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Annual Performance Report for

STEELHEAD AND SEA-RUN CUTTHROAT
TROUT LIFE HISTORY STUDY IN
SOUTHEAST ALASKA

by

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RESEARCH PROJECT SEGMENT

State: Alaska Name: Sport Fish Investigations
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Study No.: AFS 42 Study Title: STEELHEAD AND SEA-RUN CUT-
THROAT TROUT LIFE HISTORY
STUDY IN SOUTHEAST ALASKA

Job No.: AFS 42-3-A Job Title: Life History of Steelhead
Trout

Period Covered: July 1, 1974 to June 30, 1975.

ABSTRACT

This report covers the fourth year's operation of the project on the Petersburg Creek system, designed to study the life history of the steelhead trout, Salmo gairdneri Richardson, in a typical Southeast Alaska lake-stream system. Between April 13, 1974 and June 16, 1974 an estimated 369 steelhead migrated upstream past the Petersburg Creek weir. The peak of in-migration occurred on May 17, 1974 which was two weeks later than that recorded in 1973. Adult steelhead tagged at the weir spent an average of 30 days above the Petersburg Creek weir before spawning was completed and they migrated downstream to the sea. Age composition of the adult steelhead was determined from a total of 275 scale samples. The 1974 steelhead run to Petersburg Creek was comprised of 24 age classes with repeat spawners comprising 32.7 percent of the total run. Adult steelhead ranged in size from 60.9 cm and 2.1 kg to 95.3 cm and 9.4 kg with an overall average 78.2 cm and 4.9 kg. Adult steelhead were found spawning throughout Petersburg Creek and most of its tributaries with the preferred redd composed of 10.1 cm to 15 cm gravel located at the tail of pools in 15 cm to 20 cm of water.

The out-migration of steelhead smolts from Petersburg Creek began on April 27, 1974, peaked on June 2, 1974 and was complete by July 6, 1974. A total of 383 smolt were trapped and sampled during this period. This was the smallest number of steelhead smolt recorded leaving Petersburg Creek since the project started in 1971. A total of 65,029 fish of various species passed both upstream and downstream during the operation of the Petersburg Creek weir in 1974.

RECOMMENDATIONS

Research

The determination of the timing and numbers of in- and out-migrant steelhead, their length, weight, sex and age should be continued for the

Petersburg Creek population.

The location of the spawning grounds and spawning requirements of the Petersburg Creek steelhead should be continued in order to compile a comprehensive map of these sites.

Tagging of in-migrant adult steelhead should be continued to determine effects of tagging on stream and spawning survival and to determine length of residence in Petersburg Creek.

The determination of the number, length, age and migration timing of the steelhead smolts leaving Petersburg Creek system should be continued. This data will give an index to the productive potential of Petersburg Creek to rear steelhead smolts.

Investigations delineating the limiting factors on steelhead smolt production should be initiated.

Stream surveys for potential steelhead egg take sites should be conducted.

Management

In general, the life history study of the steelhead population in Petersburg Creek indicates that only minor management changes are needed. The Petersburg Creek steelhead, Salmo gairdneri Richardson, population is comprised of many age classes of adults with a large percentage (40 percent), of the total run comprised of repeat spawners. The repeat spawners are usually large "trophy" size fish and are avidly sought by the sport angler. A larger harvest of these repeat spawners with an attendant lower harvest of initial spawners would not greatly affect future runs. The percentage of steelhead that make more than two spawning migrations is small, where as the numbers of initial spawners surviving to come back to spawn again is good. If changes occur in bag limits, consideration should be given to additional protection of the smaller, initial spawners.

The Crystal Lake Hatchery is presently rearing approximately 18,000 steelhead. The steelhead will be marked (fin clipped) and 9,000 smolts will be released in June 1975 in Petersburg Creek at a point midway between the lake and tidewater. Survival of these smolts will be monitored as they pass downstream through the weir. Overall survival will be obtained as these steelhead return as adults two and three years hence. The remaining 9,000 steelhead smolts will be released in Crystal Creek near the hatchery to establish the first of a run of steelhead for future hatchery egg takes.

The procurement of 225,000 steelhead eggs is planned for the spring of 1975. These eggs will come from streams adjacent to the Mitkof Highway and from Petersburg Creek.

It is recommended that streams containing fall-run steelhead be surveyed and a suitable location established for the procurement of eggs from fall-run steelhead.

Angler effort on the better steelhead streams of Southeast Alaska is increasing at a rapid rate. This is partly a result of better access to some streams and to a better knowledge by the angling public of where and when. This heavy pressure on a select number of streams has altered the wilderness experience and has the potential to harvest large numbers of steelhead. In view of this increasing fishing pressure, I recommend a reduction of the bag and possession limit in those areas most affected. I also recommend the establishment of artificially produced steelhead runs in streams close to population centers as soon as smolts are available from the Crystal Lake Hatchery.

OBJECTIVES

1. Determine the number of in- and out-migrant adult steelhead in the Petersburg Creek system.
2. Determine the length, weight, sex and age of steelhead in the Petersburg Creek system.
3. Determine the number, length and age of steelhead smolt leaving the Petersburg Creek system.
4. Determine the spawning grounds and spawning requirements and distribution of steelhead in the Petersburg Creek system.
5. Determine the length of time spent on the spawning grounds by adult steelhead in the Petersburg Creek system.
6. Investigate systems other than Petersburg Creek for potential egg take sites.
7. Investigate selected systems for selection as sites for future hatchery-reared steelhead plants.
8. Compile an annotated bibliography of selected references on steelhead.

TECHNIQUES USED

Background information from prior studies conducted by the Alaska Department of Fish and Game and other agencies was reviewed.

The horse and deck weir, incorporating in- and out-migrant traps, constructed in 1972, was given annual maintenance and was fishing on April 9, 1974.

The completed weir was 50 meters long and .91 meters high. An additional .91 meters of height was added to compensate for the higher high tides by addition of screens mounted above the weir deck. The weir was of an inclined screen panel type, using 1.60 cm hardware cloth screens for normal water levels and 2.54 cm hardware cloth screens during high water periods. Three traps, 3.6 meters by 2.7 meters, were placed near the east bank as this area has been determined to be the most attractive to

migrating fish. The three traps were designed to be used as either in- or out-migrant traps depending upon the direction of the bulk of the migrating fish. A three-meter weir section, located in midstream, was modified to allow boat traffic to pass through the weir. All in- and out-migrant adult steelhead captured at the weir were anesthetized with Tricaine Methanesulfonate (MS-222), sexed, measured and weighed. All in-migrant adult steelhead were marked by removal of the adipose fin and tagged with numbered "Floy" internal anchor type tags. Scale samples were also collected from all adult steelhead for age determinations. The sampled steelhead were then placed in a freshwater tank to recover before being released in the direction of original migration.

All out-migrant steelhead smolts captured at the weir were anesthetized with MS-222, enumerated and measured. Every twentieth smolt was killed, measured and sexed. Otoliths were collected from these smolts for age determinations. Stomach contents were examined and classified.

Foot surveys and sampling by hook and line were used to determine the location and distribution of spawning steelhead in the Petersburg Creek system.

The in- and out-migration of Dolly Varden, Salvelinus malma, and the enumeration of the various salmon species was achieved by removing the fish from the traps by dip net, or removing a weir screen and tally counting as they crossed a "flash board".

FINDINGS

Work was performed on all the above objectives with the exception of number 6 and 7. No work was accomplished on objectives 6 and 7 during this reporting period due to a lack of time and manpower.

Adult Steelhead - Numbers and Timing

The total in-migration of adult steelhead, Salmo gairdneri, to Petersburg Creek in 1974 was estimated to be 369 fish. Of this total, 50 were harvested from the system by 263 sport anglers.

The actual and total count of in-migrant adult steelhead was impossible due to periodic flooding of Petersburg Creek during the spring of 1974 and the passage upstream of some adults before the research weir was in operation in April. During the early in-migration and during periods of high water, undetermined numbers of steelhead passed upstream. To estimate the total in-migration of adult steelhead in 1974, a marked to unmarked ratio of the out-migrants (Bailey's modification of Peterson's formula: Ricker, 1958) was used. The estimated total in-migration was computed as follows:

$$N = \frac{M(C+1)}{R+1} = \frac{180(163)}{92} = 319$$

Where M = 180 marked fish
C = 162 fish sampled
R = 91 marked fish recaptured

A comprehensive creel census of the steelhead anglers on Petersburg Creek was conducted during April, May and June 1974.

A total of 263 anglers fish a total of 928 hours to harvest 50 steelhead from the 1974 steelhead run. The addition of these 50 sport-caught fish brings the overall estimated steelhead run to 369 for 1974.

The 1974 in-migration of 369 adult steelhead to Petersburg Creek is the lowest recorded since initiation of the project in 1971 (Table 1).

Close examination of Table 1 shows a steady decline in adult steelhead numbers during the past four years. Exact causes for the decline is not known. Fishing pressure has remained almost constant with 50 to 80 steelhead removed each year. It was thought that the research weir might be inducing an undetermined delayed mortality on adults; however, the percentage of repeat spawners in the total run has remained nearly constant during the past four years. Perhaps the Petersburg Creek steelhead are cyclic as are other species of salmonids or perhaps greater than average mortalities occurred on the smolts and maturing adults during 1971 and 1972.

The in-migration of adult steelhead to Petersburg Creek probably began sometime in late February or early March, before the research weir was in operation, peaked on the 17th of May and was complete by June 16, 1974.

In-migration patterns during 1974 closely paralleled those observed in previous years (Jones, 1972, 1973, 1974) with the exception that the peak of in-migration was two weeks later in 1974.

The out-migration of spent adult steelhead from the Petersburg Creek system was delayed approximately two weeks in 1974 due to a late spring with low cold water. The out-migration started on May 13, peaked on June 18, and was complete by July 16, 1974. Out-migrant steelhead seemed reluctant to enter the out-migrant traps. To avoid delaying their out-migration, a beach seine was employed to capture the steelhead for release below the weir. Presented in Table 2 are the monthly totals for steelhead actually counted at the Petersburg Creek weir in 1974.

Adult Steelhead Tag Recovery

As the adult steelhead passed upstream through the Petersburg Creek weir, they were tagged with numbered "Floy" internal anchor tags. These highly visible tags enabled observations of the steelhead on their spawning grounds. As the steelhead migrated seaward after spawning, they were trapped; the tag number recorded and released below the weir.

