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

D. E. JONES

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**ALASKA DEPARTMENT  
OF FISH AND GAME**

James V. Brooks, Commissioner

**Sport Fish Division**

Support Building  
JUNEAU, ALASKA

STATE OF ALASKA

*Jay S. Hammond, Governor*



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 of Alaska

Study No.: AFS-42 Study Title: STEELHEAD AND SEA-RUN CUTTHROAT TROUT LIFE HISTORY STUDY IN SOUTHEAST ALASKA.

Job No.: AFS-42-4-B Job Title: Life History of Cutthroat Trout

Period Covered: July 1, 1975 to June 30, 1976.

## ABSTRACT

Knowledge of the basic life history of sea-run cutthroat in Southeast Alaska, necessary to properly manage wild native population, was not generally available prior to initiation of the sea-run cutthroat life history study in 1971. This report covers the fifth 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 Southeast Alaska lake-stream system. The out-migration of sea-run cutthroat began to leave Petersburg Creek in early May. The out-migration exhibited a tri-modal peak of timing, with the highest number of out-migrants occurring on May 28, 1975. The out-migration was complete by July 22, 1975. The out-migrant cutthroat ranged in length from 86 mm to 515 mm with an average of 243 mm. The out-migrant cutthroat ranged in age from three to eight with 83.1% occurring in the four through six year class.

Surveys of the spawning grounds for the sea-run cutthroat in the Petersburg Lake area resulted in the discovery that cutthroat apparently spawn only during the hours of darkness. Cutthroat were observed moving onto the spawning beds around 2400 hours and they had returned to deeper water by 0500 hours. Observations indicate that individual fish spawn over a period of four or five consecutive nights.

Investigations of the resident population of cutthroat in Petersburg Lake were continued in 1975. Age-length of the 1975 sample was comparable to that observed in 1974. In addition, 107 lake resident cutthroat were tagged in an effort to identify their interaction with the sea-run population.

The in-migration of sea-run cutthroat to the Petersburg Creek System began in May, remained low throughout the summer, reached a peak in late September, and terminated in late October. A total of only 271 sea-run cutthroat were counted in 1975 due to the loss of the weir structure for 13 days in early September and the failure of the repaired structure to fish adequately for the remainder of the season. The 1975 in-migrant cutthroats timing, age, size and fecundity were similar to what has been observed since 1973.

Sea-run cutthroat tagged at the Petersburg Creek weir in 1975 spent an average of 61 days at sea and grew an average of 18.0 mm. Tagged cutthroat were recovered in nearly all of the 13 area streams previously identified as feeding areas for fish tagged at Petersburg Creek. No new areas were located during the 1975 surveys.

A total of 168 sea-run cutthroat were tagged in six area streams in an effort to determine their contribution to the overwintering population of cutthroat in the Petersburg Creek system. Unfortunately, the loss of the weir in September and its subsequent poor fishing ability after repairs were effected, precluded the capture of any of these tagged cutthroat.

Surveys were carried out on three streams to assess their potential as sources for sea-run cutthroat eggs. Two of the larger systems contain good numbers of cutthroat, but are logistically difficult. The third system, while not supporting a large sea-run cutthroat population, is smaller and would require only a minimum of time and money to develop as a source of sea-run cutthroat eggs for brood stock purposes.

A total of 64,772 fish of various species passed both upstream and downstream during the operation of the Petersburg Creek weir in 1975.

## BACKGROUND

Prior to initiating the sea-run cutthroat study in 1971, only limited life history research had been conducted on the sea-run cutthroat in Alaska. A review of research literature on sea-run cutthroat in the Pacific Northwest proved helpful in planning research activities in Southeast Alaska.

Several streams throughout Southeast Alaska were surveyed and Petersburg Creek was selected as a study site because of its location and its reputation as a fine sea-run cutthroat producer. Since 1971, the number of sea-run cutthroat, their age, size, rearing requirements and migration timing have mostly been determined for Petersburg Creek. In addition, migration patterns for marked cutthroat leaving Petersburg Creek have been determined and mapped through the cooperation of local anglers who turned in tags from cutthroat caught in the Petersburg Area.

The sea-run cutthroat population overwintering in the Petersburg Creek system is comprised of cutthroat of several age classes that originate in several systems in the Petersburg area. Of these overwintering

cutthroat, only 50% are mature fish nearing sexual maturity. This means that the cutthroat population in Petersburg Creek may be supported by about 300 females each year.

The result of these research findings has resulted in management procedures aimed at preserving the quality of cutthroat angling that now exists throughout much of Southeast Alaska.

Studies of the rearing habits and requirements of young sea-run cutthroat within the Petersburg Creek system have shown that cutthroat are quite selective in their rearing sites and that only small sections of the entire system could be classified as prime rearing areas. With these findings, recommendations can be made to protect this critical habitat from alteration by agencies planning land use activities within the watershed.

Petersburg Creek and Lake contain resident populations of cutthroat. Studies have been initiated to study the interaction between this resident population and the sea-run population.

The rearing facilities of the Crystal Lake Hatchery have not as yet been utilized to produce sea-run cutthroat smolts. However, it will become a valuable management tool for supplementing wild runs once the basics of the sea-run cutthroat's life history are understood.

## RECOMMENDATIONS

### Research

The determination of the timing and numbers of in- and out-migrant sea-run cutthroat, their length, weight, sex and age should be continued for the Petersburg Creek system.

Investigation of the spawning areas and spawning habits of the Petersburg Creek sea-run and resident cutthroat populations should be continued.

Investigation of the contribution of cutthroat from non-lake systems to the Petersburg Creek population needs to be continued.

The interaction of the sea-run and "resident" cutthroat populations of the Petersburg Creek system have not been determined to any extent. Investigation of these two populations should continue.

Stream systems, other than Petersburg Creek, should be surveyed for potential as possible sources of eggs for creation of a brood stock.

Studies of the ecological relationship between steelhead sea-run cutthroat, coho salmon, and Dolly Varden should be initiated as all of these species are potential competitors for the available rearing habitat within the Petersburg Creek system.

