

The Resources Agency of California  
Department of Fish and Game

CASPAR CREEK STUDY COMPLETION REPORT 1/

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SUMMARY

The Department of Fish and Game assisted in an interagency study on Caspar Creek, a small coastal stream in Mendocino County. This study included the effects of logging on the stream and its population of silver salmon (Oncorhynchus kisutch) and steelhead trout (Salmo gairdnerii).

Caspar Creek has two forks of similar size, one of which was to be logged, the other left unlogged as a control. The main stem had already been badly silted as a result of logging.

Upstream-downstream counting weirs were built on each of the two forks of Caspar Creek. Before the experiment started, adult fish had been counted for one season in the fishway at a millpond dam near the mouth of the stream. This dam was removed by the owner and a counting weir was built by the Department on the main stem of Caspar Creek about 12 miles from the ocean. This structure was completed in November 1964, but badly damaged by the record floods of December 1964 soon after the 1964-65 upstream migration began.

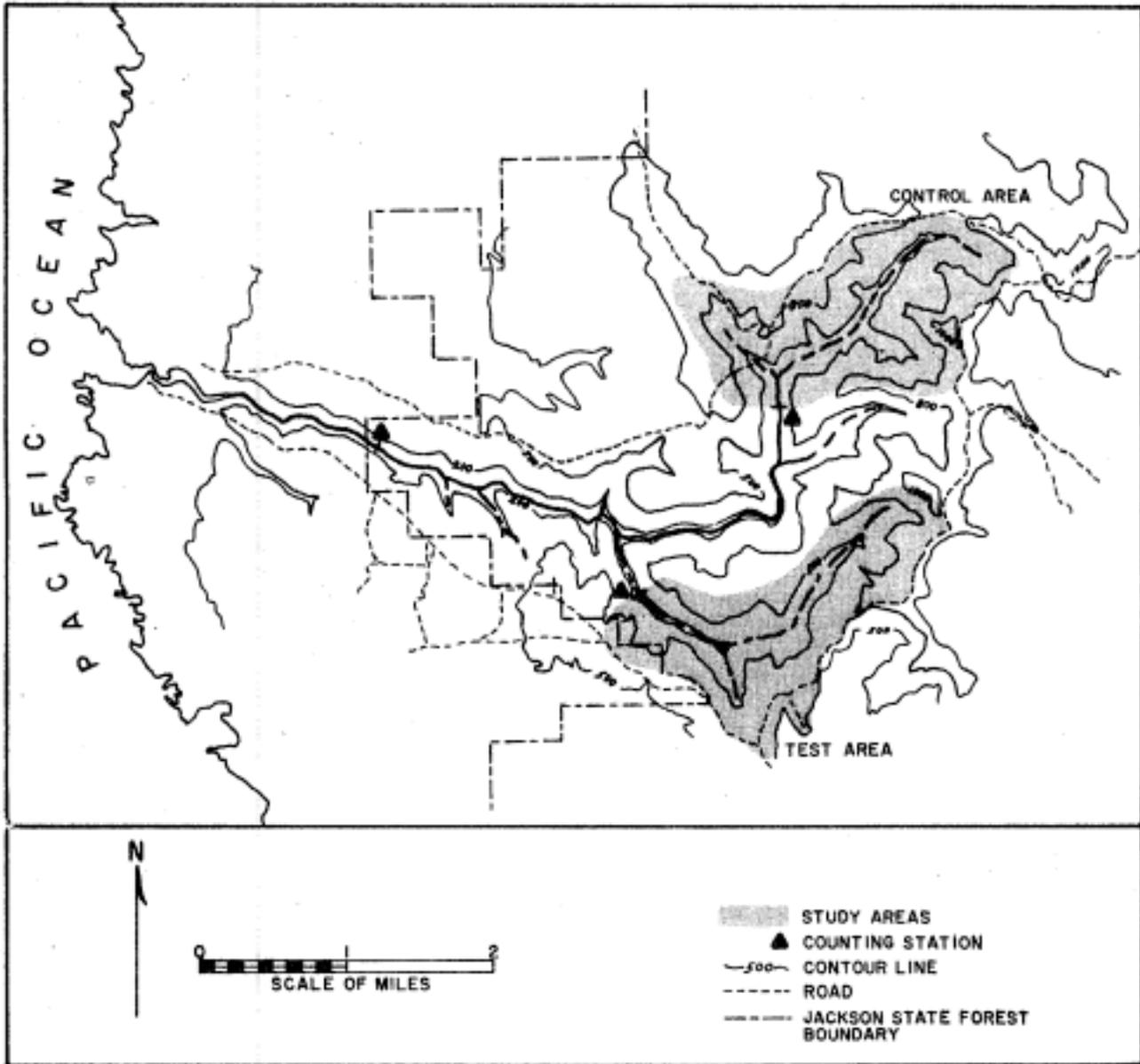
Habitat was surveyed in both forks and in the main stem of Caspar Creek. It developed that most of the spawning and nursery area was in the lower part of the stream and that the number of spawners and resulting young above the counting weirs on the two forks were primarily dependent on the flows available to the upstream migrating adults. As a result, the primary objective of the study could not be reached.

Collateral information is presented on both silver salmon and steelhead, including behavior of adults and young, counts, length frequencies, length weight relationship and length fecundity relationship. Some of the data presented are from other nearby streams.

It is recommended that in any future experiment of this nature, two separate streams, each tributary to the ocean, should be used instead of two forks of a single stream. Each stream should be considerably larger than the individual forks of Caspar Creek.

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- 1/ Marine Resources Branch Administrative Report No. 67-4  
This work was performed as part of Dingell-Johnson Project California F-10-R, "Coastal Salmon and Steelhead Study", supported by Federal Aid to Fish Restoration Funds.
- 2/ Now with Water Projects Branch, Contract Services Section.

FIGURE I  
CASPAR CREEK  
MENDOCINO COUNTY



## INTRODUCTION

In 1961, the Department was invited to assist in a cooperative study of the effects of logging on streamflow, sedimentation, fish life; and fish habitat in Caspar Creek<sup>3/</sup>. Participating agencies were the California Division of Forestry and the U. S. Forest Service (Pacific Southwest Forest and Range Experiment Station). These agencies proposed to establish experimental watersheds in the North and South forks of Caspar Creek. "The South Fork is to be carefully logged using the best knowledge of side slope and stream bank protection available through research and experience; the North Fork is to be left unlogged as a control."

Our assignment was: (1) To measure changes in anadromous fish production through analysis of counts of upstream and downstream migrants. Counts were to be made at the streams' mouth and at the downstream boundary of each of the two experimental watersheds (study areas) where flow-gaging weirs with fish passage structures were to be constructed by the California Division of Forestry. (2) To survey existing habitat in the stream and observe changes that occurred as the study progressed.

Study plans were incorporated into D-J Project F-10-R's Plans, Specifications, and Estimates in 1963-64.

## DESCRIPTION OF CASPAR CREEK

Caspar Creek, Mendocino County, California, originates in Townships 17, and 18 North, Range 17 West, Mount Diablo Meridian, at an approximate elevation of 1,000 feet. It drops rapidly to an elevation of 300 feet, levels off, and slopes gradually for about 6 miles to the Pacific Ocean (Figure 1).

The drainage basin, in California's Lower Conifer Zone, is approximately 5,000 acres and most of it is timbered with second growth trees 65 to 80 years old. Most of the watershed is in the Jackson State Forest.

Study areas (Figure 1), in the headwaters sections of the two main forks, are about 1,000 acres each and support dense stands of Douglas-fir and redwoods.

That part of the drainage within the State Forest below the study areas has been and is being logged by methods ranging from clear-cut to limited tree selection. A system of roadways is partially constructed.