After the last out-migrant adult steelhead had migrated past the weir in July, an analysis was made of stream residency for individual fish. It was found that the overall average for both sexes was 30 days with a range of two to 63 days. This average is four days longer than that

Table 1. Estimated Adult Steelhead Run to Petersburg Creek, 1971-1974.

| <u>Year</u> | <u>Estimated No. Adult Steelhead</u> |
|-------------|--------------------------------------|
| 1971 | 806 |
| 1972 | 536 |
| 1973 | 401 |
| 1974 | 369 |

Table 2. Adult Steelhead Trapped by Biweekly Periods, Petersburg Creek Weir, 1974.

| <u>Biweekly Period</u> | <u>Direction of Migration</u> | |
|------------------------|-------------------------------|---------------------|
| | <u>In-Migrants</u> | <u>Out-Migrants</u> |
| 4/7 - 4/20 | 7 | -- |
| 4/21 - 5/4 | 58 | -- |
| 5/5 - 5/18 | 73 | 6 |
| 5/19 - 6/1 | 36 | 13 |
| 6/2 - 6/15 | 4 | 33 |
| 6/16 - 6/29 | 2 | 99 |
| 6/30 - 7/13 | -- | 7 |
| 7/14 - 7/27 | -- | <u>4</u> |
| Total | 180 | 162 |

recorded in 1973 (Jones, 1974) and may be a factor of colder water temperatures in 1974. A breakdown by sex revealed that male steelhead spent an average of four days longer on the spawning grounds than did females (Table 3). This is considerably less than that recorded in 1973 when males spent an average of 13 days longer on the spawning grounds. Only two years of data has been recorded; however, it appears that stream temperatures and flow dictate length of stream residency for spring-run steelhead in Southeast Alaska.

Adult Steelhead Age - Sex Relationships

To obtain the age-sex relationships of the Petersburg Creek steelhead run, scale samples were collected and sex determined from all steelhead trapped at the weir during in- and out-migrations. A total of 275 scales were readable for total age determinations.

Twenty-four age classes (ages 2.1s - 5.2) were found among the Petersburg Creek steelhead population in 1974 (Table 4). This corresponds to 23 age classes in 1971, 29 in 1972 and 22 in 1973 (Jones, 1972, 1973, 1974). Age classes are presented using the aging method described by Narver and Withler, 1971. Repeat spawners are listed with an "s" after ocean age. This "s" represents a spawning run and is added to the total to determine the overall total age of repeat spawners. For example, a steelhead with an age of 3.2s is a total of six years old at the time the sample was obtained. This steelhead spent three winters rearing in Petersburg Creek before migrating to sea as a smolt. It then matured at sea for two winters before ascending Petersburg Creek to spawn for the first time. This steelhead survived the initial spawning run and has returned on its second spawning run to Petersburg Creek. This steelhead was sampled prior to spawning just as it was entering its seventh year of life and the second "s" was not added. However, if this steelhead survives the second spawning run and returns in 1975, the second "s" will be added to its total age. Initial steelhead spawners are those fish without an "s" in their total age.

Adult steelhead sampled in 1974 had spent two (4.1 percent), three (64.5 percent), four (31.6 percent) and five (0.7 percent) winters in freshwater before migrating to sea.

Presented in Table 5 are the freshwater ages of steelhead adults sampled from Petersburg Creek from 1971 through 1974. Examination of this data shows a shift in the age of steelhead smolts leaving Petersburg Creek. Steelhead sampled in 1971 were comprised of 27.5 percent Age 2 smolts and only 15.7 percent Age 4 smolts. Adults sampled during 1974 were comprised of 4.1 percent Age 2 smolts and 31.6 percent Age 4 smolts. The cause for the shift to older smolts is not known but may reflect a lack of good rearing conditions that delayed the growth of the rearing steelhead.

The number of winters spent in saltwater by the sampled steelhead were two (41.5 percent), three (47.2 percent), four (9.1 percent), five (2.3 percent) and six (0.8 percent). The 1974 run differed from that observed in 1971-1973 in that two ocean fish were almost twice as abundant.

Table 3. Adult Steelhead Stream Residency in Petersburg Creek, 1974.

| <u>Sex</u> | <u>Number</u> | <u>Average No. of Days</u> | <u>Range</u> |
|------------|---------------|----------------------------|--------------|
| Females | 39 | 27.8 | 6-63 |
| Males | <u>22</u> | <u>32.8</u> | <u>2-53</u> |
| Total | 61 | 30.0 | 2-63 |

Table 4. Steelhead Trout Age Classes, Petersburg Creek, 1974.

| <u>Age Classes</u> | <u>No. SH.</u> | <u>No. of Females</u> | <u>No. of Males</u> | <u>Percent of Total</u> |
|--------------------|----------------|-----------------------|---------------------|-------------------------|
| 2.1s | 1 | 1 | 0 | 0.4 |
| 2.2 | 4 | 2 | 2 | 1.5 |
| 2.2s | 2 | 2 | 0 | 0.7 |
| 2.3 | 4 | 3 | 1 | 1.5 |
| 3.1s | 13 | 3 | 10 | 4.7 |
| 3.1ss | 6 | 4 | 2 | 2.2 |
| 3.1sss | 3 | 2 | 1 | 1.1 |
| 3.1ssss | 1 | 1 | 0 | 0.4 |
| 3.2 | 49 | 6 | 43 | 17.8 |
| 3.2s | 23 | 17 | 6 | 8.4 |
| 3.2ss | 8 | 7 | 1 | 2.9 |
| 3.2sss | 2 | 2 | 0 | 1.5 |
| 3.2ssss | 1 | 1 | 0 | 0.4 |
| 3.3 | 68 | 49 | 19 | 24.7 |
| 3.4 | 1 | 1 | 0 | 0.4 |
| 4.1s | 6 | 3 | 3 | 2.2 |
| 4.1ss | 2 | 2 | 0 | 0.7 |
| 4.2 | 39 | 16 | 23 | 14.2 |
| 4.2s | 7 | 6 | 1 | 2.5 |
| 4.2ss | 13 | 13 | 0 | 4.7 |
| 4.2sss | 1 | 1 | 0 | 0.4 |
| 4.2ssss | 1 | 1 | 0 | 0.4 |
| 4.3 | 18 | 15 | 3 | 6.5 |
| <u>5.2</u> | <u>2</u> | <u>1</u> | <u>1</u> | <u>0.7</u> |
| Totals | | | | |
| 24 | 275 | 159 | 116 | 99.9 |

Table 5. Freshwater Ages of Steelhead Adults, Petersburg Creek,
1971 through 1974.

| <u>Fresh Water Ages</u> | | | | | |
|-------------------------|-------------|--------------|--------------|-------------|--------------------|
| <u>Year</u> | <u>Two</u> | <u>Three</u> | <u>Four</u> | <u>Five</u> | <u>Sample Size</u> |
| 1971 | 27.5% | 56.8% | 15.7% | 0% | 280 |
| 1972 | 13.1% | 60.4% | 24.9% | 1.1% | 170 |
| 1973 | 11.3% | 67.3% | 20.7% | 0.7% | 266 |
| <u>1974</u> | <u>4.1%</u> | <u>64.5%</u> | <u>31.6%</u> | <u>0.7%</u> | <u>275</u> |

Steelhead Frequency of Spawning

Examination of the steelhead, Salmo gairdneri, scale samples, obtained during the operation of the Petersburg Creek weir in 1974, revealed that 67.3 percent of the total run were initial spawners and that 32.7 percent of the run showed one or more spawning checks on their scales. The number of years 1974 sampled steelhead spawned is presented in Table 6.

Initial Steelhead Spawners

Steelhead, S. gairdneri, spawning for the first time in Petersburg Creek in 1974 numbered 185 or 67.3 percent of the fish sampled. These steelhead were from eight age classes with Age 3.3 the most numerous for all fish aged (Table 7). The 1974 run again contained a few steelhead in the 2.2 age class that was missing from the 1973 run. It was theorized that there would be a good return of Age 2.3 steelhead in 1974; however, this age class was very weak comprising only 2.2 percent of the total and could be part of the reason for the low number of adults entering Petersburg Creek in 1974.

The sex ratio of initial spawners was 1.01:1 with females only slightly more numerous than males.

Examination of the ocean ages of initial steelhead spawners to Petersburg Creek from initiation of the study in 1971 through 1974 has shown that there is a wide variation from year to year in the ocean ages.

In 1971, 60.1 percent of the initial spawners were two ocean fish and this may account in part for the large run recorded in 1971. During 1972 and 1973 the percentage of two ocean fish in the total run had decreased (Table 8) together with a decrease in total numbers of steelhead returning to Petersburg Creek. Apparently growing conditions at sea were not good during 1971 and 1972 which caused the steelhead to remain at sea an additional year. During the 1974 migration the percentage of two ocean fish was again up to near 50 percent; however, the total run was still below those recorded in previous years.

The 1974 run notwithstanding, it appears that the higher the percentage of two ocean fish in the total run, the larger the run will be (Table 8).

Repeat Steelhead Spawners

The 1974 steelhead run to Petersburg Creek was comprised of 32.7 percent repeat spawning steelhead. This is the lowest percentage of repeat spawners in the total run recorded since the study was initiated in 1971 (Table 9).

Exact cause for the depressed return of repeat spawners in 1974 is not known. Perhaps delayed mortalities were induced by handling of spawned out steelheads as they left the system in 1973. Whatever the cause, the lack of repeat spawners contributed to the overall low numbers of steelhead counted in Petersburg Creek during 1974.

Table 6. Steelhead Trout Spawning Frequency, Petersburg Creek, 1974.

