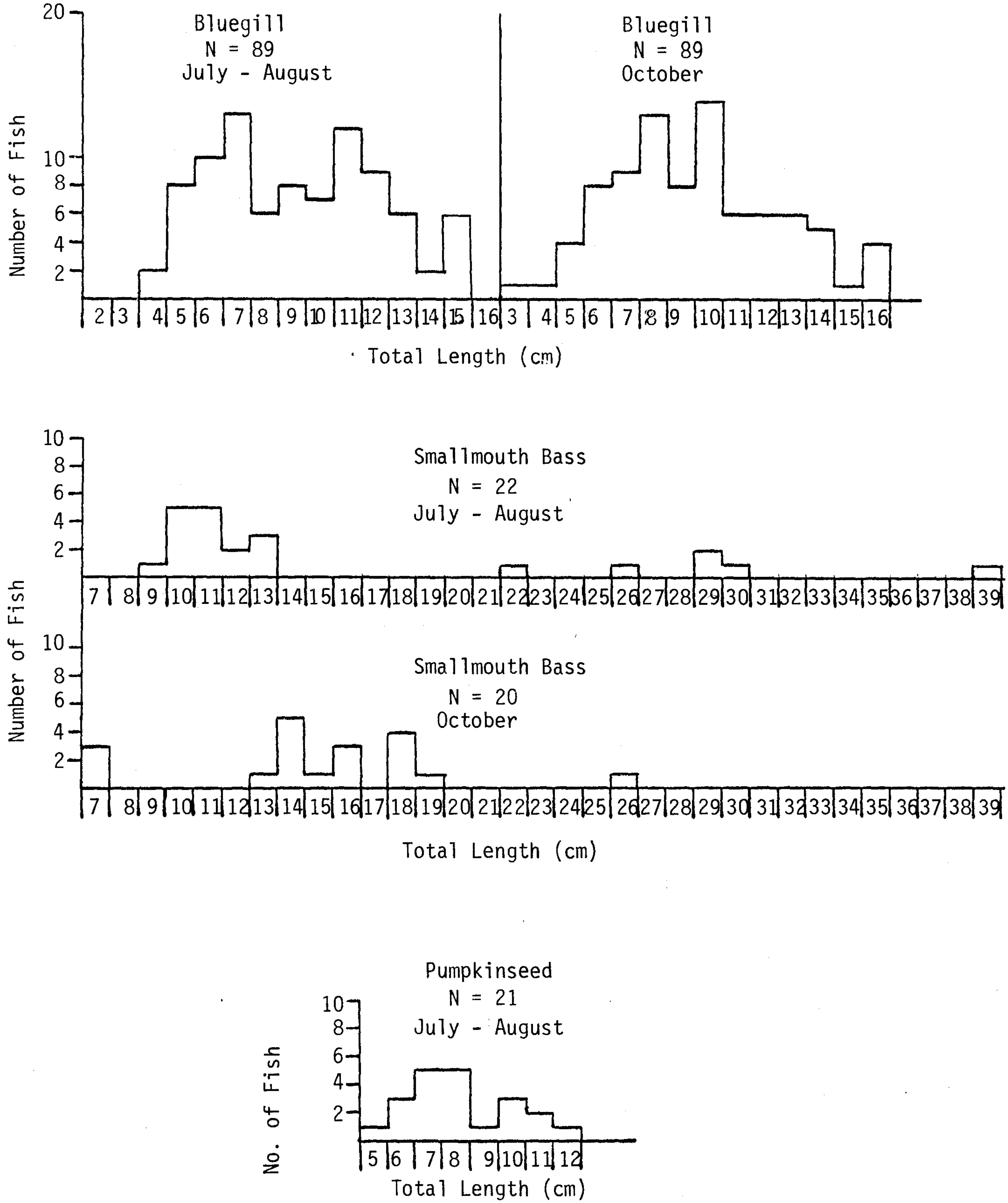


Figure 12. Length frequencies for pumpkinseed, smallmouth bass and bluegill in electrofishing samples from the Boise River (Ft. Boise upstream to Barber Dam) during one or two time periods, 1974.

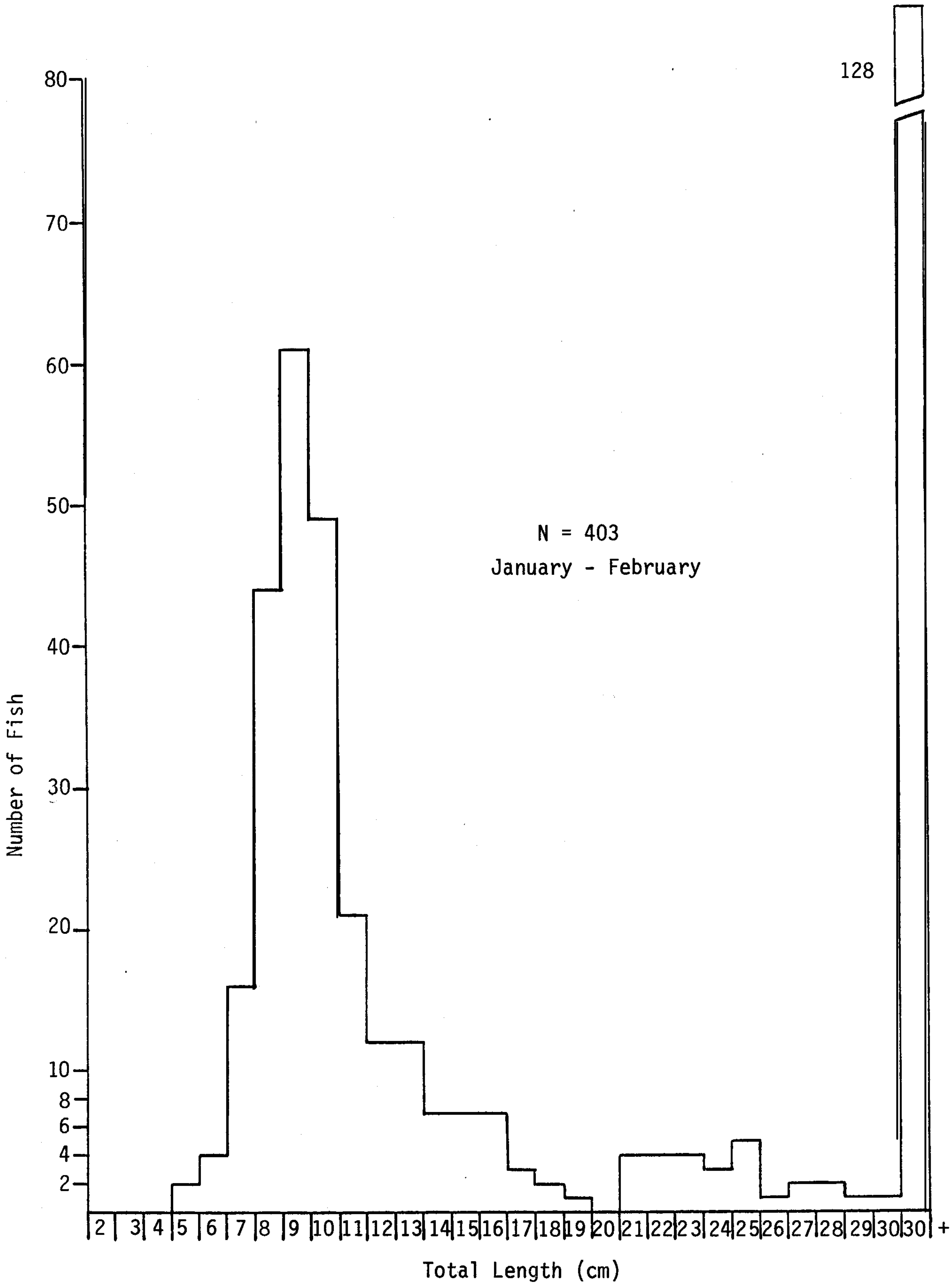


Figure 13. Length frequency for suckers in the January-February electrofishing sample from the Boise River (Ft. Boise upstream to Barber Dam), 1974.

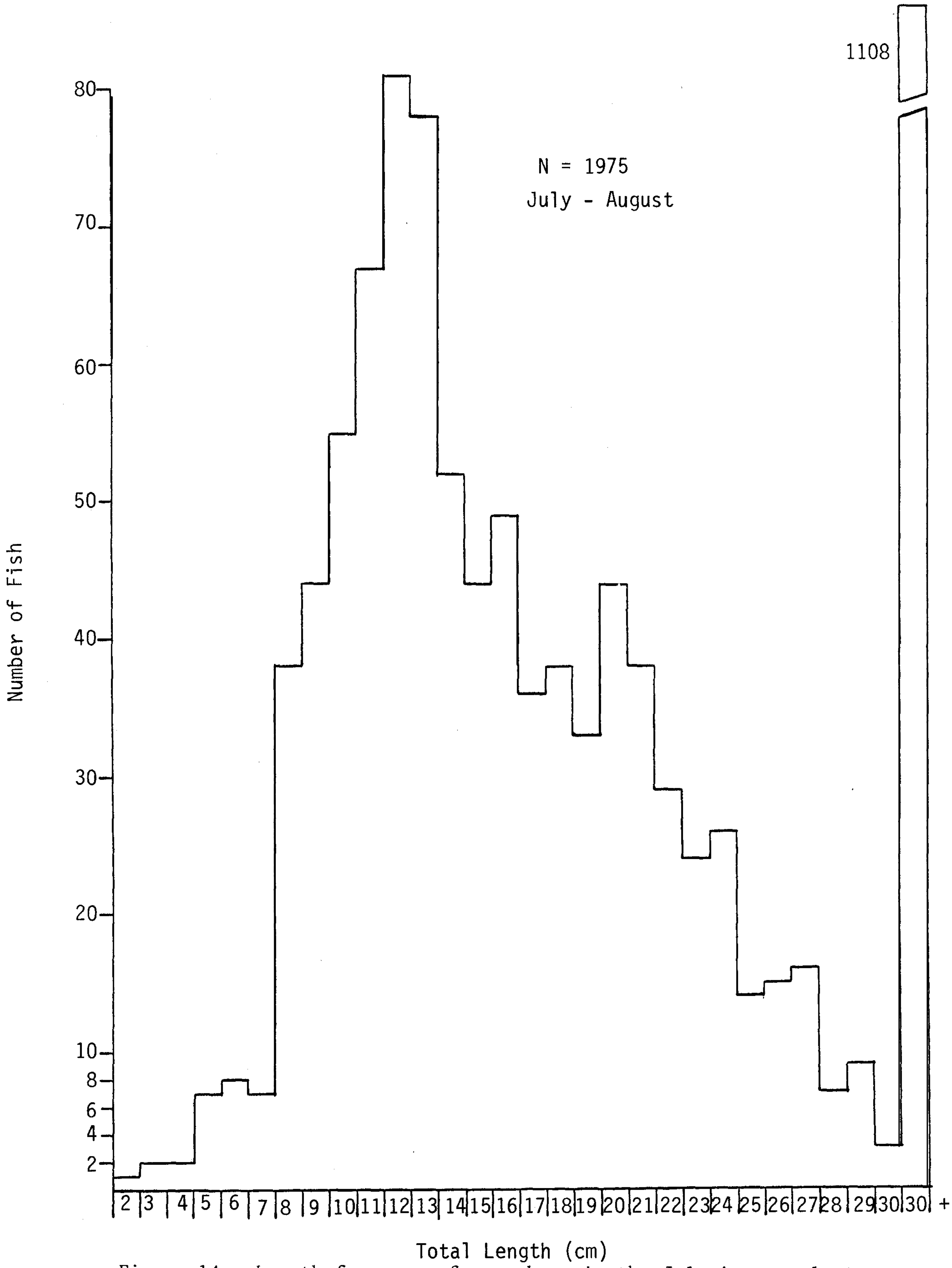


Figure 14. Length frequency for suckers in the July-August electrofishing sample from the Boise River (Ft. Boise upstream to Barber Dam), 1974.

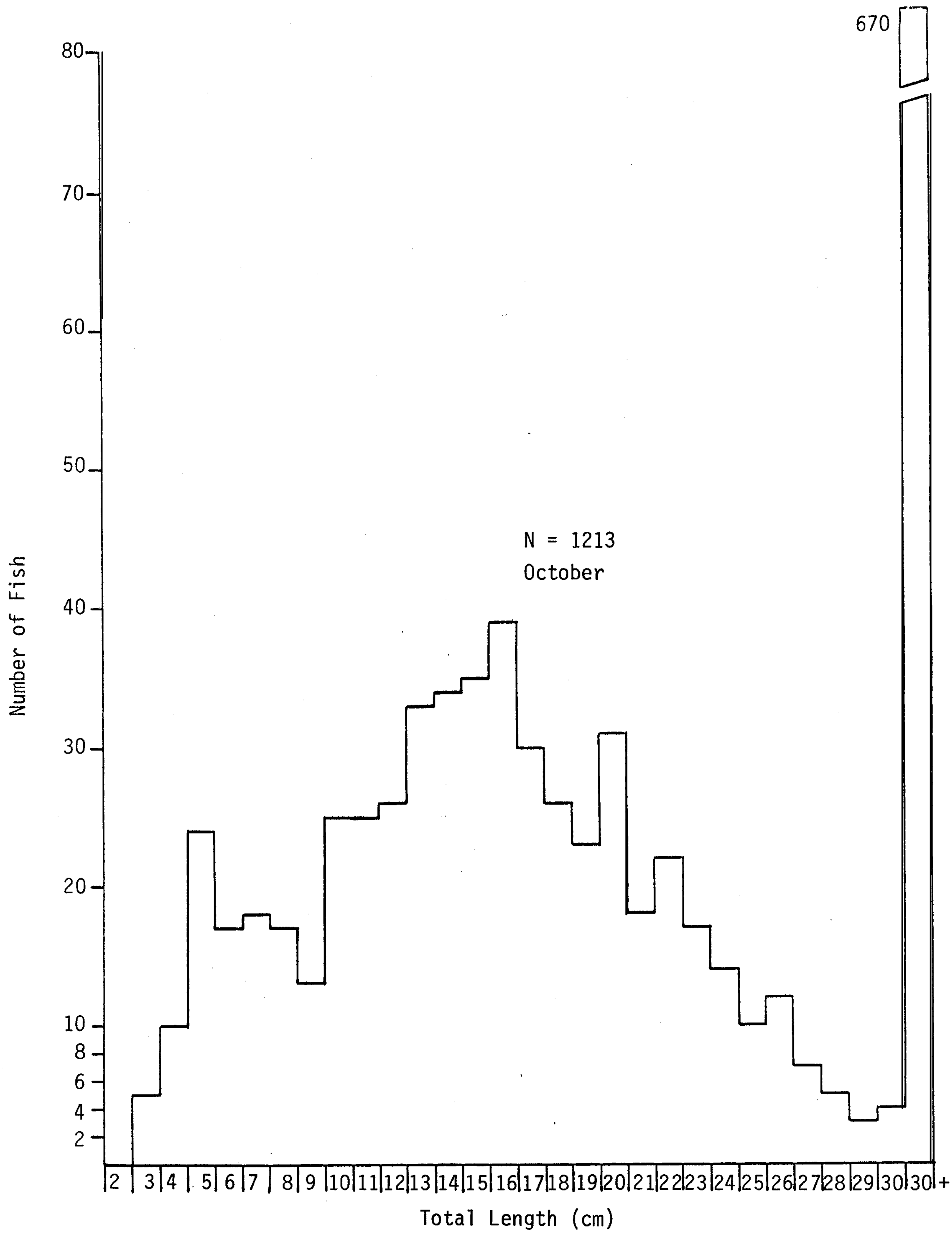
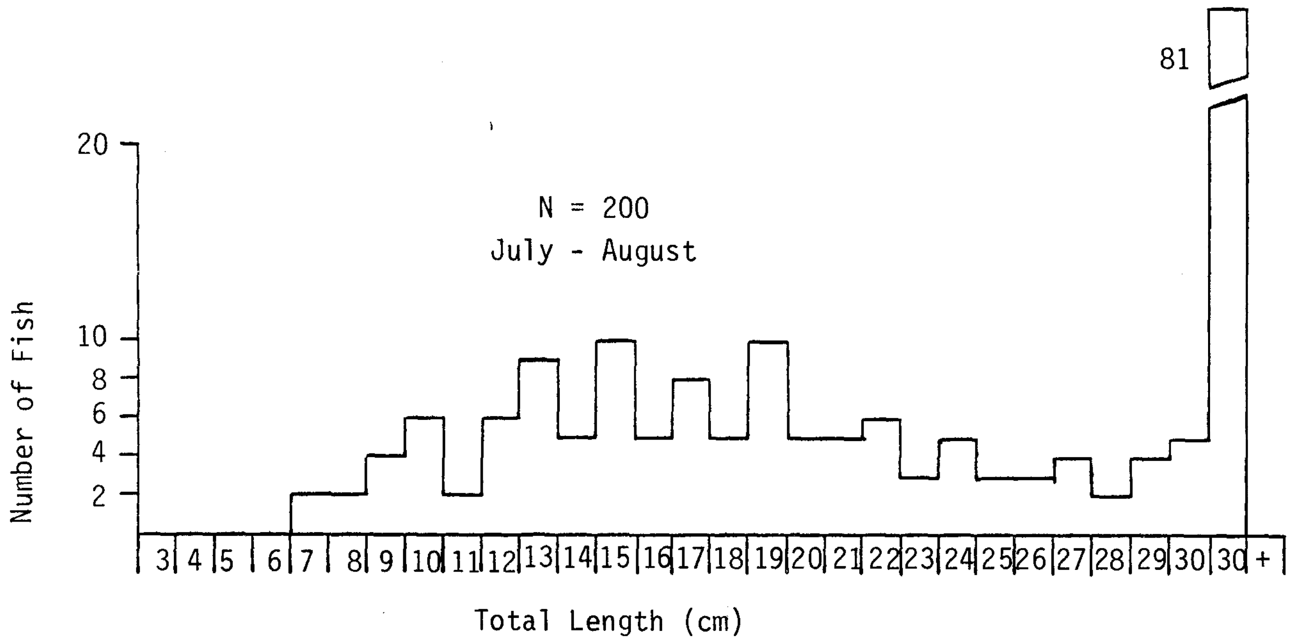