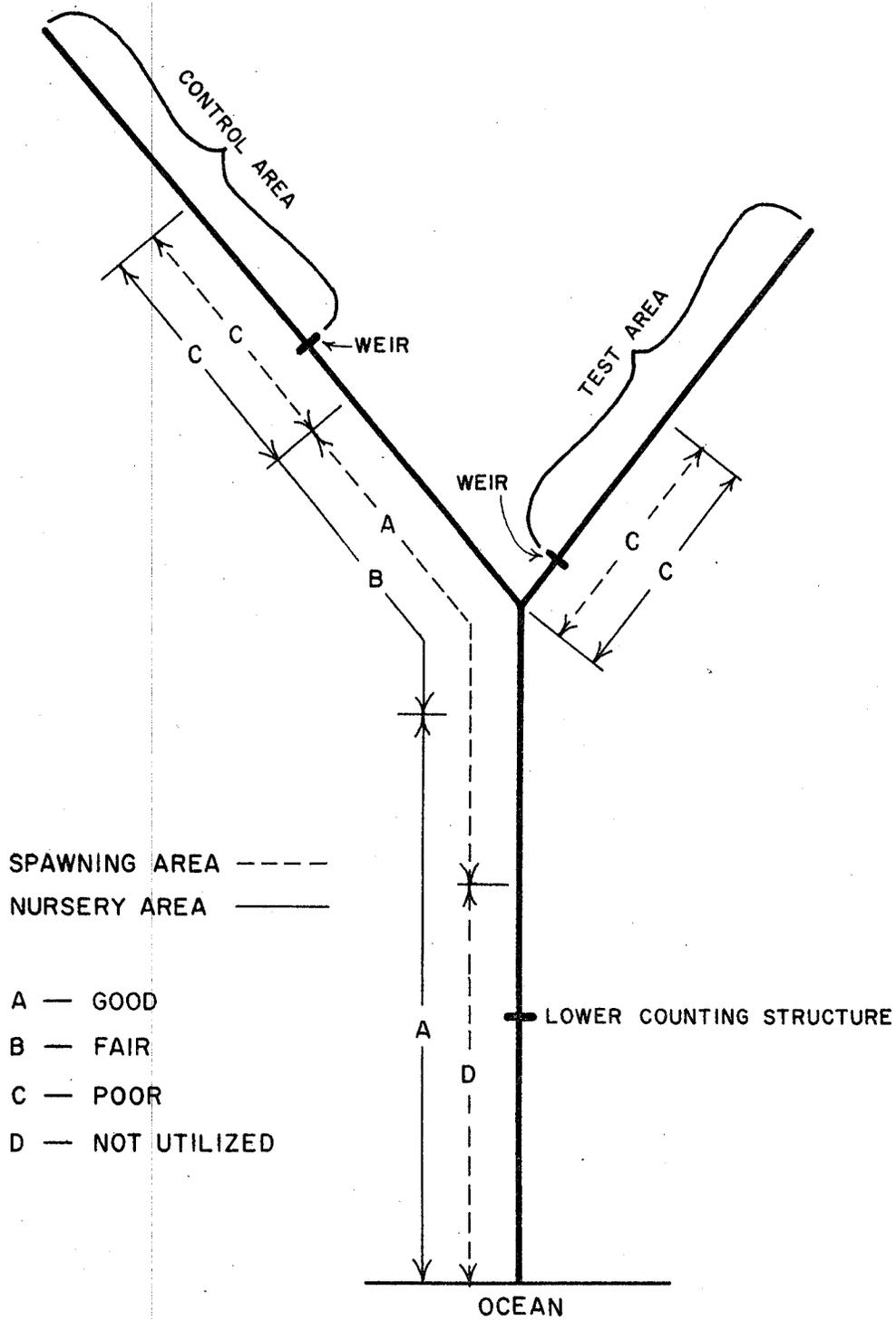
## Stream Flows

Both forks of the creek become intermittent in the study areas. Flow below the fork, however, is continuous and no gravel bar forms during summer months to block the mouth of the stream. Highly variable flows typify this creek. Low flows at the flow-gaging weirs (Pacific Southwest Forest and Range Experiment Station, 1963-64 Progress Report) have been 0.11 cfs in the South Fork and 0.06 cfs in the North Fork; maximum recorded flows (personal communication from Division of Forestry) occurred in January 1966 when 288 cfs was recorded in the South Fork and 305 cfs in the North Fork. Maximum flow at the mouth of the creek, at this time, was estimated to be in excess of 1,000 cfs. Flood flows peak and drop off very rapidly in this drainage.

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3/ Employees of the California Department of Water Resources, University of California and U. S. Geological Survey also assisted in an advisory capacity.

FIGURE 2  
CASPAR CREEK  
ANADROMOUS FISH HABITAT



### Precipitation

Most precipitation occurs in the late fall, winter, and early spring months. Rainfall records are available at the Pacific Southwest Forest and Range Experiment Station in Berkeley.

### Suspended Sediment and Bedload

Records of suspended sediment and bedload movement have not been published; they also are available at the Pacific Southwest Forest and Range Experiment Station.

### Water Temperatures

The Department maintained recording thermographs at each flow-gaging station from March 6, 1963, through December 16, 1964 (Table 1). The maximum water temperature recorded at the North Fork was 64.5°F. during August 19-25, 1964; maximum at the South Fork was 58.0°F. during September 10-17, 1963. Minimum temperature recorded at the North Fork was 38.5°F. during March 13-19, 1963, and February 12-19, 1964; minimum at the South Fork was 36.0°F. during November 18-24, 1964. These temperatures are generally described as suitable for salmonids.

### Fish Population

Silver salmon (Oncorhynchus kisutch) and steelhead rainbow trout (Salmo gairdnerii) are the anadromous salmonids that inhabit Caspar Creek. At least one sculpin (Cottus sp.) and the three-spined stickleback (Gasterosteus aculeatus) are common. Some of the trout in the upper part of the creek are probably resident rather than migratory.

### HABITAT SURVEY

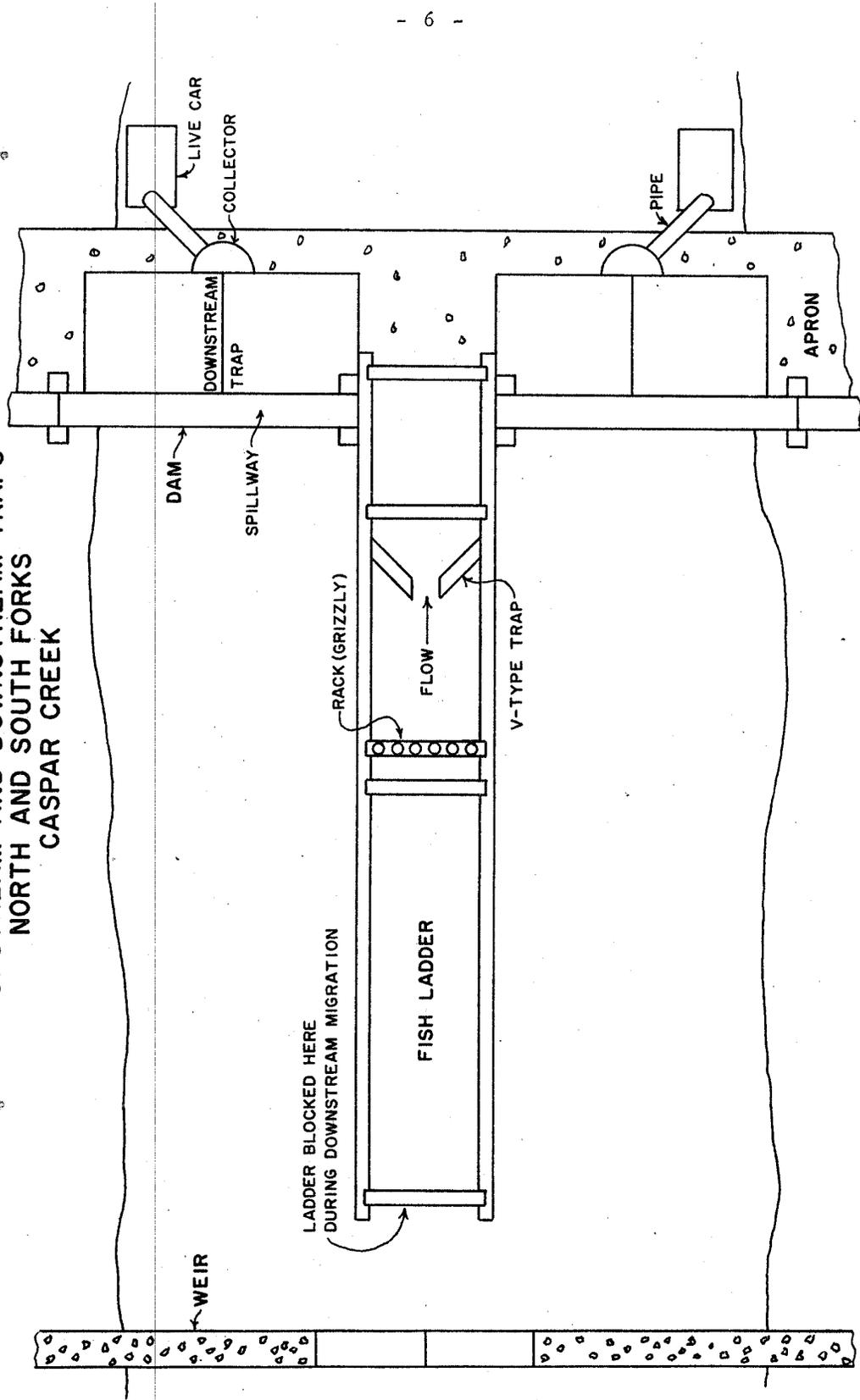
#### Nursery Area

Juvenile silver salmon and steelhead were found from about one mile above each flow-gaging weir to the ocean. The primary nursery area of Caspar Creek is below both the test and control areas (Figure 2). It was found that fish in the study areas are but fringe elements of a single population whose use of these areas is controlled by variables unrelated to logging. Living space is a critical factor; flows in the study areas become intermittent during summer months.

The main nursery area begins about one-half mile below the forks and extends almost to the ocean. Over one mile of this area was below the site of the lower counting structure. The quality of this area has been adversely affected by sediments, debris, and rubble left by past logging operations and land uses. Many side channels of the creek contain debris deposits several feet deep. Current logging operations may further reduce the quality of the nursery area and thereby lower the production and survival of ocean migrants even more.

Heavy storms such as those of December 1964 and January 1966 may be very important to rapid recovery. About two feet of debris deposits were eroded from the stream channel just below the North Fork weir by each of these storms.