## Management

Many aspects of the sea-cutthroat trout life history in the Petersburg Creek system have been determined. Research has shown that the sea-run population is not large and is **subjected to long annual exposure** to the angling public. Creel census has shown a steady decline in the number of cutthroat in the Petersburg Creek system. In an effort initiated to relieve some of the angling pressures, a reduced bag limit was granted in 1975. However, the census conducted in 1975 indicated that nearly as many cutthroat were harvested under the new bag limit.

The life history pattern of sea-run cutthroat further complicates management programs. They originate in non-lake systems in the area and use the Petersburg Creek system as an overwintering ground. In other words, the local angler is exploiting many different races of cutthroat when fishing in the Petersburg Creek system in early spring and again in the fall. Until the origin of these races is defined and enumerated, effective management will prove difficult.

No additional changes should be made in the present seasons and bag limits for sea-run cutthroat until data have been obtained on the interaction of the various races of cutthroat within a given geographical area.

Careful guidelines should be developed for any agency planning land use (logging-road building) adjacent to any stream containing cutthroat populations since research has shown that the cutthroat rearing habitat is limited in any given water shed.

An egg take site should be established for sea-run cutthroat and a brood stock should be developed at the Crystal Lake Hatchery for future experimental stocking.

## OBJECTIVES

1. Determine the number, length, age, sex and maturity of immigrant anadromous cutthroat in the Petersburg Creek system.
2. Determine the number and distribution of anadromous and non-migratory cutthroat within Petersburg Lake.
3. Determine the distribution of spawning anadromous cutthroat within the Petersburg Creek system.
4. Determine the migration of anadromous cutthroat after they leave the Petersburg Creek system.
5. Determine the contribution of cutthroat to the Petersburg Creek system from nearby nonlake streams.
6. Investigate selected streams for potential egg take sites for anadromous cutthroat.

7. Continue compilation of the 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, constructed in 1972, required major reconstruction and was not completed until April 23, 1975.

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 incline screen panel type for use at normal water levels, with 2.54 cm hardware cloth screens for high water periods. Three traps, 3.6 meters by 2.7 meters were placed near the east bank since 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 out-migrant cutthroat captured at the weir were anesthetized with treacaine methanesulfonate (MS-222), enumerated, and measured. Those over 200 mm FL were tagged with numbered "Floy" internal anchor tags and were given an upper caudal punch mark.

Cutthroat under 200 mm F.L. were given an upper caudal punch but not tagged. All cutthroat were then placed in a tub of fresh water and were observed until it was determined that all were active before they were released below the weir.

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

Samples of in-migrant cutthroat were obtained from anglers' catches and from cutthroat found dead at the weir. These samples were measured, weighed and sexed. Otoliths were collected for age determination. The condition of the gonads was examined to determine maturity.

The resident non-migratory cutthroat population in Petersburg Lake was sampled with hook and line, gill net, and baited minnow traps. The cutthroat captured were anesthetized with MS-222, then measured and tagged with numbered "Floy" internal anchor tags. These cutthroat were then released at their point of capture. A sample of the resident cutthroat population was obtained from anglers catches. This sample was measured, sexed and otoliths were collected for age determinations.

The distribution of the **anadromous cutthroat** spawners was determined by periodic foot surveys of the spawning grounds. **Actual observation** of the spawning behavior was done during the hours of darkness using a "Coleman" lantern for illumination. Foot surveys, hook and line sampling, and angler contact were used to determine the distribution of tagged cutthroat once they had left the Petersburg Creek system.

The contribution of sea-run cutthroat to the Petersburg Creek system from nearby non-lake systems was determined by capturing cutthroat by hook and line. These cutthroat were anesthetized with MS-222, measured and tagged with "Floy" tags, and then released at their point of capture.

Potential egg take sites for anadromous cutthroat were determined by surveying known cutthroat systems for abundance of fish, time and area of spawning, and suitable weir sites.

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

## FINDINGS

### Cutthroat Trout Out-Migration

A total of 691 cutthroat trout, Salmo clarki, were counted through the Petersburg Creek weir on their out-migration in 1975. The 691 cutthroat enumerated in 1975 was well above the 501 recorded in 1973 and the 584 recorded in 1974 but somewhat less than the excellent run of 837 recorded in 1972.

The 1975 cutthroat out-migration from Petersburg Creek began on May 3, peaked on May 28, and was complete by July 22, 1975. The 1975 out-migration showed three periods of peak out-migration with the highest peak occurring on May 28, 1975. The second peak period of out-migration occurred near the end of the period on July 17, 1975, (Figure 1). The wide variation in migration timing as depicted in Figure 1 is not fully understood at this time.

Water temperatures of Petersburg Creek during the cutthroat out-migration ranged from 4°C to 10°C with peak movement occurring when temperatures reached 5°C-6°C. Nearly all of the out-migrant cutthroat entered the traps during the hours of darkness on moderate stream flows. Migration virtually stopped during extreme high or low stream flows.

Presented in Table 1 are the average length and length range of out-migrant cutthroat from Petersburg Creek for 1975. Small numbers of large cutthroat (>,300 mm average length) were the first out-migrants trapped. These were followed by the average size fish (+ 250 mm) during the first and second peak periods of movement. The small out-migrant

