# YUKON RIVER TECHNICAL REPORT

prepared by

THE JOINT CANADA/UNITED STATES
YUKON RIVER TECHNICAL COMMITTEE

March 6-8, 1990

Whitehorse, Yukon

Table of Contents

## 1.0 Introduction

The chief Negotiators of the Canadian and United States delegations to the Yukon River Salmon Negotiations directed the Joint Technical Committee (JTC) to address the subject areas described in this document. The JTC met in Whitehorse on March 6 - 8, 1990. The meeting was attended by the following persons:

Canadian Department of Fisheries and Oceans
- Michael Henderson (co-chair)
- Ken Wilson
- Sandy Johnston
- George Cronkite

Yukon Territorial Government
- Mark Hoffman

Alaska Department of Fish and Game
- Ron Regnart (co-chair)
- Louis Barton
- Gene Sandone
- Larry Buklis

United States Fish and Wildlife Service
- Dick Marshall
- Rebecca Everett
- Monty Millard
- Richard Wilmot

National Marine Fisheries Service
- Aven Anderson

## 2.0 1989 Commercial Fishery - Alaska

A total of 1,441,213 salmon was commercially harvested in the Alaskan portion of the Yukon River (Figure 1) in 1989. The catch was composed of 102,280 chinook salmon, 966,614 summer chum, 286,836 fall chum and 85,483 coho salmon (Table 1). Additionally, 288,549 pounds of summer chum salmon roe and 14,749 pounds of fall chum salmon roe were harvested. The chinook salmon catch was 15% below the 1984-1988 average (Table 2). The summer chum salmon catch and roe production were 41% and 35%, respectively, greater than the recent 5-year average. The fall chum salmon harvest in the Alaska portion of the drainage was 85% greater than the 1984-1988 average. A near record coho harvest was achieved.

Yukon River fishermen in Alaska received an estimated $10.1

million for their catch, approximately 30% greater than the recent 5-year average. Nine buyer-processors operated in the Lower Yukon Area, and 16 buyer-processors and 11 registered catcher-sellers operated in the Upper Yukon Area of Alaska.

Lower Yukon fishermen received an average landed price per pound of $2.77 for chinook, $0.34 for summer chum, $0.50 for fall chum, and $0.66 for coho salmon. Upper Yukon commercial fishermen received an estimated per-pound average price of $0.83 for chinook, $0.27 for summer chum, $0.27 for fall chum, $0.35 for coho salmon, and $4.41 for salmon roe.

## 2.1 Chinook Salmon

The Yukon River delta was generally free of ice by 31 May. Chinook salmon migratory timing into the lower river appeared to be about average while summer chum salmon migratory timing was early. The first chinook salmon was reported to have been captured June 1 in St. Marys by a subsistence fisherman. The first chinook and summer chum salmon were caught in Department test fishing nets on June 5 and June 6, respectively. The chinook salmon entry was primarily through North and Middle Mouths in 1989 based on commercial and test net catches. Department test net catches of summer chum salmon increased rapidly while chinook catches increased less dramatically. The increase of chinook and summer chum salmon abundance was further documented by subsistence catch reports.

In response to early run timing and the large abundance of summer chum salmon, special restricted mesh size (six inch or smaller) fishing periods were implemented prior to the first unrestricted mesh size fishing periods in Districts 1 and 2. This allowed an earlier start of the commercial fishing season and an increased harvest of summer chum salmon than would have resulted if the fishery had been delayed until sufficient chinook were present to initiate the unrestricted mesh size fishery.

The first unrestricted mesh size fishing period was opened by emergency order after approximately 7-10 days of increasing subsistence and test net catches in the lower Yukon River. The fishery was opened on a staggered basis: 15 June in District 1, 18 June in District 2, and 21 June in District 3. A fishing schedule of two 12-hour periods per week was established.

The unrestricted mesh size fishing season in Districts 1 and 2 consisted of two 12-hour fishing periods and one 6-hour fishing period in each district. This was the least amount of fishing time directed for chinook salmon in the history of the fishery. The cumulative chinook salmon harvest for Districts 1 and 2 following the second District 2 unrestricted mesh size period was 57,600

fish. This harvest included 9,345 chinook salmon taken during special chum salmon directed fishing periods prior to the opening of the unrestricted mesh size fishing season. In addition to the catch being near 60,000 fish, analysis of comparative test fishing and sonar enumeration data indicated that the chinook salmon return was apparently a little below average in magnitude at this stage of the run. Therefore, fishing time was reduced to 6 hours during the last unrestricted mesh size fishing period in Districts 1 and 2. A total of seven additional restricted mesh size fishing periods in District 1 (12-hour periods), and six restricted mesh size fishing periods in District 2 (five 12-hour periods, and one 6-hour period) were allowed. A total of 29,203 chinook salmon was harvested during the restricted mesh size fishing periods following the chinook salmon directed fishery.

The total District 1 and 2 chinook salmon harvest was 92,378 fish, 3% above the mid-point of the guideline harvest range and 18% below the 1984-1988 average harvest.

In District 3, three 12-hour unrestricted mesh size fishing periods and three 12-hour restricted mesh size fishing periods were allowed from 21 June through 10 July. Fishing periods were established to occur simultaneously with District 2 commercial fishing periods to provide fishermen in the lower end of District 3 the convenience of selling fish to District 2 buyers. The initial delay in opening District 3 allowed the first segment of the chinook salmon return to pass through the district prior to the commercial fishery. In response to subsistence fishermen requests, the upper end of District 3 was closed 30 June to commercial fishing to allow increased subsistence fishing opportunities. A total of 1,645 chinook salmon was harvested in District 3, which was 18% below the mid-point of the guideline harvest range, and 20% below the recent five year average.

District 4 opened to commercial fishing by emergency order on 21 June on a twice weekly 48-hour fishing schedule. A total of 12 fishing periods occurred between 21 June and 1 August when the season closed by regulation. The commercial catch of 2,790 chinook salmon in District 4 was the second largest on record. Based on deliveries, the run peaked between 5 July and 14 July.

All subdistricts of District 5 opened by regulation on 23 June. Subdistricts 5A, 5B, and 5C closed by emergency order 6 July and Subdistrict 5D closed by emergency order on 14 July. Fishing was allowed during twice weekly 48-hour periods. A total of 3,286 chinook salmon were reported by commercial fishermen in District 5. In Subdistricts 5A, 5B and 5C, the total catch was 2,901 chinook salmon which exceeded the guideline harvest range of 2,400-2,800 fish. In Subdistrict 5D, the total catch was 385 chinook salmon which was within the guideline harvest range of 300-500 chinook salmon.

As in 1988, Commercial Fisheries Division staff met with fishermen to discuss management of the District 6 fishery prior to the fishing season. It was decided that the opening of the commercial season on the Tanana River would be delayed by approximately two weeks from the date allowed by regulation (20 June). The intent of this strategy was to allow the early portion of the chinook salmon run to pass through the district prior to commercial fishing, in an attempt to ensure that chinook salmon escapement objectives in the Chena and Salcha Rivers would be met and thereby eliminate the need for mid-season closures. Chinook salmon in the Tanana River commercial fishery are considered to be incidental to the more abundant and (collectively) more valuable summer chum salmon. Therefore, it was considered preferable to implement a closure early in the season before summer chum salmon became abundant. This plan was implemented by emergency order, and staggered openings of the commercial season were scheduled as follows: Subdistrict 6-A on 7 July, Subdistrict 6-B on 10 July, and Subdistrict 6-C on 14 July.

The commercial catch of 1,741 chinook salmon was allowed to exceed the guideline harvest range of 600-800 fish after escapement objectives in the Chena and Salcha Rivers were anticipated to be met.

In-season chinook salmon abundance indicators, including lower river test fishing data and sonar enumeration at Pilot Station indicated a slightly below average return. Chinook salmon spawning escapements in 1989 were variable in magnitude between spawning areas. Aerial surveys indicated that spawning escapements appeared to be near objective levels in the lower river and below escapement objectives in middle river tributaries. The majority of aerial surveys were rated fair to poor in the Alaskan portion of the drainage and many systems were not surveyed due to poor weather.

## 2.2 Summer Chum Salmon

In Districts 1 and 2, fishing periods directed toward summer chum salmon with gill nets restricted to six-inch maximum mesh size were implemented prior to the first chinook salmon directed fishing periods. These fishing periods of 12 hours duration were implemented in response to indications of an abundance of summer chum salmon while the chinook salmon return was in an early stage of development. A total of 143,978 summer chum salmon was captured in Districts 1 and 2 during these restricted mesh size fishing periods. During unrestricted mesh size fishing periods from 15 June until 25 June in Districts 1 and 2, a total of 126,360 summer chum salmon was harvested.

After the unrestricted mesh size fishing season ended, test fishing data indicated a large abundance of summer chum salmon entering the river, therefore, additional fishing periods with gill nets restricted to six-inch maximum mesh size were allowed on 24-25 June in District 1 and 27 June in District 2. Approximately 290,000 chum were harvested during a four day time span from 24 June through 27 June. The next regularly scheduled period in District 2 was not allowed in order to reassess run strength. The sonar project at Pilot Station indicated increased fish passage rates on 28 June, and a six-hour period was implemented on 29 June in District 2. After this period, the regular fishing schedule was maintained throughout the remainder of the season.

Commercial chum salmon harvests in 1988 and early in the 1989 season indicated that 12-hour fishing periods provided ample opportunity for fishermen to harvest chum and to allow buyers to handle the volume of fish during a large return. Therefore, when the twice weekly restricted mesh size fishing schedule was initiated, fishing periods were maintained at 12 hours duration. This was a 12-hour reduction in fishing time per period from prior years during this portion of the run. During these periods, an additional 612,255 summer chum salmon were harvested. The total District 1 and 2 summer chum salmon commercial harvest was 891,593 fish, 43% above the recent 5-year average. The commercial fishing season closed 15 July by regulation.

The District 3 commercial fishery allowed for three 12-hour restricted mesh size periods following three 12-hour unrestricted mesh size fishing periods. The commercial season closed 10 July as the chinook salmon harvest approached the lower end of the guideline harvest range, and summer chum salmon flesh quality deteriorated. The closure additionally provided subsistence fishermen an increased opportunity to harvest salmon. The District 3 summer chum salmon harvest was 7,578 fish, approximately double the recent 5-year average (1984-1988). The estimated passage of summer chum salmon past the Yukon Sonar project at Pilot Station was 1.6 million fish.

As in recent years, the summer chum salmon fishery in District 4 was predominantly a salmon roe fishery. Totals of 283,305 pounds of salmon roe and 18,554 summer chum salmon were commercially harvested during twelve 48-hour fishing periods. Peak catches of summer chum salmon were made during the fishing period on 9-11 July which produced approximately 45,000 pounds of salmon roe. An average roe weight of 0.9 pounds per female was calculated from data collected in 1988 and 1989. Therefore, approximately 315,000 female chum salmon were harvested. A field crew estimated that females made up 62% of the harvest, thus the total District 4 commercial related harvest was approximately 510,000 summer chum salmon. Due to roe prices, the majority of fish sold in-the-round were males.

Summer chum salmon are generally of poor quality and are not abundant in District 5. During the 1989 season, approximately 150 summer chum and 370 pounds of roe were sold incidentally during the commercial fishery for chinook salmon.

The summer chum salmon fishery in District 6 (Tanana River) occurred coincidental to the chinook salmon fishery. Between 7 July and 9 August, ten 42-hour fishing periods occurred. Totals of 42,115 summer chum salmon and 4,871 pounds of roe were sold, which were very similar to the 1984-1988 average.

## 2.3 Fall Chum and Coho Salmon

An average return of fall chum salmon was expected in 1989 based on evaluation of brood year escapements and assuming average survival. The primary contributor to the 1989 return was expected to be 4-year old fish produced by the 1985 parent year. A projection of the fall chum salmon return based on an estimate of total parent year escapements, the average maturity schedule, and expected returns per spawner indicated the Lower Yukon Area commercial catch would be near the mid-point of the pre-1986 guideline harvest range (170,000 fish).

Initially, fall chum salmon migratory timing into the lower river appeared to be early. However, by late August, it was apparent that run timing was average and of longer duration than other comparable years. Subsistence and test net catches documented a fairly sustained entry of fall chum salmon from 16 July through 27 July. After 27 July, three pulses of fall chum entered the river during 3-6 August, 13-14 August, and 17-18 August. Coho salmon migratory timing into the lower river was about average. Consistent daily test net catches of coho salmon did not begin until 3 August, with no significant entry occurring until 8 August.

The fall season commercial salmon fishery was opened by emergency order on 27 July in District 1 and 30 July in Districts 2 and 3. A fishing schedule of 12 hours duration in the coastal "Set Net Only Area" where tides affect actual fishing time, and six hours duration in the remainder of District 1, and in Districts 2 and 3, was established. Fishing time was more conservative than anticipated in the management plan due to the efficiency of the fleet and the vulnerability of fall chum salmon because of their pulse type of entry pattern. Typically, fall chum salmon enter the river in relatively short pulses during windy weather. Fishing time was increased by four hours in the "Set Net Only Area" and three hours in the remainder of the Lower Yukon Area approximately half-way through the commercial fishing season as coho salmon abundance increased.

A total harvest of 143,000 fall chums had been taken as of 16 August. Historical test fishing and sonar data indicated that usually by 17 August, over 80% of the run has passed. The District 1 period scheduled for 17-18 August was cancelled to assure that a large enough portion of the fall chum salmon run would pass through the Lower Yukon Area to adequately contribute to:

1) escapement requirements;
2) subsistence harvest requirements; and
3) provide for reasonable commercial harvests in upper Yukon districts.

This delay also provided the Department an opportunity to further evaluate run strength and for the ratio of coho salmon to fall chum salmon within the districts to increase.

After this action was taken, test fish catches of fall chum salmon increased; therefore, further commercial fishing was allowed. Eliminating a single period did result in an atypical distribution of catches between Districts 1 and 2. This was the first year in which District 2 had a larger fall chum salmon catch than District 1, although the harvest has been nearly equal in some years. Total catch was 77,876 fall chum salmon in District 1, 97,906 in District 2, and 15,332 in District 3.

The commercial fishing season closed by emergency order on 25 August in District 1 and on 27 August in Districts 2 and 3. Sonar data indicated that coho salmon passage rates were lower than all previous years (1985-1988). The Lower Yukon Area coho salmon catch was 24,670 in District 1, 38,517 in District 2, and 3,988 in District 3. The preliminary cumulative sonar fish passage estimates at Pilot Station through termination of the project on 11 September were approximately 683,000 fall chum salmon and 181,000 coho salmon.

The summer chum and chinook salmon fishery in District 4 was closed on 1 August in order to evaluate the early portion of the fall run prior to allowing any commercial removal. Based on catches from the test fish wheel near Ruby and on subsistence catches, the run was judged to be as strong or stronger than anticipated. Accordingly, the commercial fishing season was reopened on 6 August. Ten 48-hour periods were allowed prior to the season closure on 12 September. The harvest of 11,776 fall chum salmon, 3,407 pounds of roe, and 3 coho salmon was taken by 20 fishermen in Subdistricts 4-B and 4-C. There is no fall season commercial fishery in Subdistrict 4-A.

In Subdistricts 5-A, 5-B and 5-C, four 24-hour commercial fishing periods were allowed between 12 August and 10 September. Totals of 15,296 fall chum salmon, 3,596 pounds of roe, and 84 coho salmon were taken by 20 fishermen. The fall commercial fishery was

open between 5 and 10 September in Subdistrict 5-D. Four fishermen harvested 2,919 fall chum salmon and 393 pounds of roe.

In District 6, fishermen under contract operated two fish wheels (one at Manley, one at Nenana) to provide in-season relative abundance and timing data for the second consecutive year. Although the database is limited, this information was useful for managing the fishery.

The initial commercial fishing period on 1 and 2 September was 24 hours in duration. Since available data (test fish catches, subsistence catches, and preliminary aerial surveys) indicated a surplus of fall chum salmon to be available, a fishing schedule of one 42-hour period per week was implemented.

The commercial harvest was 49,090 fall chum salmon in District 6, which was 2.8 times the 1984-1988 average. A total of 7,353 pounds of roe was sold. The commercial coho salmon catch of 16,084 fish was a record harvest and was more than double the recent 5-year average. The commercial fishing season was closed prior to the regulatory closure date of 30 September due to concern for coho salmon escapements, Toklat River fall chum salmon escapement, and to provide for subsistence fishing since the majority of subsistence catches had not occurred by this date.

## 3.0 1989 Commercial Fishery - Canada

The Canadian commercial fishery harvested a total of 27,338 salmon in 1989 which was approximately 31% below the recent five year average (1984 - 88) of 39,666 fish. The catch was composed of 9,789 chinook and 17,549 chum. The chinook catch represented 85.4% of the most recent five year average of 11,467 chinook, while the chum catch represented 62.2% of the most recent five year average of 28,199 fish.

### 3.1 Chinook Salmon

The management plan adopted for the 1989 fishery was similar to the 1988. However, a more conservative approach to management was followed with a 24 hour reduction in the weekly fishing times during the chinook fishery along with a ceiling on the total commercial catch of 11,000 pieces.

The fishery opened on July 09, 1989 for two days per week after the presence of chinook had been determined by the DFO test fishwheels located just upstream of the international border. The first fish was caught in the fishwheels on July 03 1989. Additional fishing time was allowed two weeks after an increasing trend in abundance was determined. A three day moving average was used to establish this trend.

Accordingly, commencing July 23, 1989 the fishery opened for 4 days per week for the remainder of the chinook season below the Sixty Mile River. An additional day of fishing was permitted each week in the upper fishing area located from the Sixty Mile River to Tatchun Creek. Each week the fishing started at 11 AM on Sunday and extended over the specified number of days. The maximum number of active commercial fisherman during the chinook salmon run was 18 compared to 20 in 1988. In 1989 the commercial harvest was taken predominantly with gillnets set in eddies. In addition three fishwheels were used by three separate individuals. There was only one documented instance where a driftnet was used by a commercial fisherman in 1989.

The pre-season forecast was for a below average return of Canadian origin chinook. Escapement estimates for 1982 through 1984 were below optimum and would therefore be expected to result in below average returns of five, six and seven year old chinook in 1989.

The total commercial chinook catch was 9,789 fish with approximately 9,400 of the catch occurring in the lower fishing area. The most recent five year average commercial catch is 11,467 chinook while the record catch of 13,217 occurred in 1988. Preliminary tag recovery information suggested a 1989 Canadian commercial harvest rate of approximately 23% on chinook salmon compared to 30% in 1988.

Overall, the chinook run timing appeared about average with a stronger early component. The peak catch of 2,964 occurred during the week of July 30 to August 6. On average the strong part of the run occurs during the last week of July and the first week of August.

Effort was quite consistent throughout the fishery this year with a maximum of 18 fisherman during the main two weeks of the fishery.

### 3.2 Fall Chum

The pre-season forecast for Canadian-origin upper Yukon chum salmon was for a substantially below average return. The average chum return in 1985 to the Porcupine system was expected to generate an above average return in 1989.

In light of the below average expected return and concern for upriver escapement, the fishery was reduced to three days a week below the Sixty Mile River for the first two weeks of the chum season (weeks commencing August 20 and 27). Thereafter, the fishery was managed on a four day per week opening. In addition, a catch

ceiling of 30,000 chum was in effect for the entire commercial chum season. The chum fishery above the Sixty Mile River was open an extra 24 hours on all openings.

During the second week of September, the opening time was changed to 3:00 pm at the request of the fisherman to compensate for the decreasing daylight and colder weather.

