

SALCHA RIVER SALMON ESCAPEMENT STUDIES

1974

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Introduction

The Salcha River is the most important king and summer chum salmon spawning stream in the Tanana River drainage (Figure 3). In 1972 and 1973 studies were conducted to determine the abundance and distribution of these stocks in this river. In 1974 these studies were continued and expanded to provide information on aspects of king and chum salmon life history which had not been investigated in the previous 2 years.

The objectives of the 1974 studies were: (1) Determine king and summer chum salmon abundance and distribution, (2) determine the age, sex, and size composition of the king and summer chum salmon escapement, (3) determine if there is a difference in the timing of the post-spawning dieoff between male and female salmon, (4) determine the distribution of king salmon fry in the Salcha River tributaries, (5) determine the physical and limnological characteristics of the Salcha River drainage and (6) locate major open water areas during winter months.

The Salcha River studies are especially timely and important since plans have been finalized to build the trans-Alaska hot-oil pipeline across the Salcha and two of its tributaries, Redmond and McCoy creeks, in the fall of 1975. In 1974 tentative plans were also announced to build a natural gas pipeline which would eventually cross the Salcha. Because the salmon stocks could be damaged by pipeline construction activities or by breaks in the pipeline, accurate information on salmon abundance and distribution will have to be available for possible mitigation and rehabilitation.

Methods and Materials

Helicourier aircraft were used to make aerial observations. The surveys covered the area between the river's mouth and the North Fork.

Periodic carcass sampling and enumeration surveys were conducted between August 5 and 22. A 24-foot jet outboard-powered riverboat was used

to survey the 73 river miles between the river's mouth and No Grub Creek where most of the spawning occurred.

Daily carcass surveys of the main river were conducted. All available king salmon carcasses and a portion of the chum salmon carcasses were sampled. A scale smear for age determination was taken from each carcass sampled and the length from mid-eye to fork of tail recorded. Spawning success was judged by examining the gonads of carcasses. The locations of all carcasses recovered were recorded by sampling area. All carcasses were thrown into the bank vegetation to avoid resampling.

Foot and boat surveys were made of the lower 1-1/2 miles of all the major tributaries of the Salcha. Minnow traps, 445 mm x 230 mm x 6 mm mesh, were baited with salmon eggs and placed in all of the tributaries (with the exception of Caribou Creek) to determine if king salmon fry and other species were present. Data on electro-fishing catches in the same streams was provided by the Sport Fish Division of the Alaska Department of Fish and Game.

Stream flow measurements were taken, and water chemistry was determined with a Hach AL 36-B Water Ecology Kit.

Results

Table 7 summarizes information regarding the abundance and distribution of live fish, carcasses and spawning redds for king salmon. Table 8 summarizes this same information for chum salmon except that redd counts were not made. Peak live fish counts of 1,857 kings (aerial survey) and 8,040 chums (boat survey) were obtained. The majority of king salmon redds observed during boat surveys were found in the main river between Redmond and Caribou creeks (Figure 10). Based on live fish counts made during boat surveys, the majority of chum salmon spawned between Redmond and Caribou creeks (Figure 11).

Based on 208 carcass samples, the king salmon escapement was composed of 75 percent males. Age classes 3₂ through 7₂ were represented with age class 4₂ fish comprising 44 percent of the sample (Table 9). Eighty-two percent of the male and all of the female king salmon carcasses examined were partially or completely spent (Table 10). An average of 26 eggs was retained per female. Neither male nor female kings predominated in any portion of the carcass surveys (Table 11).