Number of Years Adult Steelhead Returned to Spawn

| <u>Sex</u> | <u>One</u> | <u>Two</u> | <u>Three</u> | <u>Four</u> | <u>Five</u> | <u>Total</u> |
|---------------|------------|------------|--------------|-------------|-------------|--------------|
| Male | 92 | 20 | 3 | 1 | 0 | 116 |
| <u>Female</u> | <u>93</u> | <u>32</u> | <u>26</u> | <u>5</u> | <u>3</u> | <u>159</u> |
| Total | 185 | 52 | 29 | 6 | 3 | 275 |

Table 7. Age Classes of Initial Steelhead Trout Spawners by Sex, Petersburg Creek Weir, 1974.

| <u>Age Classes</u> | <u>No. SH</u> | <u>No. of Females</u> | <u>No. of Males</u> | <u>Percent of Total</u> |
|--------------------|---------------|-----------------------|---------------------|-------------------------|
| 2.2 | 4 | 2 | 2 | 2.2 |
| 2.3 | 4 | 3 | 1 | 2.2 |
| 3.2 | 49 | 6 | 43 | 26.5 |
| 3.3 | 68 | 49 | 19 | 36.8 |
| 3.4 | 1 | 1 | 0 | 0.5 |
| 4.2 | 39 | 16 | 23 | 21.1 |
| 4.3 | 18 | 15 | 3 | 9.7 |
| <u>5.2</u> | <u>2</u> | <u>1</u> | <u>1</u> | <u>1.1</u> |
| Totals | 185 | 93 | 92 | |

Table 8. Ocean Ages of Initial Steelhead Spawners, Petersburg Creek, 1971 - 1974.

| <u>Year</u> | <u>Number Steelhead</u> | <u>Ocean</u> | | <u>Age</u> |
|-------------|-------------------------|--------------|--------------|-------------|
| | | <u>Two</u> | <u>Three</u> | <u>Four</u> |
| 1971 | 806 | 60.1% | 39.3% | 0.6% |
| 1972 | 536 | 40.1% | 59.9% | -- |
| 1973 | 401 | 31.6% | 68.4% | -- |
| 1974 | 369 | 50.9% | 48.6% | 0.5% |

Table 9. Percent Repeat Spawners, Petersburg Creek, 1971 - 1974.

| <u>Year</u> | <u>Percent Repeat Spawners</u> |
|-------------|--------------------------------|
| 1971 | 43.0% |
| 1972 | 43.7% |
| 1973 | 41.7% |
| 1974 | 32.7% |

Sixteen age classes were represented among the repeat spawners in 1974 with the majority of females in Age Class 3.2s and the majority of the males in Age Class 3.1s (Table 10). Repeat steelhead spawners by sex show females to heavily outnumber males by a 2.8:1 ratio. Of the 66 repeat spawning females, 32 (48.5 percent) were spawning for the second time, 26 (39.4 percent) for the third time, 5 (7.6 percent) for the fourth time and 3 (4.5 percent) for the fifth time. Of the 24 repeat spawning males, 20 (83.3 percent) were spawning for the second time, 3 (12.5 percent) for the third time and 1 (4.2 percent) for the fourth time.

Steelhead Length - Weight Relationships

Length-weight relationships were collected from 275 steelhead as they passed the Petersburg Creek weir in 1974. Initial spawning males and females varied only slightly in length and weight as did lengths and weights of repeat spawners. The large differences in size occurred between initial and repeat spawners as a group (Table 11). The four year average length and weight of initial spawners was 74.9 cm and 4.4 kg while repeat spawners average 84.2 cm and 6.2 kg. As noted in Table 11, both initial and repeat spawners sampled in 1974 were very close to the overall four year average.

Steelhead Spawning Areas

Observations of steelhead spawning areas in the Petersburg Creek system have been made on an annual basis starting in 1971.

Steelhead were observed spawning in all of the main stem of Petersburg Creek with the exception of a 1 1/2 mile area above Shakey Frank's Creek (Figure 1). The area not utilized by spawners is comprised of slab bedrock with very little available gravel. Observations of steelhead redds by Briggs (1953), and Shapovalov and Taft (1954) on Prairie and Waddell creeks, California showed a preference for redd selection at the tail of pools in water 20 to 35 cm deep. Steelhead in Petersburg Creek also favored this type of spawning site but were also found spawning on large shallow open riffle areas that did not exceed 16 cm in depth. Steelhead redds in Petersburg Creek were most often located in an area with gravel five to 10 cm in diameter, however, some redds were located in areas comprised of fine gravel - less than five cm and in areas of large cobbles and boulders. As noted in California streams, redd sites were chosen in an area that would rarely be exposed by lowering stream levels. It is apparent that steelhead in Petersburg Creek utilize nearly all areas in the system that contain suitable spawning materials.

During 1974, an estimated 184 female steelhead spawned above the weir in Petersburg Creek. Fecundity studies conducted on a sample of 11 females gave an average of 5,336 eggs per female. An estimated total of 981,824 steelhead eggs were spawned in Petersburg Creek during 1974. In addition, 150,000 steelhead eggs were artificially spawned and placed in the Crystal Lake Hatchery for incubation.

Table 10. Age Classes of Repeat Steelhead Trout Spawners by Sex, Petersburg Creek, 1974.

| <u>Age Classes</u> | <u>No. SH</u> | <u>No. of Females</u> | <u>No. of Males</u> | <u>Percent of Total</u> |
|--------------------|---------------|-----------------------|---------------------|-------------------------|
| 2.1s | 1 | 1 | 0 | 1.1 |
| 2.2s | 2 | 2 | 0 | 2.2 |
| 3.1s | 13 | 3 | 10 | 14.4 |
| 3.1ss | 6 | 4 | 2 | 6.7 |
| 3.1sss | 3 | 2 | 1 | 3.3 |
| 3.1ssss | 1 | 1 | 0 | 1.1 |
| 3.2s | 23 | 17 | 6 | 25.6 |
| 3.2ss | 8 | 7 | 1 | 8.9 |
| 3.2sss | 2 | 2 | 0 | 2.2 |
| 3.2ssss | 1 | 1 | 0 | 1.1 |
| 4.1s | 6 | 3 | 3 | 6.7 |
| 4.1ss | 2 | 2 | 0 | 2.2 |
| 4.2s | 7 | 6 | 1 | 7.8 |
| 4.2ss | 13 | 13 | 0 | 14.4 |
| 4.2sss | 1 | 1 | 0 | 1.1 |
| <u>4.2ssss</u> | <u>1</u> | <u>1</u> | <u>0</u> | <u>1.1</u> |
| Totals | | | | |
| 16 | 90 | 66 | 24 | 99.9 |

Table 11. Steelhead Trout Length-Weight Relationships, Petersburg
Creek, 1974.

| | No. in <u>Sample</u> | Length Range <u>in cm</u> | Average Length <u>in cm</u> | Weight Range <u>in kg</u> | Average Weight <u>in kg</u> |
|------------------|-------------------------|---------------------------------|-----------------------------------|---------------------------------|-----------------------------------|
| Initial Spawners | 185 | 60.9-90.3 | 74.4 | 2.1-8.4 | 4.3 |
| Repeat Spawners | <u>90</u> | <u>68.6-95.3</u> | <u>85.9</u> | <u>3.3-9.4</u> | <u>6.3</u> |
| Total | 275 | 60.9-95.3 | 78.2 | 2.1-9.4 | 4.9 |

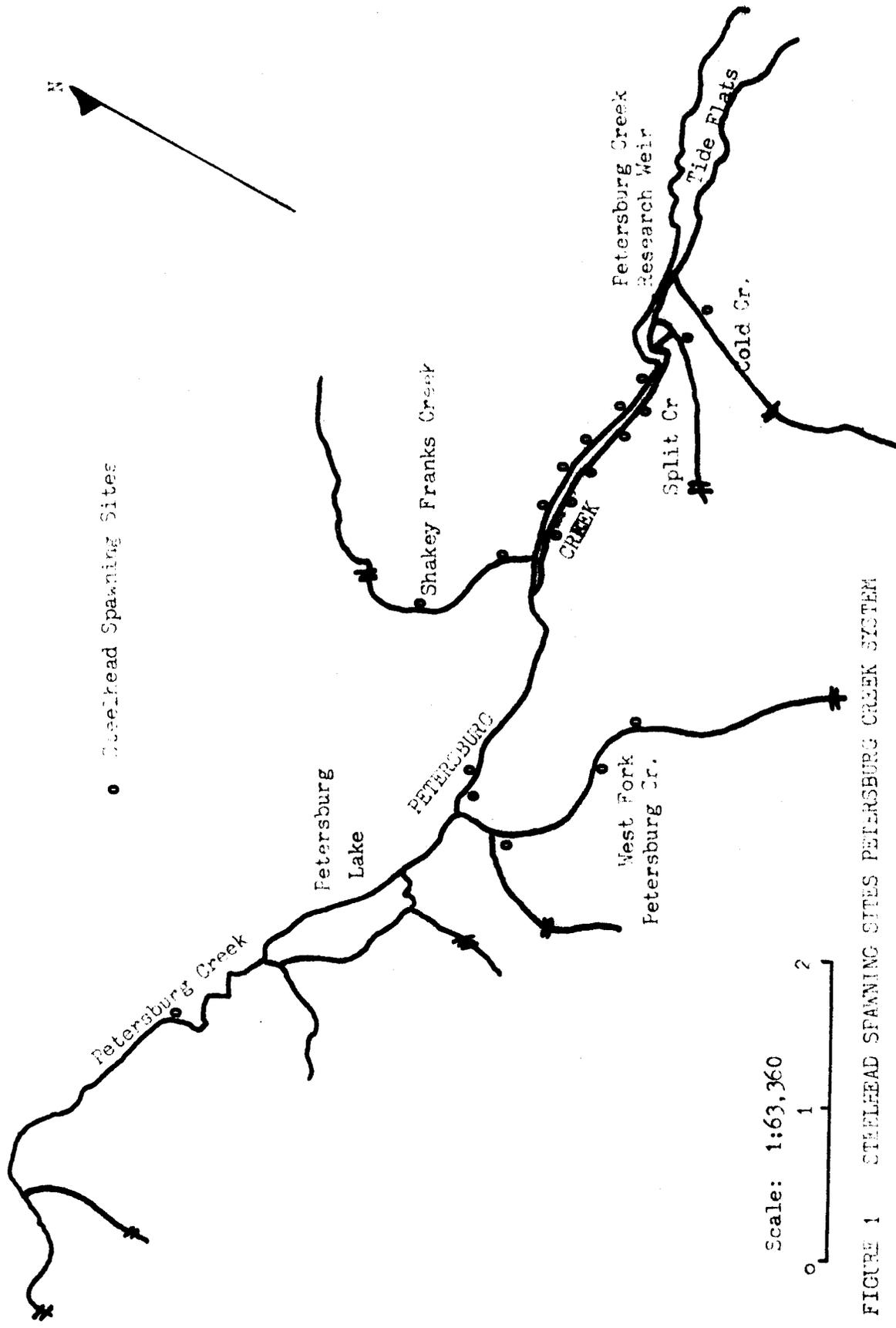


FIGURE 1 STEELHEAD SPawning SITES PETERSBURG CREEK SYSTEM

Steelhead Smolt Out-migration

The seaward out-migration of steelhead smolts through the Petersburg Creek weir began on April 27, 1974, peaked on June 2 and was complete by July 6, 1974 (Table 12). A total of only 383 steelhead smolts were trapped during 1974 which is the lowest number recorded since smolt trapping began in 1972 (Jones, 1973, 1974). An undetermined number of steelhead smolts passed downstream during periods of flooding in 1974; however, exact numbers missed were believed to be few as the 1974 out-migration was very weak. As the number of out-migrant smolts declines, the average size of smolts has increased. In 1972 the average steelhead smolt was 161 mm, in 1973 the average increased to 169 mm, and further increased to 177 mm in 1974. Rearing conditions in Petersburg Creek apparently have not been the best the past two years.

The 1974 steelhead smolt out-migration began during the same biweekly period (4/23-5/7) as in previous years. However, the 1974 out-migration peaked somewhat earlier and then terminated much sooner than that recorded in 1972 or 1973 (Figure 2).