By late September it became apparent the run was below average and poorer than inseason indicators. The fishery was cut back to three days a week for the week ending October 1 and then further cut back to two days a week until October 22 when the fishery closed with heavy ice conditions.

A maximum of 14 fisherman were active in any one week for a total catch of 17,549 chum. This is the lowest catch since 1982 with the exception of 1986 when the Han plant did not operate. This catch is nearly 38% below the 1984 to 1988 five year average of 28,199 chum. Preliminary tag recovery information suggested a commercial harvest rate of 31.4% on chum salmon compared to 43.7% in 1988.

## 4.0 1989 Subsistence, Domestic, Indian Food and Sport Fisheries

### 4.1 Alaska

Subsistence "catch calendars" were mailed to each household in all Yukon River drainage communities in May 1989 for use during the 1989 fishing season. Analysis of 1989 subsistence harvest data has not yet been completed. The average subsistence salmon catch (including personal use) in the Alaska portion of the drainage from 1984-1988 was 45,430 chinook, 274,808 summer chum, 213,341 fall chum and 53,957 coho salmon for a combined total of 587,536 fish.

Personal use harvest information is not yet available. The total personal use harvest in 1988 was 2,683 chinook, 3,547 summer chum, 4,890 fall chum, and 1,308 coho salmon. The majority of the harvest was taken in Districts 5 and 6. An estimated 186 fishermen (14 Lower Yukon Area and 172 Upper Yukon Area) participated in the personal use fishery in 1988.

## 4.2 Canada

### 4.2.1 Indian Food Fishery

The food fish monitoring program initiated in 1984 was continued in 1989. Final tabulation of catches is still in progress. However, we anticipate that catches will be similar to the recent five year (1984-1988) averages of 6,935 chinook, 4,120 fall chum salmon and coho (including Old Crow Indian food fish catches).

Coho catches in Canada are generally limited to the Porcupine drainage where they are taken in the Old Crow fishery. The recent average for this fishery is approximately 500 coho. Catch data for 1989 are incomplete.

### 4.2.2 Domestic Fishery

Preliminary catch data indicate that approximately 400 chinook and 100 fall chum were harvested for domestic use by non-native fishermen in 1989.

### 4.2.1 Sport Fishery

An assessment of the 1989 sport fishery is incomplete. Preliminary data indicate that approximately 300 chinook were harvested by sport fishermen in Canadian sections of the Yukon River basin.

# 5.0 Status of Spawning Stocks

## 5.1 Chinook Salmon

### 5.1.1 Alaska

Chinook salmon spawning escapement survey counts were 1,399 for the West Fork Andreafsky River, 1,089 for the East Fork, and under poor survey conditions, 268 for the mainstem Anvik River. The East Fork Andreafsky River count was below the objective of 1,600 chinook, however, the West Fork Andreafsky River count met the objective of 1,000 chinook salmon. The Nulato River was not surveyed due to poor weather. Aerial surveys documented 1,280 and 2,333 chinook salmon in the Chena and Salcha Rivers, respectively, under fair to poor survey ratings. Chinook salmon escapement to the Chena and Salcha Rivers,were within the escapement objective range of 1,000 - 1,700 and 1,500 - 3,500 salmon, respectively.

5.1.2 Canada

In the Canadian portion of the drainage, chinook escapements in the major spawning index areas generally showed some improvement over 1988 with increases in survey counts noted in all systems except for the Tincup and Takhini rivers and Tatchun Creek. Although spawning chinook were noted in the Takhini River, an aerial count could not be obtained due to poor visibility resulting from high glacial flour load in the river. The Tincup River count was down from last year. High water levels and turbidity in the White River system may have hindered migration. The Tatchun Creek foot surveys counted 100 chinook compared to a previous five year average of 161. Extremely low water levels obstructed migration and chinook were observed holding up at the creek mouth. Counts by DFO in the Big Salmon and Nisutlin rivers where below average. Surveys were believed to be about one week late as many vacant redds were noted during the surveys. The ADF&G surveys one week earlier showed above recent average escapements for both these systems. Other index areas to include the Ross and Little Salmon rivers showed above recent average escapements and the Wolf River, although below average, still showed a significant increase over the last two years.

The Whitehorse Fishway count of 549 represents only 96.3% of the most recent five year average of 570. However the run did show some improvement over the 1988 count of 405 chinook. It should be noted that this return included 90 tagged hatchery chinook. This represents a minimum estimate of the return of hatchery fish since not all hatchery chinook are tagged.

The preliminary tagging estimate of total spawning escapement for the Canadian portion of the upper Yukon drainage was 25,417 chinook. This estimate represents an increase of roughly 39% over the most recent five year average of 18,330 but is still well below the interim escapement range of 33,000 to 43,000 chinook. Preliminary results of the DFO tagging programme are discussed in greater detail in section 7 of this report.

5.2 Summer Chum Salmon

5.2.1 Alaska

Very few aerial survey estimates of summer chum salmon spawning escapements were obtained due to poor weather. The East Fork Andreafsky River tower project was not operated in 1989 because of budget constraints. An aerial survey count of 21,460 summer chum salmon for the East Fork Andreafsky River was obtained prior to peak spawning. An escapement estimate of 636,906 summer chum salmon was obtained by sonar in the Anvik River, which was

31% greater than the escapement objective of 487,000 fish. High, turbid water conditions in the Chena and Salcha Rivers prohibited evaluation of summer chum salmon escapements. An estimated 1,627,000 summer chum salmon were counted past the Pilot Station sonar site from 8 June through 18 July.

## 5.3 Fall Chum Salmon

### 5.3.1 Alaska

Fall chum salmon spawning escapements in the Porcupine River drainage appeared to be good. The Sheenjek River escapement was estimated to be approximately 102,000 fall chum salmon, which was 65% above the escapement objective of 62,000 fish.

Fall chum salmon escapement in the Tanana River drainage appeared to be above average. The preliminary escapement estimate to the Upper Toklat River was 30,447 fall chum salmon, which was the largest escapement since 1979. The Delta River escapement of 20,000 fish was similar to 1985 and 1988 escapements and was 82% above the escapement objective of 11,000 fish.

Over 200 radio tags were applied to fall chum salmon captured near Fairbanks in 1989. This project was conducted in an effort to estimate the total population of fall chum salmon stocks in the upper portion of the Tanana River. Results from this study are not yet available.

### 5.3.2 Canada

Chum aerial surveys were conducted on the mainstem Yukon, Kluane, Koidern, Teslin and Fishing Branch rivers in 1989. Foot surveys were conducted on the Kluane and mainstem Yukon rivers and on Tatchun Creek. Surveys conducted on the Kluane River showed a record low escapement and the mainstem Yukon, although below average, was up from 1988. There have been two particularly poor years for the mainstem Yukon in the last 7 years: 1988 and 1986. Historically, survey counts for the Kluane stocks were generally higher than those for the Minto area stocks. In 1989 this trend was reversed and the mainstem Yukon stock was stronger. However, both of these two major spawning areas showed extremely poor escapements in 1989. Only 40 chum were counted in the Koidern River, up from zero in 1988, but still a fraction of the counts of 1984 and 1985 of over 1100 chum. The Teslin River showed a slightly below average index count. Tatchun Creek was surveyed again this year as chum were observed in the creek in 1988. No chum were seen in the creek in 1989 as low water levels prevented entry to the creek. As with chinook, chum were observed holding at the mouth of the creek.

The Fishing Branch River escapement was greater than the most recent 4 year average as indicated by the weir count of 43,834 but was still well below the interim escapement range of 50,000 to 120,000 chum. It should be noted that this four year average (39,987) has dropped significantly from the 3 year average (45,450) due to the poor escapement in 1988. The aerial survey carried out on the Fishing Branch River estimated approximately 23% of the actual count through the weir at the time of the survey. Aerial surveys have ranged from 23% to 96% of the weir count from 1985 to 1988 with most falling in the 20 to 40% range. While these surveys provide valuable data on factors effecting the efficiency of aerial surveys in the Fishing Branch, the variation in efficiency from year to year is large. Weir counts should be continued on the Fishing Branch, since escapement estimates based on expansions of aerial counts using the data obtained to date will be substantially less reliable.

The preliminary tagging estimate of total spawning escapement for the Canadian portion of the upper Yukon drainage was approximately 35,974 chum, well below the interim escapement goal range of 90,000 to 135,000 chum. This estimate represents roughly 55% of the most recent five year average of 64,839 chum. It should be noted that this average has been declining in recent years. Preliminary results of the DFO tagging programme are discussed in greater detail in section 7 of this report.

### 5.4 Coho

Limited coho salmon escapement information is obtained annually. Escapements in the Tanana River drainage were about average.

## 6.0 Marine Harvest of Yukon River Salmon

### 6.1 High Seas Salmon Gillnet Fisheries

The Japanese have operated two high-seas gillnet fisheries for salmon in the North Pacific Ocean since at least 1952: the mothership fishery and the land-based gillnet fishery (Figure 2). Both are regulated by Japan under the International Convention for the High Seas Fisheries of the North Pacific Ocean (to which the United States and Canada are members) and under a bilateral agreement between Japan and the U.S.S.R.

Until 1988, the Japanese mothership salmon fishery operated

in parts of the United States' Exclusive Economic Zone (EEZ, waters from 3 to 200 miles off the coast of the United States). In 1988, a United States Federal court order prohibited the United States Department of Commerce from issuing a marine mammal permit to Japan, forceing the Japanese mothership fishery to stay out of the U.S. EEZ.

In 1989, the Japanese reported catches of 16,000 chinook salmon by its mothership fishery and 51,000 chinook by its landbased fishery, for a total catch of 67,000 chinook, the smallest ever recorded during the last 30 years (Table 3). The numbers of Western Alaska chinook (including those originating in Alaskan and Canadian portions of the Yukon River) have not yet been estimated yet for the landbased fishery during 1987-1989 or for the mothership fishery for 1989.

## 6.2 Foreign, Joint-venture, and U.S. Domestic Groundfish Fisheries.

With the Americanization of the groundfish fisheries in the EEZ off the coast of Alaska, the directed foreign groundfish fishery has been eliminated and the joint-venture fishery (U.S. vessels harvesting groundfish and delivering at sea to foreign processors) has been eliminated in the Gulf of Alaska and almost eliminated in the Bering Sea and outer Aleutian Islands areas. Accordingly, the number of salmon accidentally caught by these fisheries has declined tremendously from previous years (Tables 4 and 5).

A large foreign groundfish fleet continues to operate in international waters of the Bering Sea, an area known as the "Doughnut Hole," (see Figure 2). It has been speculated that the total groundfish harvest by all fisheries in this area may exceed 1,000,000 metric tons of groundfish annually for the last couple of years. Chinook salmon are known to be abundant in this area, but because there is no international fisheries agreement for this area that requires reports of catches, the numbers of salmon caught are unknown. Discussions are underway between the U.S., the U.S.S.R., Japan, Canada, and other countries to develop some controls for the groundfish fishery and prohibit the harvests of salmon.

The U.S. Domestic groundfish fishery has been rapidly expanding within the EEZ off the coast of Alaska. In 1977, the U.S. groundfish harvest off Alaska amounted to only 2,300 metric tons (mt), or a meagre 0.2% of the total groundfish catch by all nations in these areas. Since then, the U.S. harvests have doubled nearly every year to a record of 179,236 mt being reported from the Gulf of Alaska and 1,236,015 mt from the Bering Sea and Aleutian Island areas. In 1988, Federal permits for the groundfish

fisheries off Alaska totalled 312 for trawlers, 1609 for longliners, 255 for pot gear, and 85 for other gear, giving a total of 1891 permits.

Salmon may not be retained by the U.S. groundfish fishery and must be returned to the sea. Until 1990, however, there has been little information on the accidental catch of salmon by the U.S. groundfish fishery. Beginning in 1990, there will be scientific observers on most groundfish harvesting vessels, on all large at-sea groundfish processors, and at all shoreside groundfish processors. In addition, all groundfish harvesters and processors must maintain and submit logbooks on their groundfish harvests and their catch of the prohibited species, including crabs, halibut, herring, and salmon. Also, the North Pacific Fishery Management Council, which governs the groundfish fishery in the U.S. EEZ off Alaska, has been considering limits on the accidental catches of salmon, just as it has for crabs and halibut.

6.3. Foreign High-Seas Squid Fisheries.

Although the high-seas squid fisheries of Japan, Taiwan, and the Republic of Korea are frequently accused of catching large numbers of salmon, they are likely to catch few salmon destined for the Yukon River because of where they take place (Figure 3).

The Japanese high-seas driftnet fishery for neon flying squid, Ommastrephes bartrami, began in 1978, coincident with reductions in its other distant-water fisheries. In 1981, Japan regulated the times and areas for squid fishing to minimize the interceptions of salmon. The regulations were designed to restrict the squid fishery to areas of warm waters (15°C or warmer) where salmon are rarely found. Thus, the northern boundary of the squid-fishing area moves north during the year as the ocean warms and then retreats south as the ocean cools. In 1987, Japan had 478 vessels in the North Pacific squid fleet, with each vessel using up to 45 kilometres (28 miles) of gillnet each night for 4 to 7 months each year.

The Republic of Korea high-seas fishery for flying squid began in 1979. Its fishing grounds originally were located in the western North Pacific, but the fishery soon extended eastward to 165°W. About 130 ROK squid vessels operated in the squid fishery in 1987. The ROK has no time or area restrictions on this fishery but does prohibit the retention of salmonids.

The Taiwanese high-seas squid fishery began in 1980 and grew quickly to 150 vessels by 1984. In 1988, Taiwan operated 165 squid vessels. Because of concerns expressed by the United States, Taiwan adopted regulations for its squid fishery in 1985. These regulations are similar to those for the Japanese fishery,

restricting the fishery to specific areas and times and prohibiting the retention of salmonids.

With much evidence that some squid fishermen have violated the regulations, the United States has entered into negotiations with Japan, Republic of Korean, and Taiwan to ensure stricter enforcement of the regulations. Recently, agreements were reached with the Republic of Korea and Taiwan to expand observer coverage of the fleets, beef up enforcement, and place position indicators on board the squid boats. Japan has agreed to increased enforcement and observers but has not agreed to placing position indicators on their vessels.

## 6.4 Other Fisheries

### 6.4.1 Alaska Peninsula

The majority of salmon captured during June in the Unmiak and Shumagin Islands area, located on the south side of the Alaska Peninsula are bound for terminal fisheries in the northern Gulf of Alaska and the Bering sea, including the Yukon River. The stocks contributing to this fishery have been described by several tagging studies, including the 1987 study summarized in the November 1988 report of the Joint Technical Committee, and a 1983 scale pattern analysis study. Sockeye salmon is the target species in the June fishery, but relatively large incidental catches of Chum salmon are made. The sockeye salmon harvest is regulated by a quota that is annually adjusted according to the Bristol Bay sockeye salmon forecast. A 500,000 chum quota has been in effect for the past two years. A total of 1,728,400 sockeye and 435,000 chum salmon was taken in the June 1989 fishery.

The Alaska Board of Fisheries adopted the following new regulations which will become effective during the 1990 fishing season:

1. the chum salmon quota was increased to 600,000 fish:

2. the June season opening was delayed one week; and

3. maximum depth restrictions were placed on gill nets (90 meshes) and purse seine (375 meshes of which 350 may be a maximum of 3.5 inch mesh and 25 meshes may be of chafing gear of 9 inch maximum mesh).

These regulations changes are intended to allow full utilization of sockeye salmon without appreciably affecting the incidental harvest of chum salmon. The delay in the season opening avoids a period when chum salmon are abundant. The intent of fishing gear depth restrictions is to limit the harvest of chum

salmon which are thought to migrate at greater water depths than sockeye salmon.

## 7.0 1989 Project Summaries

### 7.1 Alaska

All ADF&G harvest monitoring and apportionment projects, run abundance projects, and spwning escapement studies described in the 1988 JTC report were continued in 1989 with the exception of the Andreafsky River tower salmon escapement project. Operational methods of all projects remained basically the same as described in the 1988 JTC report. Results from these projects are either located within the text of the Alaskan protion of this report, or are reported in the attatched tables, figures, or appendicies with the exception of the Yukon Sonar project results.

As in previous years, hydroacoustic counters were operated by ADF&G on the mainstem Yukon River near the Pilot Station from June 4 through September 11, 1989. Preliminary 1989 counts were 75,938 chinook, 1,627,932 summerchum, 638,181 fall chum, and 181,452 coho salmon. Annual counts since 1985 are listed below:

| Year | Dates of Operation | Chinook | Summer Chum | Fall Chum | Coho | Pink[a] |
|---|---|---|---|---|---|---|
| 1985 | 6/22-8/26 | 49,383 | 2,309,430 | 328,452 | 85,441 | |
| 1986 | 6/09-9/12 | 86,451 | 1,926,034 | 526,814 | 199,797 | 1,055,746 |
| 1987 | 6/09-9/06 | 109,653 | 655,545 | 586,585 | 241,409 | |
| 1988 | 6/02-9/14 | 80,834 | 1,875,830 | 506,993 | 263,887 | 536,323 |
| 1989 | 6/04-9/11 | 75,938 | 1,627,932 | 683,181 | 181,452 | |
| Average | | 80,452 | 1,678,974 | 526,405 | 194,634 | |

[a] Counts were so low in 1985, 1987, and 1989 that they were included in the non-salmonid species apportionment.

### 7.2 Canada

#### 7.2.1 Upper Yukon Test Fishing (Yukon Territory)

Run timing and relative abundance data were collected by DFO for both chinook and chum salmon from three fishwheels located near the Canada/U.S. border. Although the primary purpose of the fishwheels was to capture salmon for the tagging programme, consistency in the site selection and fishing time since 1982 does

provide the opportunity for some inter-annual and in-season comparisons. In 1989 the DFO fishwheel catch data indicated a chinook run timing approximately one week later than average with an extended single peak generated around July 16 to July 31. Throughout the 1989 tagging season the water levels were extremely low due to a hot dry summer causing glacial fed rivers to be extremely high and rain/lake fed systems to be extremely low. It is difficult to determine the relative magnitude of the run peak but preliminary population estimates indicate a run size similar to that seen in 1988 and greater still than that seen in 1987 (see table below). The comparative weekly catches in the commercial fishery suggested a run size similar to 1988 but with a strong early component.

Escapement indices generally showed increased returns over the previous year except for the Tincup River which was below the recent average possibly due to high water levels in the White River system in general.

According to the tagging fishwheel catches, both the early and late peaks of the 1989 fall chum salmon run appeared to be earlier than in 1988, with peaks occurring around August 27 and September 12. The later component was the stronger of the two, and was believed to be comprised mainly of upper Yukon mainstem spawning fish. A larger escapement was noted during aerial surveys in the Minto area this year and the Kluane stocks were depressed considerably. In the last few years the opposite has been true. Fishing pressure on the later chum stocks was somewhat lower in 1989 and may partly account for this noted difference in escapement patterns.

Small numbers of chum were first caught in the tagging fishwheels and the commercial fishery in mid to late July as was noted in 1988 and 1987. The chum salmon present in the Canadian portion of the drainage prior to mid to late August might not be best described as "fall" chum.

Total tagging fishwheel catches and preliminary population estimates derived from tagging data indicate a chum run in 1989 which was of a smaller size than in 1988 (ie. 1988 border population estimate = 69,280, 1989 border population estimate = 55,861).