Based on 480 carcass samples, the summer chum salmon escapement was composed of 53 percent females. Age classes 3₁ to 6₁ were represented with age class 4₁ comprising 77 percent of the sample (Table 12). Seventy-eight percent of the male and 96 percent of the female carcasses examined were

Table 7. King salmon abundance and distribution, Salcha River, 1974.

| Area ^{1/} | Aerial Survey (7/29) | | Carcass Survey (8/8-8/18) | | Boat Survey (8/8-8/18) | |
|--------------------|----------------------|---------|---------------------------|---------|------------------------|---------|
| | number | percent | number | percent | number of redds | percent |
| 50 | 207 | 11.0 | 16 | 7.0 | 9 | 4.0 |
| 100 | 53 | 3.0 | 18 | 8.0 | 7 | 3.0 |
| 150 | 148 | 8.0 | 62 | 26.0 | 30 | 14.0 |
| 200 | 321 | 17.0 | 39 | 17.0 | 63 | 27.0 |
| 300 | 297 | 16.0 | 35 | 14.0 | 51 | 22.0 |
| 400 | 518 | 28.0 | 45 | 21.0 | 63 | 27.0 |
| 500 | 313 ^{2/} | 17.0 | 17 | 7.0 | 8 | 3.0 |
| Totals | 1,857 | 100.0 | 232 | 100.0 | 231 | 100.0 |

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- ^{1/} 50 - river mouth to pipeline crossing
 100 - pipeline to mouth of Redmond Creek
 150 - Redmond Creek to mouth of McCoy Creek
 200 - mouth of McCoy Creek to mouth of Ninety-Eight Creek
 300 - mouth of Ninety-Eight Creek to mouth of Flat Creek
 400 - mouth of Flat Creek to mouth of Butte Creek
 500 - mouth of Butte Creek to mouth of Caribou Creek

^{2/} Includes 30 kings enumerated above Caribou Creek.

Table 8. Chum salmon abundance and distribution, Salcha River, 1974.

| Area ^{1/} | Aerial Survey (7/29) | | Carcass Survey (8/8-8/18) | | Boat Survey (8/8-8/18) | |
|--------------------|----------------------|---------|---------------------------|---------|------------------------|---------|
| | number of live fish | percent | number of carcasses | percent | number of live fish | percent |
| 50 | 1,190 | 34.0 | 1 | .2 | 200 | 2.0 |
| 100 | 365 | 10.0 | 6 | 1.1 | - | - |
| 150 | 600 | 17.0 | 162 | 30.0 | 325 | 4.0 |
| 200 | 352 | 10.0 | 43 | 7.9 | 2,115 | 26.0 |
| 300 | 275 | 8.0 | 63 | 11.7 | 1,700 | 22.0 |
| 400 | 624 | 18.0 | 205 | 38.0 | 1,200 | 15.0 |
| 500 | 104 ^{2/} | 3.0 | 60 | 11.1 | 2,500 | 31.0 |
| Totals | 3,510 | 100.0 | 540 | 100.0 | 8,040 | 100.0 |

- ^{1/} 50 - river mouth to pipeline crossing
 100 - pipeline to mouth of Redmond Creek
 150 - mouth of Redmond Creek to mouth of McCoy Creek
 200 - mouth of McCoy Creek to mouth of Ninety-Eight Creek
 300 - mouth of Ninety-Eight Creek to mouth of Flat Creek
 400 - mouth of Flat Creek to mouth of Butte Creek
 500 - mouth of Butte Creek to mouth of Caribou Creek

^{2/} Includes 4 chums enumerated above Caribou Creek.

Figure 10. Numbers and distribution of king salmon spawning redds, Salcha River, 1974.