Steelhead Smolt Age - Length Relationships

Age and length data were collected from only 13 steelhead smolts during the 1974 out-migration. The 1974 steelhead out-migration was very poor and no active sampling was conducted in an effort to minimize handling mortality. The 13 smolts sampled were obtained from fish that were found dead on the weir screens and, therefore, do not represent a random sample of the population as a whole. Of the 13 smolts sampled, 2.7 percent were Age 2, 16.8 percent were Age 3, and 30.8 percent were Age 4. These smolts ranged in size from 128 and 235 mm with an average of 188.7 mm. These averages are not unlike those recorded in 1972 and 1973 (Jones, 1973, 1974).

Other Migrants

The Petersburg Creek weir was complete and fishing on the evening of April 9, 1974. This was six days later than 1973 and two weeks earlier than 1971 and 1972. The coho salmon, Oncorhynchus kisutch, smolt and the overwintering Dolly Varden, Salvelinus malma, out-migration to salt-water was underway before the weir was fish tight, but it is believed that only small numbers were missed as the ice had been out of Petersburg Creek for only two days before the weir was completed.

Other out-migrant species from Petersburg Creek during 1974 are presented in Table 13. After the middle of July, it was almost impossible to operate the downstream traps due to the large numbers of dead spawned out salmon floating downstream. Very little downstream movement by any species occurs after mid-July and the traps were converted to trapping upstream fish.

Table 12. Numbers and Lengths of Out-migrant Steelhead Trout Smolt by Biweekly Periods, Petersburg Creek, 1974.

| <u>Biweekly Period</u> | <u>No.</u> | <u>Length Range in mm</u> | <u>Average Length in mm</u> | <u>Percent of Total</u> |
|------------------------|------------|---------------------------|-----------------------------|-------------------------|
| 4/27-5/10 | 9* | 152-193 | 174 | 2.3 |
| 5/11-5/24 | 25 | 157-211 | 184 | 6.5 |
| 5/25-6/7 | 164 | 142-255 | 182 | 42.8 |
| 6/8-6/21 | 183 | 123-241 | 172 | 47.8 |
| <u>6/22-7/5</u> | <u>2**</u> | <u>-----</u> | <u>177</u> | <u>0.5</u> |
| Totals | 383 | 123-255 | 177 | 99.9 |

* Lengths of four steelhead unknown.

** Length of one steelhead unknown.

Table 13. Number of Out-migrant Fish by Species and Month, Petersburg Creek Weir, 1974.

| <u>Month</u> | <u>Cutthroat</u> | <u>Dolly Varden</u> | <u>Steelhead</u> | <u>Coho</u> |
|--------------|------------------|---------------------|------------------|-------------|
| April | 24 | 11,552 | (9)* | (164)* |
| May | 313 | 14,122 | 19 (90) | (4,569) |
| June | 323 | 673 | 132 (283) | (411) |
| <u>July</u> | <u>52</u> | <u>0</u> | <u>11 (1)</u> | <u>0</u> |
| Total | 712 | 26,347 | 162 (383) | (5,144) |

* () indicates smolt

The in-migrant traps were complete on April 9, 1974 and the first adult steelhead were captured on April 12, 1974. It appears that the majority of the adult steelhead run was enumerated as no fish were observed before the twelveth.

Cutthroat, Salmo clarki, steelhead and the first of the Dolly Varden and red salmon, Oncorhynchus nerka, were the only in-migrants during April, May and June 1974. In-migration of all the salmon species peaked in July and August, slowed up somewhat in September, and ended abruptly on the 7th of October when the Petersburg Creek weir was lost during a severe flood. Presented in Table 14 are the monthly in-migrant trap counts, by species, for the Petersburg Creek weir during 1974.

Totals in Tables 13 and 14 do not represent the entire run for the species listed. Dolly Varden and coho salmon smolt were passing downstream before the weir was completed in April. All species passed both upstream and downstream during periods of extreme high water when the weir screens were removed. In addition, several thousand fish passed upstream after the weir was lost in early October. Several thousand pink, Oncorhynchus gorbuscha, and chum salmon, Oncorhynchus keta, normally spawn in the intertidal area below the weir and are not included in the total counts. The totals presented are the actual counts made during the 1974 weir operation.

Table 14. Numbers of In-migrant Fish by Species by Month, Petersburg Creek Weir, 1974.

| <u>Month</u> | <u>SH</u> | <u>Ct.</u> | <u>DV</u> | <u>Red</u> | <u>Pink</u> | <u>Chum</u> | <u>Coho</u> |
|--------------|------------|------------|------------|------------|-------------|-------------|-------------|
| April | 53 | --- | --- | --- | --- | --- | --- |
| May | 121 | --- | --- | --- | --- | --- | --- |
| June | 6 | 2 | 8 | 99 | --- | --- | --- |
| July | --- | 31 | 2,398 | 1,483 | 3,091 | 1,037 | --- |
| August | --- | 40 | 4,411 | 118 | 9,301 | 865 | --- |
| Sept. | --- | 531 | 3,554 | 3 | 3,882 | 11 | 173 |
| <u>Oct.*</u> | <u>---</u> | <u>85</u> | <u>798</u> | <u>0</u> | <u>0</u> | <u>0</u> | <u>234</u> |
| Total | 180 | 689 | 11,169 | 1,703 | 16,220 | 1,913 | 407 |

* weir was destroyed on October 7, 1974.

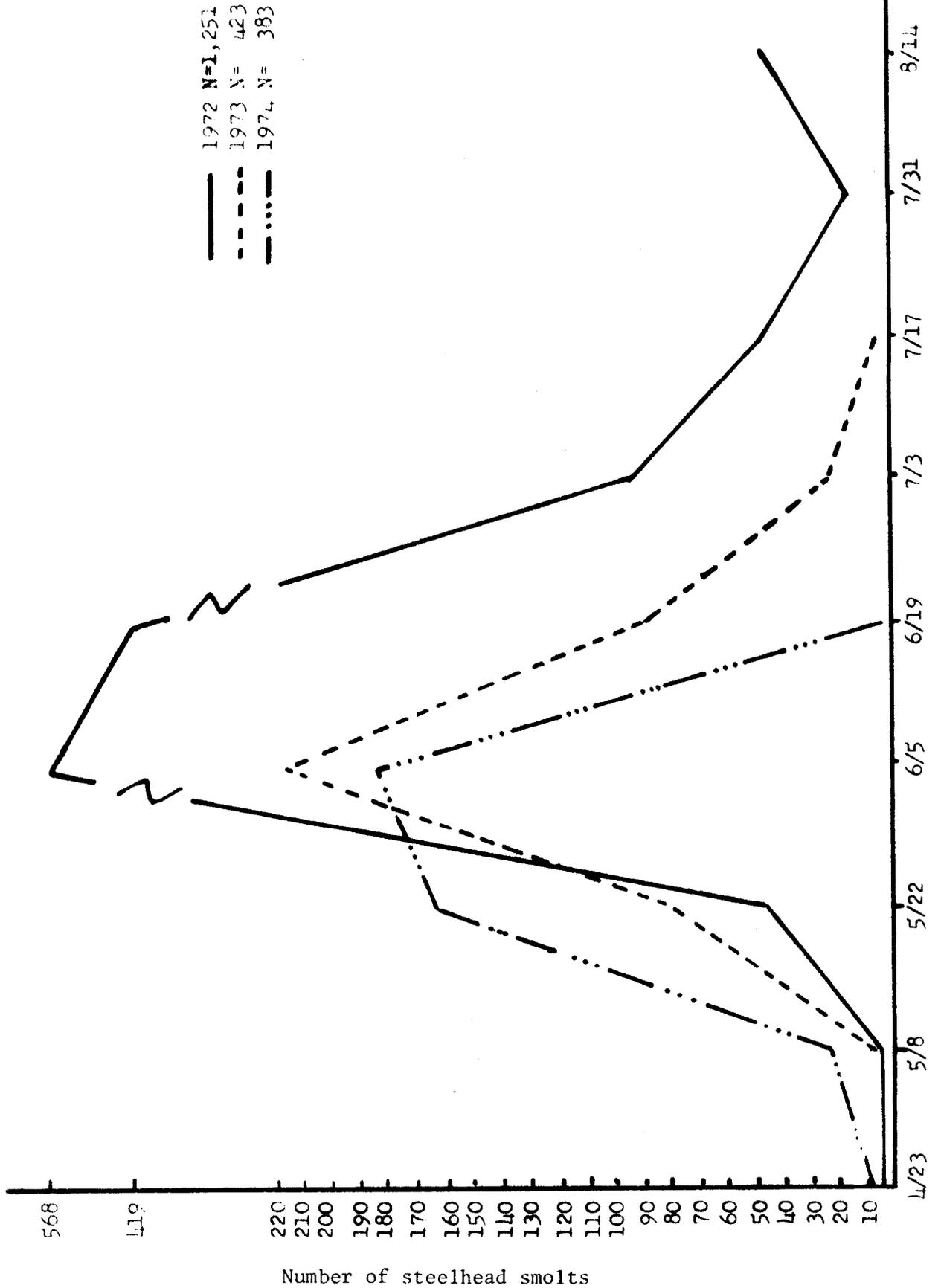


Figure 2. Outmigration of Steelhead Smolts by Bi-weekly Periods, Petersburg Creek, 1972-74.

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RESEARCH PROJECT SEGMENT

| | | | |
|------------|------------|--------------|---|
| State: | Alaska | Name: | Sport Fish Investigations of Alaska |
| Study No.: | AFS 42 | Study Title: | STEELHEAD AND SEA-RUN CUT-THROAT TROUT LIFE HISTORY STUDY IN SOUTHEAST ALASKA |
| Job No.: | AFS 42-3-B | Job Title: | <u>Life History of Cutthroat Trout</u> |

Period Covered: July 1, 1974 to June 30, 1975.

ABSTRACT

This report covers the fourth year's operation of the project on the Petersburg Creek system designed to study the life history of the sea-run cutthroat trout, Salmo clarki Richardson, in a typical Southeastern Alaska lake-stream system. The out-migration of sea-run cutthroat began in mid-April. The out-migration of cutthroat exhibited a bi-modal peak with the first peak occurring in mid-May, and the second occurring in mid-June. The out-migration was complete by mid-July 1974. The out-migration cutthroat ranged in length from 110 mm to 508 mm with an average of 262 mm. The out-migrant cutthroat ranged in age from three to ten years with 85.5 percent occurring in the four through six year class. Extensive surveys of the Petersburg Creek system failed to locate the spawning grounds of the sea-run cutthroat population.