### 7.2.2 Upper Yukon Tagging Programme

DFO has conducted a salmon tagging programme on salmon stocks in the Canadian section of the drainage since 1982 (excluding 1984). The objectives of the study have been to estimate the total return of chinook and fall chum salmon to Canada (excluding the Porcupine drainage which is partially enumerated by the Fishing

Branch weir) and to obtain estimates of total escapement, harvest rates, migration rates and run timing. Spaghetti tags are applied to salmon live-captured in the test fishwheels and subsequent recoveries are made by the different user groups fishing upstream. Population estimates are derived from those tags recovered in the commercial fishery below the Stewart River. Analysis of the 1989 data is incomplete, however the preliminary chinook salmon border population estimate is 42,620 fish (95% C.I. = 37,205 to 48,807). Of this number, approximately 25,417 chinook are estimated to have reached the various spawning grounds. Population and spawning escapement estimates for all years follow for comparison:

CANADIAN CATCHES AND ESCAPEMENTS OF YUKON RIVER CHINOOK 1982-1989

| (1) | (2) | (3) | (4) | (5) | (6) CDN TOTAL | (7) | (8) | (9) | (10) BORDER | (11) SPAWN |
|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | COMM. | DOM. | IFF | SPORT | YUKON(a) | OLD CROW | TOTAL IFF(b) | TOTAL CDN(c) | ESC (d) | ESC (e) |
| 1982 | 8640 | 435 | 7433 | 300 | 16808 | 400 | 7833 | 17208 | 36598 | 19790 |
| 1983 | 13027 | 400 | 5025 | 300 | 18752 | 200 | 5225 | 18952 | 47741 | 28989 |
| 1984 | 9885 | 260 | 5850 | 300 | 16295 | 500 | 6350 | 16795 | 44471 | 28176 |
| 1985 | 12573 | 478 | 5800 | 300 | 19151 | 150 | 5950 | 19301 | 29881 | 10730 |
| 1986 | 10797 | 342 | 8625 | 300 | 20064 | 300 | 8925 | 20364 | 36479 | 16415 |
| 1987 | 10864 | 330 | 6119 | 300 | 17613 | 51 | 6170 | 17664 | 30823 | 13210 |
| 1988 | 13217 | 282 | 7178 | 650 | 21327 | 100 | 7278 | 21427 | 44445 | 23118 |
| 1989* | 9789 | 400 | 6714 | 300 | 17203 | ? | ? | 17203 | 42620 | 25417 |

(1989* - data preliminary, some numbers are estimates)

(a) = total of column (2)+(3)+(4)+(5)
(b) = total of column (4)+(7)
(c) = total of column (6)+(7)
(d) = calculated from tagging programmes, except 1984 (based on escapement index)
(e) = (10)-(6)

The preliminary population estimate (based on incomplete data) of chum salmon migrating into Canada (excluding the Porcupine) in 1989 is 55,861 fish (95% C.I. = 51,766 to 60,269). Of this number, approximately 35,974 chum are estimated to have reached the various spawning grounds. For comparison, population and spawning escapement estimates for all years are as follows:

CANADIAN CATCHES AND ESCAPEMENTS OF YUKON RIVER CHUM 1982-1989

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | COMM. | DOM. | IFF | SPORT | CDN TOTAL YUKON(a) | OLD CROW | TOTAL IFF(b) | TOTAL CDN(c) | BORDER ESC (d) | SPAWN ESC (e) |
| 1982 | 11312 | 683 | 3096 | 0 | 15091 | 1000 | 4096 | 16091 | 47049 | 31958 |
| 1983 | 25990 | 300 | 1200 | 0 | 27490 | 2000 | 3200 | 29490 | 118365 | 90875 |
| 1984 | 22932 | 535 | 1800 | 0 | 25267 | 4000 | 5800 | 29267 | 81900 | 56633 |
| 1985 | 35746 | 279 | 1740 | 0 | 37765 | 3500 | 5240 | 41265 | 99775 | 62010 |
| 1986 | 11464 | 222 | 2150 | 0 | 13836 | 700 | 2850 | 14536 | 101826 | 87990 |
| 1987 | 40591 | 132 | 3622 | 0 | 44345 | 135 | 3757 | 44480 | 125121 | 80776 |
| 1988 | 30263 | 349 | 1882 | 0 | 32494 | 1071 | 2953 | 33565 | 69280 | 36786 |
| 1989* | 17549 | 100 | 2238 | 0 | 19887 | ? | ? | 19887 | 55861 | 35974 |

(1989* - data preliminary, some numbers are estimates)

(a) = total of column (2)+(3)+(4)+(5)
(b) = total of column (4)+(7)
(c) = total of column (6)+(7)
(d) = calculated from tagging programmes, except 1984 (based on assumed harvest rates)
(e) = (10)-(6)

In 1989 the Yukon River Salmon Tagging Programme undertook to double tag chinook and chum in order to assess the loss of spaghetti tags. In addition to a spaghetti tag, all tagged chinook and chum were permanently marked by punching a small hole in the left operculum. One crew member spent two weeks sampling the commercial fishery to determine the percentage tag loss. A total of 1263 chinook were observed in the commercial catch and 62 spaghetti tags were recovered. No fish without spaghetti tags were observed with the marked operculum, and all 62 spaghetti tagged fish exhibited a clear opercular mark. In other words no marks of either type were lost. In addition a total of 549 chinook were observed in the Whitehorse Fishway and a total of 9 spaghetti tagged fish were counted with 6 tags actually recovered. These 9 spaghetti tagged chinook were the only ones exhibiting the secondary mark. Again no tags were observed to have been lost between the tagging fishwheels near the Yukon/Alaska border and the Whitehorse power dam.

Due to budget and personnel constraints it was not feasible to duplicate these efforts in observing the commercial fishery for

tag loss on chum. It is tentatively planned that this will be done during the 1990 fishing season. However, all chum that were used for electrophoretic and biological samples in 1989 were observed for the secondary mark. In these samples, all chum with a secondary mark also still had the spaghetti tag attached. The spaghetti tags used appear to be highly reliable, and tag loss appears unlikely to bias population estimates based on tag recoveries within the commercial fishery.

### 7.2.3 Whitehorse Fishway Chinook Enumeration

A total of 549 chinook salmon was enumerated at the Whitehorse Fishway in 1989. This represents 96.3% of the 1984-1988 average of 570 chinook although the return in 1989 showed some improvement over last year. A strong return of hatchery chinook was seen this year with a total of 90 clipped fish being counted (18 female adults, 27 male adults and 45 male jacks). This was the first year for the return of adult chinook from hatchery releases. Hatchery chinook accounted for at least 16.4% of the total run through the ladder. It is likely that this percentage is actually higher due to the fact that not all hatchery raised fry were tagged.

The total run consisted of 205 females and 344 males and of these, 98 females and 84 males were taken for hatchery brood stock. High water temperatures (19°C) in the fishway were believed to account for the mortality of 57 females and 2 males held for brood stock. An additional 28 females and 8 males died in the fishway as a result of high water temperatures and a partial blockage that remained undetected for approximately one week in the early part of the run. In future years the female chinook in particular will be held in the cool hatchery water immediately upon capture to avoid any high temperature problems that may occur. Due to the advanced sexual state of these fish it is hoped that the cooler water will not significantly change the rate of ripening. Some newly migrating chinook were held in the hatchery in 1989 after the high temperature mortalities began and little or no problems were noted. However, adult holding facilities at the hatchery are extremely limited.

The total numbers of chinook spawned for the hatchery were 41 females and 82 males. The most recent green egg inventory arrived at a count of 173,885 eggs which is down considerably from recent years. The average female fecundity was 5400 eggs/female.

The fishway chinook taken for the hatchery were sampled for age-size-sex data and heads were taken from adipose clipped individuals. The chinook run timing at the fishway appeared to be similar to 1988 with 50% of the run being recorded by August 13 as compared to August 15 in 1988. The first chinook appeared on July 24 which is a fairly early showing and the peak count of 36

occurred on August 12. The total potential naturally spawning population was 79 females and 252 males; this takes into account the fishway mortalities and hatchery donor stock.

### 7.2.4 Big Salmon River Chinook Weir

The Big Salmon River chinook enumeration programme was discontinued in 1989 and only aerial surveys are available for determining run strength. The run strength appeared to be above average as discussed in the aerial survey section of this report.

### 7.2.5 Fishing Branch River Fall Chum Weir

A weir to enumerate fall chum escapements to the Fishing Branch River (Porcupine drainage) was operated from 1972 to 1975. Counts during this period ranged from 16,000 to 353,000 fall chum salmon. This programme was re-established in 1985 and continued through 1989. The following table presents the weir counts since 1985 for comparative purposes:

| Year | Run Timing | Total Count | Approx. % Female |
|---|---|---|---|
| 1985 | Sep 06-Oct 20 | 56,016 | 56% |
| 1986 | Sep 01-Oct 19 | 31,378 | 54% |
| 1987 | Aug 29-Oct 18 | 48,956 | 58% |
| 1988 | Sep 05-Oct 16 | 23,597 | 58% |
| 1989 | Aug 30-Oct 17 | 43,834 | 49% |

In 1989 a total of 900 chum were live-sampled at the weir and 50 tissue samples were taken for electrophoretic analysis. In addition, 100 carcasses were sampled. Run timing showed an extended run that was strongly bimodal in nature. This bimodality has not been noted in previous years, but in 1989 it corresponded to, and was accentuated by, the high water periods during the run. The weir was closed for part of September 15 due to debris and turbid water, causing an especially low count on that day. However, had the weir been open for this time, the bimodality of the run would still have been quite apparent. High water has been experienced at some point during the run every year since 1985. For comparative purposes the peak counts occurred on September 30, 1985, September 9, 1986, September 19, 1987, September 12, 1988 and September 9 and 24, 1989. In 1989 a total of 11 coho and 6 chinook salmon was enumerated at the Fishing Branch weir during the period of the programme. Further work is required to determine the run sizes of both of these species due to their importance to the people of Old Crow.

### 7.2.6 Escapement Surveys

Salmon escapement abundance is indexed at selected spawning areas throughout the drainage primarily by aerial surveys from fixed winged aircraft (ADF&G) and helicopter (DFO). Some of the escapement information is also obtained from surveys by boat and by foot. The results of those surveys are presented in the stock status section of this report (section 5.0).

Escapement surveys were conducted on the following rivers for chinook salmon: Tincup, Nisutlin, Little Salmon, Ross, Wolf, Big Salmon, Ibex and Takhini rivers and Tatchun Creek. For chum salmon the Kluane River, mainstem Yukon, Teslin, Fishing Branch and Koidern rivers and Tatchun Creek were surveyed. Samples were collected for age-size-sex on ground surveys in Kluane and the mainstem Yukon River.

### 7.2.7 Electrophoretic Sampling

Chum electrophoretic samples were collected from the Fishing Branch, mainstem Yukon and Teslin rivers. Attempts were made to gather chum tissues from the Big Salmon and White rivers but an early cold spell and freeze-up made this impossible. These two rivers will be tentatively sampled in 1990.

## 8.0 Enhancement

### 8.1 Whitehorse Hatchery

From a total egg take of 363,229 eggs in September 1988, 271,331 fry were released in June 1989 for an egg to fry survival rate of 75%. A total of 197,923 fry were released into Michie Creek and 22,388 were released into Wolf Creek. Wolf Creek releases were not tagged but of the 197,923 released into Michie Creek, 102,199 were coded wire tagged. The remaining 51,020 fry were imprinted on the fishway water and then released below the dam in the hopes of obtaining some information in future years on differential survival of juveniles above and below the Whitehorse Dam. The 1989 egg take yielded approximately 173,885 eggs from adult chinook captured as they migrated upstream through the Whitehorse Fishway past the Whitehorse dam (av. female fecundity = 5400 eggs). A total of 182 chinook salmon including 98 females and 84 males were sacrificed for brood stock in 1989. Of this number a total of 57 females and 2 males died prematurely due to extremely high water temperatures as discussed in section 7.3 of this report. Attempts were made to use the eggs from the females that died but their viability has proven to be low.

# 9.0 1990 Run Outlook

## 9.1 Chinook Salmon

### 9.1.1 Alaska

The majority of the chinook salmon returning to the Yukon River are 6-year old fish, however, 5 and 7-year old fish make a significant contribution to the run. Spawning area escapements in the lower Yukon and Canadian portions of the drainage in the 1984 brood year (age 6 in 1990) were judged to be average to above average in magnitude as indicated by comparative escapement information. Spawning escapements in the Tanana River drainage were well below average in 1984. Survival and production of the 1984 brood year was apparently average based on preliminary findings of a normal contribution of 5-year old fish to the 1989 commercial catch. It is expected that the 1990 return of 5-year olds (1985 brood year) will be average based on near average escapements during 1985, and average numbers of 4-year old fish in the 1989 commercial catch. The return of 7-year old fish (1983 year class) is expected to be average, as the return of this year class in 1988 as 5-year-olds, and in 1989 as 6-year-olds, was average in magnitude. Overall, the 1990 chinook salmon return is anticipated to be average in strength.

### 9.1.2 Canada

The total in-river return of Canadian-origin chinook during the past five years (1984-1988) has averaged approximately 121,000 chinook (based on Canadian population estimates, in-river catch data and Alaskan scale pattern analysis). The Canadian spawning escapement for this period averaged about 18,300 which is considerably below the interim escapement goal range of 33,000 to 43,000. The majority of the return is usually composed of 6 year old chinook (64.2%) with significant contribution from 7 year olds (16.9%) and 5 year olds (14.9%).

Assuming the age composition produced from each of the principal brood years will be similar to the recent average, the major contributor to the 1990 chinook run is expected to originate from the 1984 brood year. Lesser but significant production should also stem from the 1983 and 1985 brood years. The total estimated Canadian chinook salmon spawning escapement in these years (excluding the Porcupine River) was as follows:

| Year | Estimated Spawning Escapement |
|---|---|
| 1985 | 10,730 |
| 1984 | 28,176 |
| 1983 | 28,989 |

It should be noted that there was no tagging study conducted in 1984 from which to derive a total escapement estimate. The 1984 estimate of 28,176 is based on relating the index counts in five systems in 1984 (Whitehorse Fishway, Nisutlin, Wolf, Big Salmon, Tatchun) to the average proportion this cumulative index represented compared to spawning escapements developed from the tagging programme in 1982, 1983, 1985-89. On average the five system index represents approximately 12.3% of the total escapement.

Combining the brood year escapement and average age composition data with an expected average production rate of 3 returning adults per spawner, which is used in the chinook rebuilding model, the projected total return for 1990 is roughly 76,800 chinook. If a productivity of 4:1 is used, the predicted return is approximately 102,400. Basic productivity (return/spawner) estimates from recent brood years have averaged from 4.1 (U.S. estimate: 1978-81 brood years) to 4.6 (Canadian estimate: 1978-83 brood years) returns per spawner. Both estimates of the 1990 return are below average compared to the recent five year average of 121,000 chinook.

## 9.2 Summer Chum Salmon

### 9.2.1 Alaska

Summer chum salmon return primarily as 4-year old fish, although substantial 5-year old returns often result from brood years with high survival rates. The return of 4-year old fish in 1990 will be dependent on production from the 1986 brood year and survival of the resulting cohort. Based on available catch and escapement data, the magnitude of the 1986 summer chum salmon return was judged to be above average in abundance. The return of 5-year old fish in 1990 is expected to be above average in strength based on the above average return of 4-year old fish in 1989. The Anvik River summer chum salmon stock is expected to be the primary contributor to the 1990 return. In summary, based on evaluation of brood year run size data and assuming average survival, it is expected that the Yukon River summer chum salmon return in 1990 will be above average in magnitude.

## 9.3 Fall Chum Salmon

### 9.3.1 Alaska

Similar to summer chum salmon, fall chum salmon return primarily as 4-year old fish. Escapements in 1986 (which will

produce 4-year old fish in 1990) ranged from below average in the Tanana River drainage to about average in magnitude in the Porcupine River drainage and Yukon River mainstem in Canada. The contribution of age-3 fish in the 1989 return was below average to average based on preliminary age composition data. The return of 5-year old fish (1985 brood year) is expected to be above average overall based on the strong contribution of age-4 fish to 1989 catches and the majority of stocks having above average escapements in 1985. The only poor escapement in 1985 was the Yukon River mainstem in Canada which also experienced a poor return in 1989. In summary, based on evaluation of brood year escapements and assuming average survival, an average return of fall chum salmon is expected in 1990, however, the return of the Tanana River stock is anticipated to be relatively poor.

9.3.2 Canada

The estimated escapement of Canadian origin chum stocks (excluding the Porcupine River drainage) has averaged approximately 65,000 chum over the period 1984 to 1988. This is below the interim escapement goal range of 90,000 to 135,000. On average, the run is composed primarily of four year old chum (73%), with lesser though variable proportions of three and five year olds.

During the 1984 to 1988 period, the average total fall chum run of Canadian origin is estimated to be 176,000 to 230,000 chum. Total stock sizes were estimated by: 1.) assuming that 30%-50% of the U.S. total fall chum harvest was composed of Canadian-origin stocks; 2.) assumming that the ratio [ Canadian origin upper Yukon chum : Cnadian origin Porcupine chum] in the estimated U.S. catch of Canadian chum was the same as the ratio [chum border escapement:(Fishing Branch escapement + Old Crow catch)]; and 3.) adding the chum border escapement to the estimated U.S. catch of Canadian upper Yukon chum.

It is expected that the major contributing brood year for the 1990 return will be 1986 when tagging studies indicated a total escapement of approximately 87,990 chum. Assuming a productivity of two returning adults per spawner and combining this with age composition data, and other brood year escapement data, the 1990 return is expected to approximate 163,000. If a productivity of 2.5:1 is assumed (which is used in the chum rebuilding model), a total return of 203,900 is expected. These estimates represent an average to below average return.

The return of chum salmon to Canadian portions of the Porcupine drainage should originate primarily from the 1986 brood year. The escapement through the Fishing Branch weir in 1986 was approximately 31,400 which falls below the interim escapement range of 50,000 to 120,000. The weir has been in operation since 1985 (following a ten year hiatus) and counts have averaged about 40,000

from 1985 through 1989. Assuming a productivity of two returning adults per spawner and combining this with age composition data and other brood year escapement data, the 1990 return is expected to approximate 74,900. The predicted return using a productivity of 2.5 returns per spawner is 93,700 chum.

The expected return of Canadian origin, Porcupine drainage chum of 74,900 to 93,700 represents an average return. The average total return of Porcupine chum for 1984 to 1988 is estimated to be 67,600 to 88,000 fish. Annual returns were estimated by: 1) assuming a 30% to 50% contribution of Canadian stocks to the total U.S. harvest of fall chum - this provides an estimate of the U.S. catch of Canadian origin chum; 2.) assuming the ratio [ Canadian origin upper Yukon chum : Porcupine chum] in the estimated U.S. catch is the same as the ratio [Maintsem chum border escapement: Fishing Branch escapement + Old Crow catch] (this provides an estimate of the annual U.S. catch of Canadian-origin Porcupine drainage chum stocks) and, then 3.) adding this estimated U.S. catch of Porcupine chum to the Porcupine border escapement (Fishing Branch escapement + Old Crow catch).

It should be emphasized that chum stocks in both the upper Yukon and Porcupine drainages appear to have been depressed in recent years and therefore recent averages probably do not represent healthy stocks.

## 9.4 Coho Salmon

### 9.4.1 Alaska

Coho salmon return primarily as 4-year old fish. Comprehensive escapement information for coho salmon is lacking, but escapement surveys in the Tanana River system indicated average run strength in 1986. The commercial harvest in 1990 will be dependent on the timing and frequency of fishing periods allowed for fall chum salmon.