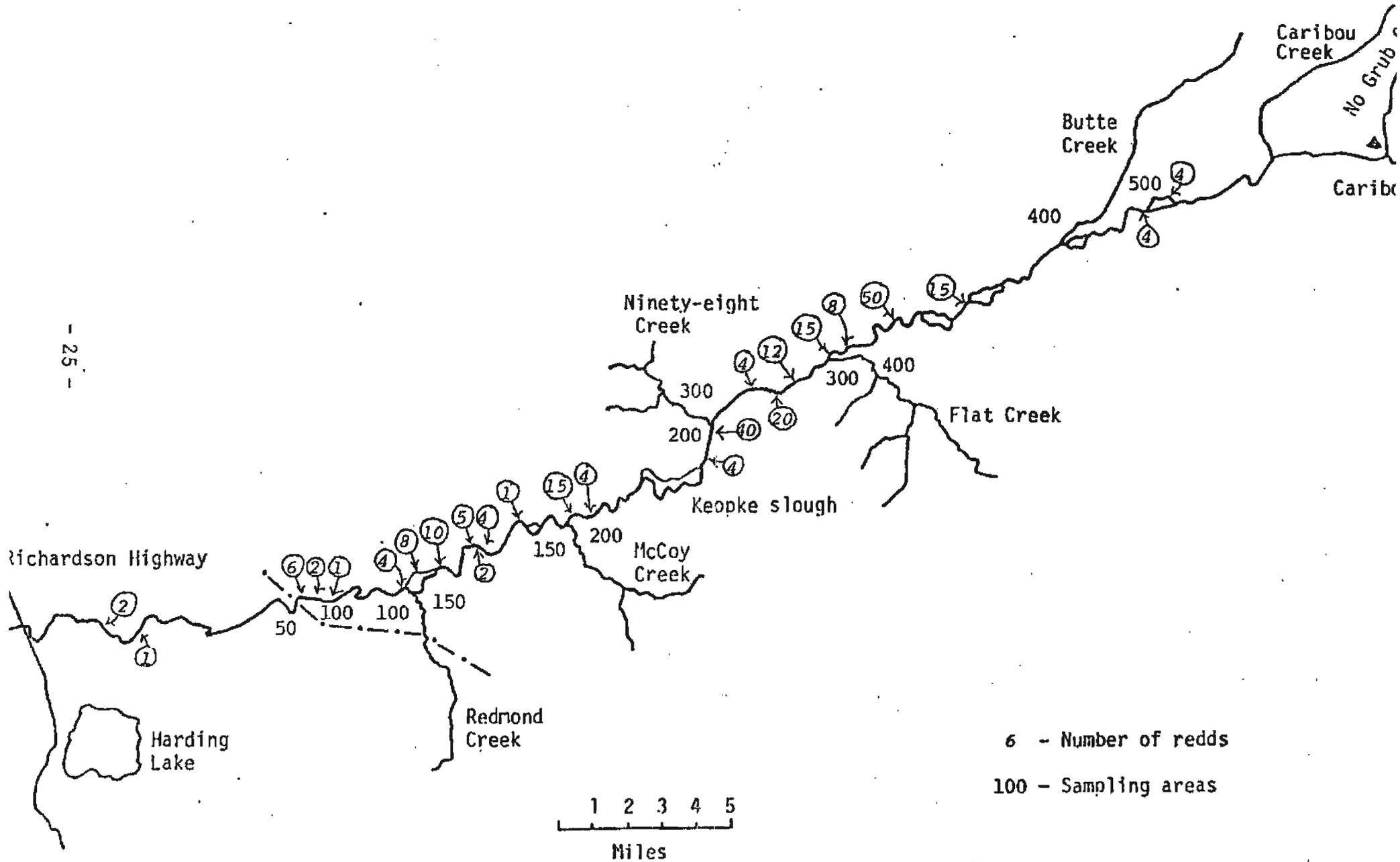


Figure 11. Numbers and distribution of spawning chum salmon, Saicha River, 1974.