Figure 15. Length frequencies for suckers in the October electrofishing sample from the Boise River (Ft. Boise upstream to Barber Dam), 1974.



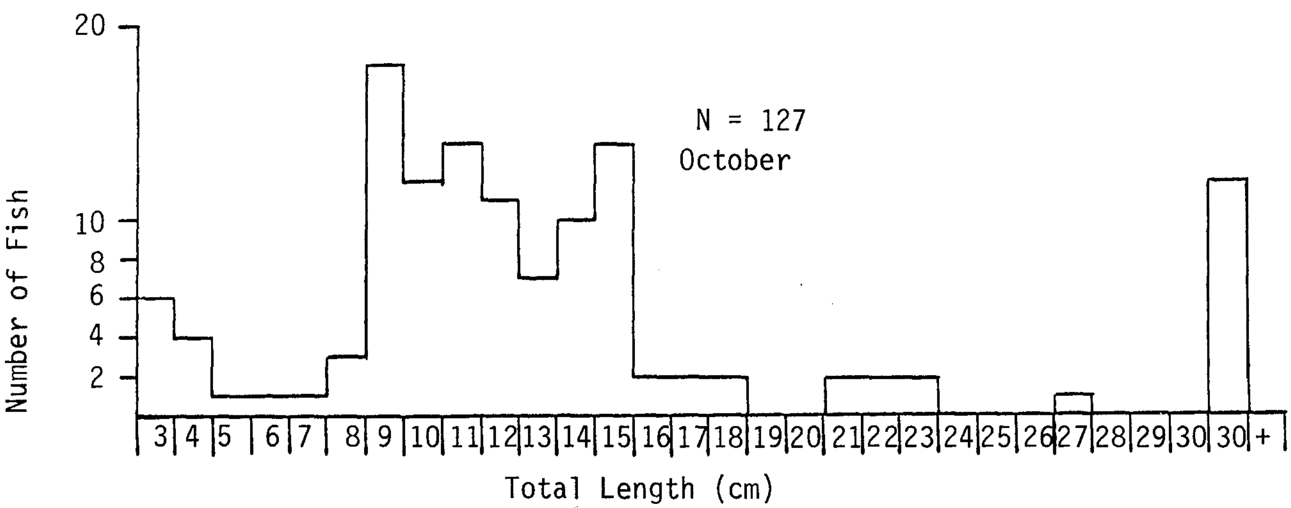


Figure 16. Length frequencies for northern squawfish in electrofishing samples from the Boise River (Ft. Boise upstream to Barber Dam) during two time periods, 1974.

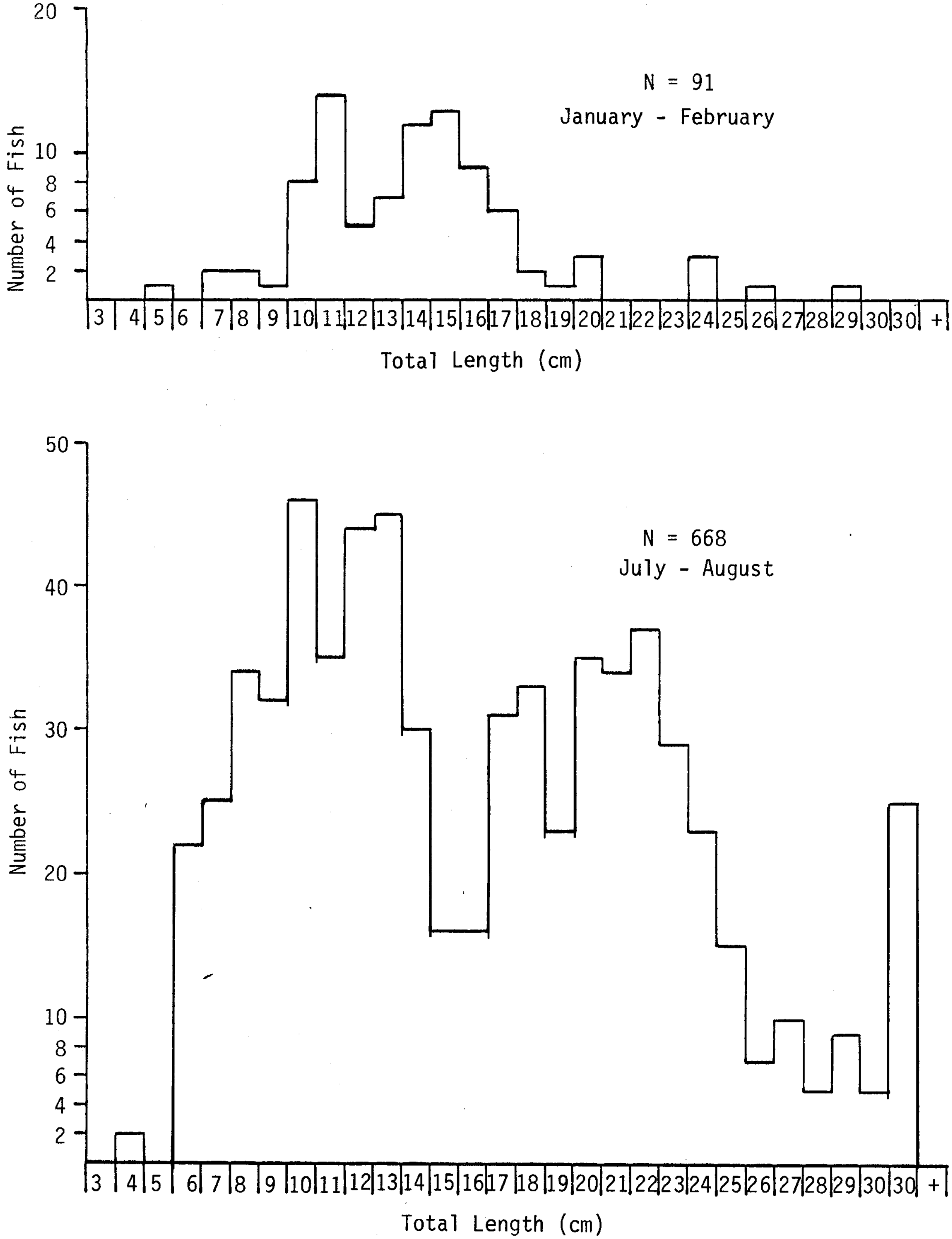


Figure 17. Length frequencies for chiselmouth in electrofishing samples from the Boise River (Ft. Boise upstream to Barber Dam) during two time periods, 1974.

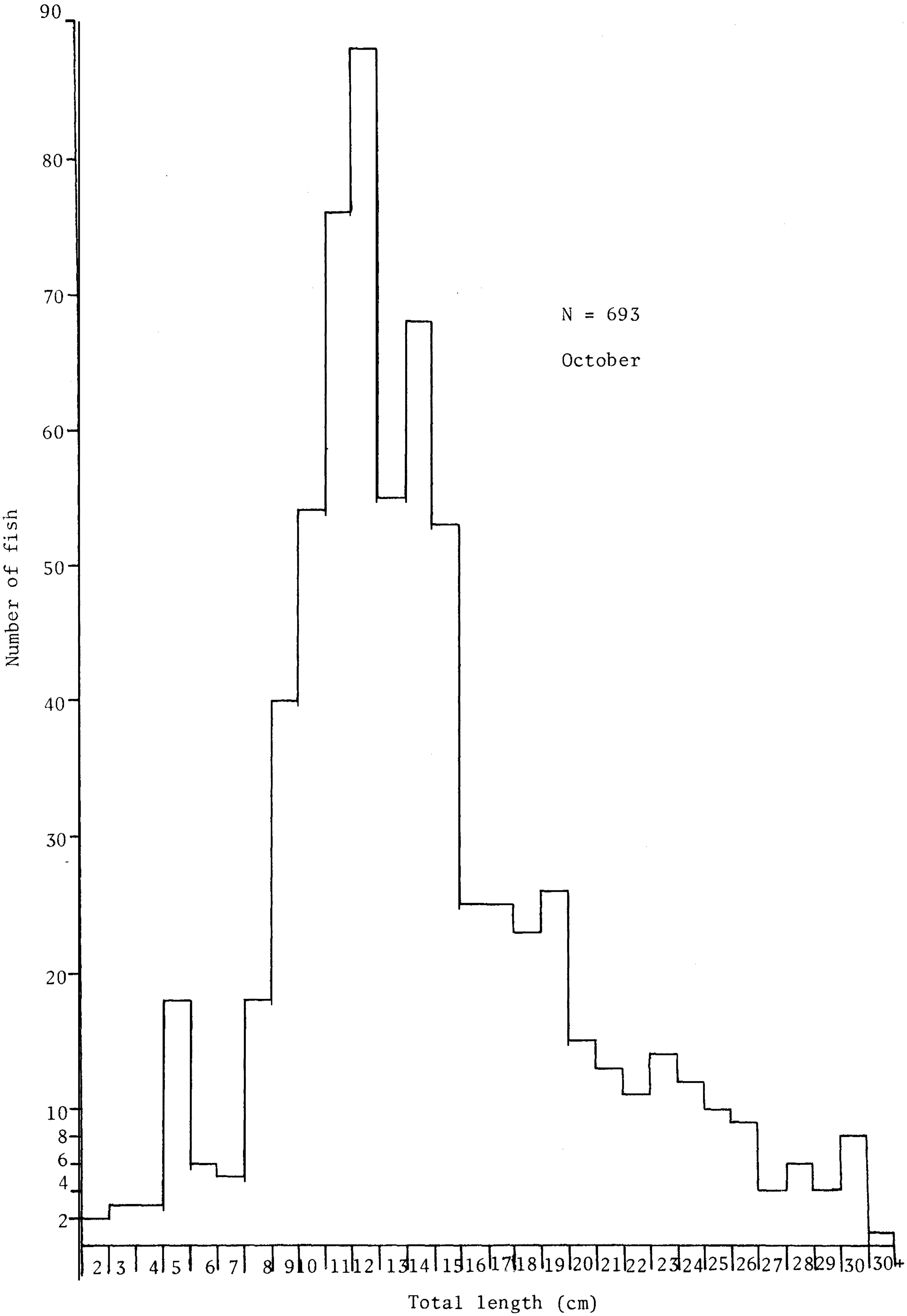


Figure 18. Length frequency for chiselmouth in the October electrofishing sample from the Boise River (Ft. Boise upstream to Barber Dam), 1974.

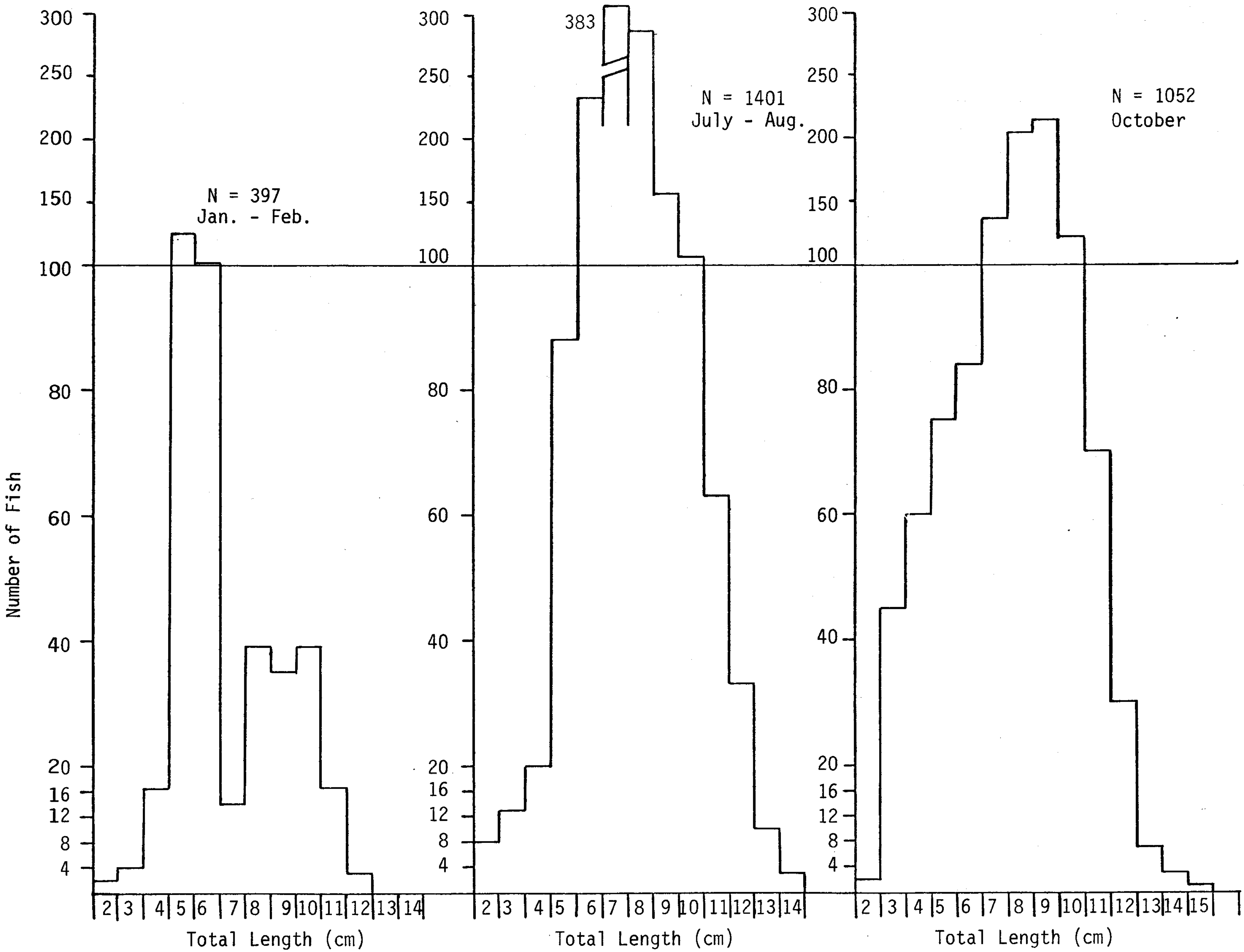


Figure 19. Length frequencies for redside shiners in electrofishing samples from the Boise River (Ft. Boise upstream to Barber Dam) during three time periods, 1974.