## Tables and Figures

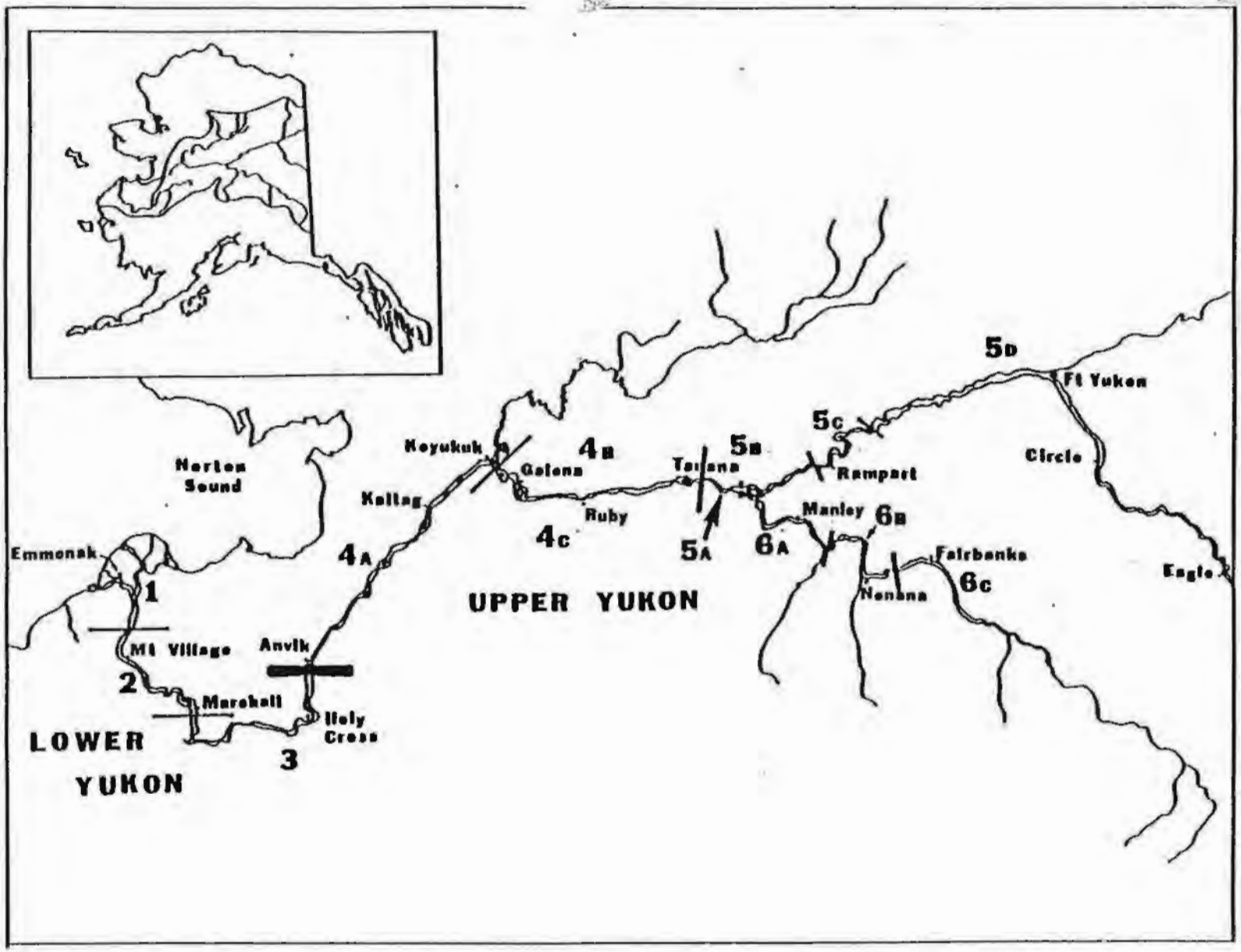
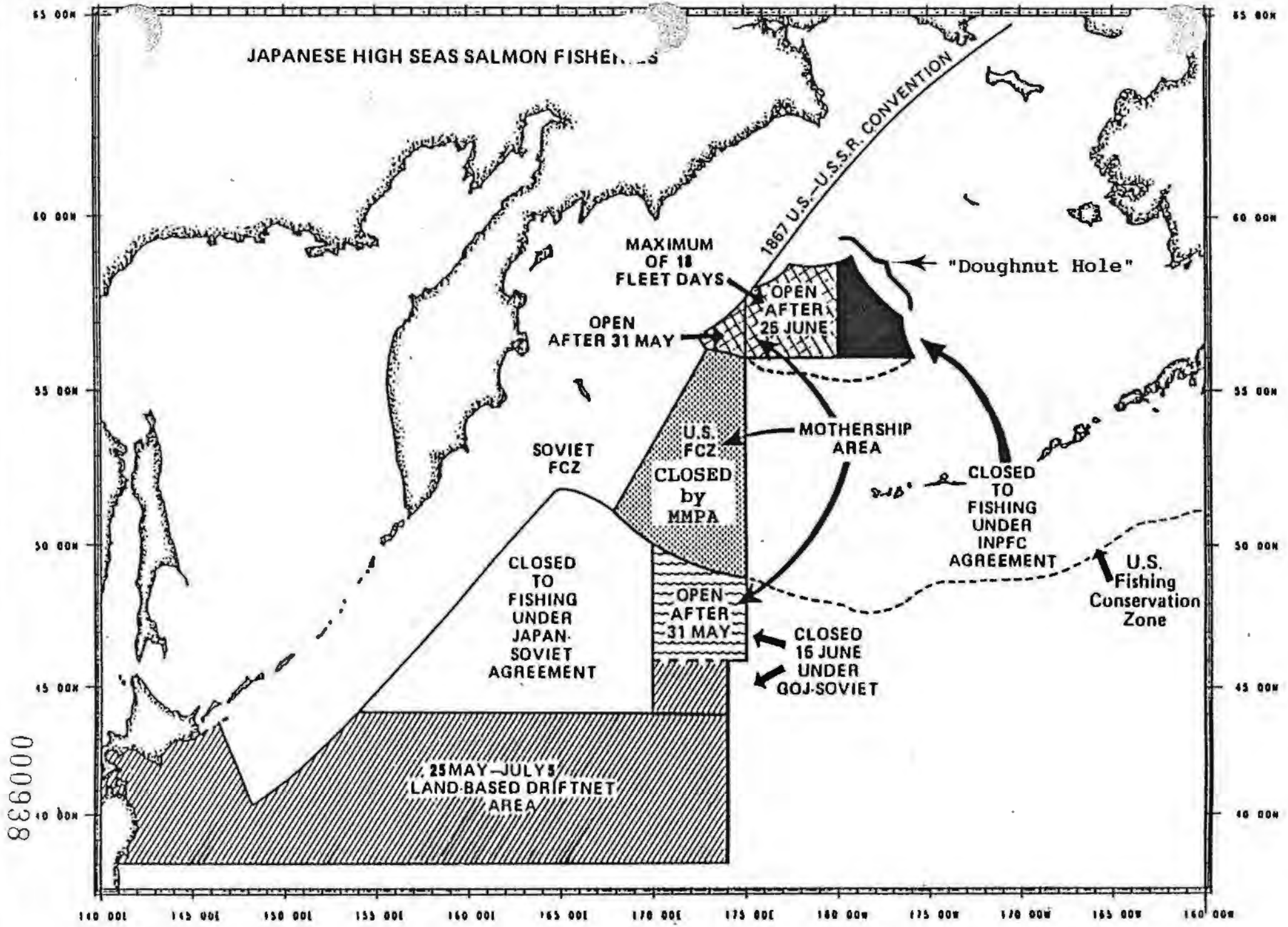



Figure 1. Map of the Alaskan portion of the Yukon River, showing fishing district boundaries.




000938

Figure 2. Time and area restrictions for the high-seas salmon fisheries of Japan as [illegible] INPFC treaty and the Japan-Soviet agreement of 1989.

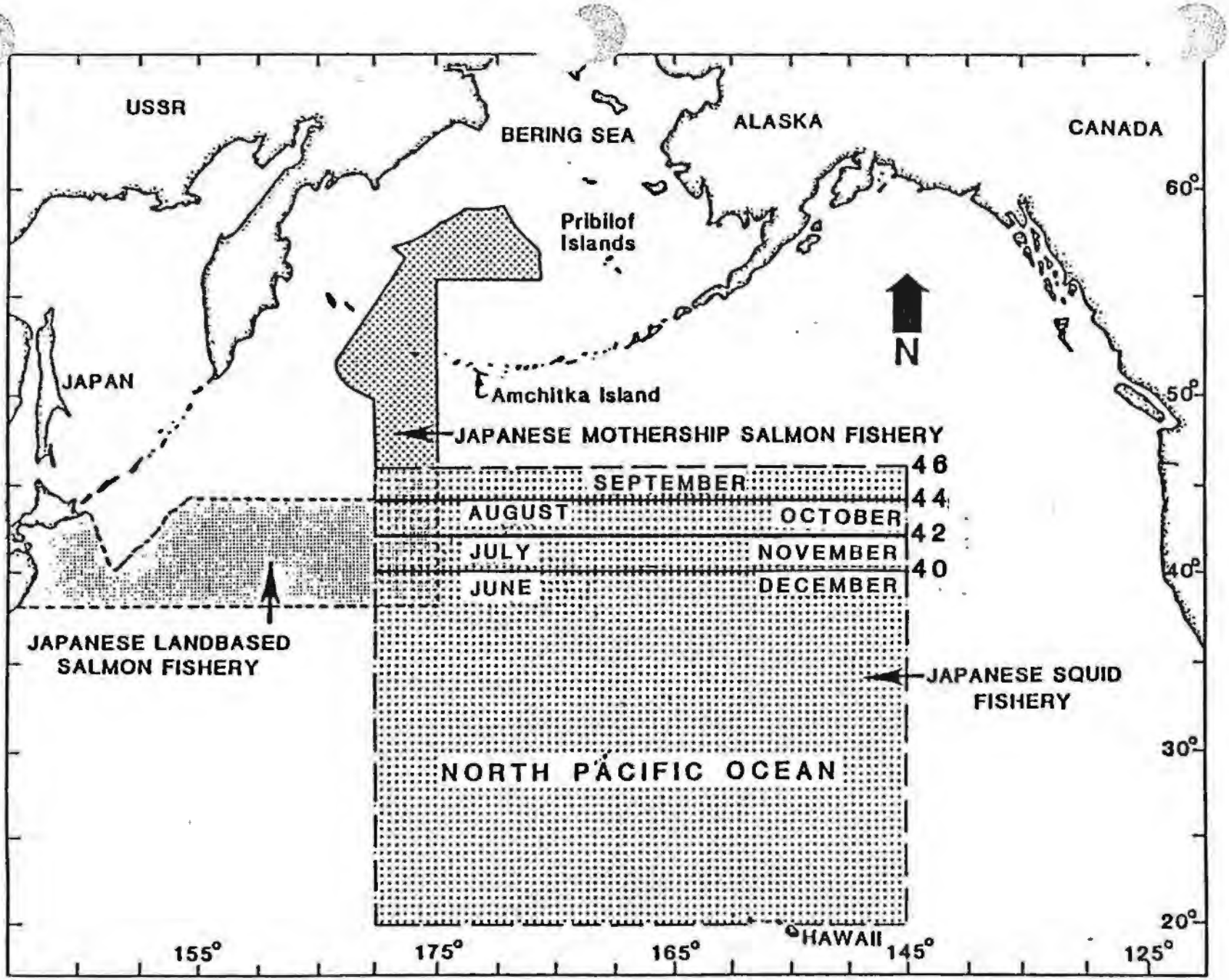





Figure 3. Location of the High-Seas Fisheries for Flying Squid. The large square shows the squid fishing area for Japan and Taiwan and how the area changes by month. The Republic of Korea squid fishery operates within this area and to the west.

Table 1. Alaskan commercial catch of Yukon River salmon in 1989.

| District Subdist. | No. of Fishermen | Chinook | Summer Chum | | Fall Chum | | | Total Salmon | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Numbers | Roe (lbs) a | Numbers | Roe (lbs) b | Coho | Numbers | Roe (lbs) |
| 1 | 445 | 59,153 | 547,631 | 0 | 77,876 | 0 | 24,672 | 709,332 | 0 |
| 2 | 243 | 33,225 | 343,962 | 0 | 97,906 | 0 | 38,522 | 513,615 | 0 |
| Subtotal | 680 | 92,378 | 891,593 | 0 | 175,782 | 0 | 63,194 | 1,222,947 | 0 |
| 3 | 16 | 1,645 | 7,578 | 0 | 15,332 | 0 | 3,988 | 28,543 | 0 |
| Total Lower Yukon | 687 | 94,023 | 899,171 | 0 | 191,114 | 0 | 67,182 | 1,251,490 | 0 |
| 4-A | 80 | 59 | 14,397 | 270,039 | 0 | 0 | 0 | 14,456 | 270,039 |
| 4-B,C | 34 | 2,731 | 4,157 | 13,266 | 11,776 | 3,407 | 3 | 18,667 | 16,673 |
| Subtotal District 4 | 99 | 2,790 | 18,554 | 283,305 c | 11,776 | 3,407 | 3 | 33,123 | 286,712 |
| 5-A,B,C | 33 | 2,901 | 113 | 373 | 15,296 | 3,596 | 84 | 18,394 | 3,969 |
| 5-D | 5 | 385 | 41 | 0 | 2,919 | 393 | 0 | 3,345 | 393 |
| Subtotal District 5 | 38 | 3,286 | 154 | 373 | 18,215 | 3,989 | 84 | 21,739 | 4,362 |
| District 6 | 32 | 1,741 | 42,115 | 4,871 | 49,090 | 7,353 | 16,084 | 109,030 | 12,224 |
| Total Upper Yukon | 169 | 7,817 | 60,823 | 288,549 | 79,081 | 14,749 | 16,171 | 163,892 | 303,298 |
| Total Yukon Area d | 856 | 102,280 | 966,614 | 288,549 | 286,836 | 14,749 | 85,483 | 1,441,213 | 303,298 |

a May include small amount of chinook salmon roe.
b Includes small amount of coho salmon roe.
c Total District 4 commercial related catch was approximately 510,000 summer chum salmon.
d Includes ADF&G test fish sales in District 6.

Table 2. Alaskan commercial sales of Yukon River salmon, 1961-1989. a,b

| Year | Chinook | Summer Chum | | Fall Chum | | Coho | Total | |
|---|---|---|---|---|---|---|---|---|
| | | Numbers | Roe | Numbers | Roe | | Numbers | Roe |
| 1961 | 119,664 | - | - | 42,461 | - | 2,855 | 164,980 | - |
| 1962 | 94,734 | - | - | 53,116 | - | 22,926 | 170,776 | - |
| 1963 | 117,048 | - | - | 0 | - | 5,572 | 122,620 | - |
| 1964 | 93,587 | - | - | 8,347 | - | 2,446 | 104,380 | - |
| 1965 | 118,098 | - | - | 23,317 | - | 350 | 141,765 | - |
| 1966 | 93,315 | - | - | 71,045 | - | 19,254 | 183,614 | - |
| 1967 | 129,656 | 10,935 | - | 38,274 | - | 11,047 | 189,912 | - |
| 1968 | 106,526 | 14,470 | - | 52,925 | - | 13,303 | 187,224 | - |
| 1969 | 91,027 | 61,966 | - | 131,310 | - | 15,093 | 299,396 | - |
| 1970 | 79,145 | 137,006 | - | 209,595 | - | 13,188 | 438,934 | - |
| 1971 | 110,507 | 100,090 | - | 189,594 | - | 12,203 | 412,394 | - |
| 1972 | 92,840 | 135,668 | - | 152,176 | - | 22,233 | 402,917 | - |
| 1973 | 75,353 | 285,509 | - | 232,090 | - | 36,641 | 629,593 | - |
| 1974 | 98,089 | 589,892 | - | 289,776 | - | 16,777 | 994,534 | - |
| 1975 | 63,838 | 710,295 | - | 275,009 | - | 2,546 | 1,051,688 | - |
| 1976 | 87,776 | 600,894 | - | 156,390 | - | 5,184 | 850,244 | - |
| 1977 | 96,757 | 534,875 | - | 257,986 | - | 38,863 | 928,481 | - |
| 1978 | 99,168 | 1,052,226 | 25,761 | 236,383 | 10,628 | 26,152 | 1,413,929 | 36,389 |
| 1979 | 127,673 | 779,316 | 40,217 | 359,946 | 18,466 | 17,165 | 1,284,100 | 58,683 |
| 1980 | 153,985 | 928,609 | 139,106 | 293,430 | 5,020 | 8,745 | 1,384,769 | 144,126 |
| 1981 | 158,018 | 1,006,938 | 189,068 | 466,451 | 11,285 | 23,680 | 1,655,087 | 200,3 |
| 1982 | 123,644 | 461,403 | 152,819 | 224,187 | 805 | 37,176 | 846,410 | 153,6 |
| 1983 | 147,910 | 744,879 | 149,999 | 302,598 | 5,064 | 13,320 | 1,208,707 | 155,06 |
| 1984 | 119,904 | 588,597 | 167,224 | 208,232 | 2,328 | 81,940 | 998,673 | 169,552 |
| 1985 | 146,188 | 516,997 | 248,625 | 267,744 | 2,525 | 57,672 | 988,601 | 251,150 |
| 1986 | 99,970 | 721,469 | 271,691 | 139,442 | 577 | 47,255 | 1,008,136 | 272,268 |
| 1987 | 134,760 | 442,238 | 121,968 | 0 | 0 | 0 | 576,998 | 121,968 |
| 1988 | 101,421 | 1,152,237 | 256,535 | 160,963 | 3,227 | 99,907 | 1,514,528 | 259,762 |
| 1989 | 102,280 | 966,614 | 288,549 | 286,836 | 14,749 | 85,483 | 1,441,213 | 303,298 |
| 5 Yr Avg 1984-88 Alaska | 120,449 | 684,308 | 213,209 | 155,276 | 1,731 | 57,355 | 1,017,387 | 214,940 |
| 5 Yr Avg 1984-88 Lower Yukon | 114,272 | 625,335 | 0 | 104,903 | 0 | 47,515 | 892,025 | 0 |
| 5 Yr Avg 1984-88 Upper Yukon | 6,177 | 58,972 | 213,209 | 50,373 | 1,731 | 9,840 | 125,362 | 214,940 |

a Catches reported in numbers of fish sold in the round and pounds of unprocessed roe.
b Includes ADF&G test fish sales.