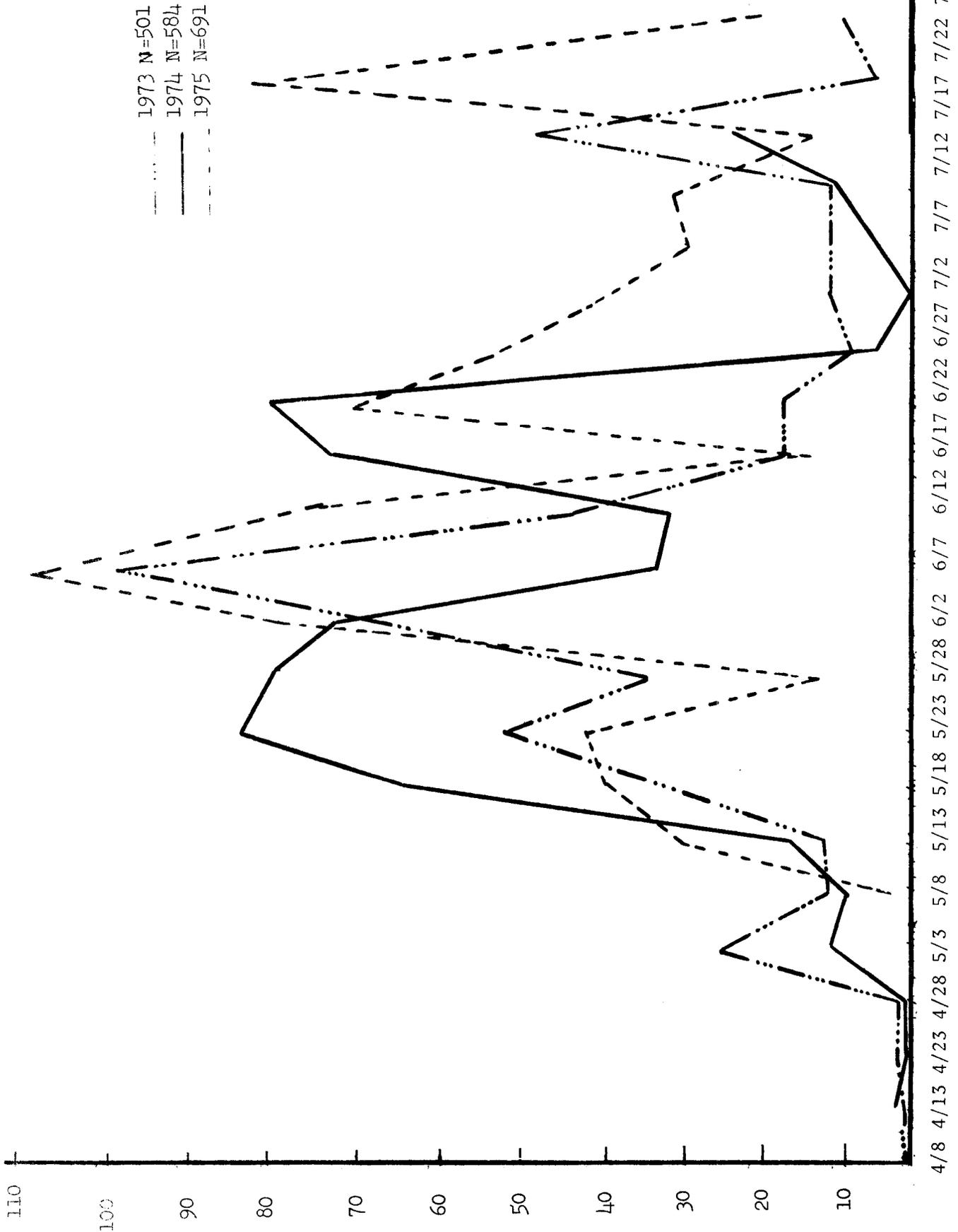


Figure 1. Out-migrant Cutthroat Trout by Five-day Periods, 1973, 1974, 1975 - Petersburg Creek

cutthroat (<200 mm) comprised the bulk of the last peak period of movement in mid-July. The pattern of large early out-migrants, followed by average size fish, and small cutthroat near the end of the out-migration period has occurred annually since 1972, (Jones 1973-1974, 1975). The timing adaptive to size and migration comprise one of the few consistent patterns noted from year to year for the sea-run cutthroat in Petersburg Creek. A total of 141 cutthroat under 200 mm in fork length were recorded during the 1975 cutthroat out-migration. These small cutthroat represent the bulk of the cutthroat smolt that are produced in Petersburg Creek and head to sea for the first time.

Table 1. Length Frequencies and Average Length of Out-migrant Sea-Run Cutthroat by Five Day Periods. Petersburg Creek Weir - 1975

Five Day Period	No.	Fork Length Range in mm.	Mean Fork Length in mm.	No. of Cutthroat 200 mm.
5/01 - 5/05	2	286-372	329	0
5/06 - 5/10	28	236-417	355	0
5/11 - 5/15	33	200-396	280	0
5/16 - 5/20	36	211-430	295	0
5/21 - 5/25	11	180-347	266	1
5/26 - 5/30	74	170-415	270	3
5/31 - 6/04	111	180-515	253	13
6/05 - 6/09	68	212-325	253	0
6/10 - 6/14	14	199-340	252	1
6/15 - 6/19	66	156-420	256	6
6/20 - 6/24	46	159-376	238	10
6/25 - 6/29	36	114-348	226	6
6/30 - 7/04	26	145-298	212	7
7/05 - 7/09	28	145-256	193	15
7/10 - 7/14	14	160-268	209	5
7/15 - 7/19	79	106-297	185	58
7/20 - 7/24	19	86-235	174	16
Totals	691	86-515	250	141

Age-Length Relationships of Out-Migrant Cutthroat Trout

A total of 59 sea-run cutthroat trout were sampled during the spring out-migration for age-length relationships. These samples were obtained from anglers' catches and from cutthroat found dead at the weir. Ageing was accomplished by counting the number of annuli on the sampled cutthroat's otoliths. The 1975 cutthroat out-migration contained trout in six age groups with ages ranging from three to eight, and 83.1% of the fish occurring in the four through six age class (Table 2). Cutthroat in age classes nine and ten were missing from the 1975 sample and may reflect some bias in the sampling schedule. Sixty-nine percent of the out-migrant cutthroat sampled were between 211 mm and 330 mm. in fork length. The 1975 run shows a shift toward larger cutthroat in all age classes. This shift toward larger average size fish may be a result of sampling technique or it may reflect better than average growth increments for the various age classes during the 1974 season.

Table 2. Age-Length Relationships of Out-migrant Cutthroat Trout, Petersburg Creek Wier, 1975.