The in-migration of sea-run cutthroat to the Petersburg Creek system began in mid-July, peaked in late September, and a total of 560 were enumerated when field data collections terminated in early October 1974. In-migrant cutthroat size and ages were similar to those in the out-migration. Fecundity studies of the in-migrant cutthroat were conducted and it was found that 52 percent of the in-migrants were mature fish. Eggs per female averaged 880 and it was estimated that a total of 128,480 eggs will be deposited in the Petersburg Creek system in 1975. Sea-run cutthroat tagged at the Petersburg Creek weir during 1974 spent an average of 92 days at sea and grew an average of 34.4 mm.

Investigation of the resident population of cutthroat in Petersburg Lake were initiated during 1974. Age and growth data collected from the resident cutthroat was comparable to that for the sea-run population. A total of 65,029 fish of various species passed both upstream and downstream during the operation of the Petersburg Creek weir in 1974.

RECOMMENDATIONS

Research

The determination of the number of in- and-out-migrant cutthroat, Salmo clarki, their length, weight, sex, and age should be continued for the Petersburg Creek population. The investigations of the spawning areas and spawning requirements of the Petersburg Creek sea-run and resident population of cutthroat should be continued. Investigations of that portion of the cutthroat population in the Petersburg Creek system that is nonmigratory will be continued to determine its interaction, if any, with the sea-run population.

To investigate the numbers of sea-run cutthroat that originate in adjacent nonlake systems but use the Petersburg Creek system as an overwintering area. Stream systems, other than Petersburg Creek, that contain good populations of sea-run cutthroat should be surveyed for potential egg take sites.

Management

The life history study of the sea-run cutthroat, Salmo clarki, population in Petersburg Creek has shown that the population is not large and is subjected to long exposure to the angling public. Creel census studies since 1966 have shown a steady decline in average size and abundance of sea-run cutthroat in the Petersburg Creek system. With this data in hand, a request was made to reduce the daily bag limit on cutthroat. This reduction was granted and the bag limits in 1975 will be 2/3 of what they were. A comprehensive creel census during 1975 should show the effects of the reduced bag limits on the overall population levels.

For Southeast Alaska, I recommend that no additional changes be made in bag limits until an evaluation has been made of the present new rules. I further recommend that an egg take site be established for sea-run cutthroat and that a hatchery-supported run of cutthroat be established on a trial basis.

OBJECTIVES

1. Determine the number of in- and outmigrant anadromous cutthroat in the Petersburg Creek system.
2. Determine the length, weight, sex, and age of anadromous cutthroat in the Petersburg Creek system.
3. Determine the maturity composition of the anadromous cutthroat in the Petersburg Creek system.
4. Investigate that portion of the cutthroat population in the Petersburg Creek system that is non-migratory.

5. Investigate the spawning grounds and spawning requirements of the anadromous cutthroat population in the Petersburg Creek system.
6. Investigate the migration patterns and distribution of marked cutthroat after they have left the Petersburg Creek system.
7. Investigate streams, other than Petersburg Creek, for potential egg take sites for anadromous cutthroat.
8. Compile an annotated bibliography of selected references on anadromous cutthroat.

TECHNIQUES USED

Background information from prior studies conducted by the Alaska Department of Fish and Game and other agencies was reviewed.

The horse and deck weir incorporating in- and out-migrant traps that was constructed in 1972, was given annual maintenance and was fishing on April 9, 1974. The completed weir was 50 meters long and .91 meters high. An additional .91 meters of height was added to compensate for tides higher than 171 by addition of screens mounted above the weir deck. The weir was of an inclined screen panel type using 1.60 cm hardware cloth screens for normal water levels and 2.54 cm screens during periods of high water. Three traps, 3.6 meters by 2.7 meters, were placed near the east bank as this area has been determined to be most attractive to migrating fish. The three traps had screens of 1.27 cm hardware cloth in order to trap small migrants and were designed to be used as either in- or out-migrant traps depending upon the direction of the bulk of the migrating fish. A three meter weir section, located in mid-stream, was modified to allow boat traffic to pass through the weir. As the out-migrant cutthroat entered the traps, they were anesthetized with Tricaine Methanesulfanate (MS 222). They were measured; those over 200 mm and not already fin clipped and/or tagged, were given an adipose fin clip and tagged with numbered "Floy" internal anchor type tags. Cutthroat under 200 mm were adipose fin clipped but not tagged. All cutthroat were then placed in a freshwater tub and were observed until all were active before release below the weir.

As the in-migrant cutthroat entered the traps, they were handled using the same procedures as were the out-migrants. All in-migrant cutthroat were measured and examined for fin clips and tags.

Every twentieth in- and out-migrant cutthroat captured at the weir was killed, measured, weighed, and sexed. Otoliths and scales were taken for age determinations. The condition of the gonads was examined to determine maturity.

Foot surveys, hook and line, and angler contacts were used to determine the distribution of tagged cutthroat in streams other than Petersburg Creek. Hook and line and variable mesh gill nets were used to sample the resident population of cutthroat in Petersburg Lake.

The in- and out-migration of Dolly Varden, Salvelinus malma, and the enumeration of the various salmon species were counted past the weir by removing them from the traps by dip net or removing a weir screen and tally counting as they crossed a flash board.

FINDINGS

Work was performed on all the above objectives with the exception of No. 7. No work was accomplished on Objective No. 7 during this reporting period due to a lack of time and manpower.

Cutthroat Trout Out-Migration

A total of 584 cutthroat trout, Salmo clarki, began their seaward migration from Petersburg Creek on April 13, 1974. The 1974 out-migration differed from previous years in that there were two peak periods of out-migration as compared to a single peak during 1973 (Figure 1).

Water temperatures during the out-migration ranged from 2°C to 15°C. Water temperatures were 4°-5°C during the early peak of out-migration and 9°-10°C during the second peak of movement. Nearly all of the out-migrant cutthroat entered the traps during the hours of darkness on moderate stream flows. Movement virtually stopped on extreme high or low stream flows.

Presented in Table 1 are the average length and length range of out-migrant cutthroat by five-day periods for 1974. Small numbers of large cutthroat (350 mm) were the first out-migrants observed, followed by average size fish (260 mm) during the two peak periods of movement. The small cutthroat (110-229 mm) comprised the last of the out-migration in mid-July. Cutthroat smolt (fish less than 200 mm in length) had two peak periods of out-migration. The first peak period of movement occurred from mid to late June and the other occurred at the end of the out-migration in mid-July. The bi-modal pattern of peak out-migration was also recorded in 1973; however, the timing of the first peak period of movement was ten days earlier in 1973 (Jones, 1974).

Age-Length Relationships of Out-Migrant Cutthroat Trout

A total of 55 cutthroat trout, Salmo clarki, were sampled during the spring out-migration for age-length relationships. Aging was accomplished by counting the number of annuli on their otoliths. The 1974 cutthroat out-migration contained trout in eight age groups with ages ranging from three to ten with 85.5 percent of the fish occurring in the four through six age class (Table 2). Cutthroat in age classes nine and ten, first recorded during the 1973 out-migration, were again noted in small numbers in the 1974 out-migration. Sixty-five percent of the out-migrant cutthroat sampled were between 191 mm and 270 mm in fork length. This corresponds favorably with findings in 1972 and 1973 (Jones, 1973 and 1974).

Table 1. Average Length and Length Range of Out-Migrant Cutthroat by Five Day Periods, Petersburg Creek Weir, 1974.

| Five Day Period | No. | Length Range in mm | Average Length | Number of Cutthroat Less than 200 mm |
|-----------------|-----|-----------------------|----------------|--|
| 1/14-1/18 | 2 | 183-465 | 324.0 | 1 |
| 1/19-1/23 | 1 | ----- | 268.0 | 0 |
| 1/24-1/28 | 1 | ----- | 394.0 | 0 |
| 4/29-5/3 | 9 | 302-427 | 371.5 | 0 |
| 5/4-5/8 | 7 | 198-255 | 228.8 | 1 |
| 5/9-5/13 | 14 | 185-409 | 309.3 | 2 |
| 5/14-5/18 | 61 | 189-435 | 333.3 | 2 |
| 5/19-5/23 | 82 | 171-411 | 266.6 | 11 |
| 5/24-5/28 | 79 | 183-415 | 255.7 | 10 |
| 5/29-6/2 | 71 | 172-471 | 267.7 | 8 |
| 6/3-6/7 | 52 | 175-360 | 260.7 | 3 |
| 6/8-6/12 | 51 | 153-400 | 256.8 | 11 |
| 6/13-6/17 | 71 | 135-508 | 260.2 | 18 |
| 6/18-6/22 | 78 | 145-425 | 250.7 | 14 |
| 6/23-6/27 | 4 | 157-199 | 161.7 | 4 |
| 6/28-7/2 | 0 | ----- | ----- | 0 |
| 7/3-7/7 | 10 | 110-235 | 153.2 | 9 |
| 7/8-7/12 | 9 | 153-229 | 186.4 | 7 |
| 7/13-7/17 | 22 | 139-190 | 168.8 | 22 |
| Totals | 584 | 110-508 | 261.9 | 123 |