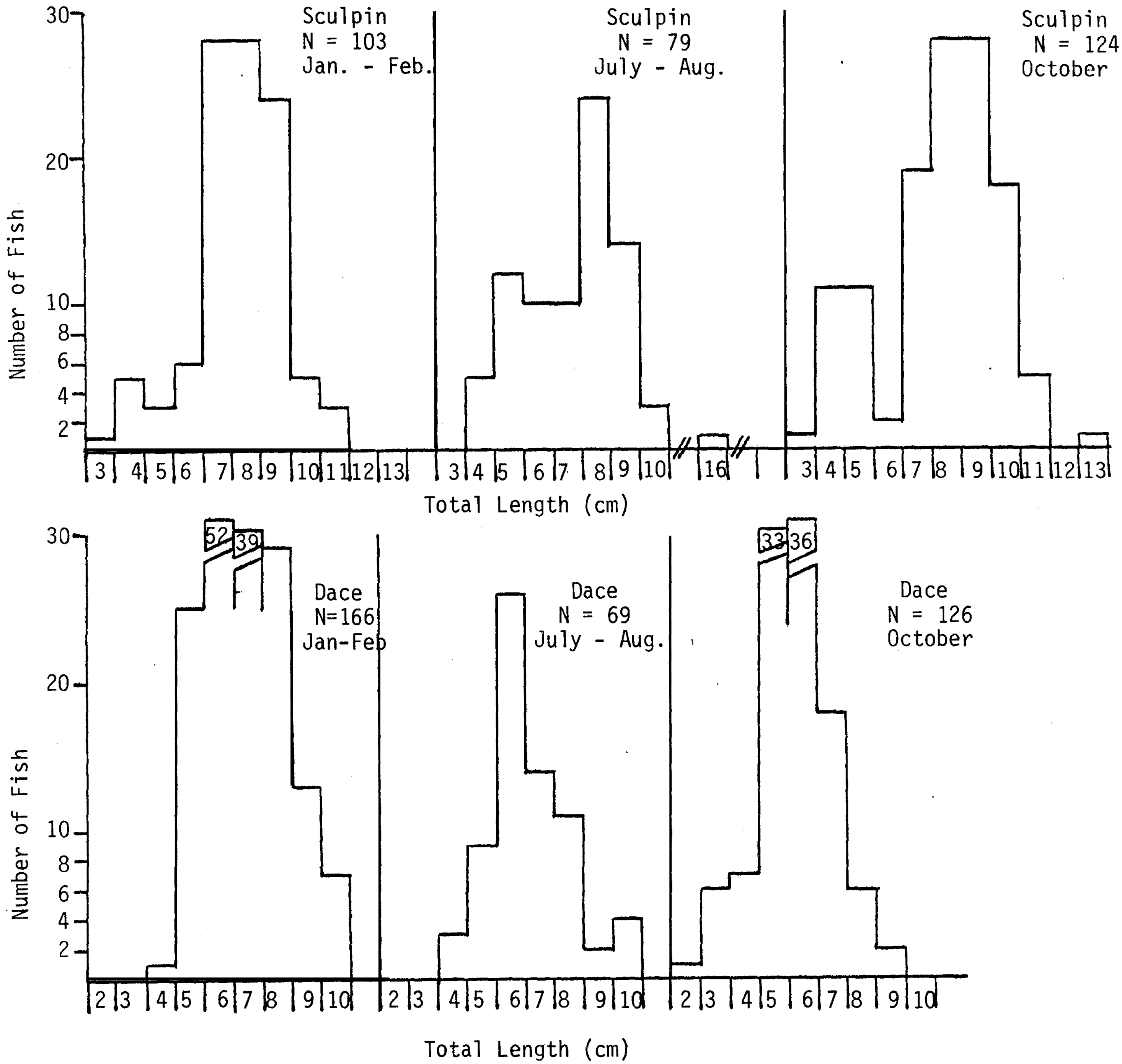


Figure 20. Length frequencies for dace and sculpin in electrofishing samples from the Boise River (Ft. Boise upstream to Barber Dam), 1974.

Table 5. Mean condition factors for each age group of fish species captured in the Boise River mouth upstream to Barber Dam), July-August and October 1974.

	Age group									
	0+	1+	2+	3+	4+	5+	6+	7+	8+	9+
Mountain whitefish										
July-August										
Number of sample fish	29	18	73	24	1					
Fish size range (mm)	70-120	165-210	222-289	280-337	328					
Mean condition factor	.87	1.08	.84	.89	.94					
October										
Number of sample fish	21	18	25	6		1				
Fish size range (mm)	128-175	200-248	240-300	282-309		414				
Mean condition factor	.80	.85	.80	.92		.82				
Largemouth bass										
July-August										
Number of sample fish	27	9	5	5	6	4	8	3	3	
Fish size range (mm)	41-77	89-150	200-246	253-280	285-320	342-386	350-408	408-417	416-452	
Mean condition factor	1.3	1.48	1.61	1.62	1.74	1.75	1.69	1.99	2.07	
October										
Number of sample fish	19	25	8	4	5	2	2	3		1
Fish size range (mm)	47-118	119-198	184-229	257-272	304-328	356-360	373-380	406-450		496
Mean condition factor	1.18	1.34	1.43	1.47	1.55	1.60	1.50	1.62		1.68
Bluegill										
July-August										
Number of sample fish	2	38	28	7	1					
Fish size range (mm)	48	49-98	94-140	135-157	158					
Mean condition factor	1.82	1.87	2.05	2.06	1.96					
October										
Number of sample fish		28	13	8	3					
Fish size range (mm)		50-105	110-134	132-150	162-167					
Mean condition factor		1.86	2.1	2.08	2.32					

Table 5 (continued). Mean condition factors for each age group of fish species captured in the Boise River (mouth upstream to Barber Dam) July-August and October 1974.

	Age group										
	0+	1+	2+	3+	4+	5+		7+	8+		Other
Black crappie											
July-August											
Number of sample fish	1	3	3	4	1						
Fish size range (mm)	53	99-131	137-153	160-220	250						
Mean condition factor	1.28	1.44	1.43	1.78	1.53						
October											
Number of sample fish	3	3	3	1	1						
Fish size range (mm)	71-80	123-130	179-202	200	224						
Mean condition factor	1.57	1.61	1.50	1.53	1.64						
Channel catfish											
July-August											(14+
Number of sample fish				1	3		8	1			1
Fish size range (mm)				272	280-309		290-360	304			460
Mean condition factor				.75	.77		.76	.76			.86
October										11+	12+
Number of sample fish							2		2	1	1
Fish size range (mm)							322-324		393-434	339	499
Mean condition factor							.90		.95	.84	.95
Smallmouth bass											
July-August											
Number of sample fish		12		1	3	1					
Fish size range (mm)		90-132		260	292-300	390					
Mean condition factor		1.56		1.53	1.54	1.33					
October											
Number of sample fish	2	16									
Fish size range (mm)	72-77	141-199									
Mean condition factor	1.22	1.27									
Pumpkinseed (No October data)											
July-August											
Number of sample fish	12	8	2								
Fish size range (mm)	55-83	84-116	115-120								
Mean condition factor	1.80	2.07	2.08								

Captured smallmouth bass were predominately in the 0+ age class. The condition factor of bass sampled during July-August averaged higher than those from the Snake River (1.49) during a comparable time period (Gibson 1974). Smallmouth bass of 0+ and 1+ ages in our fall sample were in worse condition than those we captured **in** the summer and those from the Snake River (0+ = 1.5, 1+ = 1.38) captured during September, 1973.

Because of few pumpkinseed captured during the fall, I was only able to determine an age structure for this species captured during the summer period. This species averaged poorer condition than those I found in the Snake River (K = 2.11) in 1974 (Gibson 1975).

Length-weight relationships

We captured six game fish species in quantity suitable for length-weight relationships. Whitefish (Fig. 21) and smallmouth bass (Fig. 22) length-weight relationships are similar to those plotted for the same species captured from the Snake River downstream from the proposed Guffey Dam site (Gibson 1974). Relationships of Boise River largemouth bass (Fig. 23) are similar to Snake River bass of less than 300 mm (11.8 in), but Boise River fish are heavier for lengths greater than 300 mm.

Length-weight curve of channel catfish (Fig. 24) from the Boise River is similar in slope to the empirical curve of Snake River catfish. However, catfish of equal length weigh less from the Boise River than from the Snake River. Length-weight relationships of pumpkinseed and bluegill (Fig. 25) are expressed only for fish less than 120 and 150 mm (4.7-5.9 in), respectively.

Food habits of mountain whitefish

We collected 62 stomachs from mountain whitefish captured by electrofishing. All stomachs contained at least one type of food or nonfood. Eighty-seven percent carried four or more types of items. A stomach from a 262 mm (10.3 in) whitefish contained the maximum of 13 types. A total of 21 foods or nonfoods were found in the stomachs examined from our sample (Table 6).

Immature aquatic insects, chiefly Diptera, Ephemeroptera, Trichoptera and Lepidoptera were the most important food items (Table 7). Tendipedidae, Pyralidae and Baetidae occurred most often in whitefish stomachs from the Boise area. Tendipedidae, Baetidae and Heptagenidae occurred most frequently in the Eagle area, and Tendipedidae, Hydropsychidae and Pyralidae were most common in stomachs from the Middleton section of the Boise River.

Whitefish from 150 to 249 mm (5.9-9.8 in) preferred Tendipedidae, Baetidae, Pyralidae and Simulidae in order of consumption (Table 8). As they grew to 250 to 299 mm (9.8-11.8 in), they ingested less Tendipedidae but greater volumes of Pyralidae, Simulidae and nonfood items such as sand, sticks and leaves. Whitefish from 300 to 349 mm (11.8-13.7 in) began consuming less of those insects important to smaller fish, but consumed more Hydropsychidae and nonfood items (pebbles, sand and sticks). No stomachs contained evidence of fish consumption.

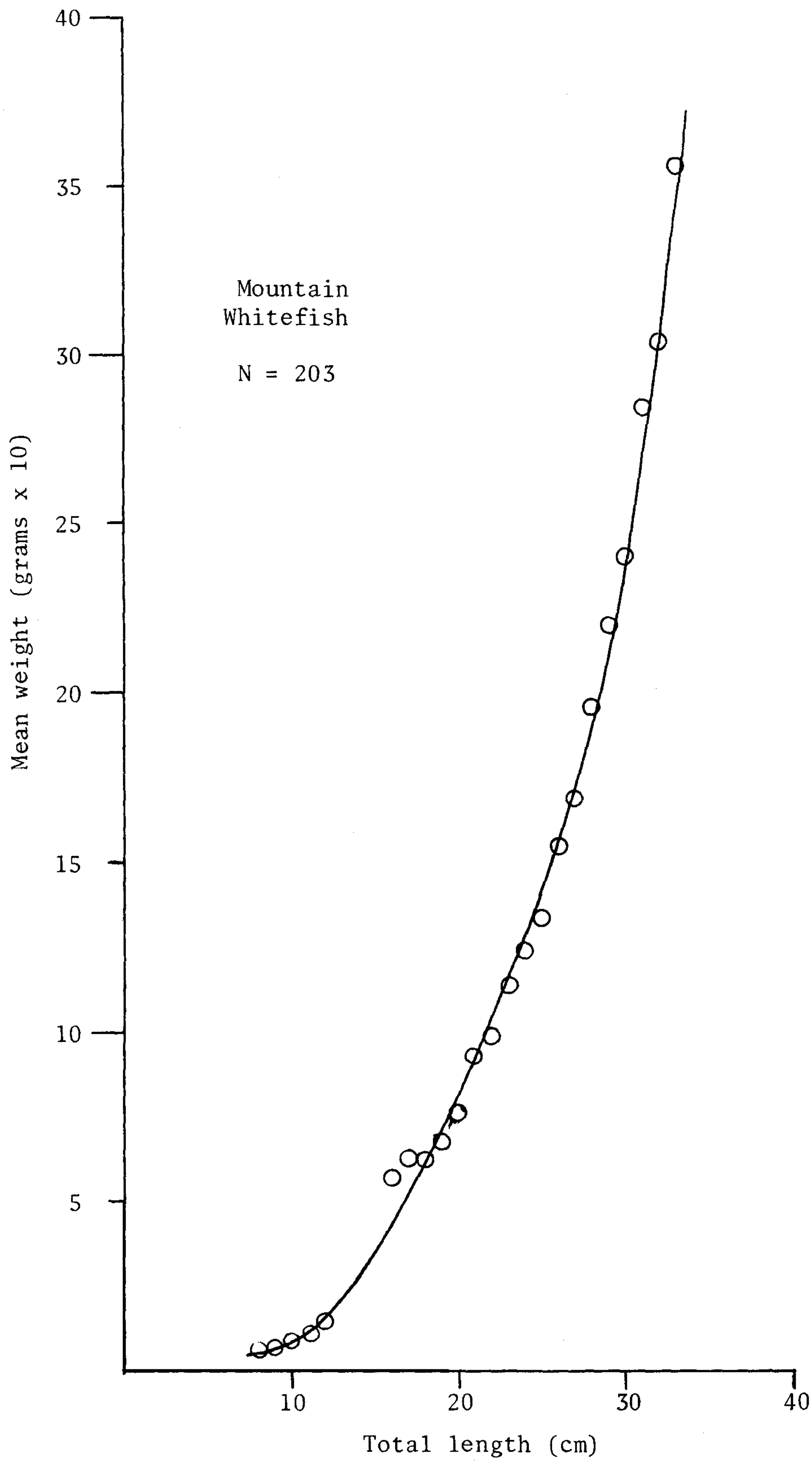


Figure 21. Length-weight relationship for whitefish in electrofishing sample from the Boise River (Ft. Boise upstream to Barbar Dam) July-August, 1974.