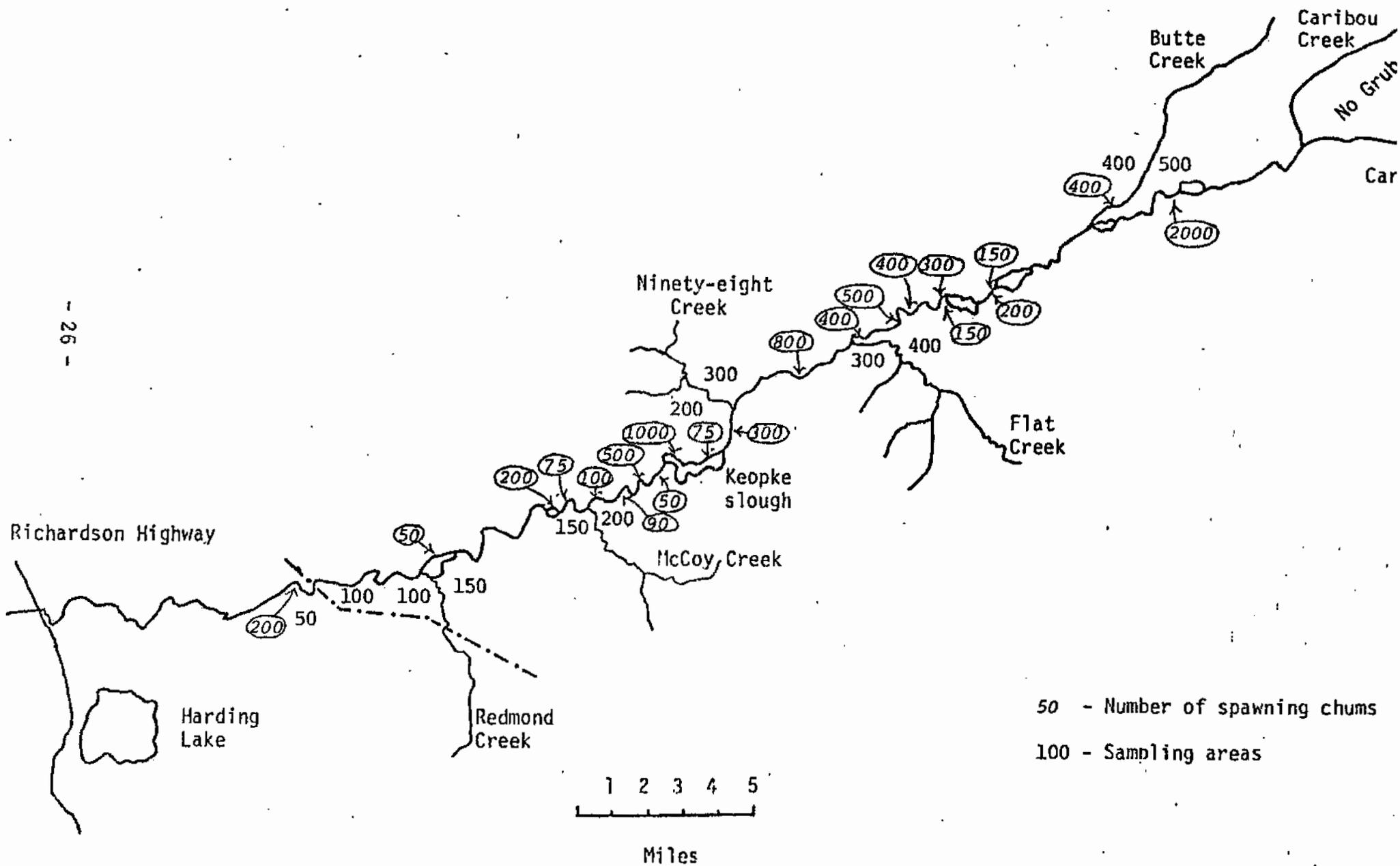


Table 9. Age, sex, and size composition of king salmon carcass sample, Salcha River, 1974.

| | Age Class | | | | | Total |
|--------------------------------|----------------|----------------|----------------|----------------|----------------|-------|
| | 3 ₂ | 4 ₂ | 5 ₂ | 6 ₂ | 7 ₂ | |
| Males | | | | | | |
| Number | 2 | 91 | 21 | 39 | 4 | 157 |
| Percent | 1.0 | 44.0 | 10.0 | 18.0 | 2.0 | 75.0 |
| Mean length (mm) ^{1/} | 370 | 570 | 690 | 880 | 940 | 760 |
| Females | | | | | | |
| Number | - | - | 3 | 47 | 1 | 51 |
| Percent | - | - | 1.0 | 23.0 | 1.0 | 25.0 |
| Mean length (mm) | - | - | 840 | 870 | 880 | 870 |
| Combined | | | | | | |
| Number | 2 | 91 | 24 | 86 | 5 | 208 |
| Percent | 1.0 | 44.0 | 11.0 | 41.0 | 3.0 | 100.0 |
| Mean length (mm) | 370 | 570 | 710 | 870 | 930 | 780 |

^{1/} All lengths from mid-eye to fork of tail.