FIGURE 3  
 FISH PASSAGE FACILITY  
 UPSTREAM AND DOWNSTREAM TRAPS  
 NORTH AND SOUTH FORKS  
 CASPAR CREEK



1 0 1

SCALE: .2" = 1'

TOP VIEW

### Population Density

Fish in the nursery areas were found to be in poor condition by late summer, indicating that under present conditions, Caspar Creek produces near its capacity of yearling fish.

To obtain a measure of population density, a sample was taken August 6, 1964, by draining a section of the creek about three-quarters of a mile below the forks. The sample consisted of 59 silver salmon 1.7 to 3.5 inches F. L. (fork-length) that weighed 4.5 ounces; 25 steelhead 1.4 to 8.0 inches F. L. that weighed 9.0 ounces (5 weighed 8 ounces), and 13 cottids 3.2 to 6.5 inches F. L. that weighed 9.0 ounces. The standing crop of salmonids was 0.22 ounces per square yard (7.63 grams per square meter); the standing crop of cottids was 0.15 ounces per square yard (5.08 grams per square meter).

Expressed in the three-dimensional aspect of their environment, the standing crops were as follows:

Salmonids:	0.338 ounces/cu.yd. (12.51 grams/cu. meter)
Cottids:	0.225 ounces/cu.yd. ( 8.24 grams/cu. meter)

Sticklebacks in the sample were not counted or weighed.

### Spawning Area

Approximately six linear miles of Caspar Creek are utilized by spawning silver salmon and steelhead (Figure 2). The area begins about two and one-half miles from the ocean and ends about one mile above each flow-gaging weir. The best spawning area begins two and one-half miles from the ocean and extends into the North Fork to a point about one-half mile below the weir.

### ANADROMOUS FISH PRODUCTION

Anadromous fish production may be defined as the number of juvenile ocean migrants produced by a stream which are of the age; size, and condition necessary for ocean survival.

Previous studies conducted on coastal streams in California and other states (Shapovalov and Taft, 1954; Salo and Bayliff, 1958) have shown that most juvenile silver salmon migrate to the sea at one year of age and that the migration is confined to a relatively short period of time (2-3 months). Investigations have also shown that the seaward migration behavior of steelhead is somewhat more complicated. Steelhead migrate at all ages up to and including four years, and during all months of the year, if there is enough water to permit it.

This information-indicated that the measurement of steelhead production would require a much more complex analysis than that required for silver salmon. As the study began, plans were developed to determine a production index based on counts of adult silver salmon entering Caspar Creek and the study areas, and of yearling silver salmon. migrating out of the study areas. However, as the investigation progressed and numerous observations were made of

FIGURE 4

WEIGHT-LENGTH RELATIONSHIP  
CASPAR CREEK SILVER SALMON  
1960-61

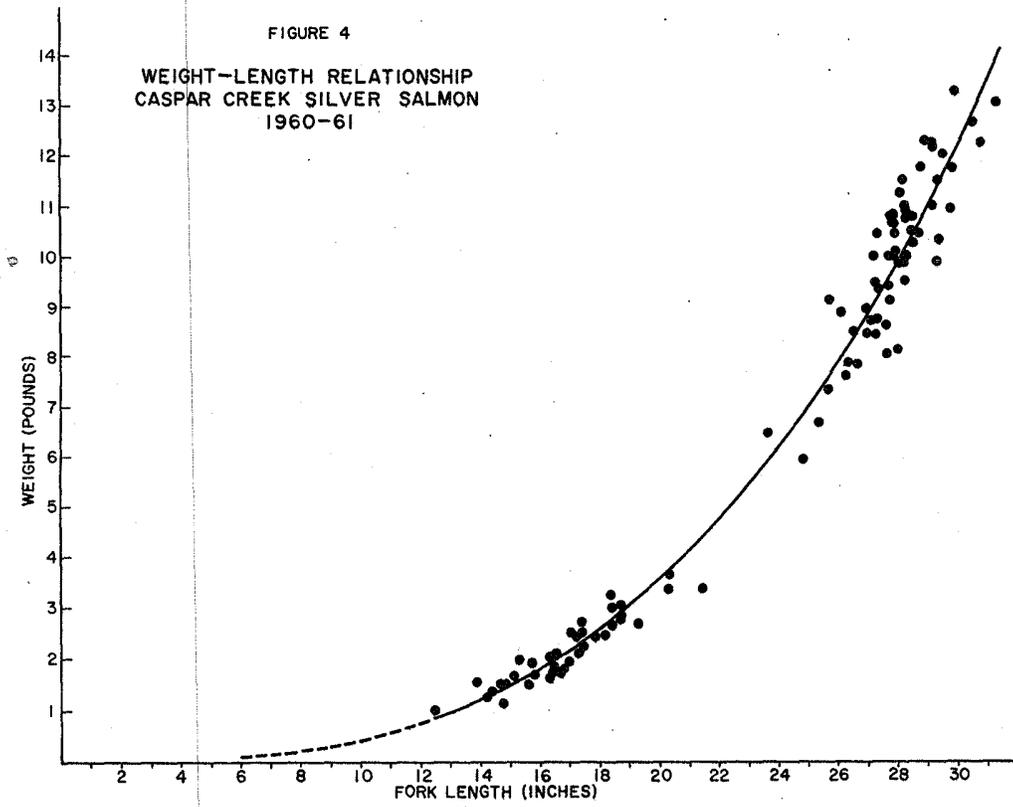
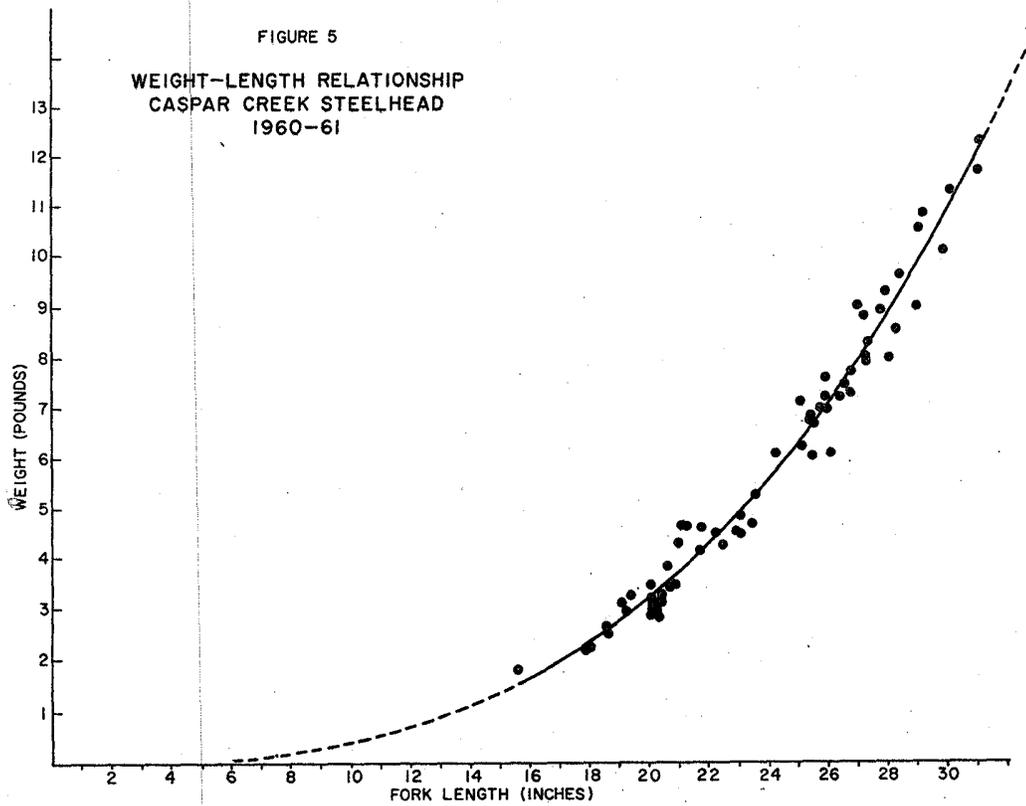


FIGURE 5

WEIGHT-LENGTH RELATIONSHIP  
CASPAR CREEK STEELHEAD  
1960-61



juvenile fish in the test and control areas, it became apparent that the downstream migratory behavior of juvenile silver salmon from the upper reaches of the stream was significantly different from expected behavior in downstream areas, and that the enumeration of migrant yearlings within the stream would not provide an accurate measurement of those that actually move into salt water. This behavior and some of the factors influencing it are discussed in a following section.

#### Counting Structures and Fish Counts

Fish passage structures at the downstream boundaries of the test and control areas consisted of fish ladders and control dams designed to provide adult fish access over the flow-measuring weirs which were installed at these sites. The ladders and control structures were incorporated in the design plans and specifications for the weirs, and were constructed, as were the weirs, by State Division of Forestry personnel. Construction began in the spring of 1962 (Table 2). The South Fork facility was completed in November 1962, but only the weir was completed in the North Fork at this time. The ladder and control dam was not completed until August 1963. Upstream (adult) and downstream (juvenile) traps at these sites were constructed and tested by project personnel.

Upstream traps were of the V-type and were installed in the lower end of one pool of the ladder. Upstream passage was blocked by a grizzly placed at the upper end of the pool (Figure 3). Trapped fish were systematically removed, counted, and placed above the grizzly to continue their migration upstream. These traps were relatively trouble free and functioned effectively. Table 2 shows counts obtained during the study period.