Table 3. Total catch and estimated catch of Western Alaska (including Canadian Yukon) chinook salmon (in thousands of fish) in Japanese high seas salmon gillnet fisheries, 1964-1989[a,b]

| | Mothership | | Landbased | | Combined | |
|---|---|---|---|---|---|---|
| Year | Total Catch | W.AK Catch | Total Catch | W.AK Catch | Total Catch | W.AK Catch |
| 1964 | 410 | 179 | 208 | 40 | 618 | 219 |
| 1965 | 185 | 106 | 102 | 20 | 287 | 126 |
| 1966 | 208 | 108 | 118 | 22 | 326 | 130 |
| 1967 | 128 | 71 | 115 | 22 | 243 | 93 |
| 1968 | 362 | 244 | 97 | 18 | 459 | 262 |
| 1969 | 554 | 367 | 88 | 17 | 642 | 384 |
| 1970 | 437 | 312 | 148 | 28 | 585 | 340 |
| 1971 | 206 | 132 | 139 | 27 | 345 | 159 |
| 1972 | 261 | 189 | 107 | 20 | 368 | 209 |
| 1973 | 119 | 56 | 165 | 31 | 284 | 87 |
| 1974 | 361 | 208 | 188 | 36 | 549 | 244 |
| 1975 | 162 | 108 | 137 | 20 | 299 | 407 |
| 1976 | 285 | 117 | 201 | 42 | 486 | 159 |
| 1977 | 93 | 55 | 146 | 31 | 239 | 86 |
| 1978 | 105 | 36 | 210 | 63 | 315 | 99 |
| 1979 | 126 | 69 | 162 | 45 | 286 | 114 |
| 1980 | 704 | 416 | 160 | 22 | 864 | 438 |
| 1981 | 88 | 30 | 190 | 55 | 278 | 85 |
| 1982 | 107 | 45 | 165 | 41 | 272 | 86 |
| 1983 | 87 | 31 | 178 | 44 | 265 | 75 |
| 1984 | 82 | 36 | 92 | 21 | 174 | 57 |
| 1985 | 66 | 25 | 100 | 22 | 167 | 47 |
| 1986 | 60 | 24 | 76 | 20[c] | 137 | 44[c] |
| 1987 | 39 | 20 | 74 | NA[d] | 116 | NA[d] |
| 1988 | 26 | 23 | 47 | NA[d] | 73 | NA[d] |
| 1989 | 16 | NA[d] | 51 | NA[d] | 67 | NA[d] |

[a]Sources: 1964-83: Rogers, Donald et al., 1984. Origins of chinook salmon in the area of Japanese Mothership Fisheries. Fisheries Research Institute, University of Washington. 215 pgs. 1984-1987 Western Alaska catch estimate for mothership fishery: Mike Dahlburg, National Marine Fisheries Service, Juneau, AK. 1988-1989 data from Mike Dahlberg.

[b]Western Alaska catches represent fish from Bristol Bay, Kuskokwim, Yukon River and Norton Sound areas.

[c]From Rogers, Donald. April 1987. Interceptions of Yukon Salmon by High Seas Fisheries, Fishery Research Institute, University of Washington, 34 pp. Dahlburg, Michael T. (NMFS) reported 9/27/86 an estimate of 24,000 west AK chinook salmon intercepted by mothership fleet. The difference between these two estimates results in the estimate of 20,000 western AK chinooks intercepted in the landbased fishery for 1986.

[d]Data not available.

Table 4. Estimated incidental catches (numbers and metric tons) of salmon (*Oncorhynchus spp.*) in the foreign and joint venture groundfish fisheries in the Bering Sea and Aleutian Islands region, 1977-1989[a].

| | Foreign | | Joint Venture | | Total | |
|---|---|---|---|---|---|---|
| Year | Numbers | Tons | Numbers | Tons | Numbers | Tons |
| 1977 | 47,840 | 198 | NF[b] | NF | 47,840 | 198 |
| 1978 | 44,548 | 137 | NF | NF | 44,548 | 137 |
| 1979 | 107,706 | 340 | NF | NF | 107,706 | 340 |
| 1980 | 120,104 | 381 | 1,898 | 7 | 122,002 | 388 |
| 1981 | 42,337 | 137 | 854 | 3 | 43,191 | 140 |
| 1982 | 21,241 | 85 | 2,382 | 8 | 23,623 | 92 |
| 1983 | 18,173 | 66 | 24,493 | 54 | 42,666 | 120 |
| 1984 | 16,516 | 51 | 67,622 | 160 | 84,138 | 211 |
| 1985 | 10,003 | 33 | 10,420 | 30 | 20,423 | 63 |
| 1986 | 1,643 | 5 | 19,340 | 66 | 20,983 | 71 |
| 1987 | 3,386 | 13 | 10,848 | 41 | 13,234 | 54 |
| 1988 | NF | NF | 9,213 | N/A[c] | 9,213 | N/A |
| 1989 | NF | NF | 14,538 | N/A | 14,538 | N/A |

[a]Estimated catches for years 1977-1987 from Berger and Weikart, 1988, NOAA Tech. Memo. NMFS F/NWC-148. Data for 1988 from National Marine Fisheries Service, Alaska Region, Juneau, Alaska.

[b]NF = No fishing.

[c]N/A = Data not available.

Table 5. Estimated incidental catches (numbers and metric tons) of Pacific salmon (*Oncorhynchus spp.*) in the foreign and joint-venture groundfish fisheries in Gulf of Alaska, 1977-1989[a].

| | Foreign | | Joint Venture | | Total | |
|---|---|---|---|---|---|---|
| Year | Numbers | Tons | Numbers | Tons | Numbers | Tons |
| 1977 | 5,272 | 19 | NF[b] | NF[b] | 5,272 | 19 |
| 1978 | 45,603 | 131 | -[c] | -[c] | 45,603 | 131 |
| 1979 | 20,410 | 69 | 1,050 | 2 | 21,460 | 71 |
| 1980 | 35,901 | 107 | 168 | 1 | 36,069 | 108 |
| 1981 | 30,860 | 96 | 0 | 0 | 30,860 | 96 |
| 1982 | 5,556 | 19 | 1,411 | 3 | 6,967 | 22 |
| 1983 | 9,621 | 32 | 4,253 | 12 | 13,874 | 44 |
| 1984 | 12,001 | 36 | 63,845 | 169 | 75,846 | 205 |
| 1985 | 365 | 2 | 13,737 | 39 | 14,102 | 41 |
| 1986 | NF | NF | 20,820 | 54 | 20,820 | 54 |
| 1987 | NF | NF | 1,221 | 4 | 1,221 | 4 |
| 1988 | NF | NF | 137 | N/A[d] | 137 | N/A |
| 1989 | NF | NF | NF | NF | NF | NF |

[a]Estimates for years 1977-1988 are from Berger and Weikart, 1988, NOAA Tech. Memo. NMFS F/NWC-148. Estimates for 1988 are from the National Marine Fisheries Service, Alaska Region, Juneau, Alaska.

[b]No estimates of incidental catch were made of the limited joint-venture fishery in 1978.

[c]NF = No fishing.

[d]N/A = Data not available.

Appendix 1

Appendix Table 1. Alaskan and Canadian total utilization of Yukon River salmon, 1903-1989.[a]

| | Alaska | | | Canada | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | Chinook | Other Salmon | Total | Chinook | Other Salmon | Total | Chinook | Other Salmon | Total |
| 1903 | | | | 4,666 | | 4,666 | | | 4,666 |
| 1904 | | | | | | | | | |
| 1905 | | | | | | | | | |
| 1906 | | | | | | | | | |
| 1907 | | | | | | | | | |
| 1908 | | | | 7,000 | | 7,000 | | | 7,000 |
| 1909 | | | | 9,238 | | 9,238 | | | 9,238 |
| 1910 | | | | | | | | | |
| 1911 | | | | | | | | | |
| 1912 | | | | | | | | | |
| 1913 | | | | 12,133 | | 12,133 | | | 12,133 |
| 1914 | | | | 12,573 | | 12,573 | | | 12,573 |
| 1915 | | | | 10,466 | | 10,466 | | | 10,466 |
| 1916 | | | | 9,566 | | 9,566 | | | 9,566 |
| 1917 | | | | | | | | | |
| 1918 | 12,239 | 1,500,065 | 1,512,304 | 7,066 | | 7,066 | 19,305 | 1,500,065 | 1,519,370 |
| 1919 | 104,822 | 738,790 | 843,612 | 1,800 | | 1,800 | 106,622 | 738,790 | 845,412 |
| 1920 | 78,467 | 1,015,655 | 1,094,122 | 12,000 | | 12,000 | 90,467 | 1,015,655 | 1,106,122 |
| 1921 | 69,646 | 112,098 | 181,744 | 10,840 | | 10,840 | 80,486 | 112,098 | 192,584 |
| 1922 | 31,825 | 330,000 | 361,825 | 2,420 | | 2,420 | 34,245 | 330,000 | 364,245 |
| 1923 | 30,893 | 435,000 | 465,893 | 1,833 | | 1,833 | 32,726 | 435,000 | 467,726 |
| 1924 | 27,375 | 1,130,000 | 1,157,375 | 4,560 | | 4,560 | 31,935 | 1,130,000 | 1,161,935 |
| 1925 | 15,000 | 259,000 | 274,000 | 3,900 | | 3,900 | 18,900 | 259,000 | 277,900 |
| 1926 | 20,500 | 555,000 | 575,500 | 4,373 | | 4,373 | 24,873 | 555,000 | 579,873 |
| 1927 | | 520,000 | 520,000 | 5,366 | | 5,366 | | 520,000 | 525,366 |
| 1928 | | 670,000 | 670,000 | 5,733 | | 5,733 | | 670,000 | 675,733 |
| 1929 | | 537,000 | 537,000 | 5,226 | | 5,226 | | 537,000 | 542,226 |
| 1930 | | 633,000 | 633,000 | 3,660 | | 3,660 | | 633,000 | 636,660 |
| 1931 | 26,693 | 565,000 | 591,693 | 3,473 | | 3,473 | 30,166 | 565,000 | 595,166 |
| 1932 | 27,899 | 1,092,000 | 1,119,899 | 4,200 | | 4,200 | 32,099 | 1,092,000 | 1,124,099 |
| 1933 | 28,779 | 603,000 | 631,779 | 3,333 | | 3,333 | 32,112 | 603,000 | 635,112 |
| 1934 | 23,365 | 474,000 | 497,365 | 2,000 | | 2,000 | 25,365 | 474,000 | 499,365 |
| 1935 | 27,665 | 537,000 | 564,665 | 3,466 | | 3,466 | 31,131 | 537,000 | 568,131 |
| 1936 | 43,713 | 560,000 | 603,713 | 3,400 | | 3,400 | 47,113 | 560,000 | 607,113 |
| 1937 | 12,154 | 346,000 | 358,154 | 3,746 | | 3,746 | 15,900 | 346,000 | 361,900 |
| 1938 | 32,971 | 340,450 | 373,421 | 860 | | 860 | 33,831 | 340,450 | 374,281 |
| 1939 | 28,037 | 327,650 | 355,687 | 720 | | 720 | 28,757 | 327,650 | 356,407 |
| 1940 | 32,453 | 1,029,000 | 1,061,453 | 1,153 | | 1,153 | 33,606 | 1,029,000 | 1,062,606 |
| 1941 | 47,608 | 438,000 | 485,608 | 2,806 | | 2,806 | 50,414 | 438,000 | 488,414 |
| 1942 | 22,487 | 197,000 | 219,487 | 713 | | 713 | 23,200 | 197,000 | 220,200 |
| 1943 | 27,650 | 200,000 | 227,650 | 609 | | 609 | 28,259 | 200,000 | 228,259 |
| 1944 | 14,232 | | 14,232 | 986 | | 986 | 15,218 | | 15,218 |
| 1945 | 19,727 | | 19,727 | 1,333 | | 1,333 | 21,060 | | 21,060 |
| 1946 | 22,782 | | 22,782 | 353 | | 353 | 23,135 | | 23,135 |
| 1947 | 54,026 | | 54,026 | 120 | | 120 | 54,146 | | 54,146 |
| 1948 | 33,842 | | 33,842 | | | | 33,842 | | 33,842 |
| 1949 | 36,379 | | 36,379 | | | | 36,379 | | 36,379 |
| 1950 | 41,808 | | 41,808 | | | | 41,808 | | 41,808 |
| 1951 | 56,278 | | 56,278 | | | | 56,278 | | 56,278 |
| 1952 | 38,637 | 10,868 | 49,505 | | | | 38,637 | 10,868 | 49,505 |
| 1953 | 58,859 | 385,977 | 444,836 | | | | 58,859 | 385,977 | 444,836 |
| 1954 | 64,545 | 14,375 | 78,920 | | | | 64,545 | 14,375 | 78,920 |
| 1955 | 55,925 | | 55,925 | | | | 55,925 | | 55,925 |
| 1956 | 62,208 | 10,743 | 72,951 | | | | 62,208 | 10,743 | 72,951 |
| 1957 | 63,623 | | 63,623 | | | | 63,623 | | 63,623 |
| 1958 | 75,625 | 337,500 | 413,125 | 11,000 | 1,500 | 12,500 | 86,625 | 339,000 | 425,625 |
| 1959 | 78,370 | | 78,370 | 8,434 | 3,098 | 11,532 | 86,804 | 3,098 | 89,902 |
| 1960 | 67,597 | | 67,597 | 9,653 | 15,608 | 25,261 | 77,250 | 15,608 | 92,858 |

-continued-

Appendix Table 1. (p. 2 of 2)

| | Alaska | | | Canada | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | Chinook | Other Salmon | Total | Chinook | Other Salmon | Total | Chinook | Other Salmon | Total |
| 1961 | 141,152 | 461,597 | 602,749 | 13,246 | 9,076 | 22,322 | 154,398 | 470,673 | 625,071 |
| 1962 | 105,844 | 434,663 | 540,507 | 13,937 | 9,436 | 23,373 | 119,781 | 444,099 | 563,880 |
| 1963 | 141,910 | 429,396 | 571,306 | 10,077 | 27,696 | 37,773 | 151,987 | 457,092 | 609,079 |
| 1964 | 109,818 | 504,420 | 614,238 | 7,408 | 12,187 | 19,595 | 117,226 | 516,607 | 633,833 |
| 1965 | 134,706 | 484,587 | 619,293 | 5,380 | 11,789 | 17,169 | 140,086 | 496,376 | 636,462 |
| 1966 | 104,887 | 309,502 | 414,389 | 4,452 | 13,192 | 17,644 | 109,339 | 322,694 | 432,033 |
| 1967 | 146,104 | 352,397 | 498,501 | 5,150 | 16,961 | 22,111 | 151,254 | 369,358 | 520,612 |
| 1968 | 118,632 | 270,818 | 389,450 | 5,042 | 11,633 | 16,675 | 123,674 | 282,451 | 406,125 |
| 1969 | 105,027 | 424,399 | 529,426 | 2,624 | 7,776 | 10,400 | 107,651 | 432,175 | 539,826 |
| 1970 | 93,019 | 585,760 | 678,779 | 4,663 | 3,711 | 8,374 | 97,682 | 589,471 | 687,153 |
| 1971 | 136,191 | 547,448 | 683,639 | 6,447 | 16,911 | 23,358 | 142,638 | 564,359 | 706,997 |
| 1972 | 113,098 | 461,617 | 574,715 | 5,729 | 7,532 | 13,261 | 118,827 | 469,149 | 587,976 |
| 1973 | 99,670 | 779,158 | 878,828 | 4,522 | 10,135 | 14,657 | 104,192 | 789,293 | 893,485 |
| 1974 | 118,053 | 1,229,678 | 1,347,731 | 5,631 | 11,646 | 17,277 | 123,684 | 1,241,324 | 1,365,008 |
| 1975 | 76,883 | 1,307,037 | 1,383,920 | 6,000 | 20,600 | 26,600 | 82,883 | 1,327,637 | 1,410,520 |
| 1976 | 105,582 | 1,026,908 | 1,132,490 | 5,025 | 5,200 | 10,225 | 110,607 | 1,032,108 | 1,142,715 |
| 1977 | 114,338 | 1,090,330 | 1,204,668 | 7,527 | 12,479 | 20,006 | 121,865 | 1,102,809 | 1,224,674 |
| 1978 | 129,465 | 1,631,479 | 1,760,944 | 5,881 | 9,566 | 15,447 | 135,346 | 1,641,045 | 1,776,391 |
| 1979 | 158,678 | 1,631,072 | 1,789,750 | 10,375 | 22,084 | 32,459 | 169,053 | 1,653,156 | 1,822,209 |
| 1980 | 196,709 | 1,783,274 | 1,979,983 | 22,546 | 22,218 | 44,764 | 219,255 | 1,805,492 | 2,024,747 |
| 1981 | 187,708 | 2,097,214 | 2,284,922 | 17,809 | 22,281 | 40,090 | 205,517 | 2,119,495 | 2,325,012 |
| 1982 | 151,802 | 1,269,392 | 1,421,194 | 17,208 | 16,091 | 33,299 | 169,010 | 1,285,483 | 1,454,493 |
| 1983 | 197,388 | 1,677,390 | 1,874,778 | 18,952 | 29,490 | 48,442 | 216,340 | 1,706,880 | 1,923,220 |
| 1984 | 162,332 | 1,554,314 | 1,716,646 | 16,795 | 29,267 | 46,062 | 179,127 | 1,583,581 | 1,762,708 |
| 1985 | 185,959 | 1,655,909 | 1,841,868 | 19,301 | 41,265 | 60,566 | 205,260 | 1,697,174 | 1,902,434 |
| 1986 | 145,208 | 1,756,395 | 1,901,603 | 20,364 | 14,536 | 34,900 | 165,572 | 1,770,931 | 1,936,503 |
| 1987[b] | 187,884 | 1,244,038 | 1,431,922 | 17,664 | 44,480 | 62,144 | 205,548 | 1,288,518 | 1,494,066 |
| 1988 | 148,011 | 2,312,894 | 2,460,905 | 21,427 | 33,565 | 54,992 | 169,438 | 2,346,459 | 2,515,897 |
| 1989[c] | 147,710[d] | 2,221,092[d] | 2,368,802 | 17,203 | 19,887 | 37,090 | 164,913 | 2,240,979 | 2,405,892 |

[a]Commercial and subsistence harvest combined in numbers of fish, including "equivalent fish" converted from roe sales. See ADF&G 1985 Yukon Area Annual Management Report for data sources and methods of catch estimation used for some years.
[b]Revised Alaskan catches explained in Appendix Tables 3 and 5.
[c]Preliminary.
[d]Subsistence harvest data unavailable. Most recent 5-year subsistence harvest average substituted.

Appendix Table 2. Alaskan and Canadian total utilization of Yukon River chinook and fall chum salmon, 1961-1989.[a]

| Year | Chinook | | | Fall Chum | | |
|---|---|---|---|---|---|---|
| | Canada[b] | Alaska[c] | Total | Canada[b] | Alaska[c] | Total |
| 1961 | 13,246 | 141,152 | 154,398 | 9,076 | 144,233 | 153,309 |
| 1962 | 13,937 | 105,844 | 119,781 | 9,436 | 140,401 | 149,837 |
| 1963 | 10,077 | 141,910 | 151,987 | 27,696 | 99,031[e] | 126,727 |
| 1964 | 7,408 | 109,818 | 117,226 | 12,187 | 128,707 | 140,894 |
| 1965 | 5,380 | 134,706 | 140,086 | 11,789 | 135,600 | 147,389 |
| 1966 | 4,452 | 104,887 | 109,339 | 13,192 | 122,548 | 135,740 |
| 1967 | 5,150 | 146,104 | 151,254 | 16,961 | 107,018 | 123,979 |
| 1968 | 5,042 | 118,632 | 123,674 | 11,633 | 97,552 | 109,185 |
| 1969 | 2,624 | 105,027 | 107,651 | 7,776 | 183,373 | 191,149 |
| 1970 | 4,663 | 93,019 | 97,682 | 3,711 | 265,096 | 268,807 |
| 1971 | 6,447 | 136,191 | 142,638 | 16,911 | 246,756 | 263,667 |
| 1972 | 5,729 | 113,098 | 118,827 | 7,532 | 188,178 | 195,710 |
| 1973 | 4,522 | 99,670 | 104,192 | 10,135 | 285,760 | 295,895 |
| 1974 | 5,631 | 118,053 | 123,684 | 11,646 | 383,552 | 395,198 |
| 1975 | 6,000 | 76,883 | 82,883 | 20,600 | 361,600 | 382,200 |
| 1976 | 5,025 | 105,582 | 110,607 | 5,200 | 228,717 | 233,917 |
| 1977 | 7,527 | 114,338 | 121,865 | 12,479 | 340,757 | 353,236 |
| 1978 | 5,881 | 129,465 | 135,346 | 9,566 | 331,250 | 340,816 |
| 1979 | 10,375 | 158,678 | 169,053 | 22,084 | 593,293 | 615,377 |
| 1980 | 22,546 | 196,709 | 219,255 | 22,218 | 466,087 | 488,305 |
| 1981 | 17,809 | 187,708 | 205,517 | 22,281 | 654,976 | 677,257 |
| 1982 | 17,208 | 151,802 | 169,010 | 16,091 | 357,084 | 373,175 |
| 1983 | 18,952 | 197,388 | 216,340 | 29,490 | 495,526 | 525,016 |
| 1984 | 16,795 | 162,332 | 179,127 | 29,267 | 383,055 | 412,322 |
| 1985 | 19,301 | 185,959 | 205,260 | 41,265 | 474,216 | 515,481 |
| 1986 | 20,364 | 145,208 | 165,572 | 14,536 | 303,485 | 318,021 |
| 1987 | 17,664 | 187,884[d] | 205,548 | 44,480 | 361,663[d,e] | 406,143 |
| 1988 | 21,427 | 148,011 | 169,438 | 33,565 | 320,666 | 354,231 |
| 1989[f] | 17,203 | 147,710[g] | 164,913 | 19,887 | 500,177[g] | 520,064 |
| Average | | | | | | |
| 1961-78 | 6,597 | 116,354 | 122,951 | 12,085 | 210,563 | 222,648 |
| 1979-83 | 17,378 | 178,457 | 195,835 | 22,433 | 513,393 | 535,826 |
| 1984-88 | 19,110 | 165,879 | 184,989 | 32,623 | 368,617 | 401,240 |

[a]Catch in numbers of fish, including "equivalent fish" converted from roe sales.
[b]Commercial, Indian Food, and Domestic catches combined.
[c]Commercial, subsistence, and personal-use catches combined.
[d]Revised catches explained in Appendix Tables 3 and 5.
[e]Subsistence catch only; commercial fishery did not operate.
[f]Preliminary.
[g]Subsistence harvest data unavailable. Most recent 5-year subsistence harvest average substituted.