Table 10. Post-spawning condition of king salmon carcasses, Salcha River, 1974.

| Sex | Spawning out | Partially spent | Did not spawn | Total | Average no. of eggs retained per female |
|---------|--------------|-----------------|---------------|------------|---|
| Males | 87 (62%) | 29 (20%) | 26 (18%) | 142 (100%) | - |
| Females | 28 (70%) | 12 (30%) | - - | 40 (100%) | 26 |
| Totals | 115 (63%) | 41 (23%) | 26 (14%) | 182 (100%) | - |

Table 11. Comparative sex composition of king salmon carcass sample by 3-day period, Salcha River, 1974^{1/}.

| Date | Males | | Females | |
|-------------|-------|---------|---------|---------|
| | No. | Percent | No. | Percent |
| 8/8 - 8/10 | 86 | 48 | 26 | 48 |
| 8/11 - 8/13 | 63 | 36 | 20 | 37 |
| 8/14 - 8/16 | 21 | 12 | 3 | 6 |
| 8/17 - 8/18 | 8 | 4 | 5 | 9 |
| Total | 178 | 100 | 54 | 100 |

^{1/} Survey started several days after post-spawning dieoff began.

Table 12. Age, sex and size composition of summer chum salmon carcass sample, Salcha River, 1974.

| | Age Class | | | | Totals |
|-----------------------------------|----------------|----------------|----------------|----------------|--------|
| | 3 ₁ | 4 ₁ | 5 ₁ | 6 ₁ | |
| Males | | | | | |
| Number | 18 | 171 | 32 | 2 | 223 |
| Percent | 4.0 | 35.6 | 7.0 | 0.4 | 47 |
| Mean Length (mm) ^{1/} | 560 | 580 | 590 | 630 | 580 |
| Females | | | | | |
| Number | 18 | 203 | 35 | 1 | 257 |
| Percent | 4.0 | 41.8 | 7.0 | 0.2 | 53 |
| Mean Length (mm) | 540 | 550 | 570 | 610 | 550 |
| Combined | | | | | |
| Number | 36 | 374 | 67 | 3 | 480 |
| Percent | 8.0 | 77.4 | 14.0 | 0.6 | 100 |
| Mean Length (mm) | 550 | 560 | 580 | 620 | 560 |

^{1/} All lengths from mid-eye to fork of tail.

partially or completely spent (Table 13). An average of 117 eggs was retained per female. Male chums predominated in the carcass surveys from August 8-13 and females from August 14-18 (Table 14).

Stream flows and water chemistry for six major tributaries and the main Salcha River are presented in Appendix Table 10.

A March 15 aerial survey was made to locate open water areas which are indicative of the presence of ground water. The only ice free areas were observed at Keopke Slough and at the mouth of Butte Creek (Figure 10).

Discussion

The July 29 king salmon aerial survey estimate is the third highest count on record for this river (Appendix Table 2). The chum aerial count, made before the peak of spawning, was quite low. The boat survey estimate of 8,040 spawning chums is the greatest ever recorded for the Salcha (Appendix Table 3).

Aerial, boat and carcass surveys produced widely varying estimates of chum and king salmon spawning distributions in the Salcha. Carcass surveys are not a good index of spawning distribution because of the tendency of dying salmon to drift long distances before hanging up on a sandbar. Changes in water level also affect carcass distribution.

The July 29 aerial survey was probably the best indicator of king salmon spawning distribution. Boat surveys started after the peak of spawning when many spawners had already died. Aerial survey counts indicated that 11 percent of the king salmon spawners were located downstream of the main river pipeline crossing and 22 percent downstream of McCoy Creek (Figure 10). Aerial survey counts in 1973 indicated that 8 percent of the spawning kings were downstream of the main river pipeline crossing and 32 percent downstream of McCoy Creek (Trasky, 1973).