Downstream traps tested at the study areas were of the inclined plane type and were installed on the control structures. Upper ends were attached to the spillway; lower ends were braced to the apron (Figure 3). Trapped fish were piped to live cars placed at the edge of the stream channel. Downstream migrating fish were blocked from using the ladder during these tests.

Several serious problems were encountered with the downstream traps. Although they were modified and improved extensively after the initial installations, construction of screens of sufficient size and strength to withstand high flows proved to be beyond the engineering and fiscal resources of the project. In addition, considerable difficulty was experienced with leaks in the control dams. Flow through and beneath these structures could not be stopped completely, and the traps were inoperative during periods of low flow.

Essentially all of the flow was screened and all out-migrants were trapped during a three and one-half month period (March 13 through July 1, 1964).

In the South Fork, 613 silver salmon and 79 steelhead were captured.

In the North Fork, only 44 silver salmon and 17 steelhead were captured during this period. The small number can be attributed to minimal egg deposition in the control area during the 1962-63 spawning season. The fish passage structure was not completed in time for the spawning run, and the flow-gaging weir functioned as a partial barrier to upstream migration.

FIGURE 6  
 CALCULATED LENGTH FREQUENCY  
 UPSTREAM MIGRANTS  
 CASPAR CREEK  
 1960-61

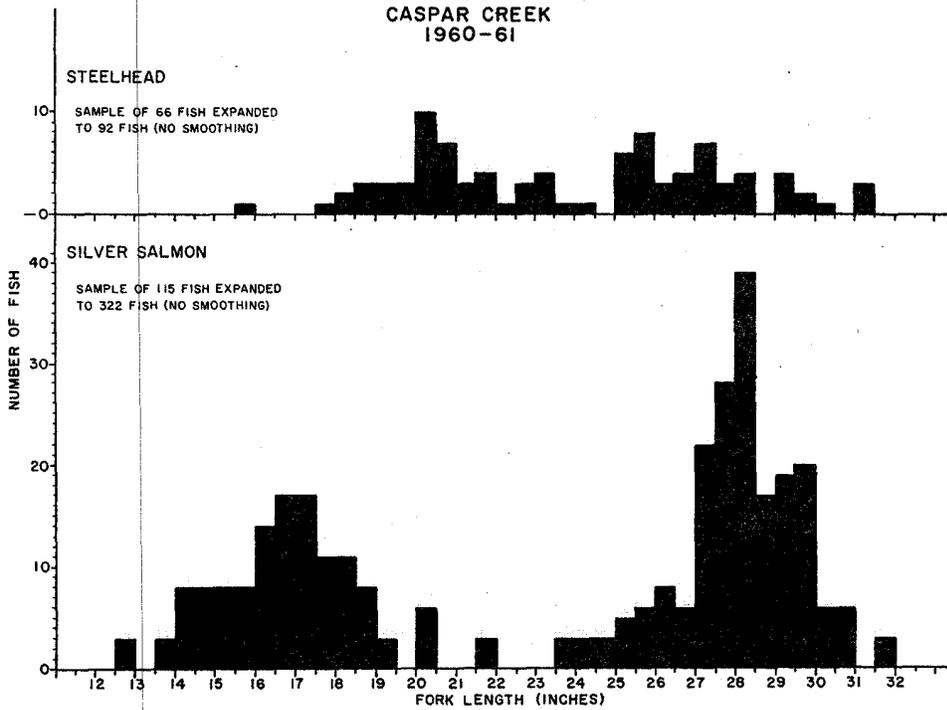
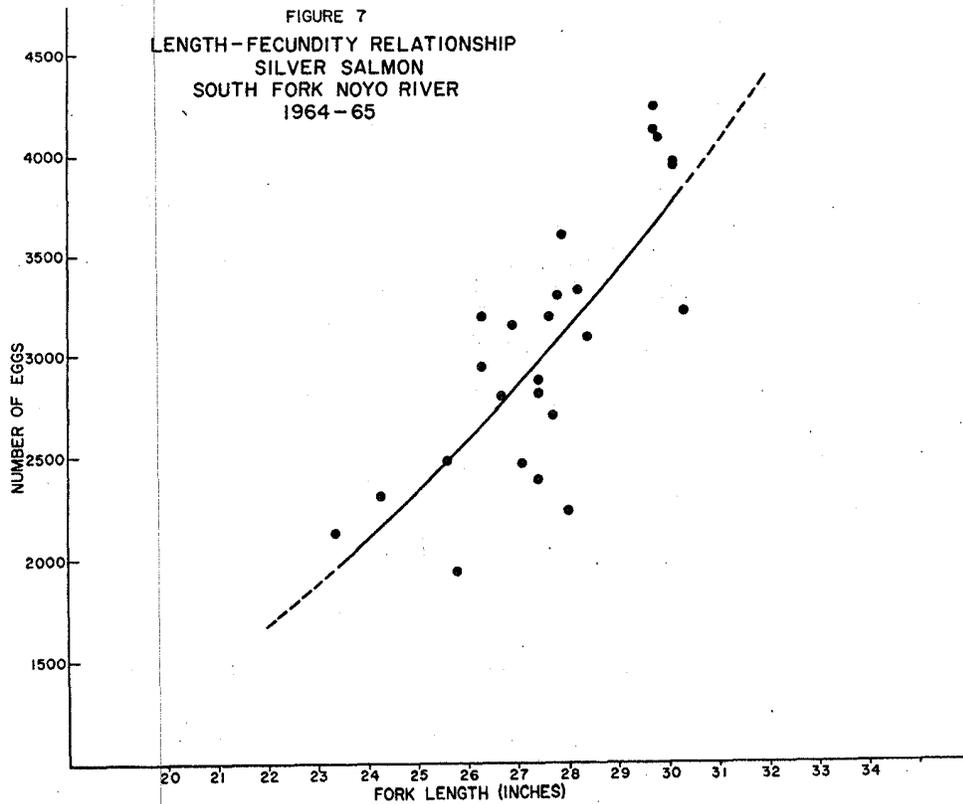


FIGURE 7  
 LENGTH-FECUNDITY RELATIONSHIP  
 SILVER SALMON  
 SOUTH FORK NOYO RIVER  
 1964-65



Upstream migrant counts at the mouth of Caspar Creek were obtained during the 1960-61 season at a fish ladder constructed on a millpond dam located on private property approximately 100 yards upstream from the ocean (Table 2). This dam and fish ladder were removed by the landowner in 1961, making further counts impossible. Attempts to secure a "land use" agreement which would allow us to rebuild and operate a structure at this location were unsuccessful. An alternate site was selected on State Forest land approximately one and one-half miles upstream. Construction of facilities at this site began in July 1964 and was completed in November 1964. A V-type upstream trap was installed by project personnel. The structure was severely damaged by extremely high flows that occurred during a record flood in December 1964, soon after the 1964-65 run began; only partial counts were obtained.

#### COLLATERAL INFORMATION

The data, observations and information included in this section are primarily of a collateral or supplementary nature. Some of this material is introduced in support of results and conclusions presented in this report; the remainder was compiled and processed during the course of the study in preparation for future needs of the investigation.

#### Adult Migrants 4/

##### Behavior

Adult silver salmon and steelhead enter Caspar Creek from November through April; spawning takes place during this period. Their entry is directly related to stream flow. The runs start when fall rains have raised water levels high enough for transport. As a general rule, the steelhead runs begins a few days to several weeks later than the silver salmon run and continues later in the season.