Fork Length in mm.	Age						Total	% of Total
	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>		
151-150	1						1	1.7
151-170	1						1	1.7
171-190	1	1					2	3.4
191-210	1	3					4	6.8
211-230	1	7	2				10	16.9
231-250	1	6	3				10	16.9
251-270		2	2	1			5	8.5
271-290		2	4				6	10.2
291-310			3				3	5.1
311-330			3	4			7	11.9
331-350			2		1		3	5.1
351-370			1	1		1	3	5.1
371-390				2	2		4	6.8
Totals	<u>6</u>	<u>21</u>	<u>20</u>	<u>8</u>	<u>3</u>	<u>1</u>	<u>59</u>	<u>100.1</u>

Table 2. Age-Length Relationships of Out-imgrant Cutthroat Trout, Petersburg Creek Weir, 1975. (Con't)

	Age						% of
	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>Total</u>
Percent of Total	10.2	35.6	33.9	13.6	5.1	1.7	100.0
Mean Fork Length in mm.	189	235	287	337	370	367	

Sea-Run Cutthroat Trout Spawning Ground Surveys.

A review of the published literature on sea-run cutthroat, Salmo clarki, in Oregon (Sumner, 1948, 1953 and 1962; Lowry, 1965 and Cramer, 1940); California (DeWitt, 1954) and Alaska, (Baade 1957; Armstrong 1971), suggests that sea-run cutthroat use small tributary streams for spawning and that they locate their redds at the tail end of pools in water 10-15 cm deep where there is a substrate of moderate to small gravel. Attempts to locate and describe the spawning ground for the sea-run cutthroat in the Petersburg Creek system have been conducted on an annual basis since 1972. Petersburg Creek and its tributaries in the area above and below Petersburg Lake contain all of the preferred conditions for spawning cutthroat. However, no actively spawning cutthroat were ever observed during the years 1972 through 1974 even though many hours were spent surveying the better areas. Gravid sea-run cutthroat were found in the larger pools and off the inlets to Petersburg Lake during these surveys but none were observed spawning.

Investigation of the spawning grounds of the sea-run cutthroat was again conducted during May and early June 1975. Surveys during the daylight hours again failed to turn up any actively spawning cutthroat. As it was obvious that adult spawners were in the area, it was decided to try a survey during the hours of darkness. Foot surveys were conducted with the aid of "Coleman Lanterns" from midnight to 4 a.m. (the period of darkness during this time of year). In addition to the foot surveys, variable mesh gillnets were fished across three of the small inlets to Petersburg Lake.

Cutthroat were observed migrating out of the deep pools of Petersburg Creek and from Petersburg Lake into the smaller tributaries. Most of the cutthroat observed were small immature fish; however, two pairs of large mature cutthroat were located approximately 100 meters up a small inlet to Petersburg Lake. These cutthroat stopped their spawning activity when subjected to light from the "Coleman Lantern" but returned to their redds within 1/2 hour. Even though observations were continued on these four fish for two hours they did not resume active spawning. The artificial light apparently made them nervous and they sought cover at the slightest disturbance. As dawn began to break, the cutthroat drifted downstream and were back in Petersburg Lake by full light at 5 a.m.

Catches in the gillnets revealed that gravid cutthroat were going up the tributaries at dark and were returning at first light, as no gravid fish were captured during the day. Examination of the gravid adults revealed that the females ranged from green to nearly spent which indicates that spawning takes place on several consecutive nights. Redd site selection was much the same as described elsewhere but was always adjacent to escape cover.

#### Petersburg Lake Resident Cutthroat

Surveys initiated in 1974 of the resident population of cutthroat within the Petersburg Creek system were continued in 1975.

The 1975 survey was conducted during mid-July, as past weir records showed that almost all of the sea-run cutthroat were out of the system during this period. Capture methods included baited minnow traps, fyke nets, and hook and line. Hook and line proved to be the most effective technique and 107 cutthroat were captured by this method during the 10 day period. The 107 trout captured by hook and line were measured and tagged with a numbered "Floy" internal anchor tag and released at their capture point. In addition 57 resident cutthroat samples were obtained from angler catches. These cutthroat were sampled for age-length data and were found to range in age from four to ten with 85.9 percent falling in the four, five or six age class (Table 3). This differs somewhat from the survey in 1974 in that the 1974 sample contained cutthroat in the three, eleven and twelve age classes as well, with only 72.2 percent in the four, five and six age classes. This was to be expected because the 1974 data were from gill net catches while the 1975 data were of fish taken by hook and line.

Very little difference was noted in 1974 between lake resident and sea-run cutthroat age-length data (Jones 1975). Comparing the 1975 age-length data from lake resident cutthroat with that of out-migrant sea-run cutthroat, (Table 2) and in-migrant fish, (Table 5 and 6) only slight differences in age-length are apparent. In 1975, studies were undertaken to determine the interaction between the two. A total of 107 resident cutthroat, ranging from 151 to 370 mm (Table 4), were tagged and released during July. None of these tagged cutthroat were observed at the Petersburg Creek weir before termination of field studies in late October. This was not unexpected as the normal out-migration period was over. If indeed these cutthroat become anadromous, they will be trapped during their out-migration in the spring of 1976.

Table 3. Age-Length Relationships of Petersburg Lake Resident Cutthroat - 1975.

Fork Length in mm.	Age							Total	% of Total
	4	5	6	7	8	9	10		
171-190	2							2	3.5
191-210	2	1						3	5.3
211-230		2						2	3.5
231-250	5	12	1					18	31.6
251-270		7	3					10	17.5
271-290		2	4					6	10.5
291-310		4	2	1				7	12.3
311-330		1		2				3	5.3
331-350					1			1	1.8
351-370				1				1	1.8
371-390			1	1			1	3	5.3
391-410						1		1	1.8
Totals	9	29	11	5	1	1	1	57	100.2
Percent of Total	15.7	50.9	19.3	8.8	1.8	1.8	1.8		
Mean Fork Length in mm.	218	261	287	333	350	400	385		

Table 4. Length Frequencies for Petersburg Lake Resident Cutthroat.  
Tagged During 1975.

Fork Length in mm.	Number of Cutthroat	Percent of Total
151-170	5	4.7
171-190	8	7.5
191-210	16	15.0
211-230	19	17.8
231-250	19	17.8
251-270	13	12.1
271-290	7	6.5
291-310	8	7.5
311-330	5	4.7
331-350	4	3.7
351-370	3	2.8
Total	<u>107</u>	<u>100.1</u>
Average Fork Length in mm - 243.		