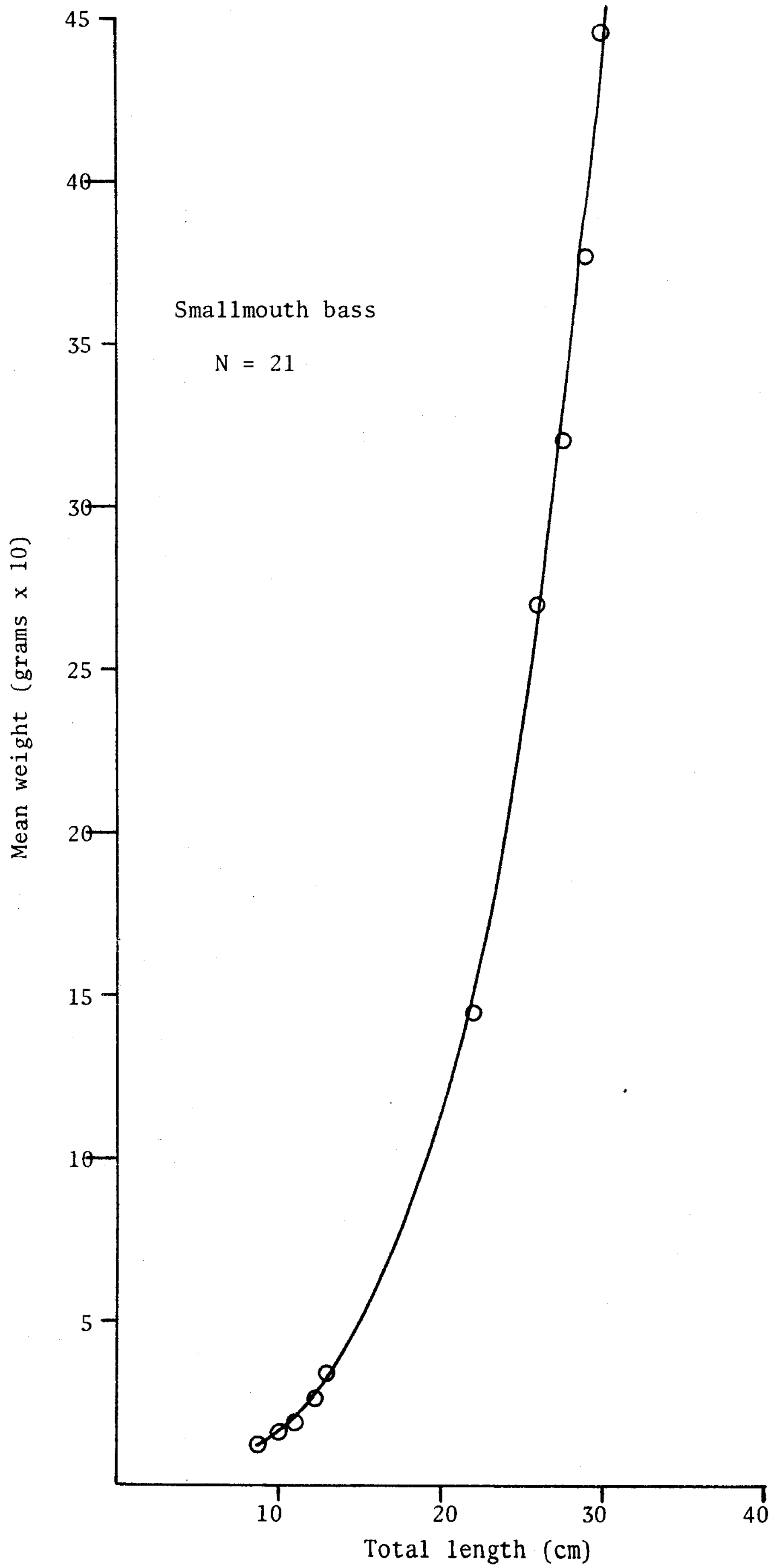


Figure 22. Length-weight relationship for smallmouth bass in electrofishing sample from the Boise River (Ft. Boise upstream to Barber Dam) July-August, 1974.

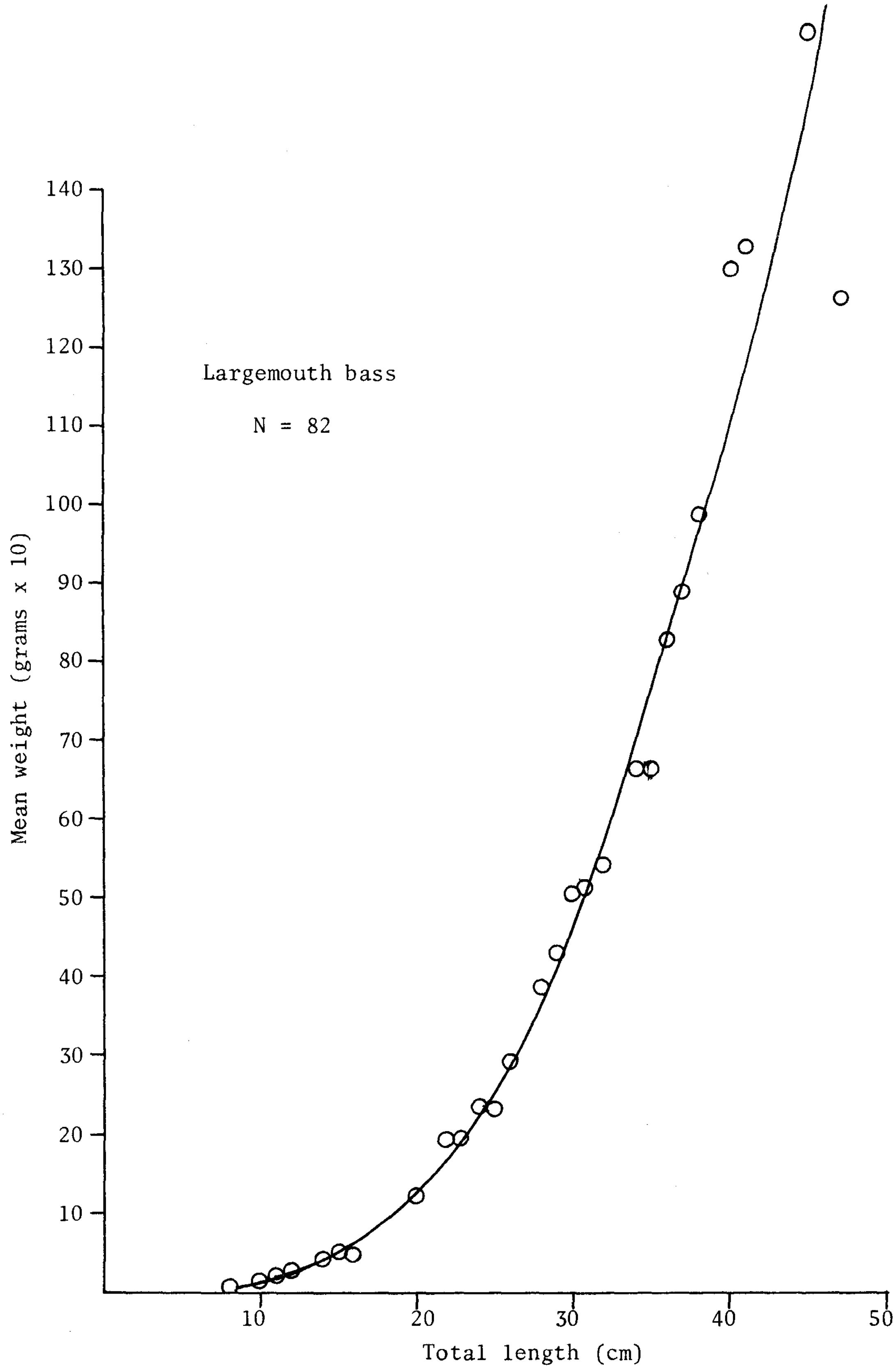


Figure 23. Length-weight relationship for largemouth bass in electrofishing sample from the Boise River (Ft. Boise upstream to Barber Dam) July-August, 1974.

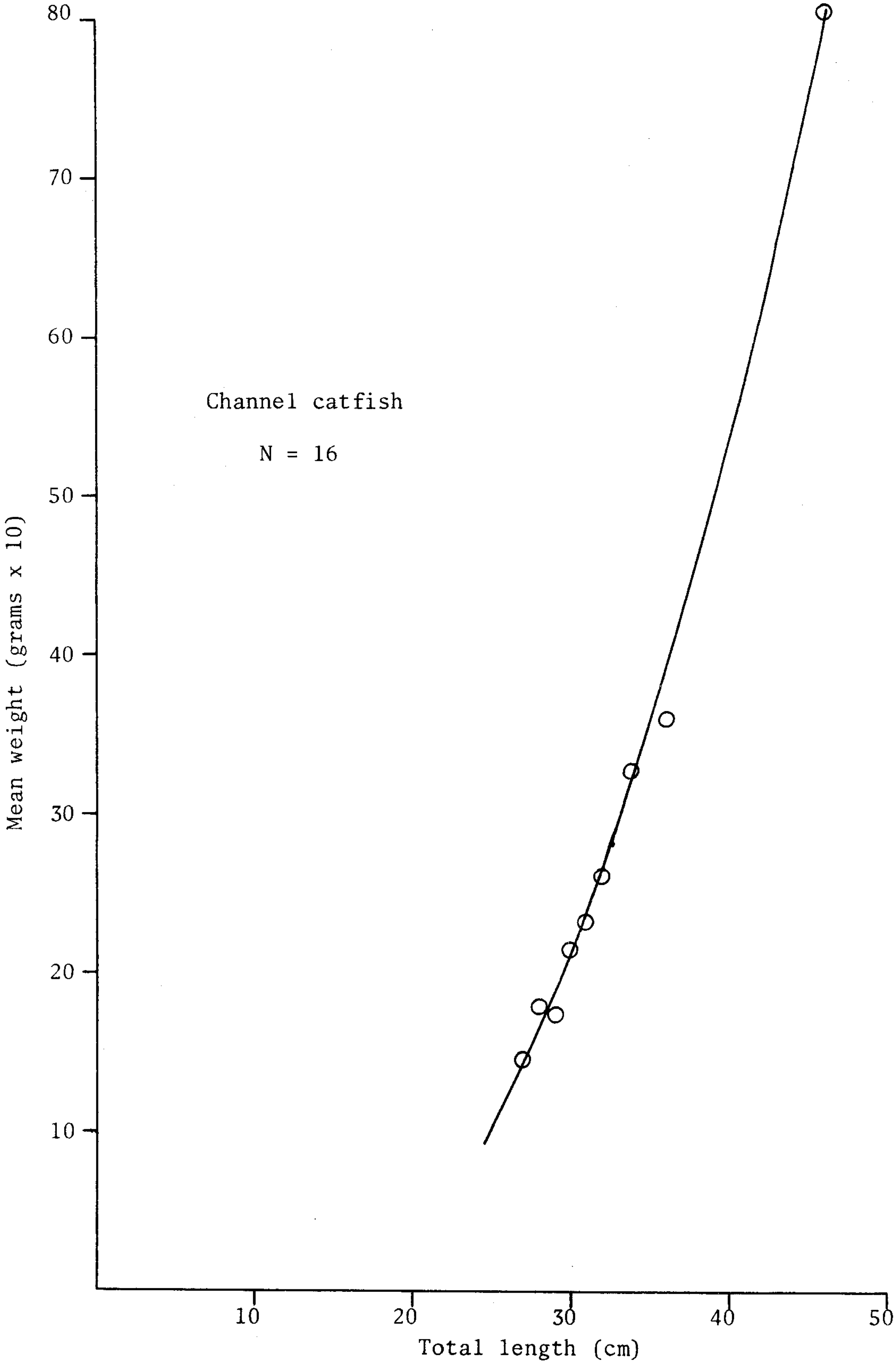


Figure 24. Length-weight relationship for channel catfish in electrofishing sample from the Boise River (Ft. Boise upstream to Barber Dam) July-August, 1974.

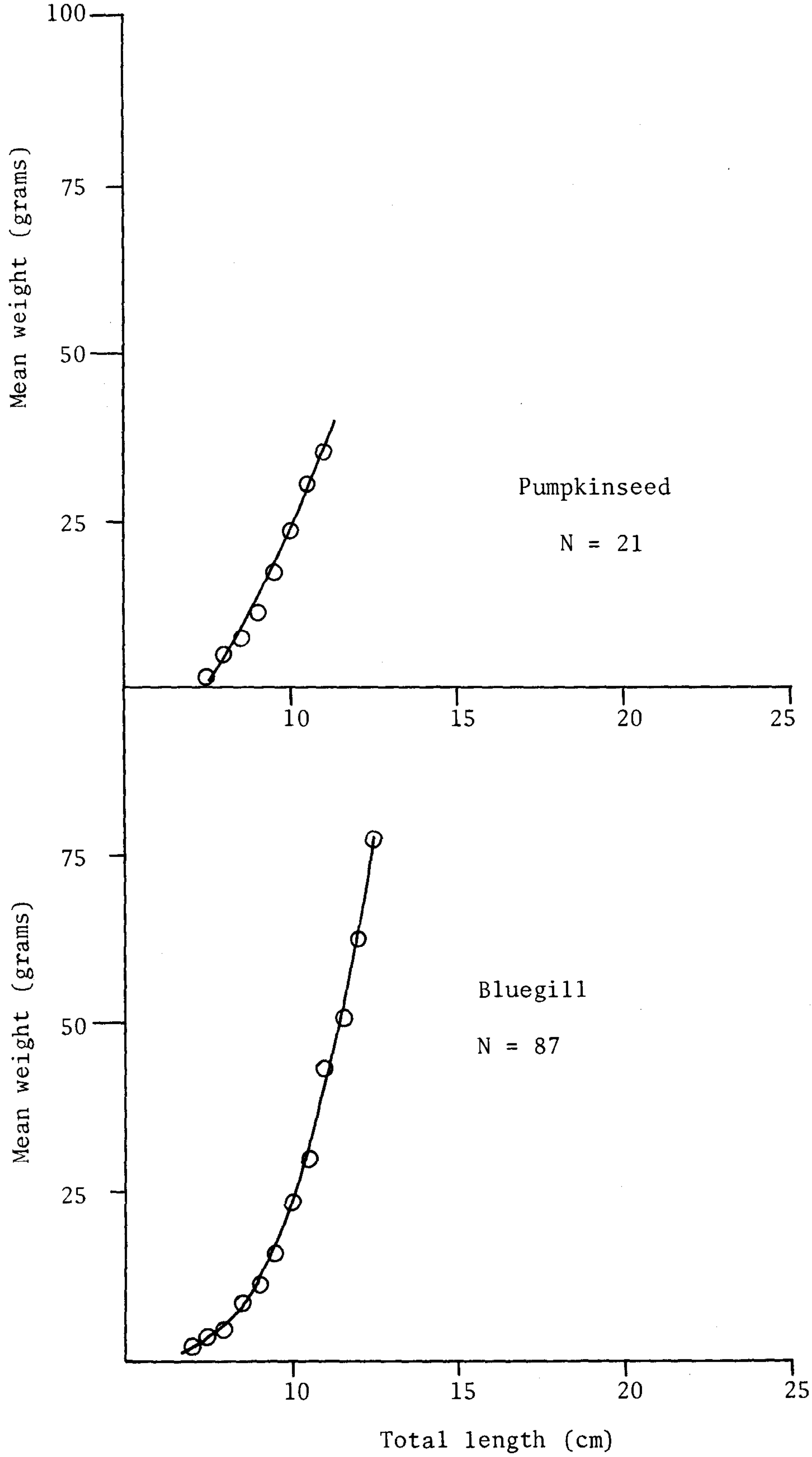


Figure 25. Length-weight relationships for bluegill and pumpkinseed in electrofishing sample from the Boise River (Fort Boise upstream to Barber Dam) July-August, 1974.

Table 6. Foods and nonfoods in stomachs from mountain whitefish captured by electrofishing in the Boise River (Barber Dam downstream to Fort Boise) summer, 1974.

1. Green algae
   - _Spirogyra_ sp.

2. Mollusca
   - _Gyraulus_ sp.

3. Crustacea
   - Isopoda
     - Aquatic Sow Bugs

Homoptera
   - Cicadellidae (leaf hoppers)

5. Hymenoptera (ants and wasps)

6. Hemiptera
   - Family Corixidae (water boatman)

7. Coleoptera (beetles)
   - Family Elmidae

8. Ephemeroptera (mayfly)
   - Family Baetidae
   - Family Heptagenidae

9. Trichoptera (caddisflies)
   - Family Hydropsychidae
   - Family Ryachophilidae

10. Lepidoptera (aquatic moths)
    - Family Pyralidae

11. Hydrachna (water mites)

12. Diptera
    - Family Tendipedidae
      - (Chironomidae) Nonbiting midges
    - Family Simulidae
      - Blackflies

13. Sand and grit

14. Pebbles

15. Sticks

16. Leaves

17. Seed

18. Egg cluster

Table 7. Percentage occurrence of food organisms in stomachs from mountain whitefish, 15 cm (6 in) or greater, collected from the Boise River (Barber Dam downstream to Fort Boise), summer, 1974.