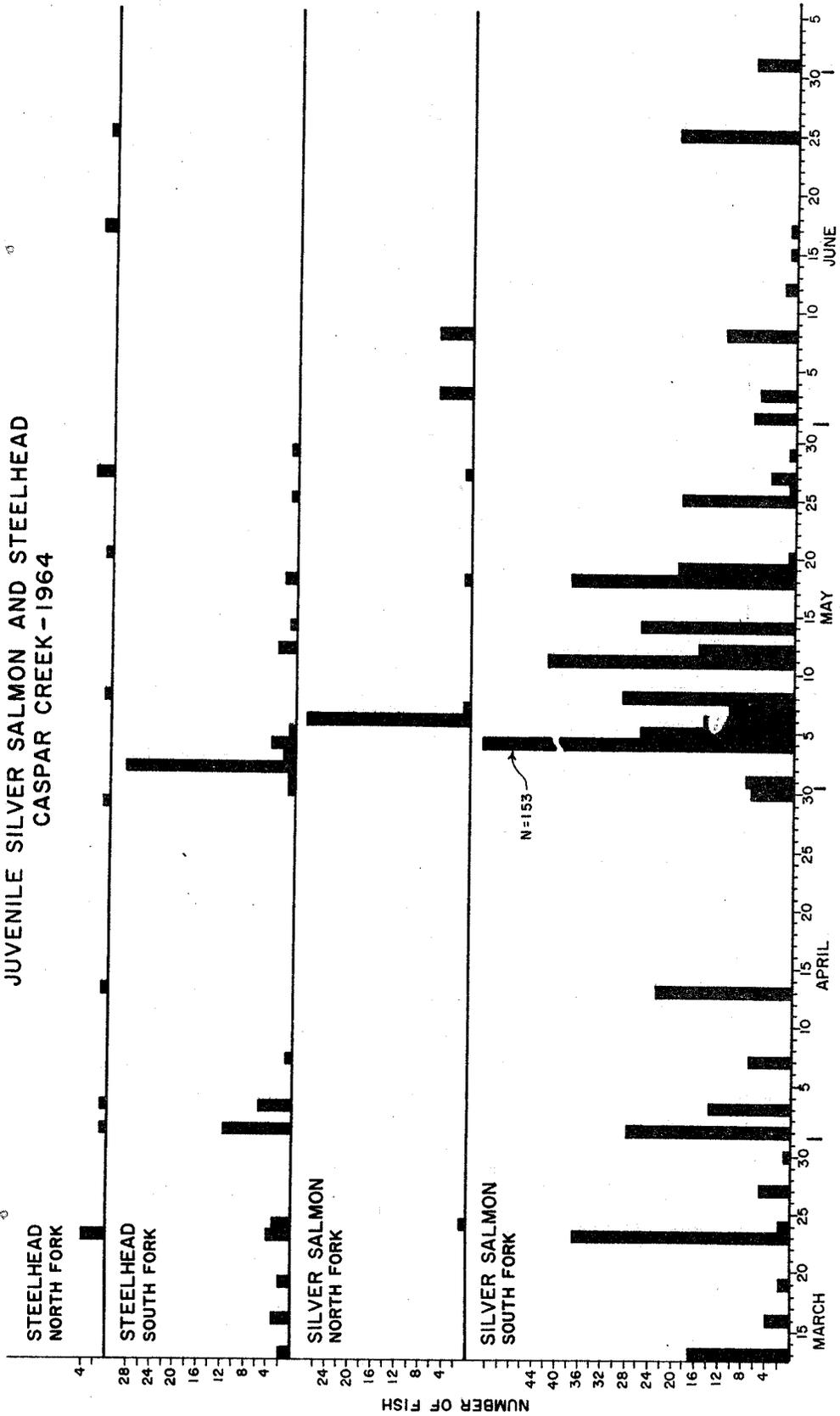
The entry of spawning fish into either the test or control areas appeared to be more closely related to the physical state of the stream rather than to the size of, the creek's total spawning population. For example, one day during the 1963-64 season, more than 100 silver salmon (both live and dead) were counted in the areas above the fork of the creek, but only 33 were trapped at the South Fork and eight at the North Fork during the entire spawning period. During this season, light rainstorms were followed by cold weather and the fish did not have the sustained transport flows necessary for their ascension into the study areas. In addition, these fish tend to "hole up" when stream flows are low and cold -- migration and spawning are delayed even when flows that appear adequate are present.

Trapping and handling of fish produces unexplained behavior patterns. Robert W. Phillips, Oregon State Game Commission (personal communication), working in a small tributary of the Alsea River, found that trapped silver salmon rejected the stream above the trap -- adults trapped and placed above the trap soon returned downstream. However, when the trap was removed, fish entered and utilized the area above the trap site. Similar behavior was observed at the Pudding Creek Counting Station, near Fort Bragg, California. Silvers entered

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4/ The term 'Adult Migrants', as it appears in this report, includes grilse.

FIGURE 8  
DOWNSTREAM MIGRATION  
JUVENILE SILVER SALMON AND STEELHEAD  
CASPAR CREEK - 1964



the trap but dropped downstream before they could be removed. These fish did not re-enter the trap for periods ranging from a few days to several weeks even though flows were adequate. Such behavior was not observed in Caspar Creek, but if there were a rejection reaction to the traps, any measure of fish production would be biased.

#### Weight-Length Relationship (1960-61 Data)

During the 1960-61 spawning season in Caspar Creek, weight-length data were collected from 115 silver salmon and 66 steelhead before this study was initiated. Fish were measured to the nearest one-tenth inch (fork-length) and weighed to the nearest ounce. Silver salmon in the sample ranged in length from 12.5 to 31.5 inches and in weight from one pound to 15 pounds 4 ounces. Steelhead ranged from 15.6 to 31.2 inches and from one pound 18 ounces to 12 pounds 6 ounces. These data were used to produce weight-length curves and tables and length-frequency histograms for each species.

Curves were plotted over scattergrams of individual weight-length pairs from the sample (Figures 4 and 5). The equation for the silver salmon curve is:

$$W = 3.82817 \times 10^{-4} L^{3.04908} \quad (\text{Log } W = -3.41758 + 3.04908 \text{ Log } L),$$

and for the steelhead curve:

$$W = 4.15598 \times 10^{-4} L^{2.99100} \quad (\text{Log } W = -3.38138 + 2.99100 \text{ Log } L).$$

Tables 3 and 4 give calculated weights for lengths from 12.0 inches to 31.9 inches at one-tenth inch intervals.

The 1960--61 run contained 322 silver salmon and 92 steelhead. A graphic representation of calculated length-frequencies is presented in Figure 6. The silver salmon histogram is characteristically bi-modal. The left-hand mode is predominantly grilse.

#### Silver Salmon Length-Fecundity Relationship

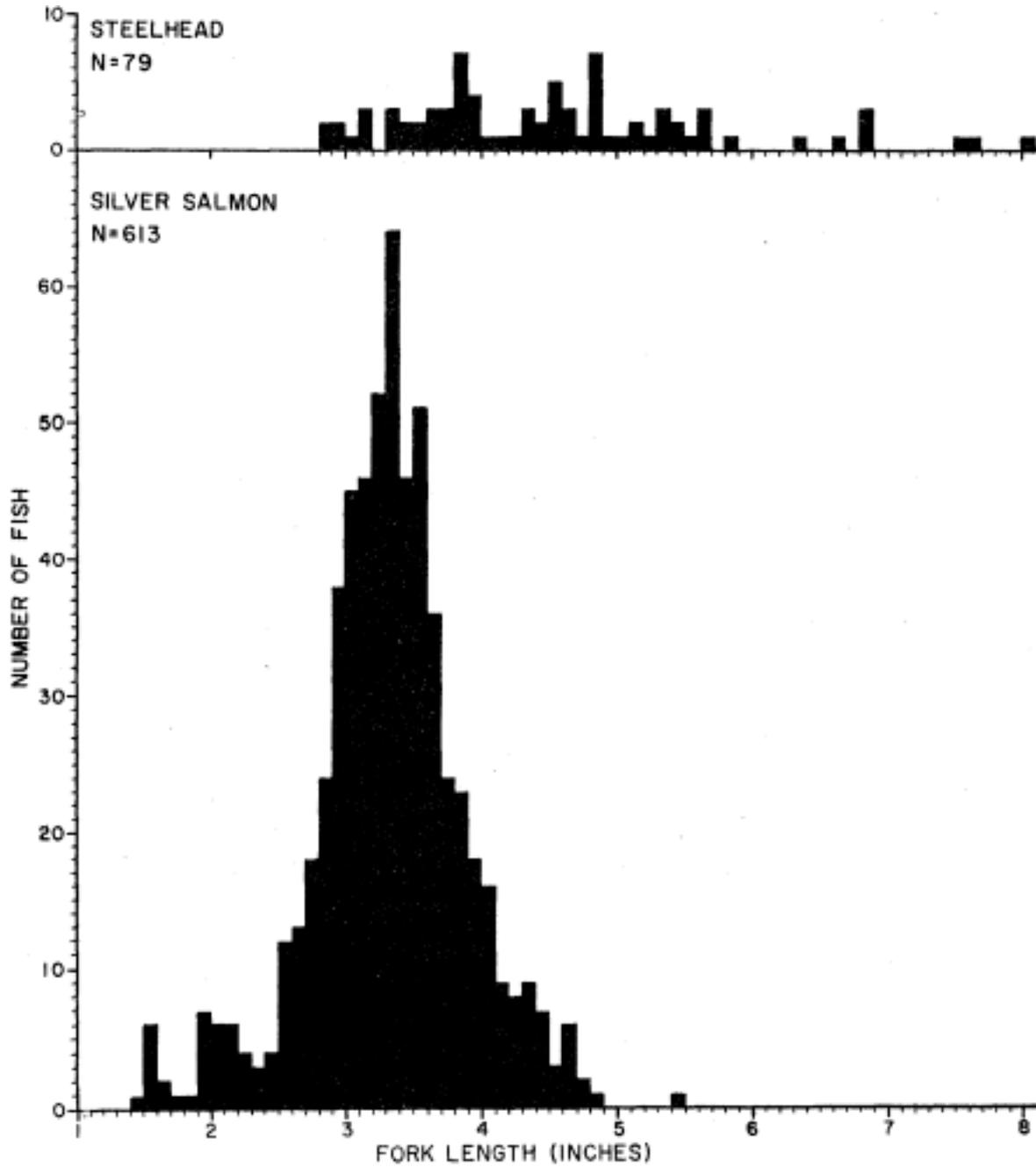
To obtain an estimate of potential egg deposition in Caspar Creek, ovaries were collected in 1964-65 from 25 fish in the Noyo River, a neighboring stream. Fish were measured (fork-length) to the nearest one-tenth inch; eggs were counted by the volumetric method. The fish ranged in length from 23.4 to 30.8 inches. Egg counts ranged from 1,946 to 4,248 eggs.

A regression curve of the form  $N = aL^n$  (where N equals number of eggs and L equals fork-length) was fitted to the data. The curve is plotted on a scattergram of the 25 coordinate pairs from the sample (Figure 7). The equation is:

$$N = .51989 L^{2.61166} \quad (\text{Log } N = -.28409 + 2.61166 \text{ Log } L)$$

Table 5 gives the calculated number of eggs for lengths at one-tenth inch intervals from 22.0 inches to 31.9 inches.