Appendix Table 3. Alaskan catch of Yukon River chinook salmon, 1961-1989.[a]

| Year | Subsistence[b] | Commercial | Total |
|---|---|---|---|
| 1961 | 21,488 | 119,664 | 141,152 |
| 1962 | 11,110 | 94,734 | 105,844 |
| 1963 | 24,862 | 117,048 | 141,910 |
| 1964 | 16,231 | 93,587 | 109,818 |
| 1965 | 16,608 | 118,098 | 134,706 |
| 1966 | 11,572 | 93,315 | 104,887 |
| 1967 | 16,448 | 129,656 | 146,104 |
| 1968 | 12,106 | 106,526 | 118,632 |
| 1969 | 14,000 | 91,027 | 105,027 |
| 1970 | 13,874 | 79,145 | 93,019 |
| 1971 | 25,684 | 110,507 | 136,191 |
| 1972 | 20,258 | 92,840 | 113,098 |
| 1973 | 24,317 | 75,353 | 99,670 |
| 1974 | 19,964 | 98,089 | 118,053 |
| 1975 | 13,045 | 63,838 | 76,883 |
| 1976 | 17,806 | 87,776 | 105,582 |
| 1977 | 17,581 | 96,757 | 114,338 |
| 1978 | 30,297 | 99,168 | 129,465 |
| 1979 | 31,005 | 127,673 | 158,678 |
| 1980 | 42,724 | 153,985 | 196,709 |
| 1981 | 29,690 | 158,018 | 187,708 |
| 1982 | 28,158 | 123,644 | 151,802 |
| 1983 | 49,478 | 147,910 | 197,388 |
| 1984 | 42,428 | 119,904 | 162,332 |
| 1985 | 39,771 | 146,188 | 185,959 |
| 1986 | 45,238 | 99,970 | 145,208 |
| 1987 | 53,124 | 134,760[c] | 187,884 |
| 1988 | 46,590 | 101,421 | 148,011 |
| 1989[d] | 45,430 | 102,280 | 147,710 |
| Average | | | |
| 1961-78 | 18,181 | 98,174 | 116,354 |
| 1979-83 | 36,211 | 142,246 | 178,457 |
| 1984-88 | 45,430 | 120,449 | 165,879 |

[a]Catch in numbers of fish.
[b]Includes personal-use catches.
[c]Includes 653 and 2,136 chinook salmon illegally sold in Districts 5 and 6 (Tanana River), respectively.
[d]Preliminary. Subsistence harvest data unavailable. Most recent 5-year subsistence harvest average substituted.

Appendix Table 4. Canadian catch of Yukon River chinook salmon (including Porcupine River), 1961-1989.[a]

| Year | Commercial | Non Commercial | | | | Total |
|---|---|---|---|---|---|---|
| | | Domestic | Indian Food Fish[b] | Sport[c] | Combined | |
| 1961 | 3,446 | | 9,800 | | 9,800 | 13,246 |
| 1962 | 4,037 | | 9,900 | | 9,900 | 13,937 |
| 1963 | 2,283 | | 7,794 | | 7,794 | 10,077 |
| 1964 | 3,208 | | 4,200 | | 4,200 | 7,408 |
| 1965 | 2,265 | | 3,115 | | 3,115 | 5,380 |
| 1966 | 1,942 | | 2,510 | | 2,510 | 4,452 |
| 1967 | 2,187 | | 2,963 | | 2,963 | 5,150 |
| 1968 | 2,212 | | 2,830 | | 2,830 | 5,042 |
| 1969 | 1,640 | | 984 | | 984 | 2,624 |
| 1970 | 2,611 | | 2,052 | | 2,052 | 4,663 |
| 1971 | 3,178 | | 3,269 | | 3,269 | 6,447 |
| 1972 | 1,769 | | 3,960 | | 3,960 | 5,729 |
| 1973 | 2,199 | | 2,323 | | 2,323 | 4,522 |
| 1974 | 1,808 | 406 | 3,417 | | 3,823 | 5,631 |
| 1975 | 3,000 | 400 | 2,600 | | 3,000 | 6,000 |
| 1976 | 3,500 | 500 | 1,025 | | 1,525 | 5,025 |
| 1977 | 4,720 | 531 | 2,276 | | 2,807 | 7,527 |
| 1978 | 2,975 | 421 | 2,485 | | 2,906 | 5,881 |
| 1979 | 6,175 | 1,200 | 3,000 | | 4,200 | 10,375 |
| 1980 | 9,500 | 3,500 | 9,546 | | 13,046 | 22,546 |
| 1981 | 8,593 | 237 | 8,979 | | 9,216 | 17,809 |
| 1982 | 8,640 | 435 | 7,833 | 300 | 8,568 | 17,208 |
| 1983 | 13,027 | 400 | 5,225 | 300 | 5,925 | 18,952 |
| 1984 | 9,885 | 260 | 6,350 | 300 | 6,910 | 16,795 |
| 1985 | 12,573 | 478 | 5,950 | 300 | 6,728 | 19,301 |
| 1986 | 10,797 | 342 | 8,925 | 300 | 9,567 | 20,364 |
| 1987 | 10,864 | 330 | 6,170 | 300 | 6,800 | 17,664 |
| 1988 | 13,217 | 282 | 7,278 | 650 | 8,210 | 21,427 |
| 1989[d] | 9,789 | 400 | 6,714 | 300 | 7,414 | 17,203 |
| Average | | | | | | |
| 1961-78 | 2,721 | 452 | 3,750 | | 3,876 | 6,597 |
| 1979-83 | 9,187 | 1,154 | 6,917 | | 8,191 | 17,378 |
| 1984-88 | 11,467 | 338 | 6,935 | 370 | 7,643 | 19,110 |

[a]Catch in numbers of fish.
[b]Includes mainstem Yukon River and Porcupine (Old Crow) Indian food fish harvest data.
[c]Sport fish harvest unknown prior to 1982.
[d]Preliminary. Does not include Old Crow Indian food fish harvest data.

ɔendix Table 5. Alaska catch of Yukon River chum salmon, 1961-1989.[a,b]

| Year | Summer Chum | | | Fall Chum | | | Total Chum | | |
|---|---|---|---|---|---|---|---|---|---|
| | Subsistence[c] | Commercial | Total | Subsistence[c,d] | Commercial | Total | Subsistence[c,d] | Commercial | Total |
| 1961 | 305,317 | | 305,317 | 101,772 | 42,461 | 144,233 | 407,089 | 42,461 | 449,550 |
| 1962 | 261,856 | | 261,856 | 87,285 | 53,116 | 140,401 | 349,141 | 53,116 | 402,257 |
| 1963 | 297,094 | | 297,094 | 99,031 | 0 | 99,031 | 396,125 | 0 | 396,125 |
| 1964 | 361,080 | | 361,080 | 120,360 | 8,347 | 128,707 | 481,440 | 8,347 | 489,787 |
| 1965 | 336,848 | | 336,848 | 112,283 | 23,317 | 135,600 | 449,131 | 23,317 | 472,448 |
| 1966 | 154,508 | | 154,508 | 51,503 | 71,045 | 122,548 | 206,011 | 71,045 | 277,056 |
| 1967 | 206,233 | 10,935 | 217,168 | 68,744 | 38,274 | 107,018 | 274,977 | 49,209 | 324,186 |
| 1968 | 133,880 | 14,470 | 148,350 | 44,627 | 52,925 | 97,552 | 178,507 | 67,395 | 245,902 |
| 1969 | 156,191 | 61,966 | 218,157 | 52,063 | 131,310 | 183,373 | 208,254 | 193,276 | 401,530 |
| 1970 | 166,504 | 137,006 | 303,510 | 55,501 | 209,595 | 265,096 | 222,005 | 346,601 | 568,606 |
| 1971 | 171,487 | 100,090 | 271,577 | 57,162 | 189,594 | 246,756 | 228,649 | 289,684 | 518,333 |
| 1972 | 108,006 | 135,668 | 243,674 | 36,002 | 152,176 | 188,178 | 144,008 | 287,844 | 431,852 |
| 1973 | 161,012 | 285,509 | 446,521 | 53,670 | 232,090 | 285,760 | 214,682 | 517,599 | 732,281 |
| 1974 | 227,811 | 589,892 | 817,703 | 93,776 | 289,776 | 383,552 | 321,587 | 879,668 | 1,201,255 |
| 1975 | 211,888 | 710,295 | 922,183 | 86,591 | 275,009 | 361,600 | 298,479 | 985,304 | 1,283,783 |
| 1976 | 186,872 | 600,894 | 787,766 | 72,327 | 156,390 | 228,717 | 259,199 | 757,284 | 1,016,483 |
| 1977 | 159,502 | 534,875 | 694,377 | 82,771 | 257,986 | 340,757 | 242,273 | 792,861 | 1,035,134 |
| 1978 | 197,144 | 1,069,146 | 1,266,290 | 94,867 | 247,011 | 331,250 | 292,011 | 1,316,157 | 1,608,168 |
| 1979 | 196,187 | 814,633 | 1,010,820 | 233,347 | 378,412 | 593,293 | 429,534 | 1,193,045 | 1,622,579 |
| 1980 | 272,398 | 1,015,886 | 1,288,284 | 172,657 | 298,450 | 466,087 | 445,055 | 1,314,336 | 1,759,391 |
| 1981 | 208,284 | 1,189,046 | 1,397,330 | 188,525 | 477,736 | 654,976 | 396,809 | 1,666,782 | 2,063 |
| 1982 | 260,969 | 578,269 | 839,238 | 132,897 | 224,992 | 357,084 | 393,866 | 803,261 | 1,197 |
| 1983 | 240,386 | 904,263 | 1,144,649 | 192,928 | 307,662 | 495,526 | 433,314 | 1,211,925 | 1,645 |
| 1984 | 230,747 | 809,552 | 1,040,299 | 174,823 | 210,560 | 383,035 | 405,570 | 1,020,112 | 1,425,682 |
| 1985 | 264,828 | 826,929 | 1,091,757 | 206,472 | 270,269 | 474,216 | 471,300 | 1,097,198 | 1,568,498 |
| 1986 | 290,825 | 1,080,362 | 1,371,187 | 164,043 | 140,019 | 303,485 | 454,868 | 1,220,381 | 1,675,249 |
| 1987 | 275,914 | 521,567 | 797,481 | 361,663[e] | 0 | 361,663 | 637,577 | 521,567 | 1,159,144 |
| 1988 | 311,724 | 1,511,459 | 1,823,183 | 159,703 | 164,190 | 320,666 | 471,427 | 1,675,649 | 2,147,076 |
| 1989[f] | 274,808 | 1,306,679 | 1,581,487 | 213,341 | 303,297 | 500,177 | 488,148 | 1,609,976 | 2,098,125 |
| Average | | | | | | | | | |
| 1961-78 | 211,291 | 354,229 | 447,443 | 76,130 | 135,023 | 210,563 | 287,420 | 371,176 | 658,596 |
| 1979-83 | 235,645 | 900,419 | 1,136,064 | 184,071 | 337,450 | 513,393 | 419,716 | 1,237,870 | 1,657,585 |
| 1984-88 | 274,808 | 949,974 | 1,224,781 | 213,341 | 157,008 | 368,617 | 488,148 | 1,106,981 | 1,595,130 |

[a]Commercial catch in numbers of fish, including "equivalent fish" converted from roe sales. Total fall chum catch may not equal the sum of the commercial and subsistence harvests since fish harvested for roe were reported as subsistence.

[b]Includes ADF&G test fish sales.

[c]Catches of summer and fall chum salmon estimated for 1961-1976 since catches other than chinook salmon were not differentiated by species.

[d]Minimum estimates of fall chum salmon for 1961-1978 because surveys were conducted prior to the end of the fishing season.

[e]Represents an increase of 110,369 fish from earlier reports due to illegal fish sales and under-reporting of subsistence catches as determined from illegal roe sales. District 6 (Tanana River) accounted for 87,992 of this increased harvest.

[f]Preliminary. Subsistence harvest data unavailable. Most recent 5-year subsistence harvest average substituted.

Appendix Table 6. Canadian catch of Yukon River fall chum salmon (including Porcupine River), 1961-1989.[a]

| Year | Commercial | Non Commercial | | | Total |
|---|---|---|---|---|---|
| | | Domestic | Indian Food Fish | Combined | |
| 1961 | 3,276 | | 5,800 | 5,800 | 9,076 |
| 1962 | 936 | | 8,500 | 8,500 | 9,436 |
| 1963 | 2,196 | | 25,500 | 25,500 | 27,696 |
| 1964 | 1,929 | | 10,258 | 10,258 | 12,187 |
| 1965 | 2,071 | | 9,718 | 9,718 | 11,789 |
| 1966 | 3,157 | | 10,035 | 10,035 | 13,192 |
| 1967 | 3,343 | | 13,618 | 13,618 | 16,961 |
| 1968 | 453 | | 11,180 | 11,180 | 11,633 |
| 1969 | 2,279 | | 5,497 | 5,497 | 7,776 |
| 1970 | 2,479 | | 1,232 | 1,232 | 3,711 |
| 1971 | 1,761 | | 15,150 | 15,150 | 16,911 |
| 1972 | 2,532 | | 5,000 | 5,000 | 7,532 |
| 1973 | 2,806 | | 7,329 | 7,329 | 10,135 |
| 1974 | 2,544 | 466 | 8,636 | 9,102 | 11,646 |
| 1975 | 2,500 | 4,600 | 13,500 | 18,100 | 20,600 |
| 1976 | 1,000 | 1,000 | 3,200 | 4,200 | 5,200 |
| 1977 | 3,990 | 1,499 | 6,990 | 8,489 | 12,479 |
| 1978 | 3,356 | 728 | 5,482 | 6,210 | 9,566 |
| 1979 | 9,084 | 2,000 | 11,000 | 13,000 | 22,084 |
| 1980 | 9,000 | 4,000 | 9,218 | 13,218 | 22,218 |
| 1981 | 15,260 | 1,611 | 5,410 | 7,021 | 22,281 |
| 1982 | 11,312 | 683 | 4,096 | 4,779 | 16,091 |
| 1983 | 25,990 | 300 | 3,200 | 3,500 | 29,490 |
| 1984 | 22,932 | 535 | 5,800 | 6,335 | 29,267 |
| 1985 | 35,746 | 279 | 5,240 | 5,519 | 41,265 |
| 1986 | 11,464 | 222 | 2,850 | 3,072 | 14,536 |
| 1987 | 40,591 | 132 | 3,757 | 3,889 | 44,480 |
| 1988 | 30,263 | 349 | 2,953 | 3,302 | 33,565 |
| 1989[b] | 17,549 | 100 | 2,238 | 2,338 | 19,887 |
| Average | | | | | |
| 1961-78 | 2,367 | 1,659 | 9,257 | 9,718 | 12,085 |
| 1979-83 | 14,129 | 1,719 | 6,585 | 8,304 | 22,433 |
| 1984-88 | 28,199 | 303 | 4,120 | 4,423 | 32,623 |

[a]Catch in numbers of fish.
[b]Preliminary.

Appendix Table 7. Alaskan catch of Yukon River coho salmon, 1961-1989.[a]

| Year | Subsistence[b] | Commercial | Total |
|---|---|---|---|
| 1961 | 9,192 | 2,855 | 12,047 |
| 1962 | 9,480 | 22,926 | 32,406 |
| 1963 | 27,699 | 5,572 | 33,271 |
| 1964 | 12,187 | 2,446 | 14,633 |
| 1965 | 11,789 | 350 | 12,139 |
| 1966 | 13,192 | 19,254 | 32,446 |
| 1967 | 17,164 | 11,047 | 28,211 |
| 1968 | 11,613 | 13,303 | 24,916 |
| 1969 | 7,776 | 15,093 | 22,869 |
| 1970 | 3,966 | 13,188 | 17,154 |
| 1971 | 16,912 | 12,203 | 29,115 |
| 1972 | 7,532 | 22,233 | 29,765 |
| 1973 | 10,236 | 36,641 | 46,877 |
| 1974 | 11,646 | 16,777 | 28,423 |
| 1975 | 20,708 | 2,546 | 23,254 |
| 1976 | 5,241 | 5,184 | 10,425 |
| 1977 | 16,333 | 38,863 | 55,196 |
| 1978 | 7,787 | 26,152 | 33,939 |
| 1979 | 9,794 | 17,165 | 26,959 |
| 1980 | 20,158 | 8,745 | 28,903 |
| 1981 | 21,228 | 23,680 | 44,908 |
| 1982 | 35,894 | 37,176 | 73,070 |
| 1983 | 23,895 | 13,320 | 37,215 |
| 1984 | 49,020 | 81,940 | 130,960 |
| 1985 | 32,264 | 57,672 | 89,936 |
| 1986 | 34,468 | 47,255 | 81,723 |
| 1987 | 84,894[c] | 0 | 84,894 |
| 1988 | 69,138 | 99,907 | 169,045 |
| 1989[d] | 53,957 | 85,471 | 139,428 |
| Average | | | |
| 1961-78 | 12,247 | 14,813 | 27,060 |
| 1979-83 | 22,194 | 20,017 | 42,211 |
| 1984-88 | 53,957 | 57,355 | 111,312 |

[a]Catch in numbers of fish. Includes ADF&G test fish catches.
[b]Catches estimated for 1961-1976 since catches other than chinook salmon were not differentiated by species. Catches for 1961-1978 represent minimum numbers since surveys were conducted prior to the end of the fishing season.
[c]Represents an increase of 36,272 fish from earlier reports due to illegal fish sales and under-reporting of subsistence catches as determined from illegal roe sales. District 6 (Tanana River) accounted for 31,276 of this increased harvest.
[d]Preliminary. Subsistence harvest data unavailble. Most recent 5-year subsistence harvest average substituted.