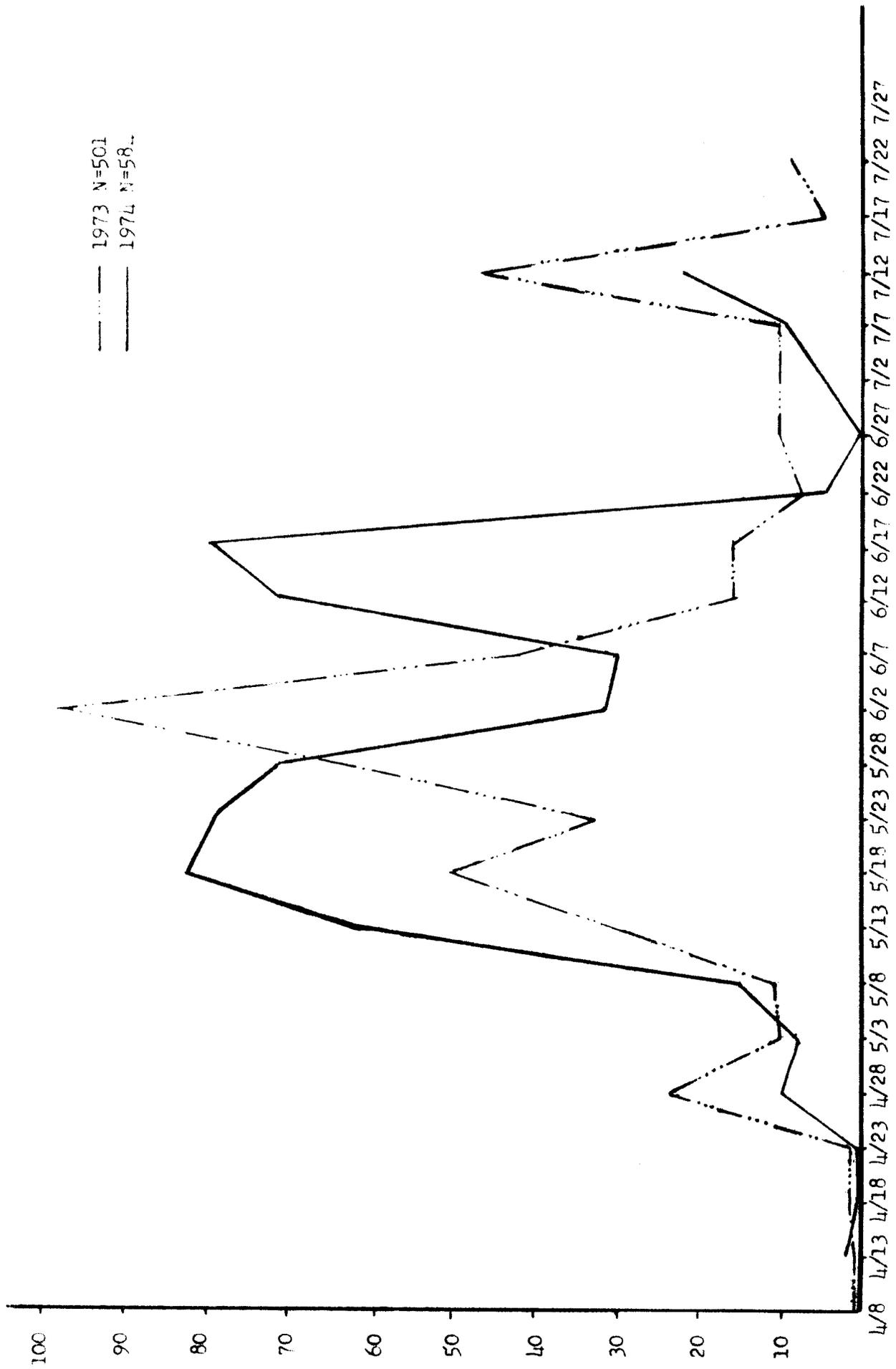


Figure 1. Out-migrant Cutthroat Trout by Five-Day Periods, 1973-74 Petersburg Creek

Table 2. Age-Length Relationships of Out-migrant Cutthroat, Petersburg Creek Weir, 1974.

| Fork Length in MM | Age | | | | | | | | Total | Percent of Total | |
|---------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------------------|------|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | |
| 151-150 | | 1 | | | | | | | | 1 | 1.8 |
| 151-170 | 1 | 1 | | | | | | | | 2 | 3.6 |
| 171-190 | 1 | 2 | | | | | | | | 3 | 5.5 |
| 191-210 | | 9 | | | | | | | | 9 | 16.4 |
| 211-230 | 1 | 2 | 1 | 2 | | | | | | 9 | 16.4 |
| 231-250 | | 4 | 3 | 2 | | | | | | 9 | 16.4 |
| 251-270 | | 2 | 6 | 1 | | | | | | 9 | 16.4 |
| 271-290 | | | | | | | | | | 0 | 0.0 |
| 291-310 | | | 1 | 3 | 1 | | | | | 5 | 9.1 |
| 311-330 | | | | 1 | 1 | | 1 | | | 3 | 5.5 |
| 331-350 | | | | 2 | | | | | | 2 | 3.6 |
| 351-370 | | | | | | 1 | | | | 1 | 1.8 |
| 371-390 | | | | 1 | | | | | | 1 | 1.8 |
| 391-410 | | | | | | | | | | 0 | 0.0 |
| 411-430 | | | | | | | | | | 0 | 0.0 |
| 431-450 | | | | | | | | | | 0 | 0.0 |
| 451-470 | | | | | | | 1 | | | 1 | 1.8 |
| Total | 5 | 21 | 14 | 12 | 2 | 1 | 1 | 1 | | 55 | |
| Percent of Total | 5.5 | 38.2 | 25.5 | 21.8 | 3.6 | 1.8 | 1.8 | 1.8 | | | |
| Ave. Fork length mm | 183.7 | 210.0 | 247.2 | 290.5 | 311.0 | 370.0 | 329.0 | 465.0 | | | |

Cutthroat Spawning Ground Surveys

Attempts to locate and describe the spawning grounds for the sea-run cutthroat in the Petersburg Creek system have been conducted on an annual basis since 1972. A review of information on sea-run cutthroat, Salmo clarki, in Oregon (Sumner, 1948, 1953, and 1963; Lowry, 1965 and Cramer, 1940); California, (DeWitt, 1954); and Alaska, (Baade, 1957) suggested that sea-run cutthroat trout used small tributaries for spawning and located their redds at the tail end of pools in water 10-15 cm deep over a substrate of moderate to small gravel. Petersburg Creek's tributaries contain all the above mentioned conditions; however, no spawning cutthroat have been noted in these areas. In fact, no cutthroat have been observed actively spawning even though many days were spent surveying all likely locations during April and May. Gravid cutthroat have been located in the main stem of Petersburg Creek just below the west fork on several surveys. Perhaps the Petersburg Creek population is utilizing the main stem of Petersburg Creek for spawning and have thus far escaped detection.

Cutthroat Trout In-Migration

The first of 560 in-migrant cutthroat, Salmo clarki, was recorded at the Petersburg Creek weir on April 14, 1974. The numbers of in-migrants remained low until the first of September when their numbers increased dramatically, reaching a peak on September 30, and falling off rapidly in early October (Figure 2). The in-migration timing of the sea-run cutthroat to Petersburg Creek was similar to the timing in 1973 (Figure 2). The in-migrant cutthroat entered the traps at night on moderate to rising stream flows. Prolonged high or low water delayed migration as these conditions appear unfavorable for in-migrants. Stream water temperatures were 15°C at the start of the in-migration, averaged 9°C during the peak, and dropped to 4°C at the end of the field season. The 1974 field season was terminated early in the morning of October 7, 1974. Continuous heavy rain for three days raised Petersburg Creek to levels far exceeding anything recorded in the past 10-20 years. During the peak of the flood, the center section of the Petersburg Creek weir was destroyed by large trees and other debris. When flood waters receded, it was apparent that the weir structure was damaged beyond repair and the field season was terminated three weeks early.

Presented in Table 3 are the length frequencies of the 1974 in-migrant cutthroat to Petersburg Creek by five-day periods. The early in-migrants in April and May were large (greater than 300 mm) mature fish headed upstream to spawning grounds above the weir. With the exception of the mature fish, the early in-migrants were mostly small (less than 200 mm) cutthroat; these were followed by average size (261 mm) fish during the peak of in-migration. During the last two weeks of the field season, the largest (444 mm) and smallest (163 mm) cutthroat passed upstream. The small cutthroat (less than 200 mm in length) were bright fish that apparently had been to sea for the first time and were returning to Petersburg Creek for the winter. Overall, the in-migrant cutthroat ranged from 130 to 444 mm, with an average of 261.6 mm. This average is midway between the 245.2 mm average recorded in 1973, and the 306 mm average noted in 1971.

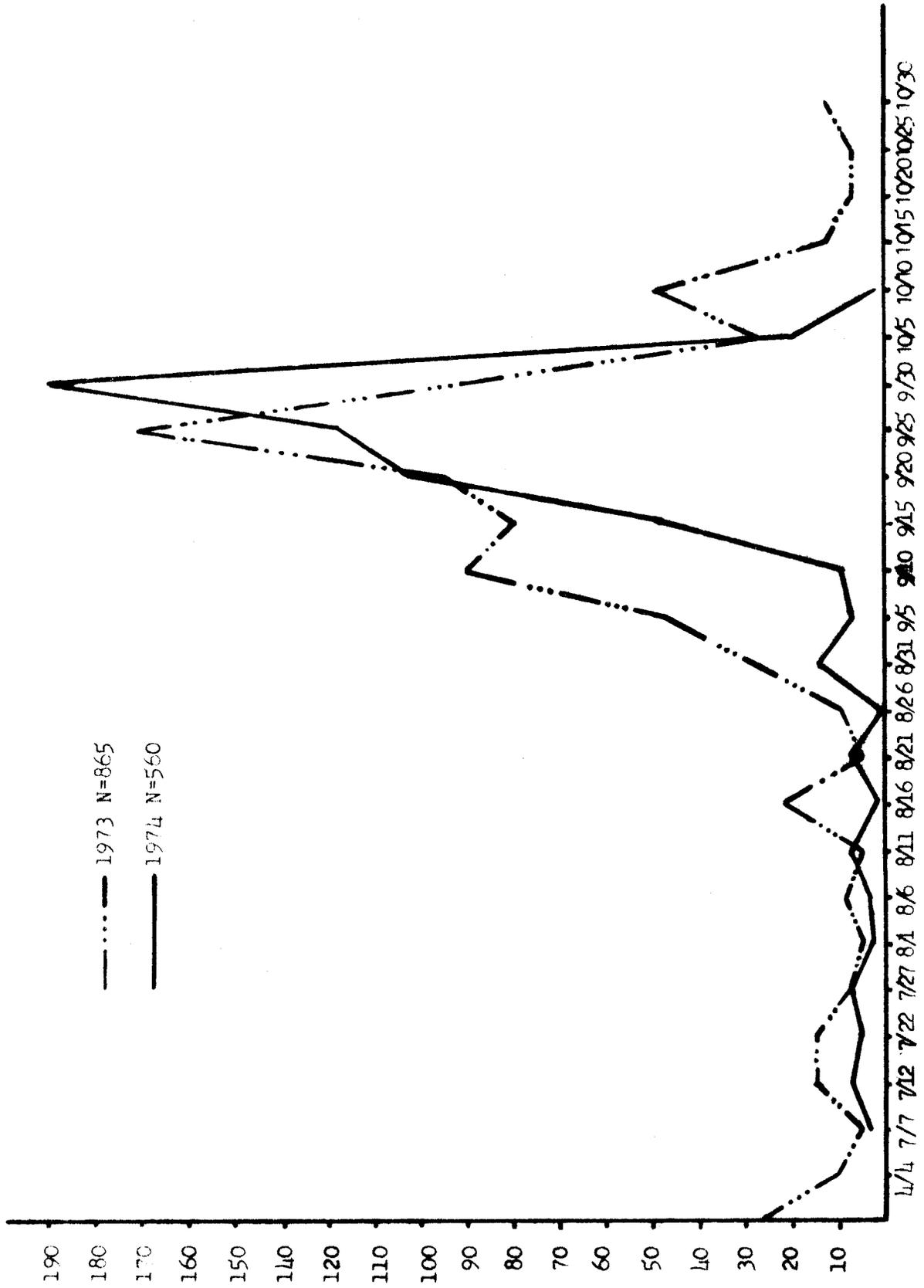


Figure 2. In-migrant Cutthroat Trout by Five-Day Periods, Petersburg Creek 1973-74