FIGURE 9  
LENGTH FREQUENCY  
DOWNSTREAM MIGRANTS  
SOUTH FORK CASPAR CREEK  
1964



## Juvenile Migrants

### Behavior

The downstream movement of juvenile silver salmon from upstream areas takes place in two and possibly three phases in Caspar Creek. First, there is a predominantly downstream displacement of fry beginning soon after their emergence and continuing well into summer. These young fish, along with older residents, populate the stream all the way to the ocean by mid-summer. After studying this behavior in other coastal streams, Chapman (1961) and others have concluded that these fish move downstream only until a suitable niche is found. Whether or not an unoccupied niche can be found depends upon the intensity and success of spawning in the stream. During some years, many fish may be displaced into the ocean before they have reached the stage of maturity necessary for ocean survival.

Second, is the regular spring-summer migration of age-one fish. There is no evidence to establish whether or not all of these fish enter the ocean. It is probable that the smaller fish in this migration remain in lower sections of the stream for an additional year. Observations and limited scale analysis indicated that many juvenile silver salmon in Caspar Creek do not become ocean migrants until age two.

Although not conclusive, some observations indicate there may be a third migration in the fall of age 0, age one and older fish.

The downstream migration pattern of steelhead from these upstream areas was not determined; However, it is likely that it is more variable than that of silver salmon. Shapovalov and Taft (op. cit.) in their study of silver salmon and steelhead in Waddell Creek, California, noted that "young steelhead exhibit much greater variation in individual behavior than do the juvenile silver salmon." This was particularly evident in their migratory behavior.

During the period March 13 - July 1, 1964, all out-migrants from the study areas were trapped, measured and counted (Tables 6,7,8, and 9); downstream migration peaked in early May (Figure 8). This agrees with the findings of Shapovalov and Taft (op. cit.), Salo and Bayliff (op. cit.), and others.

### Length Frequency

The fork-length of each downstream migrant trapped was measured to the nearest one-tenth inch. Histograms were prepared for South Fork silver salmon and steelhead (Figure 9). South Fork silvers ranged in length from 1.4 to 5.4 inches and averaged 3.3 inches; steelhead ranged from 2.8 to 8.0 inches and averaged 4.5 inches.

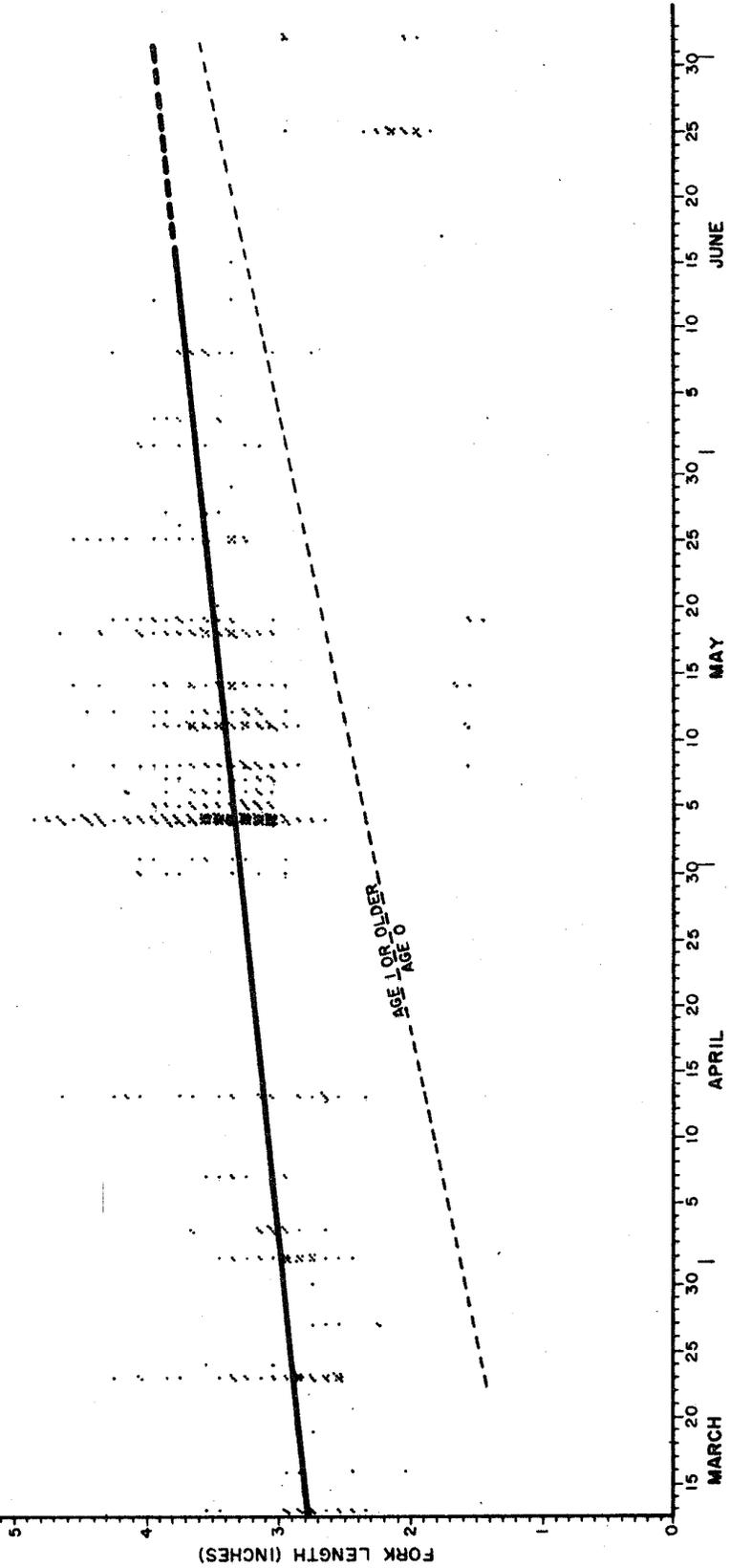
### Length-Time Relationship

An increase in length of yearling or older silver salmon with time of downstream migration was noted in the South Fork. Daily average lengths were calculated and a regression line was fitted to these data (Figure 10). The line indicates an average increase in length of one inch during the 95-day period, or approximately one-third inch per month. Since this analysis is based on only one season's data, it is very possible that the "apparent growth" is anomalous. Other workers, with data collected over a series of years, have noted the opposite trend; i.e., a decrease in size with time of migration; however,

FIGURE 10

SILVER SALMON  
LENGTH-TIME RELATIONSHIP  
AGE 1 OR OLDER DOWNSTREAM MIGRANTS  
SOUTH FORK CASPAR CREEK-1964

EACH DOT REPRESENTS ONE FISH



these data were collected in downstream areas and may be influenced by different variables.

#### Silver Salmon Production Estimate

Shapovalov and Taft (op. cit.) estimated that marine survival for Waddell Creek silvers was 4.95 percent, and Salo and Bayliff (op. cit.) calculated an average marine survival for Minter Creek silvers 3.99 percent. If we assume the 1960-61 silver salmon escapement figure is average for Caspar Creek and that a marine survival, rate of 4.5 percent (an average of those previously cited) applied, the stream would produce about 7200 ocean migrants.

#### CONCLUSIONS

1. Nursery habitat in the test and control areas is marginal. Living space becomes a critical factor during summer months as stream flow in The areas decreases and becomes intermittent.
2. Measurement of anadromous fish production, one of the primary objectives of this study, was not achieved. Mounting technological problems encountered after the program was well underway made it impossible to bring this phase of the investigation to a successful conclusion.
3. It is extremely difficult to assign "production value" to a sub-yearling fish which migrates out of a study area and into a downstream nursery area where it joins a large number of fish of the same age from the main stream and loses its "study area" identity. Once this has happened one of three events can take place: (1) The fish may be reared to ocean migration age and size and be counted through the lower structure as a unit of stream production. In this case, a fraction of this unit is assignable to "study area production", -- but which study area, and what fraction? (2) The fish may not survive to migrate to the sea (this may be the result of the logging and road building that is taking place in the downstream areas, or natural mortality). (3) The fish may be displaced into the ocean (through the lower counting structure) at an age or size that precludes ocean survival. In this case it cannot be counted as a unit of production.
4. Fish passage and trapping structures must be substantially larger and stronger than those tested if they are to withstand flows of the magnitude encountered during this study.
5. The selection of two adjacent streams about the size of Caspar Creek would provide a much better base from which to develop a comparative study of this type. Only a single upstream-downstream counting facility at the ocean would be required on each stream. Downstream migrants passing through this facility would then be true ocean migrants, and each migrant of the age, size and condition necessary for ocean survival could be counted as a unit of production.

REFERENCES

- Chapman, Donald W. 1961. Factors determining production of coho salmon, Oncorhynchus kisutch, in three Oregon streams. Ph.D. thesis, Oregon State University, 214 pp.
- Salo, Ernest O., and William H. Bayliff. 1958. Artificial and natural production of silver salmon, Oncorhynchus kisutch, at Minter Creek, Washington. Wash. State Dept. of Fish., Res. Bull. No. 4, 82 pp.
- Shapovalov, Leo, and Alan C. Taft. 1954. The life histories of the steelhead rainbow trout (Salmo gairdneri gairdneri) and silver salmon (Oncorhynchus kisutch) with special reference to Waddell Creek, California, and recommendations regarding their management. Fish Bull., Calif. Dept. Fish and Game, (98): 1-375.