Appendix Table 8. Chinook salmon escapement counts for selected U.S. spawning stocks in the Yukon River drainage, 1961-1989[a]

| Year | Andreafsky River | | Anvik River[b] | | Nulato River | Gisasa River | Chena River | Salcha River |
|---|---|---|---|---|---|---|---|---|
| | East Fork | West Fork | Aerial | Tower | | | | |
| 1961 | 1,003 | - | 1,226 | - | 543[c] | 266 | - | 2,878 |
| 1962 | 675[c] | 762[c] | - | - | - | - | - | 937 |
| 1963 | - | - | - | - | - | - | 137[c] | - |
| 1964 | 867 | 705 | - | - | - | - | - | 450 |
| 1965 | - | 355[c] | 650[c] | - | - | - | - | 408 |
| 1966 | 361 | 303 | 638 | - | - | - | - | 800 |
| 1967 | - | 276 | 336[c] | - | - | - | - | - |
| 1968 | 380 | 383 | 310[c] | - | - | - | - | 739 |
| 1969 | 231[c] | 274[c] | 296[c] | - | - | - | - | 461[c] |
| 1970 | 665 | 574[c] | 368 | - | - | - | - | 1,882 |
| 1971 | 1,904 | 1,682 | - | - | - | - | 193[c,d] | 158[c] |
| 1972 | 798 | 582[c] | - | 1,198 | - | - | 138[c,d] | 1,193 |
| 1973 | 825 | 788 | - | 613 | - | - | 21[c] | 391 |
| 1974 | - | 285 | - | 471[c] | 78[c] | 161 | 1,035[d] | 1,857 |
| 1975 | 993 | 301 | - | 730 | 204 | 385 | 316[d] | 1,055 |
| 1976 | 818 | 643 | - | 1,154 | 648 | 332 | 531 | 1,641 |
| 1977 | 2,008 | 1,499 | - | 1,371 | 487[c] | 255 | 563 | 1,202 |
| 1978 | 2,487 | 1,062 | - | 1,324 | 920 | 45[c] | 1,726 | 3,499 |
| 1979 | 1,180 | 1,134 | - | 1,484 | 1,507 | 484 | 1,159[c] | 4,789 |
| 1980 | 958[c] | 1,500 | 1,234 | - | 1,323[c] | 951 | 2,541 | 6,757 |
| 1981 | 2,146[c] | 231[c] | 763[c] | - | 791[c] | - | 600[c] | 1,237[c] |
| 1982 | 1,274 | 851[c] | - | - | - | 421 | 2,073 | 2,534 |
| 1983 | - | - | 653[c] | - | 1,006 | 572 | 2,553 | 1,961 |
| 1984 | 1,573[c] | 1,993 | 629[c] | - | - | - | 501[c] | 1,031 |
| 1985 | 1,617 | 2,248 | 993 | - | 2,780 | 735 | 2,553 | 2,035 |
| 1986 | 1,954 | 3,158 | 1,035 | - | 2,974 | 1,346 | 2,031[c] | 3,368 |
| 1987 | 1,608[c] | 3,141 | 1,043 | - | 1,638 | 431 | 1,312[c] | 1,898 |
| 1988 | 1,020 | 1,448 | 1,486 | - | 1,775 | 797 | 1,966 | 2,761 |
| 1989 | 1,399 | 1,089 | 268[c] | - | - | - | 1,280 | 2,333 |
| E.O.[e] | 1,600 | 1,000 | - | - | 1,000 | 650 | 1,000-1,700 | 1,500-3,500 |

[a]Data obtained by aerial survey unless otherwise noted. Only peak counts are listed.
[b]Mainstem including McDonald Creek.
[c]Incomplete and/or poor survey conditions resulting in minimal or inaccurate counts.
[d]Boat Survey.
[e]Interim escapement objective.

Appendix Table 9. Chinook salmon escapement counts for selected Canadian spawning stocks in the Yukon River drainage, 1961-1989.[a]

| Year | Tincup Creek | Tatchun River[b] | Little Salmon River | Big Salmon River[d] | Nisutlin River[e] | Wolf River[f] | Whitehorse Fishway[g] | Canada Mainstem Tagging[h] |
|---|---|---|---|---|---|---|---|---|
| 1961 | - | - | - | - | - | - | 1,068 | - |
| 1962 | - | - | - | - | - | - | 1,500 | - |
| 1963 | - | - | - | - | - | - | 484 | - |
| 1964 | - | - | - | - | - | - | 587 | - |
| 1965 | - | - | - | - | - | - | 903 | - |
| 1966 | - | - | - | - | - | - | 563 | - |
| 1967 | - | - | - | - | - | - | 533 | - |
| 1968 | - | - | 173[c] | 827[c] | 407 | - | 414 | - |
| 1969 | - | - | 120 | 286[c] | 105[c] | - | 334 | - |
| 1970 | - | 100 | - | 670 | 615 | - | 625 | - |
| 1971 | - | 130 | 275 | 200[c] | 650 | - | 856 | - |
| 1972 | - | 80 | 126 | 415 | 237 | 13 | 391 | - |
| 1973 | 100 | 99 | 27[c] | 72[c] | 36[c] | - | 224 | - |
| 1974 | - | 192 | - | 70[c] | 150[c] | - | 273 | - |
| 1975 | - | 175 | - | 153[c] | 249 | 40[c] | 313 | - |
| 1976 | - | 52 | - | 86[c] | 102 | - | 121 | - |
| 1977 | - | 150 | 408 | 316[c] | 77[c] | - | 277 | - |
| 1978 | - | 200 | 330 | 524 | 375 | - | 725 | - |
| 1979 | - | 150 | 489[c] | 632 | 713 | 103[c] | 1,184 | - |
| 1980 | - | 222 | 286[c] | 1,436 | 975 | 377 | 1,383 | - |
| 1981 | - | 133 | 670 | 2,411 | 1,626 | 395 | 1,539 | - |
| 1982 | - | 73 | 403 | 758 | 578 | 104 | 473 | 19,790 |
| 1983 | 54 | 264 | 101[c] | 540 | 701 | 95 | 905 | 28,989 |
| 1984 | 125 | 161 | 434 | 1,044 | 832 | 124 | 1,042 | 28,176[k] |
| 1985 | 70[c] | 190 | 255 | 801 | 409 | 110 | 536 | 10,730 |
| 1986 | 228 | 155 | 54[c] | 745 | 459[c] | 109 | 541 | 16,415 |
| 1987 | 100 | 159 | 468 | 891 | 275 | 35 | 327 | 13,210 |
| 1988 | 204 | 130 | 368 | 765 | 267 | 66 | 405 | 23,118 |
| 1989 | 62 | 100 | 862 | 1,662 | 695 | 146 | 549 | 25,417[i] |
| E.O.[j] | | | | | | | | 33,000-43,000 |

[a]Data obtained by aerial survey unless otherwise noted. Only peak counts are listed.
[b]All foot surveys except 1978 (boat survey) and 1986 (aerial survey).
[c]Incomplete and/or poor survey conditions resulting in minimal or inaccurate counts.
[d]Big Salmon Lake to South Creek.
[e]One Hundred Mile Creek to Sidney Creek
[f]Wolf Lake to Red River.
[g]Counts include fish taken for hatchery brood stock: 31 in 1984; 95 in 1985; 104 in 1986; 120 in 1987; 134 in 1988; and 182 in 1989.
[h]Estimated total spawning escapement excluding Porcupine River (estimated border escapement minus the Canadian catch).
[i]Preliminary.
[j]Interim escapement objective.
[k]Estimate derived by dividing the 1984 5-area index count (Whitehorse Fishway, Big Salmon, Nisutlin, Wolf, Tatchun) by the average proportion of the 5-area index count to the estimated spawning escapements from the DFO tagging study for years 1982, 1983 and 1985-1989.

Appendix Table 10. Summer chum salmon escapement counts for selected spawning areas in the Yukon River drainage, 1974-1989.[a]

| Year | Andreafsky River | | | Anvik River | | | | |
|---|---|---|---|---|---|---|---|---|
| | E. Fork | | W. Fork | | | | | |
| | Aerial | Sonar or Tower | | Tower & Aerial | Sonar | Nulato | Hogatza[e] | Salcha |
| 1973 | 10,149[b] | - | 51,835 | 86,665[b] | - | - | - | |
| 1974 | 3,215[b] | - | 33,578 | 201,277 | - | 51,160 | - | 3,510 |
| 1975 | 223,485[b] | - | 235,954 | 845,485 | - | 138,495 | 22,355 | 7,573 |
| 1976 | 105,347 | - | 118,420 | 406,166 | - | 40,001[b] | 20,744 | 6,474 |
| 1977 | 112,722 | - | 63,120 | 262,854 | - | 69,660 | 10,734 | 677[b] |
| 1978 | 127,050 | - | 57,321 | 251,339 | - | 54,480 | 5,102 | 5,405 |
| 1979 | 66,471 | - | 43,391 | - | 280,537 | 37,104 | 14,221 | 3,060 |
| 1980 | 36,823[b] | - | 115,457 | - | 492,676 | 14,946[b] | 19,786 | 4,140 |
| 1981 | 81,555 | 147,312[c] | - | - | 1,479,582 | 14,348[b] | - | 8,500 |
| 1982 | 7,501[b] | 181,352[c] | 7,267[b] | - | 444,581 | - | 4,984[b] | 3,756 |
| 1983 | - | 110,608[c] | - | - | 362,912 | 21,012[b] | 28,141 | 716[b] |
| 1984 | 95,200[b] | 70,125[c] | 238,565 | - | 891,028 | - | - | 9,810 |
| 1985 | 66,146 | - | 52,750 | - | 1,080,243 | 29,838 | 22,566 | 3,178 |
| 1986 | 83,931 | 167,614[d] | 99,373 | - | 1,189,602 | 64,265 | - | 8,028 |
| 1987 | 6,687[b] | 45,221[d] | 35,535 | - | 455,876 | 11,257 | 5,669[b] | 3,657 |
| 1988 | 43,056 | 68,937[d] | 45,432 | - | 1,125,449 | 42,083 | 6,890 | 2,889[b] |
| 1989 | 21,460[b] | - | - | - | 636,906 | - | - | 1,574[b] |
| E.O.[f] | 109,000 | | 116,000 | | 487,000 | | 17,000 | 3,500 |

[a]Data obtained by aerial survey unless otherwise noted. Only peak counts are listed.
[b]Incomplete survey and/or poor survey timing or conditions resulted in minimal or inaccurate count.
[c]Sonar count.
[d]Tower count.
[e]Caribou and Clear Creeks.
[f]Interim escapement objectives.

Appendix Table 11. Fall chum salmon expanded population escapement estimates for selected spawning areas in the Yukon River drainage, 1974-1989.

| Year | Delta River[a] | Upper Toklat River[b] | Chandalar River[c] | Sheenjek River[d] | Fishing Branch River[e] | Canada Mainstem Tagging Estimate[f] |
|---|---|---|---|---|---|---|
| 1974 | 5,915 | 43,484 | - | 89,966 | 32,525[g] | - |
| 1975 | 3,734 | 90,984 | - | 173,371 | 353,282[g] | - |
| 1976 | 6,312 | 53,882 | - | 26,354 | 36,584 | - |
| 1977 | 16,876 | 36,462 | - | 45,544 | 88,400 | - |
| 1978 | 11,136 | 37,057 | - | 32,449 | 40,800 | - |
| 1979 | 8,355 | 179,927 | - | 91,372 | 119,898 | - |
| 1980 | 5,137 | 26,373 | - | 28,933 | 55,268 | - |
| 1981 | 23,508 | 15,775 | - | 74,560 | 57,386[i] | - |
| 1982 | 4,235 | 3,601 | - | 31,421[c] | 15,901 | 31,958 |
| 1983 | 7,705 | 20,807 | - | 49,392[c] | 27,200 | 90,875 |
| 1984 | 12,411 | 16,511 | - | 27,130[c] | 15,150 | - |
| 1985 | 17,276[h] | 22,805 | - | 152,768[c] | 56,016[g] | 62,010 |
| 1986 | 6,703[h] | 18,903 | 59,313 | 83,197[c] | 31,378[g] | 87,990 |
| 1987 | 21,180[h] | 22,141 | 32,416 | 140,086[c] | 48,956[g] | 80,776 |
| 1988 | 18,024[h] | 13,324 | 33,619 | 38,800[c] | 23,597[g] | 36,786 |
| 1989[j] | 20,000[h] | 30,447 | 69,161 | 101,748[c] | 43,834[g] | 35,974 |
| E.O.[k] | 11,000 | 33,000 | - | 62,000 | 50,000-120,000 | 90,000-135,000 |

[a]Total escapement estimates made from migratory time density curve (Barton 1986) unless otherwise indicated.

[b]Total escapement estimates using Delta River migratory time density curve and percentage of live salmon present by survey date in the upper Toklat River area.

[c]Sonar estimate

[d]Total escapement estimates using sonar to aerial survey expansion factor of 2.22 unless otherwise indicated.

[e]Total escapement estimates using weir to aerial survey expansion factor of 2.72 unless otherwise indicated.

[f]Estimated total spawning estimates excluding Porcupine-Fishing Branch Rivers (estimated border escapement minus Canadian removal).

[g]Weir estimate.

[h]Population estimate from replicate foot surveys and stream life data.

[i]Initial aerial survey count was doubled before applying the weir to aerial survey expansion factor of 2.72 since only half of the spawning area was surveyed.

[j]Preliminary.

[k]Interim escapement objective.

Appendix Table 12. Coho salmon escapement counts for selected spawning areas in the Yukon River drainage, 1972-1989.[a]

| Year | Nenana River Drainage | | | | Delta Clearwater River[c,d] | Clearwater Lake and Outlet | Richardson Clearwater River |
|---|---|---|---|---|---|---|---|
| | Lost Slough | Clear Creek | Wood Creek[b] | 17 Mile Slough | | | |
| 1972 | - | - | - | - | 632 | 417 | 454[g] |
| 1973 | - | - | - | - | 3,322 | 551[d] | 375[d] |
| 1974 | 1,388 | - | - | 27 | 3,954 | 560 | 652[d] |
| 1975 | 943 | - | - | 956 | 5,100 | 1,575[d,e] | 4[g] |
| 1976 | 118 | 13 | - | 281 | 1,920 | 1,500[d,e] | 80[g] |
| 1977 | 524 | - | 310[c] | 1,167 | 4,793 | 730[d,e] | 327 |
| 1978 | 350 | - | 300[c] | 466 | 4,798 | 570[d,e] | - |
| 1979 | 227 | - | - | 1,987 | 8,970 | 1,015[d,e] | 372 |
| 1980 | 499 | - | 1,603[c] | 592 | 3,946 | 1,545[d,e] | 611 |
| 1981 | 274 | - | 849[h] | 1,005 | 8,563[f] | 459[g] | 550 |
| 1982 | - | - | 1,436[h] | - | 8,365[f] | - | - |
| 1983 | 766 | - | 1,044[h] | 103 | 8,019[f] | 253 | 88 |
| 1984 | 2,677 | 2,600[b,e] | 8,805[h] | - | 11,061 | 1,368 | 428 |
| 1985 | 1,584 | - | 3,773[h] | 2,081 | 5,358 | 730 | - |
| 1986 | 794 | 650[b,e] | 1,664[h] | 218[b,e] | 10,837 | 3,577 | 146[g] |
| 1987 | 2,511 | - | 2,450[h] | 3,802 | 22,300 | 4,225[d,e] | - |
| 1988 | 348 | - | 2,046[h] | - | 21,600 | 825[d,e] | - |
| 1989 | - | - | 412[h] | 824[g] | 11,000 | 1,600[d,e] | 483 |

[a]Only peak counts presented. Survey rating is fair-good unless indicated otherwise.
[b]Surveyed by F.R.E.D.
[c]Foot survey.
[d]Survey by Sport Fish Division.
[e]Boat survey.
[f]Population estimate.
[g]Poor survey
[h]Weir count.

Appendix II

# STATUS OF YUKON RIVER FALL CHUM SALMON STOCKS; INCLUDING THE 1990 FALL CHUM SALMON IN-RIVER PROJECTION

Oral Report to the US/Canada Yukon River Salmon
Joint Technical Committee
Whitehorse, Y.T. - March 6-8, 1990

(Note: This report is an abbreviated version of the oral report presented to the Alaska Board of Fisheries in Anchorage - February 1990)

by:

Louis H. Barton

Alaska Department of Fish and Game
Fairbanks, Alaska

# STATUS OF YUKON RIVER FALL CHUM SALMON STOCKS; INCLUDING THE 1990 FALL CHUM SALMON IN-RIVER PROJECTION

March 1990 - L.H. Barton

In this report I will present a brief review of Yukon River fall chum salmon stock status as well as the 1990 in-river projection which was presented to the Alaska Board of Fisheries in Anchorage on February 21 of this year.

## Fall Chum Salmon Stock Status

There are two races of chum salmon which enter the Yukon River: summer chums and fall chums. The most striking differences between the two as they pertain to this report, concern distribution of spawning throughout the drainage as well as spawning habitat requirements.

Yukon fall chum salmon are less abundant than their summer chum counterpart. The smaller overall population size is likely related to the fact that fall chum salmon possess strict spawning habitat requirements which not only limits their distribution throughout the drainage but also available spawning area within a stream.

Summer chum salmon, for the most part, spawn in runoff streams in the lower portion of the drainage (Figure 1). By comparison, fall chum salmon spawn primarily in spring-fed tributaries of the Tanana River and tributaries of the upper Yukon in eastern interior Alaska and Yukon Territory. Fall chum spawning occurs primarily in areas where upwelling ground water keeps spawning grounds relatively ice-free throughout most of the winter. Thus, fall chum salmon spawning areas can be considered more limited or finite by comparison to those of summer chums.

The tremendous distances (typically 1,000-1,500 miles) between salt water and spawning areas accounts for the very high oil content of these chums and their tendency to retain their bright silvery appearance while in the lower Yukon River. Although harvested commercially in all districts, the value of fall chum salmon as a subsistence item is far greater in the upper Yukon as opposed to the lower Yukon.

Adult fall chums attain sexual maturity and return to the Yukon for spawning in their 3rd, 4th, 5th, & 6th year of life. Age 4 fish are the most abundant followed by ages 5, 3, and 6. Age

composition of fall chum salmon from lower Yukon test fishing programs for the years 1981-1989 (9 yrs) has averaged:

Age 3 = 3%; Age 4 = 73%; Age 5 = 24%; Age 6 = < 1%

Fluctuations in age composition can be explained by differences in abundance between year classes. For example, a higher than average return of age 3 fish usually reflects high survivorship and abundance of that year class.

Whereas summer chum salmon enter the Yukon River from the end of May through mid-July, fall chum salmon enter from mid-July through early September. Although there is considerable overlap in both physical characteristics and time of entry into the Yukon, by July 15 the majority are considered to be fall chums.

Time of entry is assessed by set gill net test fishing catches in the south and middle mouths of the Yukon River Delta. Very erratic entry patterns occur with fall chum salmon, the exact reasons for which are not clearly understood. They typically enter the river in unpredictable surges lasting 1-3 days. These surges are often associated with on-shore wind events. The unpredictability of these pulses poses a management risk since they sometimes coincide with a commercial opening.

Further, this characteristic entry pattern of often makes it extremely difficult to accurately assess fall chum salmon run strength early in the season. For example, if a commercial opening coincides with a "surge" of fish entering the river, there may be a tendency to perceive a strong run. Conversely, if an opening occurs between "surges", there may be a tendency to perceive the run as being weak or late.