Table 3. Length Frequencies of In-Migrant Cutthroat by Five Day Periods, Petersburg Creek Weir, 1974.

| Five Day Period | No. | Length Range in mm | Average Length | Number of Cutthroat Less than 200 mm |
|------------------------|-----|-----------------------|----------------|--|
| 4/14-7/12 ^A | 4 | 188-396 | 310.2 | 1 |
| 7/13-7/17 | 8 | 185-340 | 261.4 | 3 |
| 7/18-7/22 | 6 | 145-285 | 182.7 | 5 |
| 7/23-7/27 | 9 | 162-348 | 243.1 | 2 |
| 7/28-8/1 | 3 | 176-320 | 233.7 | 1 |
| 8/2-8/6 | 4 | 130-215 | 203.5 | 1 |
| 8/7-8/11 | 9 | 190-280 | 233.9 | 2 |
| 8/12-8/16 | 1 | ----- | 168.0 | 1 |
| 8/17-8/21 | 6 | 185-391 | 294.8 | 2 |
| 8/22-8/26 | 0 | ----- | ----- | 0 |
| 8/27-8/31 | 13 | 145-376 | 277.0 | 3 |
| 9/1-9/5 | 8 | 181-300 | 226.7 | 3 |
| 9/6-9/10 | 10 | 187-405 | 265.7 | 3 |
| 9/11-9/15 | 48 | 165-398 | 253.1 | 16 |
| 9/16-9/20 | 104 | 168-402 | 274.0 | 5 |
| 9/21-9/25 | 115 | 184-296 | 259.9 | 10 |
| 9/26-9/30 | 189 | 163-444 | 267.1 | 20 |
| 10/1-10/5 | 20 | 179-360 | 261.2 | 1 |
| 10/6 ^{**} | 3 | ----- | ----- | -- |
| Totals | 560 | 130-444 | 261.6 | 79 |

* Sum of three month period.

** The weir was lost on 10/7/74.

In-Migrant Cutthroat Age-Length Relationships

Age-length data were collected from a sample of 51 in-migrant cutthroat, Salmo clarki, as they passed the Petersburg Creek weir in 1974. These cutthroat ranged in age from three to nine with 80.5 percent showing four, five, or six annuli on their otoliths (Table 4).

Presented in Table 5 are the in-migrant cutthroat age classes expressed in percent of total for years 1971-1974. The 1974 in-migration to Petersburg Creek was below average in age class three cutthroat, above average in age class four, and contained the first age nine in-migrant observed since initiation of the project in 1971.

Sea-Run Cutthroat Fecundity

Degree of sexual maturity was noted for the in-migrant cutthroat sampled at the weir. It was found that 48 percent of the 51 cutthroat sampled were not maturing and would not spawn during the spring of 1975. The 1974 sample had the lowest number of nonspawners in the in-migration since initiation of the project in 1971. A higher percent of older age classes comprising the 1974 run may in part account for the lower percent of nonspawners.

Ovaries from ten female cutthroat were used to obtain average fecundity. Numbers of eggs per female were low, allowing total counts. Egg counts ranged from a low of 486 for a 340 mm female to a high of 2,286 for a 460 mm female, with an average of 880 eggs per female for the ten fish sampled. These data are very close to that observed in 1973 when the average was found to be 730 eggs per female (Jones, 1974).

The tabulated in-migration of sea-run cutthroat to Petersburg Creek in 1974 was 560 fish with an overall sex ratio of 1.4:1 females to males. The run contained an estimated 146 maturing females. With an average of 880 eggs per female, the estimated possible egg deposition for the 1974 run is 128,480 eggs.

In-Migrant Cutthroat Tag Recoveries

The in-migration of marked and/or tagged cutthroat to Petersburg Creek in 1974 occurred during the same time period as that for unmarked cutthroat. A total of 54 (15 percent) cutthroat bearing a tag were recovered from a total of 361 tagged on the out-migration in the spring of 1974 (Table 6). In addition, 18 percent of the cutthroat smolt, marked on their out-migration, were recovered during the fall in-migration. Also recovered in the 1974 in-migration, were several cutthroat tagged during 1972 and 1973. These cutthroat were not noted during the 1974 spring out-migration. The recovery of these cutthroat suggests that a portion of the cutthroat run to Petersburg Creek spends one or more years in other systems in the area. The capture of tagged cutthroat on hook and line in the upper area of Blind Slough in November 1974, indicates that sea-run cutthroat do not always return to a specific system to overwinter. Cutthroat

Table 4. Age-Length Relationships of In-Migrant Cutthroat, Petersburg Creek Weir, 1974.

| Fork Length in MM | Age | | | | | | | Percent of Total | |
|--------------------------|----------|-----------|-----------|----------|----------|----------|----------|------------------|-------|
| | <u>3</u> | <u>4</u> | <u>5</u> | <u>6</u> | <u>7</u> | <u>8</u> | <u>9</u> | Total | Total |
| 131-150 | | 2 | | | | | | 2 | 3.9 |
| 151-170 | 1 | | | | | | | 1 | 2.0 |
| 171-190 | 1 | 1 | | | | | | 2 | 3.9 |
| 191-210 | | 4 | 3 | | | | | 7 | 13.7 |
| 211-230 | | 6 | 1 | | | | | 7 | 13.7 |
| 231-250 | 1 | 4 | 1 | | | | | 6 | 11.8 |
| 251-270 | | 2 | 1 | | | | | 3 | 5.9 |
| 271-290 | | 2 | 3 | 2 | | | | 7 | 13.7 |
| 291-310 | | | 1 | | 1 | | | 2 | 3.9 |
| 311-330 | | | 3 | 2 | | | | 5 | 9.8 |
| 331-350 | | | | | 1 | | | 1 | 2.0 |
| 351-370 | | | | | 1 | 1 | 1 | 3 | 5.9 |
| 371-390 | | | | 2 | 1 | 1 | | 4 | 7.8 |
| 391-410 | | | 1 | | | | | 1 | 2.0 |
| Total | <u>3</u> | <u>21</u> | <u>14</u> | <u>6</u> | <u>4</u> | <u>2</u> | <u>1</u> | <u>51</u> | |
| Percent of Total | 5.9 | 41.2 | 27.5 | 11.8 | 7.8 | 3.9 | 2.0 | | |
| Average Fork Length (MM) | 197.3 | 219.3 | 275.1 | 326.5 | 344.5 | 374.0 | 355.0 | | |

Table 5. In-Migrant Cutthroat Age Classes, 1971-1974, Petersburg Creek.

| Year | Cutthroat Age Groups Expressed as Percent of Total | | | | | | | Sample Size |
|------------------|--|-------------|-------------|-------------|------------|------------|------------|-------------|
| | <u>3</u> | <u>4</u> | <u>5</u> | <u>6</u> | <u>7</u> | <u>8</u> | <u>9</u> | |
| 1971 | 11.8% | 47.4% | 26.4% | 7.9% | 3.9% | 2.6% | -- | 76 |
| 1972 | 12.9 | 33.7 | 19.8 | 18.8 | 11.9 | 3.0 | -- | 101 |
| 1973 | 8.6 | 24.7 | 22.2 | 27.2 | 13.6 | 3.7 | -- | 81 |
| 1974 | <u>5.9</u> | <u>41.2</u> | <u>27.5</u> | <u>11.8</u> | <u>7.8</u> | <u>3.9</u> | <u>2.0</u> | <u>51</u> |
| Four Yr. Average | 9.8 | 36.7 | 23.9 | 16.4 | 9.3 | 3.3 | 2.0 | |

tagged on their out-migration in 1974 spent from 32 to 147 days at sea before returning to the Petersburg Creek weir. Early spring migrants spent the longest amount of time at sea and had the greatest average growth increment. However, their rate of recapture was lower than those migrating later in the season. Presented in Table 7 is a summary of cutthroat recoveries for the three years tagging has been conducted. The best recovery rate for tagged fish occurred in 1972 when 26.6 percent were recovered. The 1974 recovery rate was only 15 percent even though good numbers were tagged on the out-migration. It appears that average growth increments are positively correlated to the amount of time spent at sea.

Cutthroat Tag Recoveries--Other Streams

During the past three years, information has been collected on the movements of tagged cutthroat, Salmo clarki, once they have migrated out of Petersburg Creek. Tagged cutthroat have been captured in 13 streams on Kupreanof and Mitkof Islands (Figure 3). The most distant recovery (Duncan Salt Chuck) was 44 miles from the Petersburg Creek weir. There appears to be a pattern to the cutthroat's movements away from Petersburg Creek. They seem to follow the shoreline of either Mitkof or Kupreanof Islands. Extensive surveys of the mainland and Kupreanof Island north and west of Portage Bay (fed by Portage Creek, see map) has failed to turn up cutthroat tagged at Petersburg Creek. Surveys of streams on the southern and western sides of Kupreanof Island also failed to turn up tagged cutthroat. From these surveys, it is apparent that cutthroat marked at Petersburg Creek do not range beyond 50 miles from Petersburg during their feeding sojourns at sea.

Petersburg Lake Resident Cutthroat

It has been known for some time that a resident population of cutthroat resided in Petersburg Lake. Surveys were conducted in 1974 in an attempt to determine the extent of this resident population and to gather some age-length relationships from these fish.

The survey was conducted in late July as past weir records showed that almost all of the sea-run cutthroat were out of the system during this period. Sampling was conducted by hook and line and by variable mesh gill nets. No tagged or marked cutthroat were noted in the 110 cutthroat captured which strongly suggests that these were resident fish.

Seventy-two of the captured cutthroat were sampled for age-length data. These fish ranged in age from three to twelve with 72.2 percent falling in the four, five, or six age class (Table 8). It was anticipated that the lake residents would be on the average both smaller and older than sea-run fish. Comparing the age-length data from the lake resident cutthroat with that of out-migrant sea-run cutthroat, (Table 2), and in-migrant fish, (Table 4), very little differences in age-length is apparent. Conditions for cutthroat growth in Petersburg Lake are apparently better than expected. The overall resident cutthroat population did not appear to be high which may explain the excellent growth for the existing population.