# APPENDIX

TABLE 1

Caspar Creek Water Temperatures in °F.  
1963

Week beginning	North Fork		South Fork	
	Maximum	Minimum	Maximum	Minimum
Mar. 6	48.0	40.5	42.5	39.5
13	46.0*	38.5*	42.5	38.0
20	47.0*	41.0*	44.5	40.5
27	**	**	46.0*	40.5*
April 3	48.0	44.0	47.0	42.5
10	48.0	44.5	47.0	42.5
17	49.0	42.5	46.0	41.0
24	51.0*	43.0*	47.5	42.0
May 1	49.5*	45.0*	49.0*	45.0*
8	51.0	43.5	49.5	43.5
15	55.0	47.0	51.0	46.5
22	55.0	48.5	49.5	47.0
29	55.0	49.0	50.5*	48.0*
June 5	56.0	48.5	51.0	48.0
12	57.5	51.5	53.0	49.0
19	57.0	49.5	51.5	48.5
26	57.0	50.5	51.0	48.5
July 3	59.5	50.5	54.0	49.0
10	60.5	53.5	54.5	51.5
17	61.0*	53.0*	54.5	51.0
24	62.0*	54.5*	55.0	50.5
31	59.5	53.5	53.5	50.5
Aug. 7	59.5	54.0	54.5	51.0
14**				
21**				
28**				
Sept. 4**				
11	66.0	55.0	58.0*	52.5*
18	60.5*	55.0*	55.0*	51.5*
25	61.0*	55.0*	54.5*	51.5*
Oct. 2	59.0	54.5	52.5	50.5
9**				
16	55.0*	50.5*	52.0*	50.0*
23	52.0	46.0	49.5	43.5
30**				
Nov. 6	**	**	47.0*	45.5*
13	51.5*	46.0*	**	**
20	50.0	44.5	47.5	42.0
27	48.0	44.0	46.0	42.0
Dec. 4	47.5*	41.5*	45.0*	39.0*
11	44.5*	39.0*	**	**
18	46.5	41.0	41.5	38.5
25**				

\* Record incomplete for the week.

\*\* No record for the week.

TABLE 1 (continued)

Casper Creek Water Temperatures in °F.  
1964

Week beginning	North Fork		South Fork	
	Maximum	Minimum	Maximum	Minimum
Jan. 1	**	**	48.0*	42.0*
8	46.0*	41.0*	42.5*	39.0*
15	47.5	41.5	46.0	38.5
22	47.5*	44.0*	45.5	42.0
29	**	**	45.0	41.0
Feb. 5	45.5*	40.0*	42.5	37.5
12	43.0*	38.5*	40.0	38.0
19	45.0	39.0	40.5	38.5
26	43.0	39.0	40.0	38.5
Mar. 4	43.0*	39.0*	40.5*	39.5*
11	46.0*	40.0*	42.0	40.0
18	47.5	39.5	43.5	40.0
25	46.5	39.5	43.5	39.0
April 1	44.0*	40.5*	44.0*	41.0*
8	50.5	42.5	45.5	42.5
15	49.0	43.0	45.0*	43.0*
22	49.0	41.5	47.0	42.0
29	49.0*	43.5*	45.0	42.5
May 6	50.5	43.0	47.0	42.5
13	53.0*	45.0*	48.5	45.0
20	53.5	47.5	49.0	47.5
27	55.0*	49.0*	51.0	48.0
June 3	53.5*	50.0*	51.5	50.0
10	56.5*	51.0*	53.5*	50.5*
17	61.0	51.5	55.0	50.5
24	59.5	53.0	53.5	50.5
July 1**				
8**				
15**				
22	63.0	56.5	56.0	53.0
29	63.0*	56.5*	57.0	53.5
Aug. 5**				
12**				
19	64.5	58.5	56.5	54.0
26	61.0*	55.0*	55.5	51.5
Sept. 2	**	**	53.0	50.5
9**				
16	62.0	55.0	53.5	50.5
23	62.0	54.0	54.0	50.5
30	59.0	54.5	53.0	50.5
Oct. 7	58.5*	53.5*	54.0	51.0
14	57.5*	53.5*	53.5	47.0
21	63.0***	60.5***	48.5*	47.0*
28	62.0	58.5	50.0	48.0
Nov. 4	60.0*	57.5*	48.5	46.0
11	59.0	48.5	47.0	37.0
18	54.0	48.5	41.0	36.0
25	**	**	50.0	41.0
Dec. 2	59.5	53.0	49.5	41.5
9	57.5*	52.5*	45.5	41.0

\* Record incomplete for the week.

\*\* No record for the week.

\*\*\* Pen cleaned - was temperature setting changed?



TABLE 3  
Silver Salmon Weight-Length Relationship, Caspar Creek, 1960-61

Length	Weight	Length	Weight	Length	Weight	Length	Weight
12.0	0.75	17.0	2.16	22.0	4.74	27.0	8.85
12.1	0.77	17.1	2.20	22.1	4.80	27.1	8.95
12.2	0.78	17.2	2.24	22.2	4.87	27.2	9.05
12.3	0.80	17.3	2.28	22.3	4.94	27.3	9.15
12.4	0.82	17.4	2.32	22.4	5.01	27.4	9.25
12.5	0.85	17.5	2.36	22.5	5.07	27.5	9.36
12.6	0.87	17.6	2.40	22.6	5.14	27.6	9.46
12.7	0.89	17.7	2.44	22.7	5.21	27.7	9.56
12.8	0.91	17.8	2.48	22.8	5.28	27.8	9.67
12.9	0.93	17.9	2.53	22.9	5.35	27.9	9.78
13.0	0.95	18.0	2.57	23.0	5.43	28.0	9.88
13.1	0.98	18.1	2.61	23.1	5.50	28.1	9.99
13.2	1.00	18.2	2.66	23.2	5.57	28.2	10.10
13.3	1.02	18.3	2.70	23.3	5.64	28.3	10.21
13.4	1.04	18.4	2.75	23.4	5.72	28.4	10.32
13.5	1.07	18.5	2.79	23.5	5.79	28.5	10.43
13.6	1.09	18.6	2.84	23.6	5.87	28.6	10.54
13.7	1.12	18.7	2.89	23.7	5.94	28.7	10.66
13.8	1.14	18.8	2.93	23.8	6.02	28.8	10.77
13.9	1.17	18.9	2.98	23.9	6.10	28.9	10.88
14.0	1.19	19.0	3.03	24.0	6.18	29.0	11.00
14.1	1.22	19.1	3.08	24.1	6.26	29.1	11.12
14.2	1.25	19.2	3.13	24.2	6.34	29.2	11.23
14.3	1.27	19.3	3.18	24.3	6.42	29.3	11.35
14.4	1.30	19.4	3.23	24.4	6.50	29.4	11.47
14.5	1.33	19.5	3.28	24.5	6.58	29.5	11.59
14.6	1.36	19.6	3.33	24.6	6.66	29.6	11.71
14.7	1.39	19.7	3.38	24.7	6.74	29.7	11.83
14.8	1.41	19.8	3.44	24.8	6.83	29.8	11.95
14.9	1.44	19.9	3.49	24.9	6.91	29.9	12.07
15.0	1.47	20.0	3.54	25.0	7.00	30.0	12.20
15.1	1.50	20.1	3.60	25.1	7.08	30.1	12.32
15.2	1.53	20.2	3.65	25.2	7.17	30.2	12.45
15.3	1.57	20.3	3.71	25.3	7.26	30.3	12.57
15.4	1.60	20.4	3.76	25.4	7.34	30.4	12.70
15.5	1.63	20.5	3.82	25.5	7.43	30.5	12.83
15.6	1.66	20.6	3.88	25.6	7.52	30.6	12.96
15.7	1.69	20.7	3.93	25.7	7.61	30.7	13.09
15.8	1.73	20.8	3.99	25.8	7.70	30.8	13.22
15.9	1.76	20.9	4.05	25.9	7.79	30.9	13.35
16.0	1.79	21.0	4.11	26.0	7.88	31.0	13.48
16.1	1.83	21.1	4.17	26.1	7.98	31.1	13.61
16.2	1.86	21.2	4.23	26.2	8.07	31.2	13.75
16.3	1.90	21.3	4.29	26.3	8.17	31.3	13.88
16.4	1.93	21.4	4.35	26.4	8.26	31.4	14.02
16.5	1.97	21.5	4.42	26.5	8.36	31.5	14.15
16.6	2.01	21.6	4.48	26.6	8.45	31.6	14.29
16.7	2.04	21.7	4.54	26.7	8.55	31.7	14.43
16.8	2.08	21.8	4.61	26.8	8.65	31.8	14.57
16.9	2.12	21.9	4.67	26.9	8.75	31.9	14.71