Fish Length	Number stomachs with food	Aquatic Insects						Terrestrial	Other
		Tendipedidae	Baetidae	Pyralidae	Simulidae	Hydropsychidae	Others[1]	Insects[2]	
15-24.9 cm	22	95	68	64	54	23	80	18	54
25-29.9 cm	35	86	60	49	43	34	34	20	69
30-34.9 cm	5	60	20	40	20	100	80	0	80

[1]Includes Heptagenidae, Ryachophilidae and Corixidae.
[2]Flying aquatic insects were classified as terrestrials.

Table 8. Percentage of volume of food organisms in stomachs from mountain whitefish, 15 cm (6 in) or greater, collected from the Boise River (Barber Dam downstream to Fort Boise), summer, 1974.

Fish Length	Number stomachs with food	Aquatic Insects						Terrestrial	Other
		Tendipedidae	Baetidae	Pyralidae	Simulidae	Hydropsychidae	Others[1]	Insects[2]	
15-24.9 cm	22	61	6	7	5	2	8	1	10
25-29.9 cm	35	10	5	19	13	4	21	1	27
30-34.9 cm	5	2	0.8	1	0.2	13	29	0	54

[1]Includes Heptagenidae, Ryachophilidae and Corixidae.
[2]Flying aquatic insects were classified as terrestrials.

Food habits of other fish species

We collected stomachs from three hatchery rainbow trout, three smallmouth bass and two channel catfish that died during our shocking operation. The trout, 170 to 300 mm (6.7-11.8 in) total length, consumed chiefly terrestrial insects plus small numbers of immature Baetidae and Hydropsychidae. Principal terrestrial insects were Formicidae (ants) and Sarcophagidae (flesh flies).

Only one smallmouth bass stomach from a 120 mm (4.7 in) fish contained material, principally immature Heptagenidae. The two channel catfish stomachs from 30 to 31 mm (1.2 in) specimens contained chiefly immature Hydropsychidae and Tendipedidae.

Benthos abundance and distribution

We collected 26 Surber samples from six locations on the Boise River on 12-14 August 1974 (Table 9). Hydropsychidae, Baetidae, Chironomidae and Simulidae were the most abundant of the 15 total families (9 orders) in our samples. Average numbers of organisms per .09 m^2 (1 ft^2) ranged from 30.8 at Strawberry Glenn to 169.3 at Notus.

Caddisflies (Trichoptera), pollution-sensitive organisms, were most common in the Star and Notus samples. Mayflies (Ephemeroptera), also pollution-sensitive, were most abundant in our samples from Star and Fort Boise. Flies and midges (Dipteras), pollution tolerant, were most numerous in the Notus and Caldwell Surber samples. These three orders were encountered at all sampling locations but at some sites more than at others.

Fish planting

At least 20,000 rainbow trout catchables, over 150 mm (6 in), are planted each year in the Boise River from Eckhart Bridge (Barber) to the Star area. In the planting year, October 1973 to September 1974, 28,090 rainbow catchables were planted in this section of the river (County Fish Planting Summary 1974). We captured catchables (by electrofishing) downstream to the Fish and Game access site upstream from Middleton.

Because of our low electrofishing recovery rate on rainbow catchables, I could not ascertain movement, upstream or downstream, that these fish take when released from the hatchery truck. We captured hatchery rainbows halfway between release sites in which they may have migrated either upriver or downriver. I did determine, from fisherman interviews, that introduced rainbow trout were caught 457 m (500 yd) below the release site within 4 days after hatchery release.

Approximately 19,563 brown trout fingerlings, 76-150 mm (3-6 in), were planted in the Barber and Eagle areas during the 1974 planting year (County Fish Planting Summary 1974), the second year of planting brown trout. We captured brown trout, 90-170 mm (3.5-7 in), at Strawberry Glenn and Eagle, but we captured none at Boise.

Water temperature regimes

Water temperatures, both average weekly minimum (Fig. 26) and maximum

Table 9. Average number of benthos per .09 m^2 (1 ft^2) sample from six stations on the Boise River, August 1974.

	Location					
Organism	Barber	Straw-berry	Star	Caldwell	Notus	Fort Boise
Ephemeroptera (mayflies)						
Baetidae	17.3	4.2	37.3	17.0	21.0	29.3
Heptagenidae	10.5	8.8	8.3	3.5	1.3	4.5
Ephemeridae	0.5		2.5	4.0	11.8	21.0
Trichoptera (caddisflies)						
Hydropsychidae	1.0	0.2	103.8	6.8	70.3	16.3
Ryacophilidae	0.3		0.8		0.3	0.5
Hydroptilidae						0.3
Diptera						
Chironomidae (midges)	18.5	7.8	13.8	35.5	12.3	15.0
Simulidae (blackflies)	0.5	3.4	0.5	1.5	50.8	
Empididae (dance flies)		0.2	0.3	0.3		
Lepidoptera (moth)						
Pyralidae	0.3	0.2		0.5	1.0	1.0
Hymenoptera		0.2				
Coleoptera (beetles)						
Elmidae				0.3		
Nematoda (round worms)	5.8	5.8		1.0		
Hirundinea (leeches)				.2	0.5	0.2
Ave. no. of insects/sample	54.7	30.8	167.3	70.6	169.3	88.1

(Fig. 27) were much greater at Fort Boise than at Barber, particularly during the summer months. Maximum temperatures occurred at Fort Boise during July, 25 C (77 F), and at Barber during September, 18.3 C (64.9 F).

Boise River temperatures generally increased through the city of Boise from Barber (Fig. 28) downstream to Strawberry Glenn (Fig. 29). The maximum temperature difference of 3.5 C (38.3 F) between the two stations was in July. Minimum temperature differences were during the cooler temperatures of spring, fall and winter.

Temperatures continued to increase downstream, and at the critical summer period Middleton temperatures (Fig. 30) had attained a maximum increase of 5.4 C (41.7 F) over Strawberry Glenn in July. When water temperatures began decreasing in September, the water at Middleton began registering colder than at Strawberry Glenn. Fort Boise temperatures (Fig. 31) were warmer than Middleton temperatures through both the summer and fall months.

The growth rate of fish depends greatly on temperature as digestion proceeds slowly at low temperatures (Rounsefell and Everhart 1953). The largemouth bass digestion rate is low at water temperatures less than 18.3 C (65 F), but increases rapidly above this temperature (Bennett 1962). Seldom in the Boise area were water temperatures more than 18.3 C (65 F) for greater than minimum growth of largemouth bass and other warm water species. This statement agrees with our finding few warm water fish in this section of the Boise River.

The Fort Boise area has water temperatures most suitable for smallmouth bass. In 1974, they were lethargic for 6 months of the year when water temperatures were below 10 C (50 F), the dormant stage for this species (Trautman 1957). Water temperatures were greater than the preferred smallmouth temperature of 21.1 C (70 F) (Sigler 1959) only 2 months during the year. Channel catfish also do not grow well at temperatures less than 21.1 C (Macklin and Soule 1964).

Rainbow trout tolerate water temperatures from about 0 C (32 F) to over 26.6 C (80 F), but prefer temperatures less than 21.1 C (70 F) (McAfee 1966). The area only from Barber Dam downstream to Star-Middleton is suitable for optimum growth of rainbow trout. Mountain whitefish also prefer cold water temperatures.

River flows

Flows from Barber downstream are regulated by Lucky Peak Reservoir, (completed in 1954) which is 5 miles upriver from Barber Dam. The water release objective from Lucky Peak during the flood control season is a regulated flow of 6,500 cfs through the city of Boise.

Average weekly flows for the period 1953 to 1967 (USGS Weekly Runoff Reports, 1974) at Boise were maintained below 4,000 cfs (Fig. 32). The maximum flow in 1974 was over 7,000 cfs (during parts of April, May and June), greater than the average flow to 1967 or the objective flow of 6,500 cfs. During January and part of February, the weekly minimum flows were less than the graphed average flows of 1953 to 1967. The minimum weekly flows (1974) were less than the average flows (1953-1967) during July, August and September, but greater than in part of October, November and December.

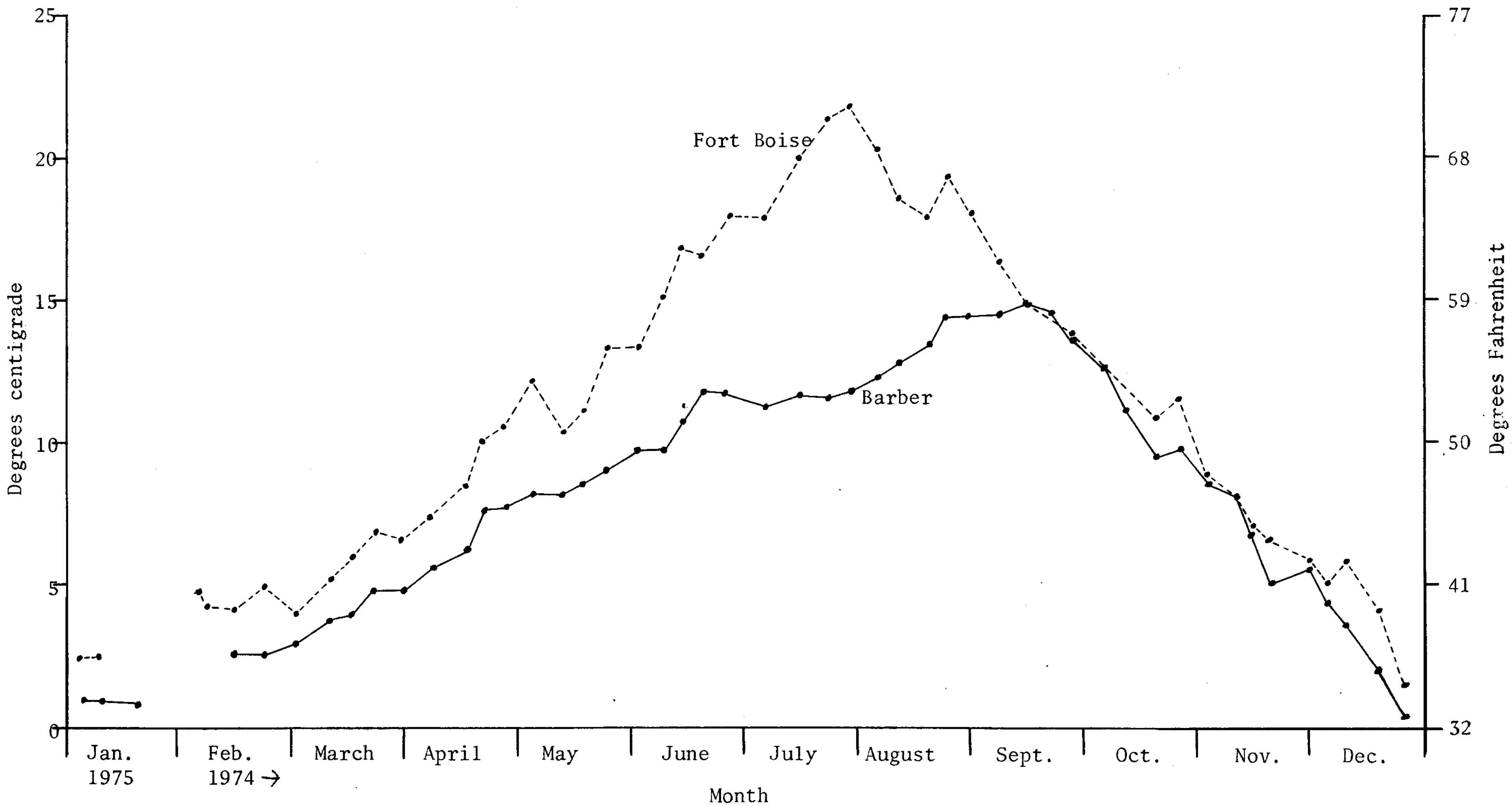


Figure 26. Average weekly minimum water temperatures at two sites on the Boise River, 1974 and January 1975.

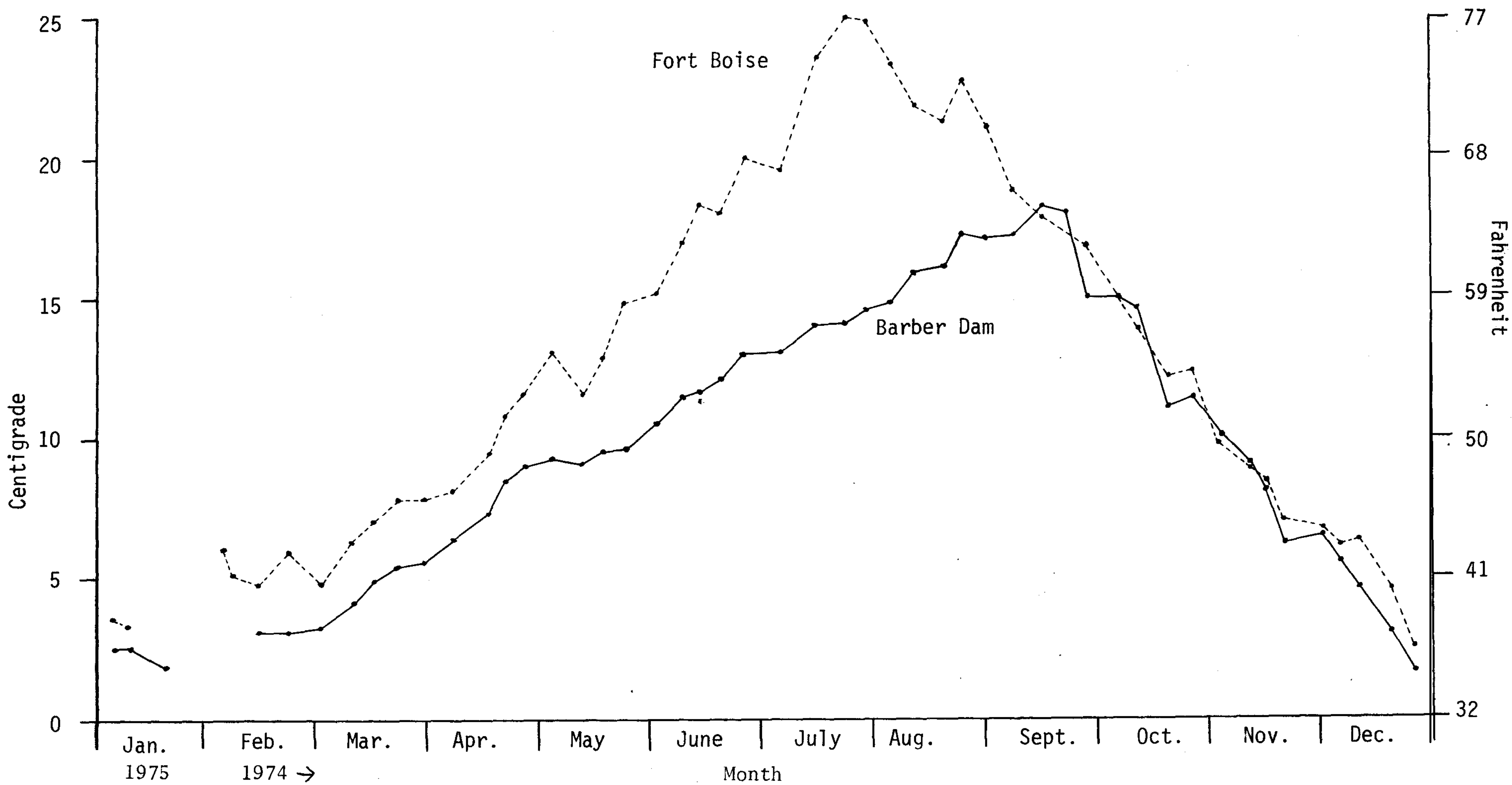


Figure 27. Average weekly maximum water temperatures at two sites on the Boise River, 1974 and January 1975.