Table 5. Length Frequencies of In-migrant Cutthroat by Five Day Periods. Petersburg Creek Weir, 1975.

Five Day Period	No.	Fork Length Range in mm.	Average Fork Length in mm.	No. of Ct 200 mm.
5/1-5/5	1	-	230	0
5/6-5/10	0	-	-	0
5/11-5/15	1	-	240	0
5/16-5/20	4	245-405	324	0
5/21-5/25	4	190-330	253	1
5/26-5/30	1	-	267	0
5/31-6/4	5	174-311	258	1
6/5-6/9	1	-	316	0
6/10-6/14	10	165-310	233	3
6/15-6/19	0	-	-	0
6/20-6/24	12	170-365	272	1
6/25-6/29	3	241-424	337	0
6/30-7/4	1	-	155	1
7/5-7/9	0	-	-	0
7/10-7/14	1	-	162	1
7/15-7/19	8	117-387	212	5
7/20-7/24	7	186-357	255	2
7/25-7/29	8	150-334	224	3
7/30-8/3	6	144-365	263	2
8/4-8/8	4	173-307	239	2
8/9-8/13	6	173-395	291	1

Table 5. Length Frequencies of In-migrant Cutthroat by Five Day Periods. Petersburg Creek Weir, 1975.

(Con't)

Five Day Period	No.	Fork Length Range in mm.	Average Fork Length in mm.	No. of Ct 200 mm.
8/14-8/18	2	240-248	244	0
8/19-8/23	0	-	-	0
8/24-8/28	3	197-273	234	1
8/29-9/2	6	191-320	236	1
9/5-9/7	36	151-401	301	2
9/8-9/12	28	156-366	280	2
9/13-9/17	4	265-330	289	0
9/18-9/22	0	-	-	0
9/23-9/27	10	220-432	306	0
9/28-10/2	54	183-415	289	3
10/3-10/7	6	188-420	265	1
10/8-10/12	3	296-376	340	0
10/15-10/17	19	142-320	233	1
10/23-10/27	16	152-333	253	1
10/28-11/1	1	-	355	0
Totals	271	117-432	263	35

Table 6. Age-length Relationships of In-migrant Cutthroat, Petersburg Creek Weir, 1975.

Fork Length in mm.	4	5	6	7	Age 8	9	10	Total	Percent of Total
151-170	1							1	3.7
171-190	-							0	.0
191-210	3							3	11.1
211-250	3	2						5	18.5
231-250	1	-						1	3.7
251-270	2	1						3	11.1
271-290		4						4	14.8
291-310		1	1					2	7.4
311-350		1	3		1			5	18.5
351-350			-					0	.0
351-370			1					1	3.7
371-390								0	.0
391-410						1		1	3.7
411-430							1	1	3.7
Total	10	9	5	0	1	1	1	27	99.9
Percent of of total.	37.0	33.3	18.5	.0	3.7	3.7	3.7		
Mean Fork Length in mm.	2.4	272	326	-	3.30	400	427	273	

### Cutthroat Trout In-migration

The first of the 271 in-migrant cutthroat enumerated at the Petersburg Creek weir was recorded on May 1, 1975. The number of in-migrants remained at a low level until mid-September. After this date substantially more cutthroat were recorded. A peak was reached on September 28, and the number fell off rapidly in early October (Figure 2).

The total number of in-migrant cutthroat enumerated at the weir in 1975 was disappointingly low. The major cause of this low count was not a lack of cutthroat but rather the inability of the weir to capture them. A severe flood on September 1, 1975, destroyed approximately 18 meters of weir, including all three traps. Repairs were not completed until September 13. This is normally a high period for in-migrating cutthroat and an unknown number passed upstream. After repairs were completed, only one upstream trap was in operation. To make matters worse, this trap lacked the attraction flow necessary to adequately trap in-migrant cutthroat. With this set of conditions, the in-migrant cutthroat were held below the weir until flood conditions caused removal of the weir screens. They then migrated past uncounted.

The in-migration timing of the sea-run cutthroat enumerated at the Petersburg Creek weir in 1975 was similar to the timing recorded in 1973 and 1974 (Figure 2). Stream water temperatures were 5°C at the start of in-migration in May, rose to a maximum of 17°C in August, averaged 10°C at the peak of migration, and dropped to 3°C at the end of the field season.

Presented in Table 6 are the length frequencies of the 1975 in-migrant cutthroat captured at the Petersburg Creek weir during five-day periods. The early May in-migrants are normally large mature fish headed upstream to spawning grounds above the weir. The in-migrants in June, July and August are normally small to average size fish and are followed by the larger sea-run fish in September and October. This pattern was broken up somewhat in 1975 due to the inability of the weir to effectively trap the majority of the in-migration. Overall, the 1975 in-migrant cutthroat ranged from 117-432 mm, with an average of 260 mm. This average is the same as that recorded in 1974 (Jones 1975).

### In-migrant Cutthroat Age-length Relationships

Age length data were collected from 27 in-migrant cutthroat during the fall of 1975. These samples were obtained from angler catches and from cutthroat found dead of natural causes at the weir site. These cutthroat ranged in age from four to ten with 70.3 percent showing four or five annuli on their otoliths (Table 6).

Presented in Table 7 are the in-migrant cutthroat age classes expressed in percent of total for years 1971-1975. Cutthroat sampled from the 1975 in-migration did not contain any fish in the three to seven year class but did contain the first fish in the ten year age class. This difference from previous years' data is most likely due to the sampling technique (rod and reel) rather than a shift in the overall age structure of the in-migrant population.