Table 6. Days at Sea and Growth Increment for Tagged Cutthroat Trout Recaptured at the Petersburg Creek Weir, 1974.

| Monthly Period | No. Tagged | No. Recovered* | Percent Recovery | Days at Sea Range | Sea Ave. | Growth Range mm | Increment Average mm |
|----------------|------------|----------------|------------------|-------------------|----------|-----------------|----------------------|
| 4/4-4/30 | 8 | 0 | 0.0 | ---- | --- | ---- | ---- |
| 5/1-5/31 | 198 | 25 | 12.6 | 44-147 | 125 | 2-149 | 37.5 |
| 6/1-6/30 | 151 | 28 | 18.5 | 32-86 | 63 | 3-87 | 31.5 |
| 7/1-7/31 | 4 | 1 | 25.0 | ---- | 78 | ---- | 39.0 |
| Totals | 361 | 54 | 15.0 | 32-147 | 92 | 2-149 | 34.4 |

* Represents cutthroat captured throughout the in-migration period.

Table 7. Days at Sea and Growth Increment for Tagged Cutthroat Trout Recaptured at the Petersburg Creek Weir, 1972-1974.

| Year | No. Tagged | No. Recovered | Percent Recovery | Days at Sea Range | Sea Ave. | Growth Range mm | Increment Average mm |
|------|------------|---------------|------------------|-------------------|----------|-----------------|----------------------|
| 1972 | 560 | 149 | 26.6 | 12-149 | 82 | 0-134 | 29 |
| 1973 | 292 | 67 | 23.0 | 7-158 | 103 | 3-145 | 42.3 |
| 1974 | 361 | 54 | 15.0 | 32-147 | 92 | 2-149 | 34.4 |

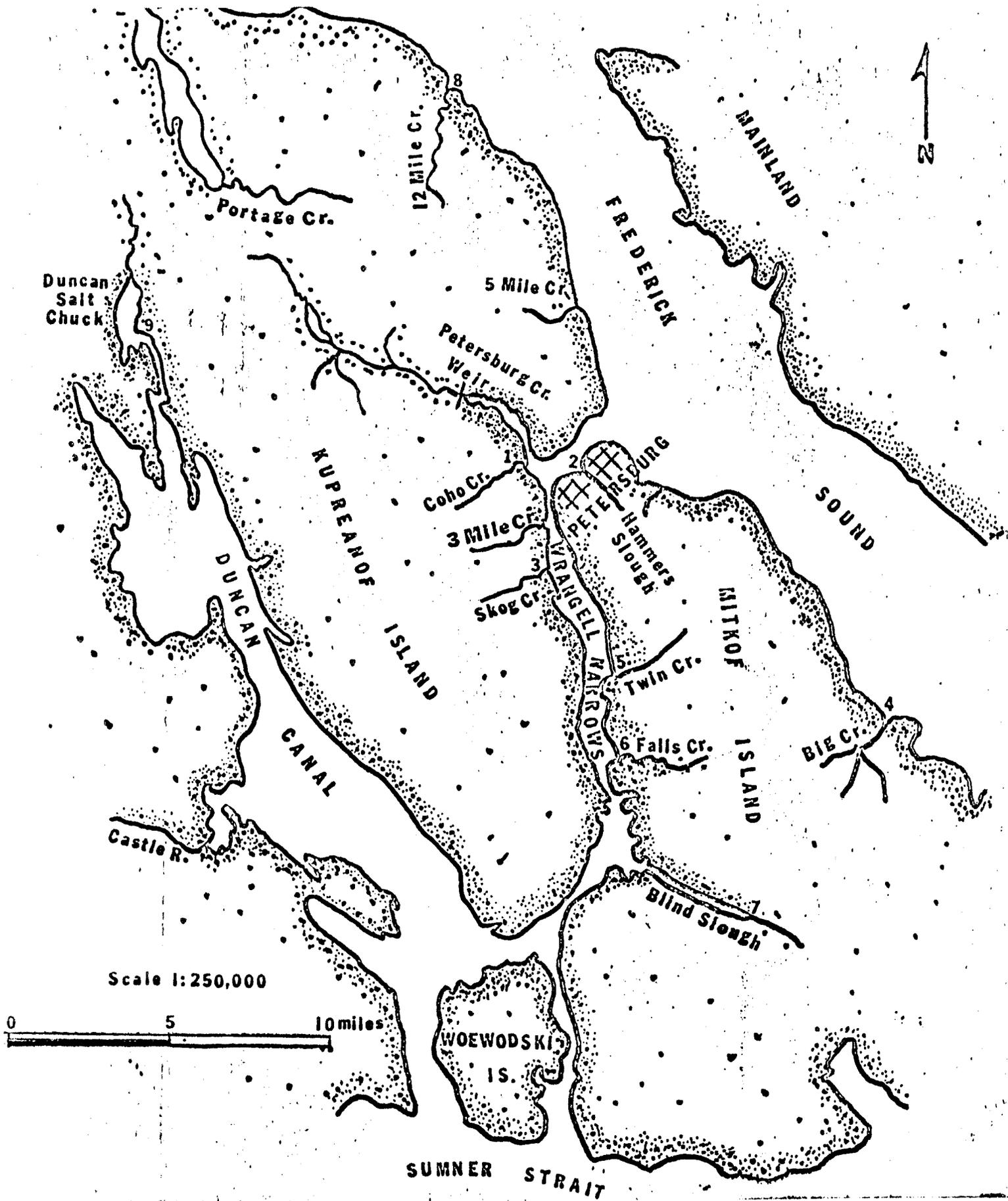


Figure 3. Recovery Areas of Cutthroat Tagged at the Petersburg Creek Weir 1972-1974.

Table 8. Age-Length Relationships of Petersburg Lake Resident Cutthroat, 1974.

| Fork length in MM | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | Total | Percent of Total |
|--------------------------|------|------|------|------|-----|-----|-----|-----|-----|-----|-------|------------------|
| 131-150 | | | | | | | | | | | 0 | 0.0 |
| 151-170 | | | | | | | | | | | 0 | 0.0 |
| 171-190 | 6 | 3 | | 1 | | | | | | | 10 | 13.9 |
| 191-210 | 2 | 11 | 1 | | | | | | | | 14 | 19.4 |
| 211-230 | 2 | 2 | 1 | | | | | | | | 5 | 6.9 |
| 231-250 | | 5 | 2 | | | | | | | | 7 | 9.7 |
| 251-270 | | 2 | 8 | | | | | | | | 10 | 13.9 |
| 271-290 | | 1 | 3 | 3 | | | | | | | 7 | 9.7 |
| 291-310 | | | 1 | 3 | 1 | 1 | | | | | 6 | 8.3 |
| 311-330 | | | | 1 | 3 | | | | | 1 | 5 | 6.9 |
| 331-350 | | | 1 | 1 | | | | | | | 2 | 2.8 |
| 351-370 | | | | 1 | 1 | | | | | | 2 | 2.8 |
| 371-390 | | | | 1 | | 1 | | | | | 2 | 2.8 |
| 391-410 | | | | | | 1 | 1 | | | | 2 | 2.8 |
| Total | 10 | 24 | 17 | 11 | 5 | 3 | 1 | 0 | 0 | 1 | 72 | |
| Percent of Total | 13.9 | 33.3 | 23.6 | 15.3 | 6.9 | 4.2 | 1.4 | 0.0 | 0.0 | 1.4 | | |
| Average Fork Length (MM) | 195 | 217 | 263 | 304 | 319 | 392 | | | | 330 | | |

Other Migrants

The Petersburg Creek weir was complete and fishing on the evening of April 9, 1974. The completion of the weir was six days later than 1973 and two weeks earlier than 1971 and 1972. The coho salmon, Oncorhynchus kisutch, smolt, and the overwintering Dolly Varden, Salvelinus malma, out-migration to saltwater was underway before the weir was fish-tight; it is believed that only small numbers were missed because the ice had been out of Petersburg Creek for only two days before the weir was completed. Other out-migrant species from Petersburg Creek during 1974 are presented in Table 9. After the middle of July, it was almost impossible to operate the downstream traps due to the large numbers of dead, spawned-out salmon floating downstream. Very little downstream movement by any species occurs after mid-July; the traps were converted to trapping upstream fish.

The in-migrant traps were complete on April 9, 1974, and the first adult steelhead were captured on April 12, 1974. It appears that the majority of the adult steelhead run was enumerated as no fish were observed before the twelfth.

Cutthroat, Salmo clarki; steelhead, S. gairdneri; and the first of the Dolly Varden and red salmon, Oncorhynchus nerka, were the only in-migrants during April, May and June 1974. In-migration of all the salmon species peaked in July and August, slowed up somewhat in September, and ended abruptly on October 7 when the Petersburg Creek weir was lost during a severe flood. The monthly in-migrant trap counts by species for the Petersburg Creek weir during 1974 are presented in Table 10.

Totals in Tables 9 and 10 do not represent the entire run for the species listed. Dolly Varden and coho salmon smolt were passing downstream before the weir was completed in April. All species passed both upstream and downstream during the period of extreme high water when the weir screens were removed. In addition, several thousand fish passed upstream after the weir was lost in early October. Several thousand pink, Oncorhynchus gorbuscha, and chum salmon, O. keta, normally spawn in the intertidal area below the weir and are not included in the total counts. The totals presented are the actual counts made during the 1974 weir operation.

Table 9. Number of Out-Migrant Fish by Species and Month, Petersburg
Creek Weir, 1974.

| <u>Month</u> | <u>Cutthroat</u> | <u>Dolly Varden</u> | <u>Steelhead</u> | <u>Coho</u> |
|--------------|------------------|---------------------|------------------|-------------|
| April | 24 | 11,552 | (9)* | (164)* |
| May | 313 | 14,122 | 19 (90) | (4,569) |
| June | 323 | 673 | 132 (283) | (411) |
| <u>July</u> | <u>52</u> | <u>0</u> | <u>11 (1)</u> | <u>0</u> |
| Totals | 712 | 26,347 | 162 (383) | (5,144) |

* () indicates smolt

Table 10. Numbers of In-Migrant Fish by Species by Month, Petersburg
Creek Weir, 1974.

| Month | <u>SH</u> | <u>Ct.</u> | <u>DV</u> | <u>Red</u> | <u>Pink</u> | <u>Chum</u> | <u>Coho</u> |
|--------------|-----------|------------|------------|------------|-------------|-------------|-------------|
| April | 53 | - | - | - | - | - | - |
| May | 121 | - | - | - | - | - | - |
| June | 6 | 2 | 8 | 99 | - | - | - |
| July | - | 31 | 2,398 | 1,483 | 3,091 | 1,037 | - |
| August | - | 40 | 4,411 | 118 | 9,301 | 865 | - |
| Sept. | - | 531 | 3,554 | 3 | 3,882 | 11 | 173 |
| <u>Oct.*</u> | <u>-</u> | <u>85</u> | <u>798</u> | <u>-</u> | <u>-</u> | <u>-</u> | <u>234</u> |
| Totals | 180 | 689 | 11,169 | 1,703 | 16,220 | 1,913 | 407 |

* Weir was destroyed on October 7, 1974.

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