TABLE 4  
Steelhead Weight-Length Relationship, Caspar Creek, 1960-61

Length	Weight	Length	Weight	Length	Weight	Length	Weight
12.0	0.70	17.0	1.99	22.0	4.30	27.0	7.94
12.1	0.72	17.1	2.03	22.1	4.36	27.1	8.03
12.2	0.74	17.2	2.06	22.2	4.42	27.2	8.11
12.3	0.76	17.3	2.10	22.3	4.48	27.3	8.20
12.4	0.77	17.4	2.13	22.4	4.54	27.4	8.30
12.5	0.79	17.5	2.17	22.5	4.60	27.5	8.39
12.6	0.81	17.6	2.21	22.6	4.67	27.6	8.48
12.7	0.83	17.7	2.25	22.7	4.73	27.7	8.57
12.8	0.85	17.8	2.28	22.8	4.79	27.8	8.67
12.9	0.87	17.9	2.32	22.9	4.85	27.9	8.76
13.0	0.89	18.0	2.36	23.0	4.92	28.0	8.85
13.1	0.91	18.1	2.40	23.1	4.98	28.1	8.95
13.2	0.93	18.2	2.44	23.2	5.05	28.2	9.04
13.3	0.96	18.3	2.48	23.3	5.11	28.3	9.14
13.4	0.98	18.4	2.52	23.4	5.18	28.4	9.24
13.5	1.00	18.5	2.56	23.5	5.24	28.5	9.34
13.6	1.02	18.6	2.61	23.6	5.31	28.6	9.43
13.7	1.04	18.7	2.65	23.7	5.38	28.7	9.53
13.8	1.07	18.8	2.69	23.8	5.45	28.8	9.63
13.9	1.09	18.9	2.73	23.9	5.51	28.9	9.73
14.0	1.11	19.0	2.78	24.0	5.58	29.0	9.83
14.1	1.14	19.1	2.82	24.1	5.65	29.1	9.94
14.2	1.16	19.2	2.86	24.2	5.72	29.2	10.04
14.3	1.19	19.3	2.91	24.3	5.80	29.3	10.14
14.4	1.21	19.4	2.95	24.4	5.87	29.4	10.25
14.5	1.24	19.5	3.00	24.5	5.94	29.5	10.35
14.6	1.26	19.6	3.05	24.6	6.01	29.6	10.45
14.7	1.29	19.7	3.09	24.7	6.09	29.7	10.56
14.8	1.32	19.8	3.14	24.8	6.16	29.8	10.67
14.9	1.34	19.9	3.19	24.9	6.23	29.9	10.77
15.0	1.37	20.0	3.24	25.0	6.31	30.0	10.88
15.1	1.40	20.1	3.28	25.1	6.38	30.1	10.99
15.2	1.42	20.2	3.33	25.2	6.47	30.2	11.10
15.3	1.45	20.3	3.38	25.3	6.54	30.3	11.21
15.4	1.48	20.4	3.43	25.4	6.62	30.4	11.32
15.5	1.51	20.5	3.48	25.5	6.69	30.5	11.43
15.6	1.54	20.6	3.54	25.6	6.77	30.6	11.55
15.7	1.57	20.7	3.59	25.7	6.85	30.7	11.66
15.8	1.60	20.8	3.64	25.8	6.93	30.8	11.77
15.9	1.63	20.9	3.69	25.9	7.01	30.9	11.89
16.0	1.66	21.0	3.74	26.0	7.09	31.0	12.00
16.1	1.69	21.1	3.80	26.1	7.18	31.1	12.12
16.2	1.72	21.2	3.85	26.2	7.26	31.2	12.24
16.3	1.76	21.3	3.91	26.3	7.34	31.3	12.35
16.4	1.79	21.4	3.96	26.4	7.43	31.4	12.47
16.5	1.82	21.5	4.02	26.5	7.51	31.5	12.59
16.6	1.85	21.6	4.07	26.6	7.59	31.6	12.71
16.7	1.89	21.7	4.13	26.7	7.68	31.7	12.83
16.8	1.92	21.8	4.19	26.8	7.77	31.8	12.96
16.9	1.96	21.9	4.25	26.9	7.85	31.9	13.08

TABLE 5

Silver Salmon Length-Fecundity Relationship, South Fork Noyo River, 1964-65

Length	Number of eggs	Length	Number of eggs
22.0	1667	27.0	2845
22.1	1687	27.1	2873
22.2	1707	27.2	2901
22.3	1727	27.3	2929
22.4	1747	27.4	2957
22.5	1767	27.5	2985
22.6	1788	27.6	3014
22.7	1809	27.7	3042
22.8	1830	27.8	3071
22.9	1851	27.9	3100
23.0	1872	28.0	3129
23.1	1893	28.1	3158
23.2	1915	28.2	3188
23.3	1936	28.3	3217
23.4	1958	28.4	3247
23.5	1980	28.5	3277
23.6	2002	28.6	3307
23.7	2024	28.7	3337
23.8	2047	28.8	3368
23.9	2070	28.9	3399
24.0	2092	29.0	3429
24.1	2115	29.1	3460
24.2	2138	29.2	3491
24.3	2161	29.3	3523
24.4	2184	29.4	3554
24.5	2208	29.5	3586
24.6	2231	29.6	3618
24.7	2255	29.7	3650
24.8	2279	29.8	3682
24.9	2303	29.9	3714
25.0	2327	30.0	3747
25.1	2352	30.1	3779
25.2	2376	30.2	3812
25.3	2401	30.3	3845
25.4	2426	30.4	3879
25.5	2451	30.5	3912
25.6	2476	30.6	3946
25.7	2501	30.7	3979
25.8	2527	30.8	4013
25.9	2553	30.9	4046
26.0	2578	31.0	4082
26.1	2604	31.1	4116
26.2	2630	31.2	4151
26.3	2657	31.3	4186
26.4	2683	31.4	4221
26.5	2710	31.5	4256
26.6	2737	31.6	4291
26.7	2764	31.7	4327
26.8	2791	31.8	4353
26.9	2818	31.9	4399



TABLE 7  
Steelhead  
South Fork Caspar Creek  
Length-Frequency and Numbers of Downstream Migrants Trapped, By Day, 1964

Length inches	March					April				May									Total	
	13	16	19	23	24	1	3	7	30	1	4	5	6	7	12	14	18	25		29
2.5																				
2.6																				
2.7																				
2.8		1				1														2
2.9						1					1									2
3.0							1													1
3.1		1	1			1														3
3.2																				
3.3						1	1				1									3
3.4						1					1									2
3.5											1	1								2
3.6					1			1												3
3.7					1						1					1				3
3.8				1			1				1	1	1	1						7
3.9					1	1					2									4
4.0		1																		1
4.1																	1			1
4.2																	1			1
4.3											3									3
4.4			1								1									2
4.5										1	4									5
4.6									1		2									3
4.7											1									1
4.8						1	1				3		1					1		7
4.9															1					1
5.0																			1	1
5.1						1	1													2
5.2											1									1
5.3				1		2					1									3
5.4	1										1									2
5.5							1													1
5.6	1					1					1									3
5.7																				
5.8													1							1
5.9																				
6.0																				
6.1																				
6.2																				
6.3															1					1
6.4																				
6.5																				
6.6											1									1
6.7																				
6.8				2		1														3
7.5											1									1
7.6											1									1
8.0											1									1
Total	2	3	2	4	3	12	6	1	1	1	29	2	4	1	3	1	2	1	1	79

TABLE 8  
Silver Salmon  
North Fork Caspar Creek  
Length-Frequency and Numbers of Downstream  
Migrants Trapped, by Day, 1964

Length inches	3/24	5/6	5/7	5/18	5/27	6/3	6/8	Total
1.0								
1.1								
1.2								
1.3								
1.4								
1.5								
1.6								
1.7								
1.8								
1.9								
2.0								
2.1								
2.2								
2.3								
2.4								
2.5								
2.6								
2.7								
2.8								
2.9								
3.0								
3.1	1							1
3.2								
3.3								
3.4								
3.5								
3.6								
3.7								
3.8		1						1
3.9			1		1			2
4.0								
4.1						1		1
4.2		1						1
4.3						2	1	3
4.4		1				2		3
4.5		1		1			1	3
4.6		3						3
4.7								
4.8		1					1	2
4.9		4					1	5
5.0		2						2
5.1		4				1		5
5.2		3						3
5.3		2						2
5.4		5					1	6
5.5								
5.6								
5.7							1	1
Total	1	28	1	1	1	6	6	44

TABLE 9  
Steelhead  
North Fork Caspar Creek  
Length-Frequency and Numbers of Downstream  
Migrants Trapped, by Day, 1964

Length inches	3/23	4/1	4/3	4/13	4/29	5/8	5/20	5/27	6/17	6/25	Total
2.5										1	1
2.6											
2.7									1		1
2.8											
2.9											
3.0											
to											
3.9											
4.0											
4.1											
4.2									1		1
4.3											
4.4											
4.5											
4.6											
4.7											
4.8			1		1						2
4.9	1										1
5.0	1										1
5.1											
5.2											
5.3											
5.4											
5.5								1			1
5.6											
5.7											
5.8											
5.9											
6.0											
6.1	1										1
6.2				1				1			2
6.3											
6.4											
6.5											
6.6							1				1
6.7											
6.8											
6.9											
7.0											
7.1		1									1
7.2											
7.3	1							1			2
7.5											
7.6											
8.0											
8.3							1				1
8.4									1		1
Total	4	1	1	1	1	1	1	3	2	2	17