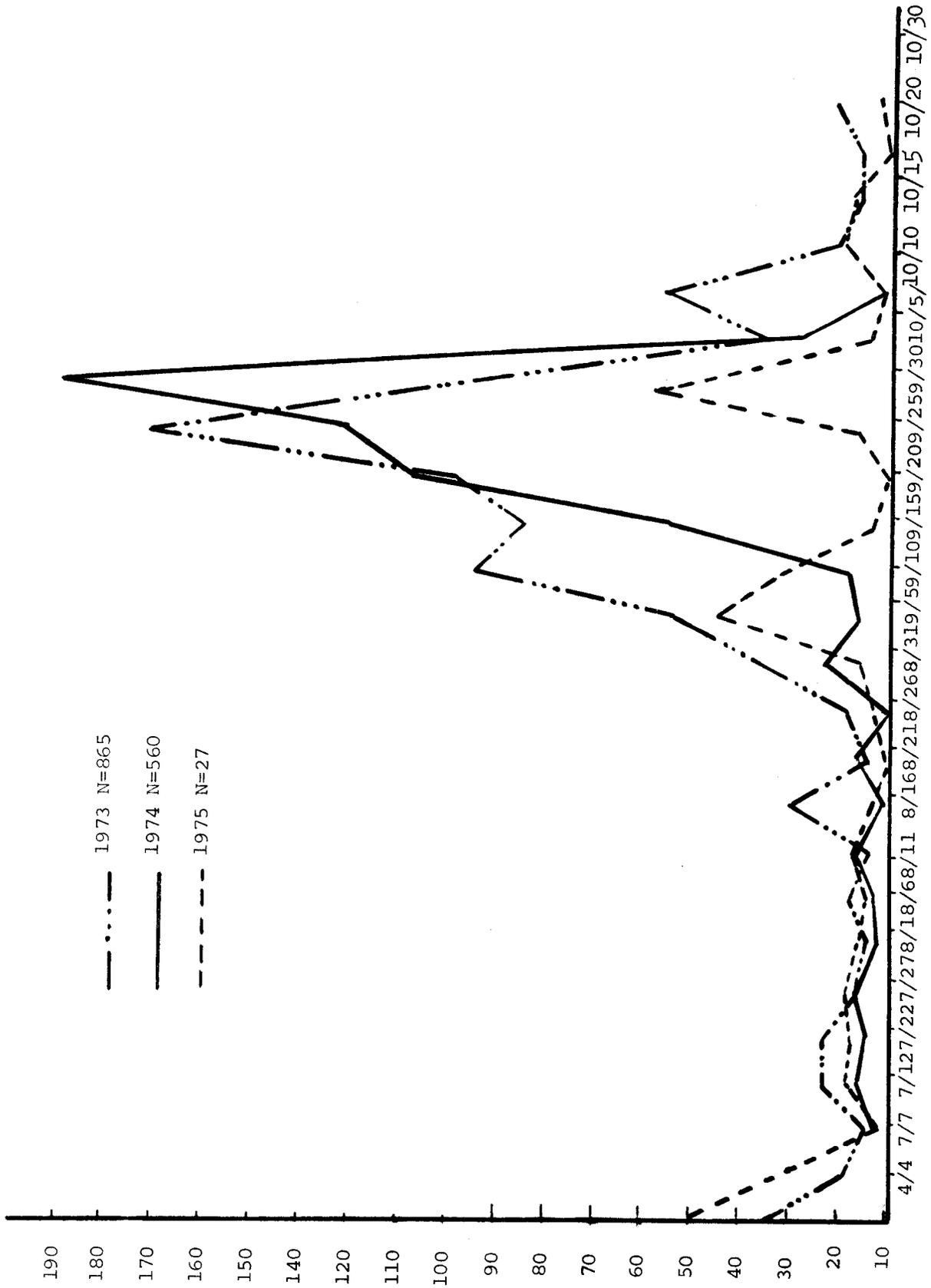


Figure 2. In-migrant Cutthroat Trout by Five-Day Periods, Petersburg Creek 1973-74-75

Table 7. In-migrant Cutthroat Age Classes, 1971-1975, Petersburg Creek.

Cutthroat Age Groups Expressed as Percent of Total									Sample Size
Year	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>	
1971	11.8%	47.4%	26.4%	7.9%	1.9%	2.6%	0	0	76
1972	12.9	33.7	19.8	18.8	11.9	3.0	0	0	101
1973	8.6	24.7	22.2	27.2	13.6	3.7	0	0	81
1974	5.9	41.2	27.5	11.8	7.8	3.9	2.0	0	51
1975	0.0	57.0	33.3	18.5	0.0	3.7	3.7	3.7	27
Five Year Average	7.8	36.8	25.8	16.8	7.0	3.4	1.1	.7	67

#### Sea-Run Cutthroat Fecundity

The degree of sexual maturity was noted for the 27 in-migrant cutthroat sampled from the 1975 run. It was found that 61% were mature fish that would spawn during the spring of 1976. The 1975 sample was biased due to the sample method because anglers tend to retain the larger more mature fish and release the smaller immature cutthroat.

Ovaries from 12 female cutthroat were used to obtain average fecundity. The number of eggs per female ranged from a low of 460 for a 340 mm female to a high of 2,342 for a 422 mm. fish, with an overall average of 862 eggs per female. These data are similar to average fecundities noted in 1973 and 1974 for the Petersburg Creek population (Jones, 1974-75). No estimate of total possible egg deposition can be made as the enumerated total in-migration was considerably below the actual run.

#### In-migrant Cutthroat Tag Recoveries

The in-migration of marked and/or tagged cutthroat to Petersburg Creek in 1975 occurred during the same time period as that for un-marked cutthroat. A total of 23 (5.9 percent) cutthroat bearing a tag were recovered from a total of 387 tagged on the out-migration in the spring of 1975, (Table 7). In addition 8% of the cutthroat smolt ( 200 mm), marked on their out-migration, were recovered during the fall in-migration.

The low recovery of tagged and/or marked cutthroat during the 1975 in-migration can be blamed on the loss of the weir structure for 13 days in September and the inability of the weir to adequately capture cutthroat once it was repaired.

Cutthroat tagged on their out-migration in 1975 spent from 3 to 122 days at sea before returning to the Petersburg Creek weir. June migrants spent the longest amount of time at sea and had the highest average growth increments (Table 8). Again data in Table 8 may not reflect the overall averages as only 23 tagged cutthroat were recaptured. Presented in Table 9 is a summary of cutthroat recoveries for the four years tagging has been conducted. As noted before, the 1975 data does not conform to previous years data as most of the tag recoveries were made prior to September 1, 1975.