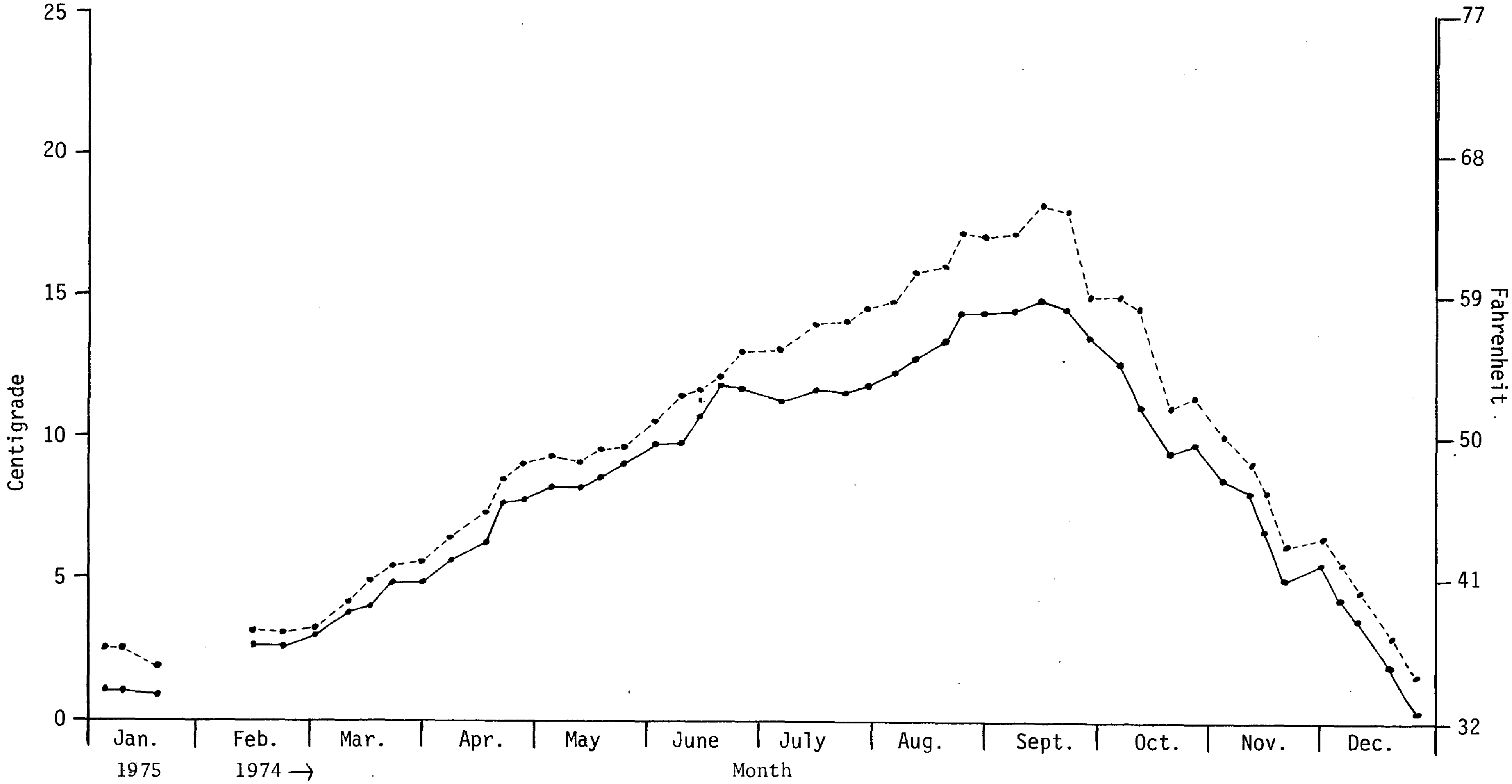


Figure 28. Average weekly maximum and minimum water temperatures at Barber on the Boise River, 1974 and January 1975.

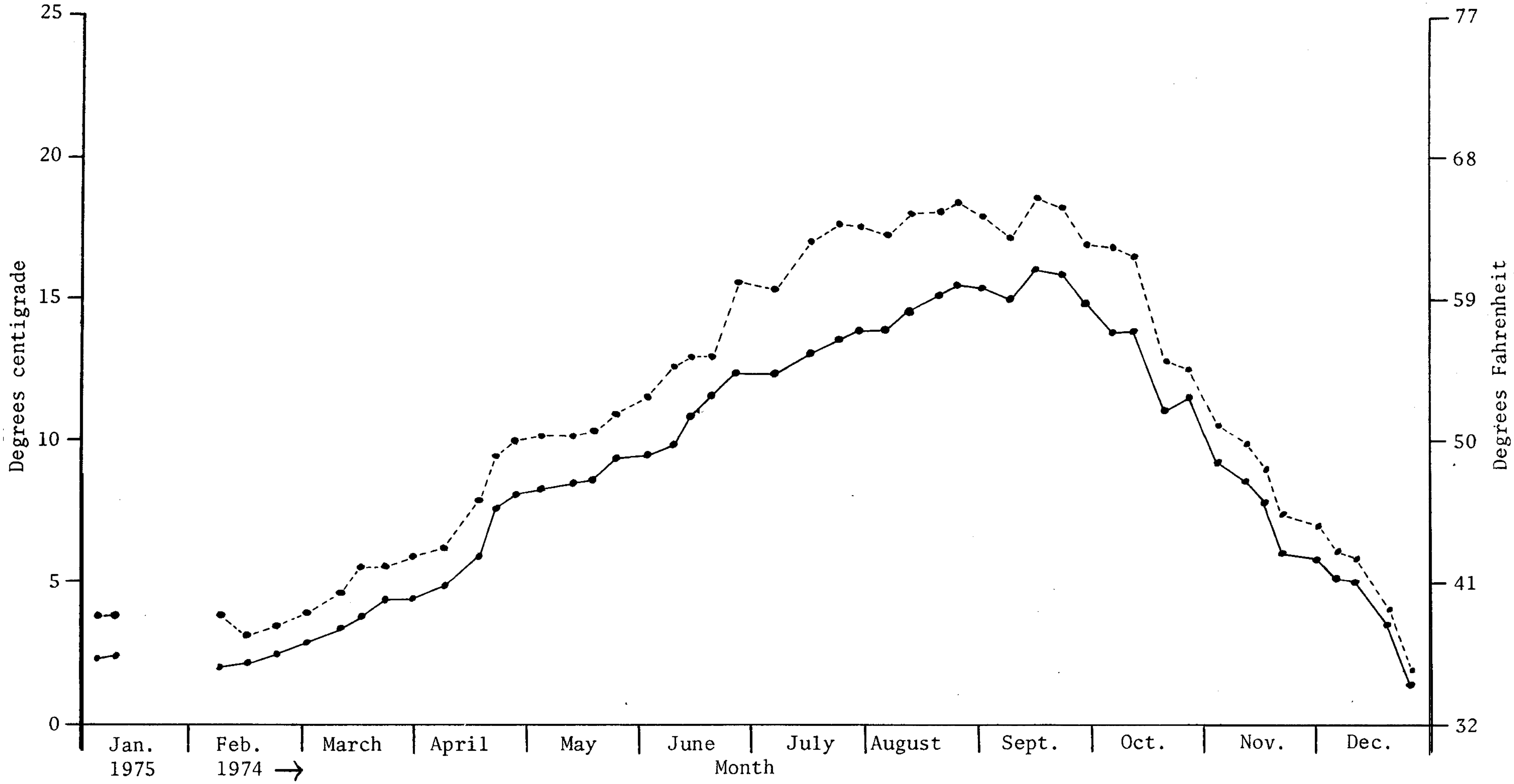


Figure 29. Average weekly maximum and minimum water temperatures at Strawberry Glenn on the Boise River, 1974 and January 1975.

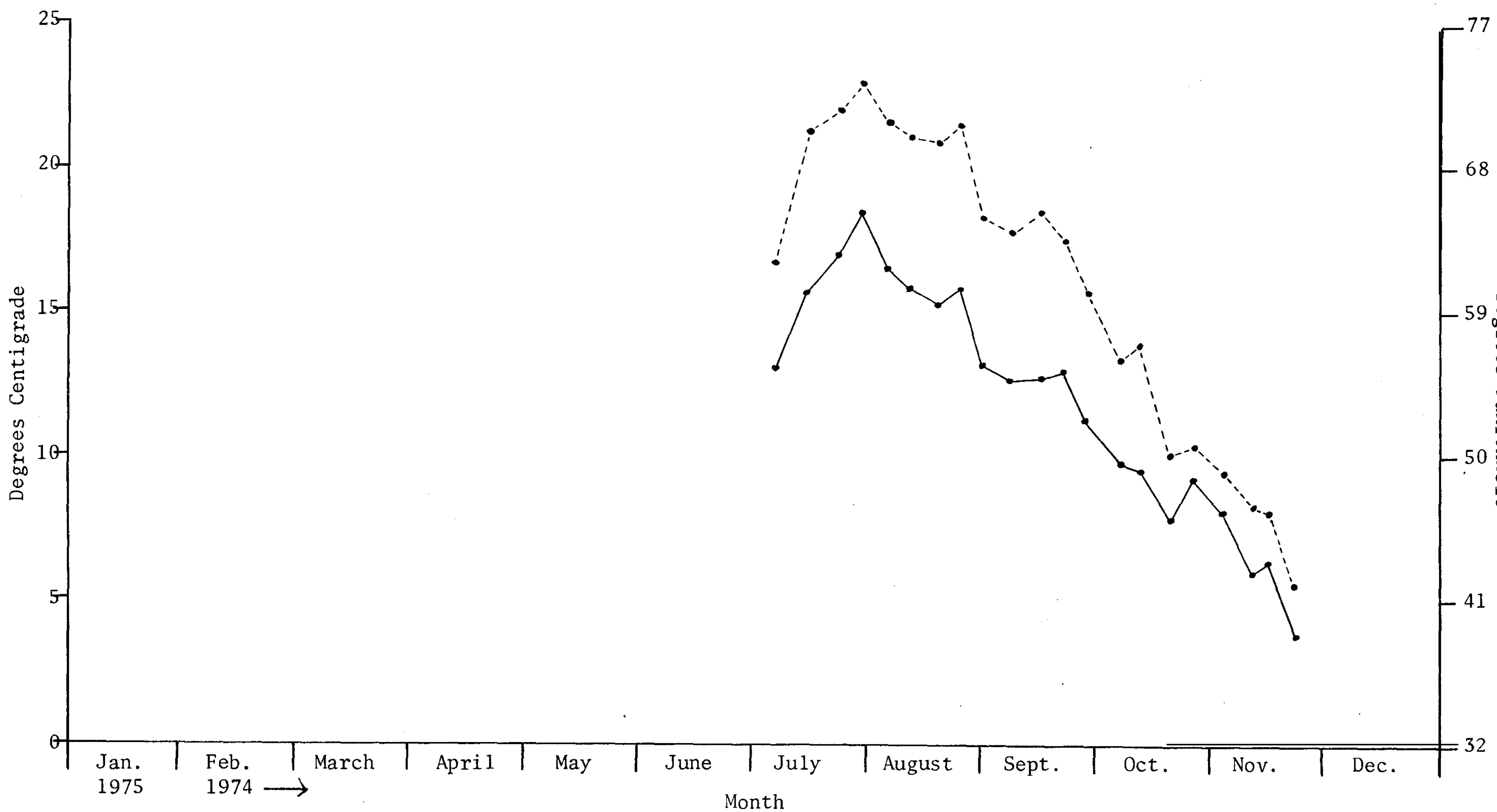


Figure 30. Average weekly maximum and minimum water temperatures at Middleton on the Boise River, 1974 and January 1975.

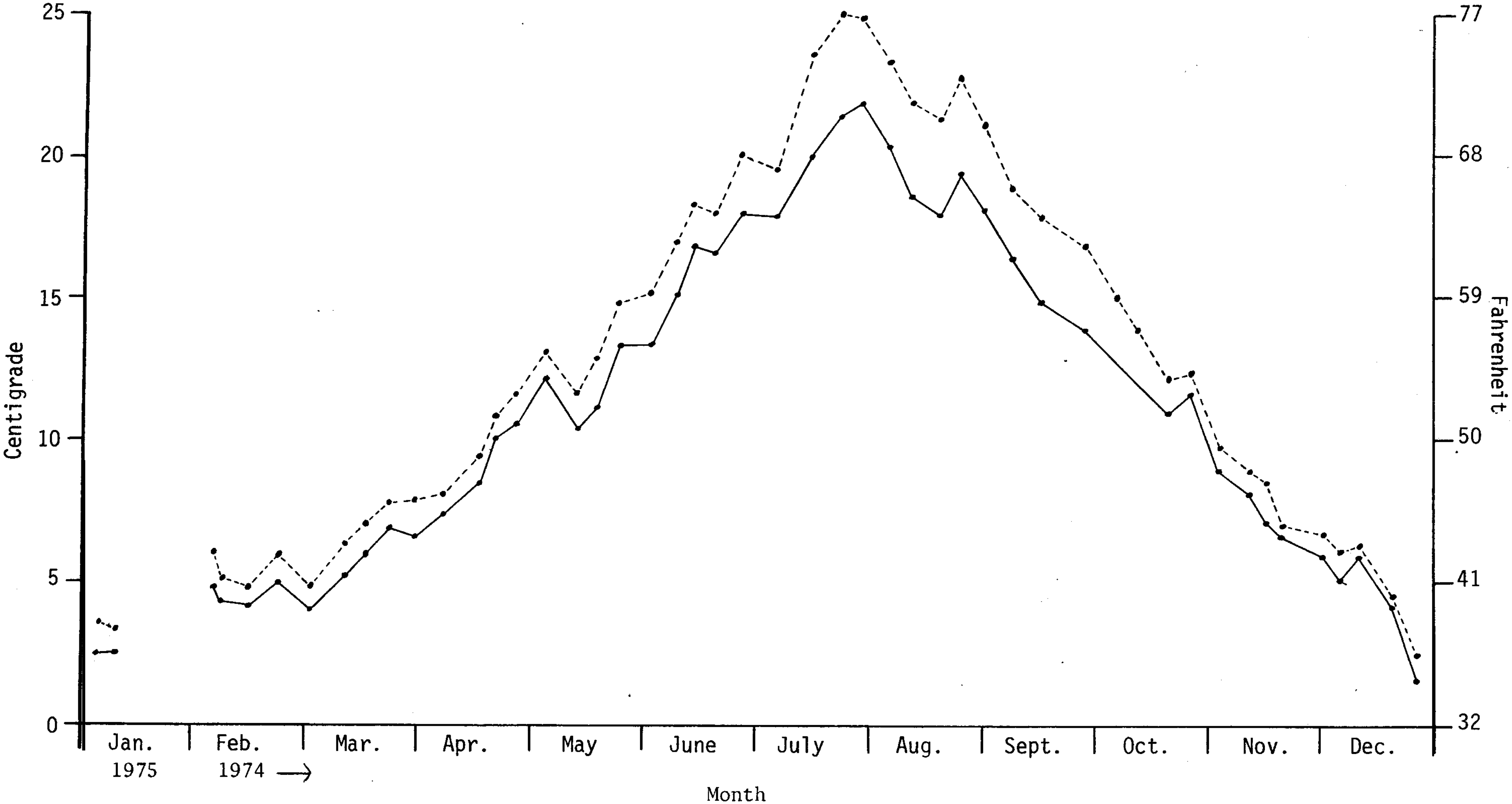


Figure 31. Average weekly maximum and minimum water temperatures at Fort Boise (mouth of river), on the Boise River, 1974 and January 1975.