The boat surveys were the best indicator of the 1974 chum salmon distribution since the aerial surveys were flown at least 2 weeks before the peak of chum spawning. Two percent of the spawning chum salmon were observed during boat surveys downstream of the main river pipeline crossing and 6 percent downstream of McCoy Creek. In 1973 these figures were 10 percent and 20 percent for the respective locations. Approximately the same number of chums utilized the spawning areas below McCoy Creek in both years, but greater numbers of chums and hence a greater percentage of the total spawning population utilized the upriver spawning areas in 1974.

The age and sex composition of the king salmon carcass sample was unusual since it was composed of 75 percent males and 44 percent 4₂ age class

Table 13. Post-spawning condition of chum salmon carcasses, Salcha River, 1974.

| Sex | Spawned out | Partially spent | Did not spawn | Total | Average no. of eggs retained per female |
|---------|-------------|-----------------|---------------|------------|---|
| Males | 122 (50%) | 69 (28%) | 55 (22%) | 246 (100%) | - |
| Females | 236 (87%) | 23 (9%) | 10 (4%) | 269 (100%) | 117 |
| Totals | 358 (70%) | 92 (17%) | 65 (13%) | 515 (100%) | - |

Table 14. Comparative sex composition of summer chum salmon carcass sample by 3-day period, Salcha River, 1974.

| Date | Males | | Females | |
|-------------|--------|---------|---------|---------|
| | Number | Percent | Number | Percent |
| 8/8 - 8/10 | 64 | 14 | 41 | 8 |
| 8/11 - 8/13 | 229 | 51 | 240 | 47 |
| 8/14 - 8/16 | 131 | 28 | 181 | 36 |
| 8/17 - 8/18 | 32 | 7 | 49 | 9 |
| Total | 456 | 100 | 511 | 100 |

fish. The age and sex composition of the Salcha sample differed from the Emmonak commercial catch sample which was composed of only 0.5 percent 4₂ age class fish (68.5% were 6₂'s) and 54.5 percent males (Appendix Table 11). The reason for the high proportion of 4₂ Salcha River kings is not completely understood but was probably influenced by selectivity of the commercial gill net fishery for larger fish. Also the high percentage of this age group may indicate good survival or early maturity of the 1970 year class.

Carcass survey data did not show any significant difference in the rate of king salmon post-spawning dieoff by sex. The data may not be indicative of what actually happened, however, since carcasses had accumulated for several days before the surveys started. In 1972 female kings predominated in the early carcass surveys (Lebida, 1972).

The age, sex and size composition of the chum salmon carcass sample was essentially the same as the Emmonak commercial catch sample, the Anvik carcass sample, and the 1973 carcass sample (Appendix Table 12). For early carcass surveys, male chums were slightly more numerous than females. This would seem to indicate that males begin to die off sooner than the females. The data available is not conclusive since the surveys covered 73 miles and the spawning areas could not be sampled each day. To accurately assess post-spawning dieoff an index area should be established and sampled each day over the entire post-spawning dieoff.

In 1973 king salmon fry were captured with a dip net in Redmond, Flat, Ninety-Eight, and McCoy creeks. Although minnow traps were set in the aforementioned streams in 1974, the only fry catches made were in McCoy and Ninety-Eight creeks. Minnow traps may not be an effective method of determining fry distribution and abundance. The minnow trap in Butte Creek did not capture fry, but several fry were captured in the area of the trap with an electroshocker.

All of the tributary streams surveyed, with the exception of McCoy and Caribou creeks, were blocked by beaver dams within 1 mile of their confluence with the Salcha. Limited observations indicated that these dams may act as barriers to migrating fish. On Flat Creek approximately 500 chum spawners were kept from reaching upstream spawning areas by a beaver dam. Salmon fry were not observed or captured in locations upstream from these dams. Whitefish and grayling were observed moving upstream after a portion of a dam on Ninety-Eight Creek was removed.