Table 8. Days at Sea and Growth Increment for Tagged Cutthroat Trout Recaptured at the Petersburg Creek Weir, 1975.

Monthly period	No. Tagged	No. Recovered*	% Recovery	Day at Sea Range	Day at Sea Average	Growth Range in mm.	Average Growth in mm.
5/1-5/31	121	4	3.3	31-45	38	0-4	2
6/1-6/30	214	18	8.4	3-122	67	0-45	21
7/1-7/31	52	1	1.9	-	11	-	5
Total	387	23	5.9	3-22	61	0-45	18

\*Represents cutthroat captured throughout the in-migration.

Table 9. Days at Sea and Growth Increment for Tagged Cutthroat Trout Recaptured at the Petersburg Creek Weir, 1972-1975.

Year	No. Tagged	No. Recovered	Percent Recovery	Days at Sea Range	Days at Sea Ave.	Growth Range (in.)	Average Growth
1972	560	149	26.6	12-149	82	0-134	29.0
1973	292	67	23.0	7-158	103	3-145	42.3
1974	361	54	15.4	32-147	92	2-149	34.4
1975	387	23	5.9	3-122	61	0-45	18.0

### Cutthroat Tag Recoveries - Other Systems

During the past four years, data have been collected on the migration patterns of tagged cutthroat after they leave the Petersburg Creek system. These data were gathered with the cooperation of the area sport fishermen who turned in tagged cutthroat. Tag recoveries during 1975 were from areas previously indentified as feeding areas for cutthroat marked at Petersburg Creek (Figure 3). There appears to be a pattern to the marked cutthroats movements away from Petersburg Creek. They are reluctant to cross large bodies of water (Frederick Sound, Summer Straits) and prefer to follow the shore line of either Mitkof or Kupreanof Island for distances of up to 44 miles.

### Cutthroat Studies - Other Systems

The fall in-migration of sea-run cutthroat into Petersburg Creek contains large numbers of unmarked cutthroat. The origin of these cutthroat is somewhat of a mystery. To determine the origin of these fish, cutthroat tagging studies were undertaken during August 1975 in six non-lake stream systems in the Petersburg area. Two streams, Big Creek and Blind Slough on Mitkof Island, and four streams, Duncan Salt Chuck, Castle River, "12 mile" Creek and "5 Mile" Creek on Kupreanof Island, were selected for tagging sites as they are all known to contain good populations of sea-run cutthroat. A total of 168 cutthroat were tagged with colored "Floy" internal anchor tags and released of point of capture (Table 10).

It was anticipated that some of these tagged cutthroat would be captured at the Petersburg Creek weir during the fall in-migration. However, probably due to the loss of the weir for part of September and its poor fishing ability for the remainder of the season, no cutthroat tag recoveries were made for fish tagged at the above mentioned locations.

Table 10. Sea-run Cutthroat Tagging Sites, Petersburg Area, 1975.

<u>Stream</u>	<u>Location</u>	<u>No. of Cutthroat Tagged</u>
Duncan Salt Chuck	Kupreanof Island	86
Castle River	Kupreanof Island	17
"12 Mile" Creek	Kupreanof Island	4
"5 Mile" Creek	Kupreanof Island	8
Big Creek	Mitkof Island	51
Blind Slough	Mitkof Island	2
	Total	<u>168</u>