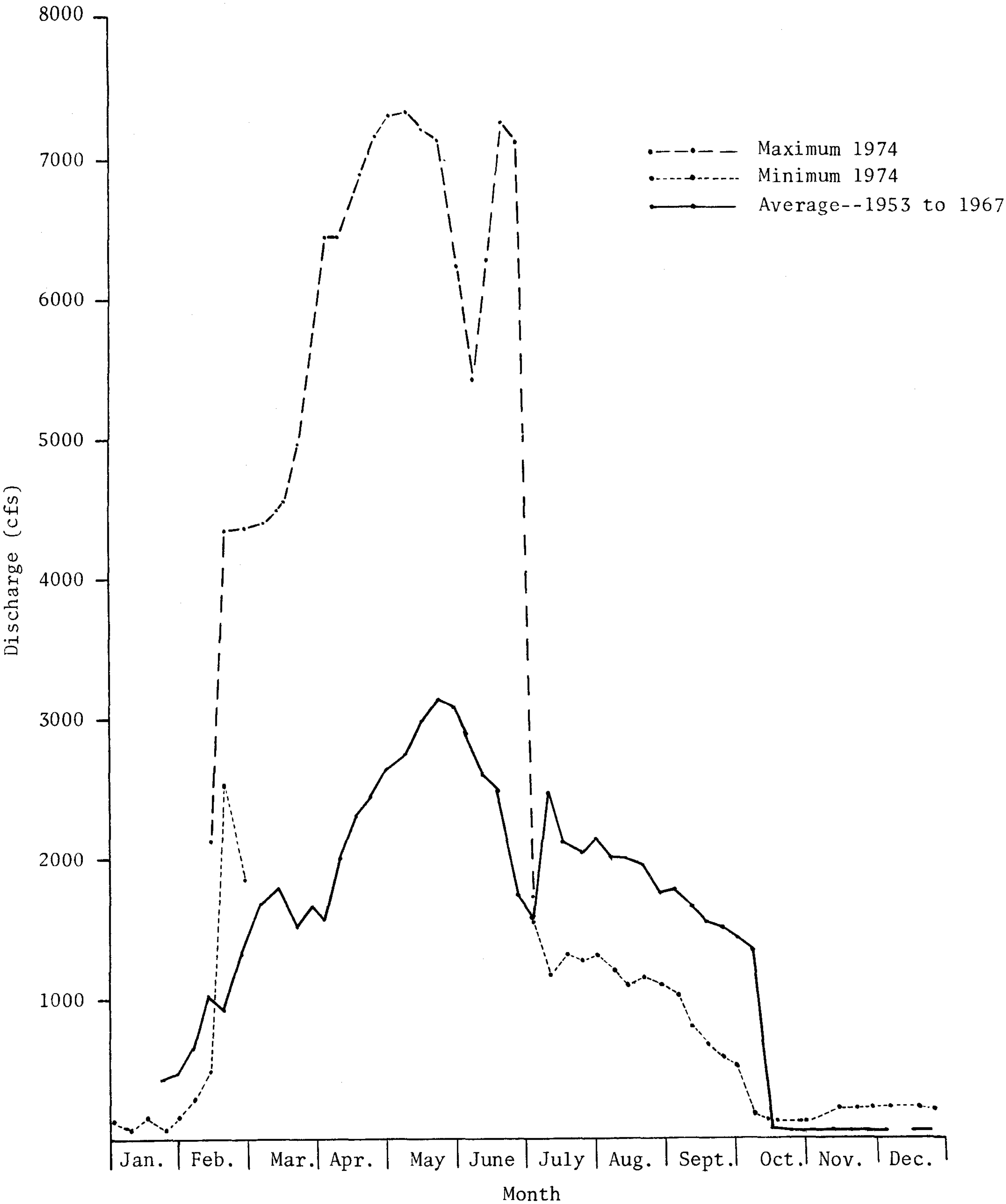


Figure 32. Average weekly flows for the period 1953 to 1967, and maximum and minimum weekly flows in 1974 during critical periods on the Boise River at Boise (provisional U.S.G.S. data).

Flow trends were similar at Boise (Fig. 33) and Parma (Fig. 34) although the between station area is characterized by irrigation outflows and returns and inlet streams. The recorded flows during the fall and winter periods were greater at Parma and less critical than at Boise.

Variations in the flow regime were sometimes large within a short time period (Fig. 33 and 34). These drastic flow changes may produce an environment less than optimum for aquatic life. Major flow changes within a short span of time produce physical damage to the stream environment and result in stranded aquatic life--both fish and invertebrates.

Low flows result in: (1) space requirements for fish are restricted or unfulfilled; (2) habitat for invertebrates and thus food for fish is constricted; and (3) because aquatic life is more concentrated in less water, it is more susceptible to stress or kill from a change in water chemistry.

Increased flows tend to carry sediment from a stream but extremely high flows are detrimental to the stream environment. The high flows that occurred in the Boise River coupled with man actively altering the stream channel have resulted in: (1) heavy bank erosion and sedimentation in the river channel; (2) loss of invertebrate production and fish spawning areas; and (3) because of faster currents some species are limited to only sloughs and protected areas.

Chemical criteria

The water chemistry of the Boise River (Barber Dam to the Snake River) is affected or altered by several influences, both natural and the activities of man. These include bank erosion from high flows and man caused factors of agricultural and industrial pollution.

The Idaho Department of Health collected chemical criteria at five stations in our study area (Tables 10, 11, 12, 13 and 14). An analysis of this data indicates a general increase in the following parameters from Barber Darn downstream to the mouth at the Snake River: pH, BOD, turbidity, total solids, specific conductance, alkalinity, sodium, potassium, sulfates, ammonia and nitrates. Dissolved oxygen was variable, but decreased in some downstream sections. Chlorides increased through Boise from the Barber station and decreased in the Boise River upstream from Caldwell, but increased again in the Notus samples. Iron and manganese were present in minute amounts difficult to analyze trends, and ortho-phosphate was very variable in the samples.

The National Technical Advisory Committee (1968) proposed the following recommendations for waters to be satisfactory for aquatic life:

(1) pH values no lower than 6.0 or higher than 9.0.
(2) alkalinity should not be less than 20 mg/1.
(3) D. 0. concentration should be above 5 mg/1 for warm water biota, should be at least 7 mg/1 in spawning areas of cold water fish, and above 6 mg/i for the growth and well being of trout.
(4) turbidity should not exceed 50 Jackson Units in warm water streams or 10 units in cold water streams.

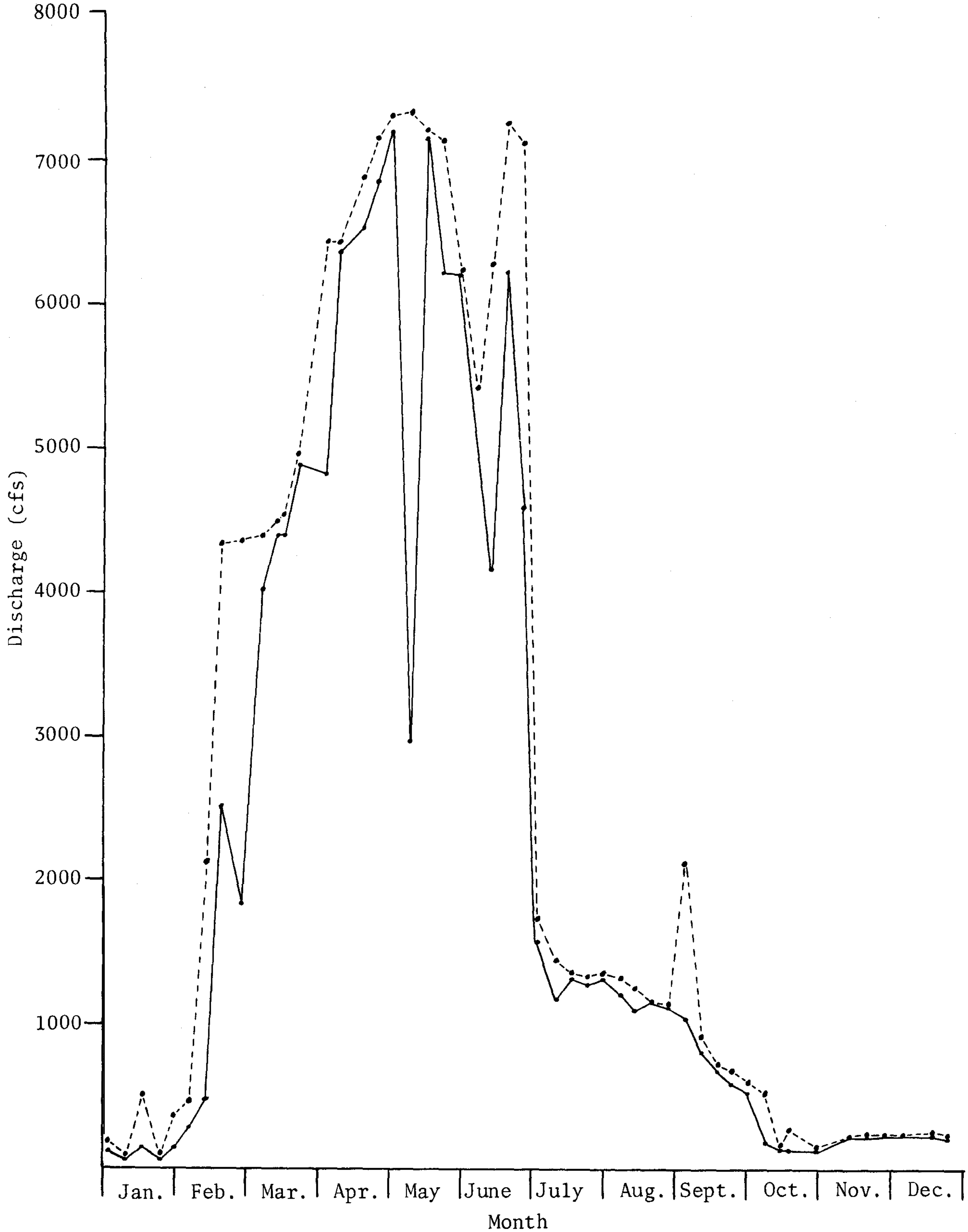


Figure 33. Minimum and maximum weekly flows of the Boise River at Boise, 1974 (provisional U.S.G.S. data).

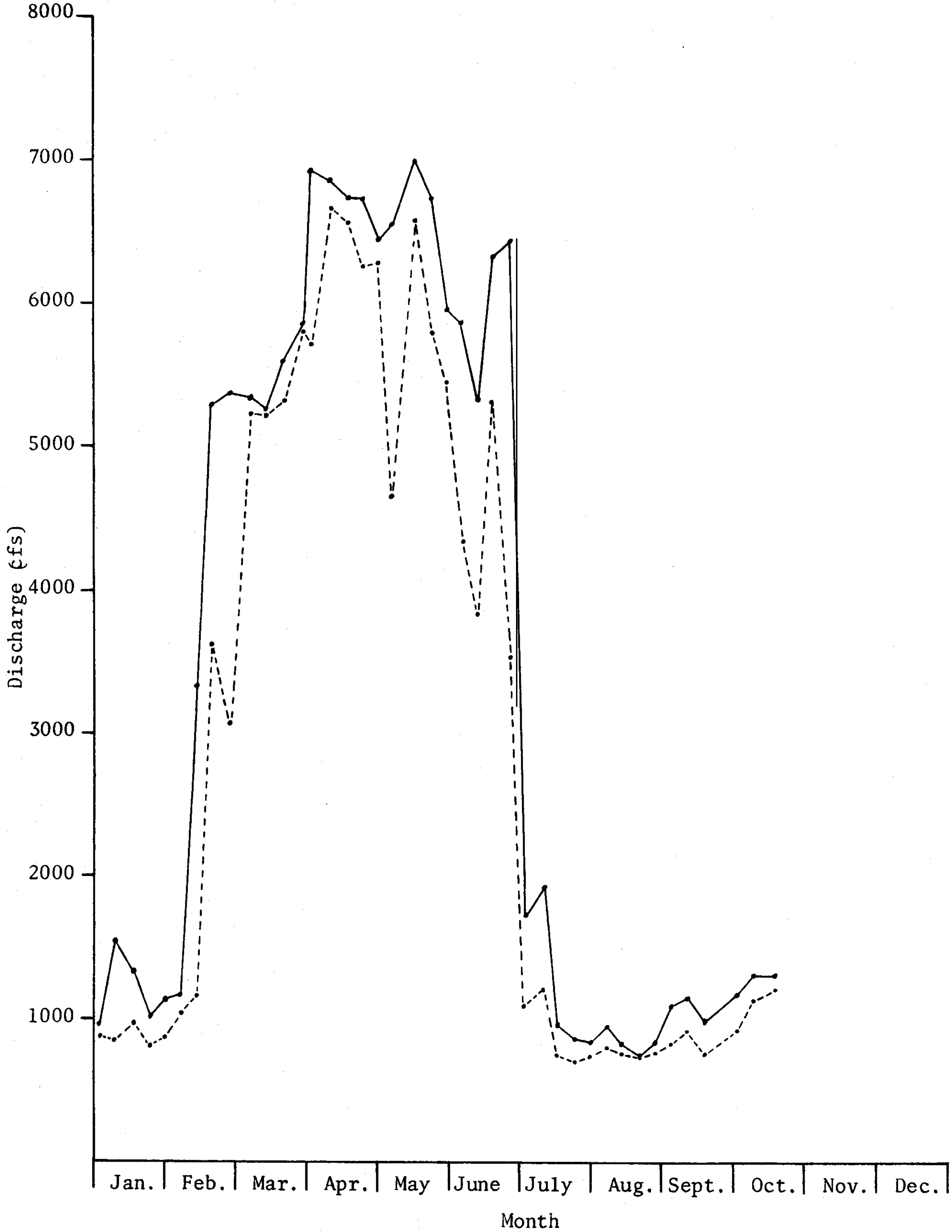


Figure 34. Minimum and maximum weekly flows of the Boise River at Parma, 1974 (provisional U.S.G.S. data).

Table 10. Water chemistry data from the Boise River (Barber). Collected and analyzed by the Idaho Department of Health, 1973 and 1974 (ppm except specific conductance of micromhos/cm at 25 C and hydrogen ion concentration).