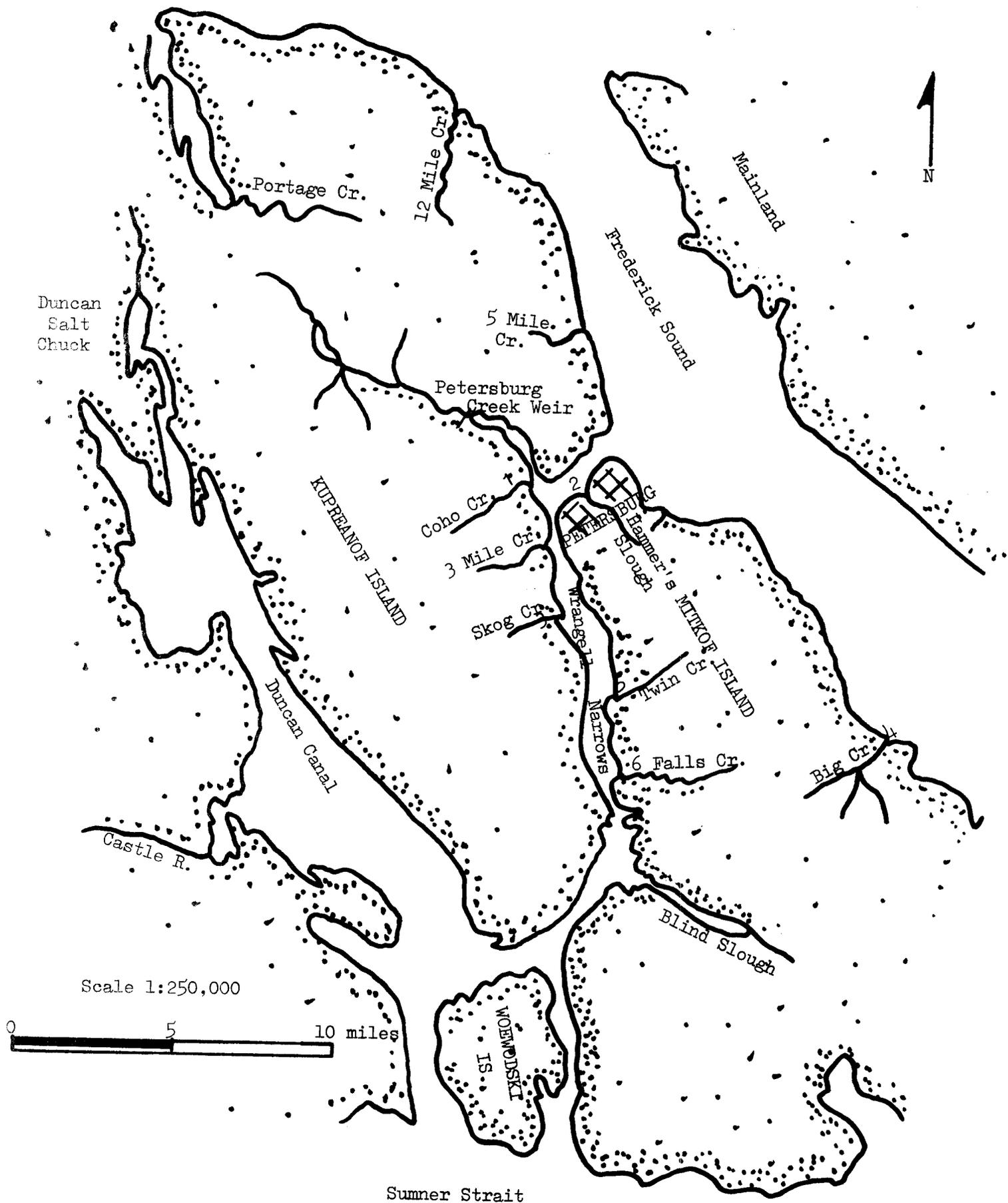


Figure 3. Recovery Areas of Cutthroat Trout Tagged at the Petersburg Creek Weir 1972-1975.

Surveys of streams other than Petersburg Creek for potential sources of cutthroat eggs have been conducted for the past two years. To date two large systems and one small stream system have been given surveys.

Kadake Creek, located on northeast Kuiu Island, was given an intensive foot survey during 1975. This is a large stream with many tributaries which made location of spawning cutthroat difficult. Good numbers of cutthroat were found in the lower 3 kilometers; however, not all were mature gravid fish. Kadake Creek should be considered as a potential source of cutthroat eggs even though obtaining those eggs will be expensive and time consuming.

Castle river, located on Kupreanof Island, has been surveyed several times in the past two years. A large population of spawners was located two kilometers upstream in two large holding holes. The only reasonable capture method would be by hook and line since this area is too large and deep to weir.

The third stream surveyed for sea-run cutthroat spawners was Blind River on Mitkof Island. A weir is presently in place on Blind River and only slight modification would be necessary to capture cutthroat spawners. The number of cutthroat in Blind River is not known but there are probably fewer available than in either Kadake Creek or Castle River.

#### Other Migrants

Major reconstruction of the Petersburg Creek weir was started in early April, 1975, and the weir was complete and fishing on the evening of April 23, 1975. The coho salmon, Oncorhynchus kisutch, smolt and overwintering Dolly Varden, Salvelinus malma, out-migration to saltwater 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 less than a week before the weir was completed.

The species and their numbers out-migrating from Petersburg Creek in 1975 are presented in Table 11. After the first of August, it was almost impossible to operate the downstream traps due to the large number of dead, spawned-out salmon floating downstream. Very little downstream movement by any species occurs after the first of August so these traps were converted to trapping in-migrant fish.

The in-migrant traps at the Petersburg Creek weir were complete on April 23, 1975, and the first adult steelhead were captured on April 24, 1975. Only 11 adult steelhead were captured before the first of May, indicating that only small numbers of adult steelhead were in Petersburg Creek before completion of the weir.

Steelhead, cutthroat, Salmo clarki, Dolly Varden and red salmon, Oncorhynchus nerka, were the only in-migrants enumerated during April, May and June, 1975. In-migration of all salmon species peaked in July and August, slowed up somewhat in September, and were nearly complete by the termination of the field season in late October, 1975 (Table 12).

Table 11. Number of Out-migrant Fish by Species and Month, Petersburg Creek, 1975.

<u>Month</u>	<u>Cutthroat</u>	<u>Dolly Varden</u>	<u>Steelhead</u>	<u>Coho</u>
April	0	982	1	0
May	209	34,171	21 (27)*	(2211)
June	336	755	75 (451)	(563)
July	175	2	25 (66)	(221)
August	<u>1</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	721	35,910	122 (544)	(2995)

\* ( ) indicates smolt

Table 12. Numbers of In-migrant Fish by Species and Month, Petersburg Creek weir. 1975.

<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	11	0	0	0	0	0	0
May	114	11	0	0	0	0	0
June	10	31	3	40	0	0	0
July	0	30	2070	699	1852	190	0
August	0	22	6699	85	6357	309	5
September*	0	130	4273	1	429	18	278
October	1	62	632	0	0	5	104
Totals		286	13,677	825	8,638	522	387

\*Weir was out of operation for 13 days in early September.

Totals presented in Table 11 and 12 do not represent the entire run for the species listed. Dolly Varden were passing downstream and adult steelhead upstream before the weir was complete in April. All species passed both upstream and downstream during periods of extreme high water when the weir screens were removed. In addition, undetermined numbers of fish passed upstream during early September when the weir was out of operation for 14 days. From several hundred to several thousand pink, Oncorhynchus gorbuscha, and chum salmon, 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 1975 weir operation.

## DISCUSSION

During the past five years of research at Petersburg Creek, much of the basic life history of the Petersburg Creek anadromous cutthroat has been learned. The numbers of cutthroat in- and out-migrating, their timing, age and size, and rearing requirements have mostly been determined. Research into the spawning habits and requirements of sea-run cutthroat has resulted in unpublished records that cutthroat in the Petersburg system spawn during the hours of darkness and leave their spawning grounds for deep water during daylight hours.

Enough basic life history information has been gathered to begin conducting research on problems of more direct application to management. Findings of the low numbers of mature spawner cutthroat that enter Petersburg Creek each fall is of special importance to management. Attempts to define the contribution of area streams to the Petersburg Creek wintering population have been started. Once these levels have been defined, management guidelines to regulate the harvest levels can be formulated.

From information gathered at Petersburg Creek, it is apparent that wild sea-run cutthroat will be hard to maintain in any number or quality under heavy fishing pressure. In order to maintain some of our better areas, it may become necessary to use hatchery reared cutthroat smolts to augment the natural production. To date, several potential sources of sea-run cutthroat eggs have been identified; however, a lack of money and manpower have precluded the development of an egg taking operation. Maintenance of the natural environment and limitation of access to the better sea-run cutthroat areas will be the best management tools for some time to come.

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