Date	pH	Dissolved Oxygen	5-Day BOD	Turbidity	Total Solids	Specific Conductnce	Alkalinity	Iron	Manganese	Sodium	Chloride	K	SO_4	NH_3	NO_3 Nitrate	PO_4 Ortho
5 Nov. 1973	7.5	11.4	.3	4.0	96	91	5	.15	.04	5.0	4.0	0.8		0.3	2.4	.14
5 Dec. 1973	7.4	13.8	.1	1.0	96	94	6	.43	.08	3.0	4.0	.4		.6	<0.1	.07
24 Jan. 1974	7.7	14.8		3.0	12	100	5	.25	.08	4.0	4.0	.8		.3	1.4	.15
19 Mar. 1974	7.8	15.0	1.7	4.0	4	78	4	.14	<.01	4.0	2.0	.9		.2	1.2	.92
15 Apr. 1974	7.4	10.8	.6	6.0	88	65	4	.4	.02	3.5	2.0	1.1		.39	1.7	.07
7 May 1974	8.1	10.2	.6	6.0	72	57	4	.31	.01	3.1	3.0	.8	6.0	.22	.63	.02
10 June 1974	7.6	10.4	.4	5.0	10	52	3	.14	.01	2.9	6.	6.8	2.0	.08	.40	(.01
2 July 1974	6.5	7.9	.1	4.	32	48	5	.07	<.01	2.4	4.	.7		.08	.55	.05
13 Aug. 1974	7.4	11.7	.6	4.5	59	51	3	.13	.03	2.4	4.	.5	<1	<P.0	.61	.01
3 Sept. 1974	7.0	10.7	.2	3.0	72	58	4	.08	.02	3.8	6.0	1.1	4.0	.63	.40	1.66
10 Oct. 1974	7.2	10.8	.8	4.9	67									.06	.3	.08
22 Oct. 1974	7.1	11.1	3.9	4.8	58									.41	.53	.75
31 Oct. 1974	7.4	11.2	.5	4.1	13	155	8	.11	.18	13.0	8.0	1.9	12	.07	1.51	.11
3 Dec. 1974	7.1	15.2	.7	6.0	95	125	6	.27	.02	10.0	5.0	1.7	10	x.01	1.67	.72
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Table 11. Water chemistry data from the Boise River (Glenwood Bridge). Collected and analyzed by the Idaho Department of Health, 1973 and 1974 (ppm except specific conductance of micromhos/cm at 25 C and hydrogen ion concentration).

Date	pH	Dissolved Oxygen	5-Day BOD	Turbidity	Total Solids	Specific Conductance	Alkalinty	Iron	Manganese	Sodium	Chlorine	K	SO^4	NH^3	NO^3 Nitrates	PO^4 Ortho
5 Nov. 1973	7.1	10.2	14.2	15.0	174	175	88	.14	.07	14	8.0	1.2		4.4	3.4	2.6
5 Dec. 1973	7.6	12.0	2.1	3.0	144	154	88	.41	.04	2.0	9.0	.4		.6	3.5	.09
24 Jan. 1974	7.5	12.8		6.0	204	190	84	.30	.05	16.0	8.0	1.9		.8	3.0	1.37
2 July 1974	6.9	6.5	.08	3.	72	60	58	.06	<.01	3.8		1.0		.15	.37	.06
18 Oct. 1974	7.4	12.2	5.0	4.3	126									1.1	2.22	.84
22 Oct. 1974	7.5	11.4		4.6	113									1.0	2.46	.48
31 Oct. 1974	7.2	11.6	1.5	10.3	117	135	72	.48	.17	11.0	10.0	2.0	<10	.19	1.48	.69
3 Dec. 1974	7.1	14.9	5.3	5.2	110	140	72	.17	<.01	12.0	8.0	1.8	<10	1.1	1.11	1.18
17 Dec. 1974	7.4	18.0	7.3	7.9	110	145	68	.17	.01	10.0	15.	1.7	14	1.5	1.57	1.03

Table 12. Water chemistry data from the Boise River (Caldwell) collected and analyzed by the Department of Health, 1973 and 1974 (ppm except specific, conductance of micromhos/cm at 25 C and hydrogen ion concentration).

Date	pH	Dissolved Oxygen	5-Day BOD	Turbidity	Total Solids	Specific Conductance	Alkalinty	Iron	Manganese	Sodium	Chlorine	K	SO^4	NH^3	NO^3 Nitrates	PO^4 Ortho
5 Nov. 1973	7.8	10.6	3.3	2.0	376	370	196	.09	.01	42	2.0	3.1		.3	7.0	.5
16 Jan. 1974	7.9	11.6		55	420	310	132	.06	.03	38		3.2		.8	3.8	1.1
2 July 1974	7.3	5.6	0.7	12	160	118	72	.13	1.Ol	8.01	3	1.6		.06	1.9	.25
22 Oct. 1974	8.0	12.4	3.5	3.7	163									.44	3.8	.5
3 Dec. 1974	7.3	14.6	6.8	3.7	144	190	90	.10	.03	17.5	1.0	1.9	12	.18	3.4	.07

Table 13. Water chemistry data from the Boise River (Notus) collected and analyzed by the Idaho Department of Health, 1973 and 1974 (ppm except specific conductance of micromhos/cm at 25 C and hydrogen ion concentration).

Date	pH	Dissolved Oxygen	5-Day BOD	Turbidity	Total Solids	Specific Conductanc	Alkalinty	Iron	Manganese	Sodium	Chlorine	K	SO^4	NH^3 Nitrate	PO^4 Ortho
6 Nov. 1973	7.9	9.1		5.0	484	625	244	.12	.02	44	2.0	3.6	1.2	8.8	.77
10 Dec. 1973	7.5	12.0	2.8	3.0	480	570	226	.09	<.01	44	14.0	4.0	1.1	10.8	.84
23 Jan. 1974	7.8	12.2		20.	616	478	596	.22	.05	58	4.0	4.0	1.0	4.3	.91
2 July 1974	7.5	5.2	0.8	5.2	220	190	66	.13	x.01	16	7.0	2.6	.06	2.65	.37

Table 14. Water chemistry data from the Boise River (Fort Boise) collected and analyzed by the Idaho Department of Health, 1973 and 1974 (ppm except specific conductance of micromhos/cm at 25 C and hydrogen ion concentration).

Date	pH	Dissolved Oxygen	5-Day BOD	Turbidity	Total Solids	Specific Conductance	Alkalinty	Iron	Manganese	Sodium	Chlorine	K	SO^4	NH^3	NO^3 Nitrates	PO^4 Ortho
23 Jan. 1974	7.7	12.0		16	520	475	188	.19	.05	48	4.0	5.2		.8	5.9	1.0
27 Feb. 1974	7.3	15.6	3.3	6.0	204	160	72	.23	<.01	14	4.0	1.4	7.0	.5	1.4	.13
19 Mar. 1974	8.1	10.6	.3	9	92	160	76	.28	.01	12.5	5.0	2.2		.3	2.1	.34
2 Apr. 1974	8.1	13.0	.8	10	152	145	76	.27	.03	11.	12.	2.1		.3	1.0	.27
1 May 1974	7.6	10.0	.6	11	176	100	60	.44	.03	7.0	9.0	1.6	9.0	.3	1.2	.16
3 June 1974	7.9	10.2	1.6	8	172	160	80	.21	<.01	10.0		1.6		.02	2.1	.2
2 July 1974	7.5	5.6	1.0	18	208	195	139	.11	.01	18.0	8	2.4		.02	2.3	.38
9 July 1974	7.4	7.8	1.7	27	436	340	148	.32	.02	29	3	4.4	38	.6	4.9	.55
31 July 1974	7.5	8.9	2.0	17	472	420	170	.07	K.01	52.0	13	4.7	74	.42	5.4	.73
12 Aug. 1974	8.0	9.5	1.0	15	280	450	176	.11	.02	43.0	4.0	4.7	10	0.1	5.5	.59
3 Sept. 1974	7.8	11.2	1.2	10	500	460	200	.06	.01	52.0	14.0	4.7	84	.31	5.8	.61

Ellis (1944) maintained that ammonia should not total more than 1.5 mg/l to support a good mixed fish fauna. McKee, et al (1963), recognized that the best waters for the support of diversified aquatic life are those with pH between 7 and 8 and total alkalinity of 100 mg/1 or more. They also conclude that amounts of manganese less than 1.0 mg/1 is not deleterious to fish and other aquatic life.

Water samples from all stations sampled by the Health Department were within the recommended pH range of 7 to 8. All samples also had an alkalinity value greater than 20 mg/1, but samples from the Boise area were less than the recommended minimum of 100 mg/1 for best support of diversified aquatic life. Stations from Caldwell downstream exhibited alkalinity values generally greater than 100, but some samples did measure 60 mg/1.

Oxygen values from collected samples indicate sufficient oxygen in the Boise sections of the river for spawning growth and well being of cold water and warm water fish. During the water sample dates during 1974 in the Caldwell to mouth section, trout would have been stressed in the 0_2 values less than 6 mg/1. Values were still greater than the 5.0 mg/1 lower limit for warm water fish.

Boise stations' samples were generally below the upper limit for turbidity except in a November 1973 sample from Glenwood. In the Caldwell to Snake River section, turbidity values were in the limits for warm water fish, but in the January 1974 sample in Caldwell, trout might have been stressed. In general, ammonia was less than the recommended maximum limit of 1.5 mg/1 except for the November 1973 sample taken near Glenwood Bridge. All samples were less than the recommended maximum for manganese.

Most samples from the Boise River (Table 15) contained chlorides and iron in concentrations similar to 50% of U. S. waters while nitrates, sodium and potassium were in larger concentrations comparable to 95% of U. S. waters. The Fort Boise samples were similar to 50% while samples from the Boise stations were of much lower concentrations and comparable with 5% sulfate-low waters.

Although these water samples indicate no problems with the reported water quality parameters, this section of the Boise River has received numerous fish kills in past years. These kills are usually a result of: (1) low (or no) flow periods and the resulting critically low levels of oxygen, and (2) discharge of pollutants into the river. These pollutants affect the fish directly or indirectly by loss of food or deoxygenation of the water. Without continuous water quality monitoring, it is extremely difficult to detect these types of conditions.

<u>Access areas</u>

The Boise River receives use from several types of access. From Barber Dam downstream to Strawberry Glenn, access is gained mainly at bridges and park areas. Waldorf (1975) found that recreationists predominately use eight access areas within this river section. We were able to launch our 4.9 m (16 ft) jet boat, with difficulty, and motor small distances from three of these sites--Eckhart Bridge (Barber), Glenwood Bridge and Strawberry Glenn immediately downstream from Glenwood.

Table 15. Ranking of water quality values of Boise River samples (collected and analyzed by the Idaho Department of Health and Welfare) to values found in 95%, 50% or 5% of U. S. waters supporting a good fish fauna (Hart el al 1945). Refer to Tables 10, 11, 12, 13 and 14 for sampling sites on the Boise River.

Chemical	Concentration	Percent of U. S. waters	Boise River sample
Chlorides	170 mg/1 or less	95	
	9 mg/1 or less	50	Most areas
Iron	0.7 mg/1 or less	95	
	0.3 mg/1 or less	50	Most areas
Nitrates	4.2 mg/1 or less	95	Most areas*
	0.9 mg/1 or less	50	
Sodium plus	85 mg/1 or less	95	Most areas
Potassium	10 mg/1 or less	50	
Sulfates	32 mg/1 or less	50	Ft. Boise area
	11 mg/1 or less	5	Boise area

*Some samples from Caldwell downstream were greater than 4.2 mg/1.

Downstream from Strawberry Glenn, access to the Boise River is predominately at bridges and sportsman access areas. Waldorf noted 15 use areas in this section, six of which are Idaho Fish and Game access sites. We launched our jet boat at Linder Bridge, downstream from Eagle, and at the Fort Boise Management Area. The Department of Fish and Game boat ramp (dirt-gravel) on the Snake River at Fort Boise is downstream from the mouth of the Boise River.

Refer to Waldorf's report (1975) for description and location of the 23 access areas he recorded on the Boise River. In addition, sportsmen may gain access at other spots on private land after first obtaining permission.

Indian Creek electrosamples

We electrofished three areas on Indian Creek (a tributary to the Boise River) at the mouth, .8 km (.5 mi) upstream and at Caldwell. We sampled 640 m (700 yd) of lineal stream, working both banks and parts of a large pool or pond at the mouth, that required 42 minutes to sample.

One largemouth bass (length=230 mm), 1 chiselmouth, 1 sucker and 6 carp were captured from the pool at the mouth. At the next section up, above the sewage plant, we captured 7 suckers, 5 chiselmouths, 1 squawfish, 2 shiners, 1 black crappie (length=130 mm) and 12 carp from 251 m (275 yd) of stream.

The sampling section in Caldwell, 3.2 km (2 mi) upstream from the mouth, yielded 26 suckers and 2 wild rainbow trout (160 and 190 mm) from 297 m (325 yd) of stream.

LITERATURE CITED:

Bennett, George W. 1962. Management of artificial lakes and ponds. New York, Rheinhold Publ. Corp. 283 pp.

County Fish Planting Summary. 1974. Idaho Fish and Game Department.

Davis, Jackson. 1959. Management of channel catfish in Kansas. Univ. Kan., Mus. Nat. Hist. Misc. Publ. no. 21, 56 pp.

Ellis, M. M. 1944. -Water purity standards for fresh water fishes. Special scientific report No. 2. Dept. of the Interior.

Gibson, Harry. 1974. Survey of fish populations in the Snake River from (1) Brownlee flow line to proposed Guffey Dam site (near Murphy, Idaho); (2) Grandview, Idaho to C. J. Strike Dam. Project F-63-R-3, Job III-b (Part I). Idaho Fish and Game Department. 35 pp.

Gibson, Harry. 1975. Survey of fish populations and water quality in the Weiser River from its mouth upstream to the headwaters. Project F-63-R-4, Job VI. Idaho Fish and Game Department.

Gibson, Harry. 1975. Survey of fish populations in the Snake River from (1) Brownlee flow line to proposed Guffey Dam site (near Murphy, Idaho); (2) Grandview, Idaho to C. J. Strike Dam. Project F-63-R-3, Job III-b (Part II). Idaho Fish and Game Department.

Hart, W. B., P. Doudoroff and J. Greenhank. 1945. Evaluation of toxicity of ind.;st.r?.al wastes, chemicals and other substances to fresh water fishes. Water Control Lab. Atlantic Refining Co., Philadelphia, Penn.

Hooper, Douglas R. 1973. Evaluation of the effects of flows on trout stream ecology. Dept. of Eng. Res. Pacific Gas and Electric Co. Emeryville, Calif. 97 pp.

Lynch, Thomas M., P. A. Buscemi and D. G. Lemons. 1953. Limnological and fishery conditions of Two Buttes Reservoir, Colorado, 1950 and 1951. Colo. St. Game and Fish Dept., Report to Fish Mgmt. Div. 93 pp.

McAfee, William R. 1966. Rainbow trout from inland fisheries management. Alex Calhoun, editor. Calif. Dept. Fish and Game. 546 pp.

McCammon, George W. 1956. A tagging experiment with channel catfish (Ictalurus punctatus) in the lower Colorado River. Calif. Fish and Game.,. Vol. 42, No. 4, pp. 323-335.

McKee, J. E. and H. W. Wolf. 1963. Water quality criteria. The Resources Agency of California, State Water Quality Control Board, Pub. No. 3-A. 548 pp.

Macklin, Robert and Scott Soule. 1964. Feasibil4ty of establishing a warm water fish hatchery. Calif. Dept. Fish and Game, Inland Fish. Admin. Rept. No. 64-14. 13 pp (mimeo).

Reid, Will. 1975. Survey of fish populations and water quality in the Payette River from its mouth upstream to Black Canyon Reservoir. Project F-63-R-4, Job V. Idaho Fish and Game Department.

Report of the National Technical Advisory Committee. 1968. Water quality criteria. Federal Water Pollution Control Administration. U. S. Gov. Print. Office. Wash. D. C.

Ritchie, Clark A., 1972. Ritchie fish computer booklet. Oklahoma City, Oklahoma.

Rounsefell, George A. and W. Harry Everhart. 1953. Fishery science, its methods and applications. Published by John Wiley and Sons, Inc., New York. p. 322.

Sigler, William F. 1959. The taxonomy and life history of some fresh water fish. Utah St. Univ., Dept. of Wildl. Mgmt. (Mimeo).

Trautman, Milton B. 1957. The fishes of Ohio. Ohio St. Univ. Press. 683 pp.

United States Geological Survey Reports 1974. Pacific Northwest Water Resources. U. S. Department of the Interior. Portland, Oregon.

Waldorf, Larry. 1975, Recreation on the lower Boise River. Corps of Engineers. Walla Walla, Wash. (To be published--about 135 pp.)