Apart from weather and environmental conditions, our perception of fall chum salmon stock timing has been that a multimodal entry pattern occurs, with Porcupine River stocks (particularly the Fishing Branch River stock) among the first to arrive, followed by a cluster or mixture of upper Yukon River stocks (Chandalar, Sheenjek, Kluane, mainstem upper Yukon). Tanana River stocks are thought to enter the Yukon River the latest.

Since about 1985, stock identification studies have been implemented to help address the question of Yukon River fall chum stock timing. Although results from stock identification based upon SPA have proven to be inconclusive, very preliminary results of GSI based upon electrophoresis are not entirely consistent with our perception of stock timing. These preliminary results suggest an even greater mixing of fall chum salmon stocks through the lower Yukon River (including those destined for the Tanana River). This further illustrates why single stock management in the lower Yukon River is clearly not possible at this time. We view continuing GSI

studies as an important element of US/Canada related investigations.

During the period 1960 through 1980, only various segments of annual returns of fall chum salmon were occasionally estimated from mark-and-recapture studies. Excluding these tagging experiments and apart from aerial assessment of selected tributaries since the early 1970's, comprehensive enumeration studies were sporadic and limited to only 2 streams (Fishing Branch River 1972-75; Delta River 1973-78). Only in the more recent years (particularly since 1985) have comprehensive enumeration studies intensified (Figure 2).

Sheenjek River sonar 1981-89 (9 yr)
Chandalar River sonar 1986-89 (4 yr)
Fishing Branch River weir 1985-89 (5 yr)
Delta River intensive ground surveys 1985-89 (5 yr)

These comprehensive studies have allowed expansion of past aerial survey point estimates on these streams to estimates of total season escapement. In addition to these studies, two other projects have been implemented during the past decade: Pilot Station sonar (rivermile 123, 1985-89) and DFO tagging near Dawson (1982-89, excluding 1984). In addition, a fall chum salmon radio telemetry study was conducted in the upper Tanana River in 1989 to estimate abundance of spawners upstream of Fairbanks.

The most complete database on fall chum salmon escapements exists for 4 major spawning areas: Delta, Toklat, Sheenjek, and Fishing Branch Rivers. Presently, it is observations of escapement to these 4 areas which are used to evaluate total Yukon River fall chum salmon escapement. Existing interim escapement objectives to these areas are 11,000 (Delta), 33,000 (Toklat), and 62,000 (Sheenjek). Objectives for these 3 areas were developed by the Alaska Department of Fish and Game (ADF&G) in 1987. The interim escapement objective for the Fishing Branch River is in the form of a range (50,000 - 120,000) which was established by the JTC; also in 1987. For purposes of this presentation, when speaking to the Fishing Branch River escapement objective, I am referring to the lower end of the objective range of 50,000 fish. Thus, the 4-area index escapement objective is 156,000 fish.

I will also mention that another fall chum salmon interim escapement objective exists (and in the form of a range). It is for mainstem Yukon fall chums which spawn in Yukon Territory and was established by the US/Canada JTC in 1987. That interim objective is 90,000-135,000 fall chum salmon and is based upon results from DFO mark-and-recapture studies conducted from 1982-86 (excluding 1984). However, since no formal project reports have been provided on those studies since 1983, it is considered very preliminary.

Our escapement objectives represent an approximate number of desired spawners which will optimize production based upon historic performance, i.e., they are predicated upon some measure of historic averages. Further, all escapement objectives are considered as interim objectives as they are subject to periodic evaluation and revision as new information is obtained annually.

Figure 3 shows the annual trend in estimated total escapement to each of the 4 index streams since 1974 along with respective interim escapement objectives for each. Although escapement objectives were established in 1987, I have extended the lines back through previous years for comparison. You will note that the escapement objectives were met in 4 of the last 5 years in both the Delta and Sheenjek Rivers. It was met in the Fishing Branch River in 1985 and nearly achieved in 2 other years (1987 + 1989) since objectives have been established. However, the escapement objective has never been achieved in the last 5 years in the Toklat River. The closest it has come since 1979 was last season but still fell some 3,000 spawners short. Also please note that there was no US commercial fishery for fall chum salmon in 1987.

The top graph in Figure 4 shows annual escapement trends to the 4 areas combined and the overall 4-area escapement objective of 156,000 fish. Note the three years of low escapements occurring consecutively in 1982, 1983, and 1984. The bulk of returns from those 3 low escapement years occurred in 1986-1988 as fall chum salmon return predominantly as 4-yr-old's. Again, there was no U.S. commercial fishery on fall chum salmon in 1987.

The bottom graph in Figure 4 shows the proportion each of the 4 component stocks contributed to the 4-area index. You will note (in top graph) that in 1989, the 4-area escapement totaled approximately 196,000 fish, exceeding the 4-area index objective of 156,000 by approximately 40,000 fish. However, (note bottom graph) strength of the Sheenjek River fall chum salmon escapement drove the 4-area index in 1989 as it has done for the past 9 years, particularly in 1985, 1986, and 1987. Escapement to the Sheenjek River represented 52% of the 4-area total in 1989, and it represented approximately 60% of the 4-area total in each of 1985, 1986, and 1987.

The goal of our harvest management strategy is to achieve the escapement objective for each fall chum salmon spawning stock, and thus, for the 4-area index as well. The fact that the 4-area objective was achieved in 1985, 1987, and 1989 does not dismiss the fact that the Toklat, and to a lesser extent the Fishing Branch River stocks, have not rebuilt to objective levels. The relative contribution to the 4-area escapement index by each of the 4 component stocks in substantially different in recent years compared to the late 1970's.

Figure 5 shows the trend of the 4-area index in 4 year averages. Average escapement to the 4 areas decreased approximately 27% from the 4-year period 1974-1977 to the 4-year period 1978-1981. Average escapement to the 4 areas decreased another 41% to the 1982-1985 period. Largely as a result of our conservative management practices subsequent to 1982, the average 4-area escapement for the most recent 4-year period (1986-1989) has shown an increase of approximately 38% from the preceding 4-year period (1982-1985).

However, even though total escapement to the 4 areas during the most recent 4-year period has improved by 38% from the preceding 4-year period, please note that the average for the Sheenjek and Delta River components are approximately 150% of the escapement objectives set for these streams. By comparison the Fishing Branch escapement averaged only 74% of the lower end of its objective (26% low). The Toklat River averaged only 64% of its objective, being 36% low.

The use of an escapement index, while helpful in describing relative trends in abundance, is inadequate for discussing total in-river returns and developing future run projections. To do this requires some measure of total, drainage-wide, spawning escapements.

Presently, our measure (or estimate) of total in-river fall chum salmon spawning escapement for this modeling exercise is taken as twice the 4-area index in any given year, and is believed to be slightly conservative (Figure 6). The doubling factor is intended to account for spawning populations in the upper Yukon River (Y.T.); Chandalar River; upper Tanana River; and other non-index areas as well as areas where spawning is either suspected or reported to occur (e.g., Koyukuk River). While more comprehensive escapement information is available for some of these systems in recent years, this more subjective approach was necessary in order to build a time series of sufficient size. Eventually, we would like to use a comprehensive escapement count from the Yukon River sonar site once the historical database is sufficiently large.

Using our estimates of total river escapement (i.e., twice the 4-area index) together with documented commercial and subsistence harvest gives us an estimate of total run size. The top graph in Figure 7 shows the reported commercial and subsistence harvest of fall chum salmon for the entire Yukon River drainage as well as total estimated escapement from 1974-1989. The bottom graph shows a 4-year moving average (to smooth the curve out) of U.S. and Canadian commercial catch. Although there has been an overall reduction (16%) in total utilization of Yukon River fall chum salmon during the most recent 5-year period (417,000) from the preceding 5-year period (495,000), commercial utilization (bottom graph) during this period decreased approximately 30%, primarily due to a 29% reduction in U.S. commercial catches. During this

same period, Canadian commercial harvests increased nearly 60%. Reported subsistence utilization (U.S. and Canada) has increased approximately 9% primarily as a result of about an 11% increase in U.S. subsistence harvest.

Figure 8 shows estimated exploitation rates on fall chum salmon. Since estimates of total escapement are considered to likely be conservative, exploitation rates shown here are likely maximum estimates. The average is approximately 56%. Whereas, the exploitation rate averaged approximately 70% during the period 1980-1984, it has been decreased to about 54% during the most recent 5-year period (1985-1989). That is about a 25% decrease.

**1990 Fall Chum Salmon Run Projection**

I will preface this part of the presentation by saying that fall chums are the only species of salmon in the Yukon River for which we attempt a projection. This is because it is the only salmon species for which we have a tenable estimate of total run size for a sufficiently long period of time.

In the Yukon River fall chum salmon escapement in any given year contributes to in-river returns 3, 4, 5, and 6 years later. In making our 1990 projection we examined our database to see what return rates have been realized at various escapement levels. Table 1 indicates that fall chum salmon escapements from 1974-1984 have ranged from approximately 110,000 to 1,200,000. Corresponding R/P rates have ranged from 0.98 to 4.5 with smaller escapements tending to result in higher R/P rates (Figure 9).

An analysis of corresponding brood year returns (BYR's) for various parent year escapement levels permits an estimate of the R/P rate to be expected at various escapement levels. The predicted number of fish returning per spawner for various escapement levels are shown by the curve in Figure 9. These estimates were obtained by regressing the natural log of R/P against the natural log of P (escapement). The resulting $r^2$ value equaled 0.81 (S.E. of y = 0.24).

Assuming average survival, and using the average maturity schedule with predicted R/P rates which are likely to result from the various escapements observed from 1984-1987, our 1990 projection for the Yukon River is 784,000 fall chum salmon (Table 2).

The estimated annual in-river return for the 16-year period 1974-1989 has averaged approximately 811,000 fall chum salmon. The 1990 in-river projection falls approximately 27,000 fish below the average annual return. The potential harvestable surplus (commercial plus subsistence) would be the projection less desired escapement levels. However, that surplus may not all be realized because of run distribution in 1990 and the inherent problems

associated with mixed stock management; i.e., the inadvertent and/or deliberate under exploitation of healthy stocks to protect weaker stocks.

For example, while the overall run outlook suggests a 1990 fall chum salmon return which may approach average strength in magnitude, it is highly probable that that component of the 1990 return destined for the Tanana River will be extremely poor. This is because in 1986, the major contributor to the 1990 run, escapements to both the Delta River (6,700 fish) and Toklat River (19,000 fish) were well below escapement objectives (25,600 versus 44,000 fish for both areas combined). Further, 1990 will mark the second 4-year cycle coming off the worst escapement year on record, namely 1982. In that year, less than 8,000 fall chum salmon were estimated to have spawned in the Delta and Toklat Rivers, combined.

By comparison, it is likely the 1990 in-river fall chum salmon return will primarily be comprised of Porcupine River (particularly the Sheenjek River) and upper mainstem Yukon River stocks. This is based upon an evaluation of brood year escapements and assumes average survival. The 1986 4-area escapement index was driven by the Sheenjek River component in that year (59%). In fact, the Sheenjek River was the only one of the 4 index areas where the escapement objective was met in 1986. Escapement to the Fishing Branch River in 1986 was just over 31,000 fish, being 19,000 below the objective for that stream.

Similarly, the 1986 upper Yukon River spawning escapement was estimated at just over 87,000 fish, the second largest on record between 1982 and 1989 (excluding 1984). It is likely the 1990 return to that area will be at least average in strength.

We have attempted projections for fall chum salmon each year since 1987. Figure 10 shows pre-season projections by year (1987-1990) and how they compared to observed run size for years 1987, 1988, and 1989. Also depicted is a "hind-cast" for 1987, 1988, and 1989 using the methods employed in making the 1990 projection. Although methods were somewhat similar in making all projections, the main difference in making the 1990 projection was that an estimated R/S rate (based upon a regression analysis) was used for each of the parent year escapements suspected to contribute to the 1990 return. Projections in other years were based upon an estimated "average" R/S rate.

Figure 1.

Yukon River Drainage (330,000 sq mi).

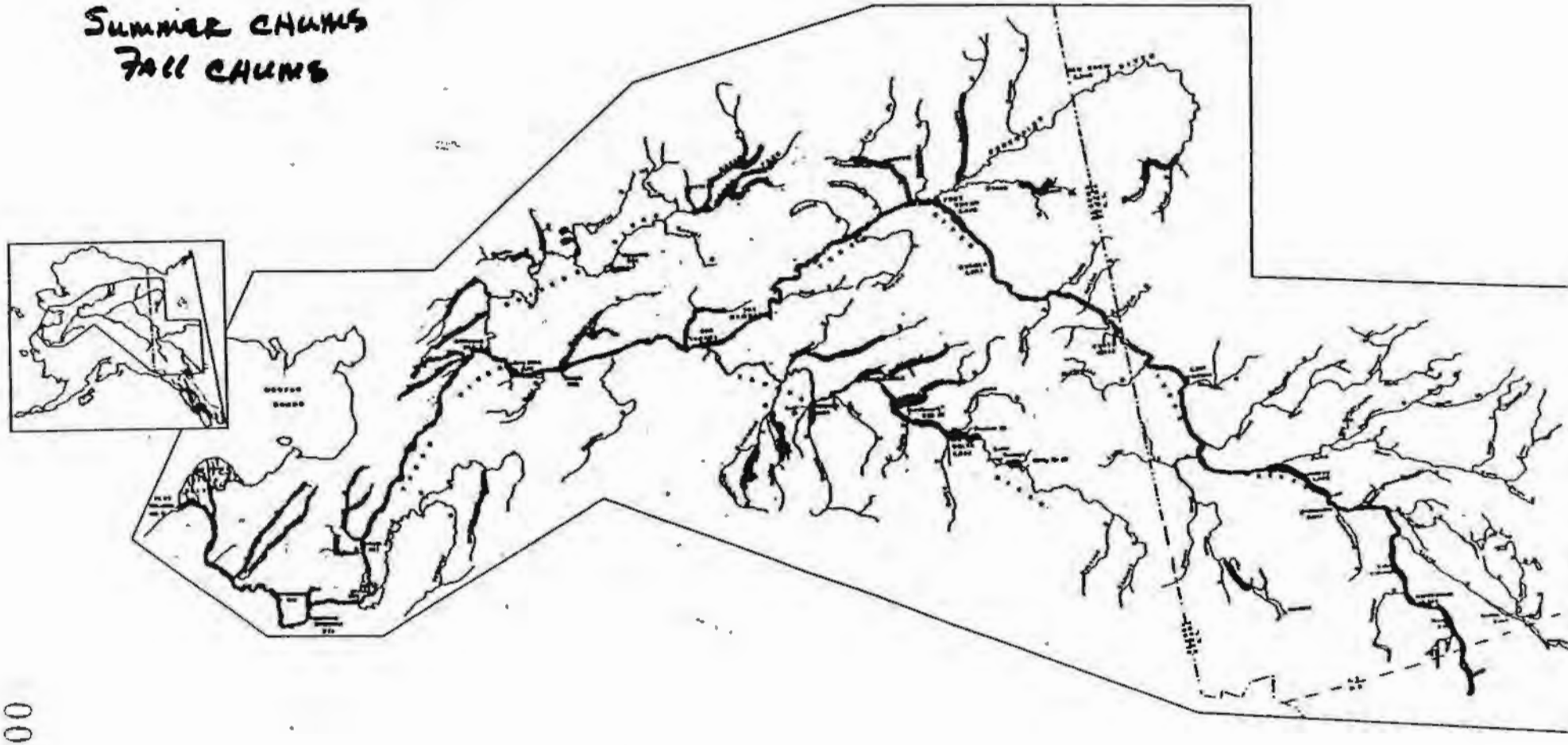


Figure 2.

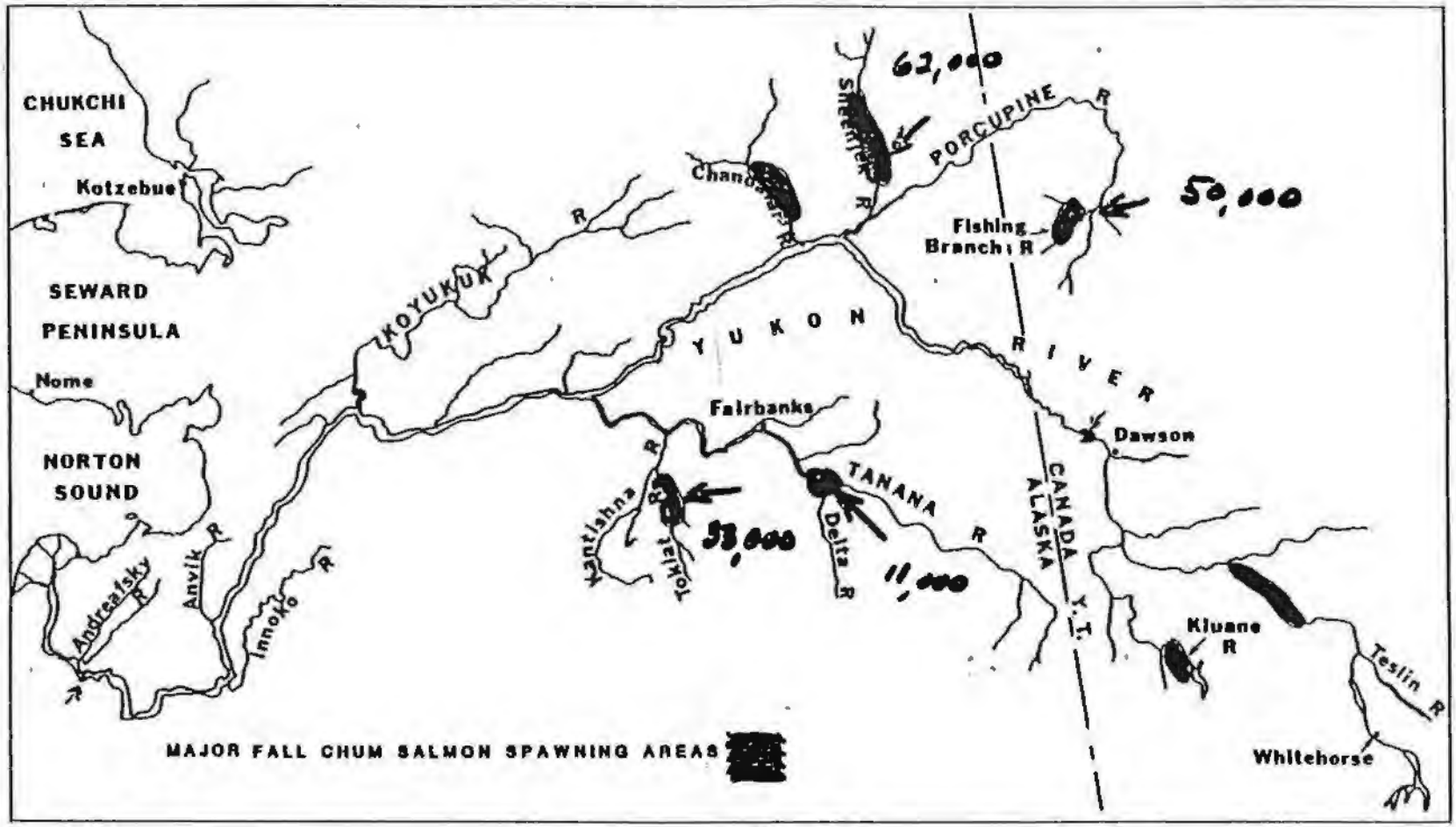


Figure 3.

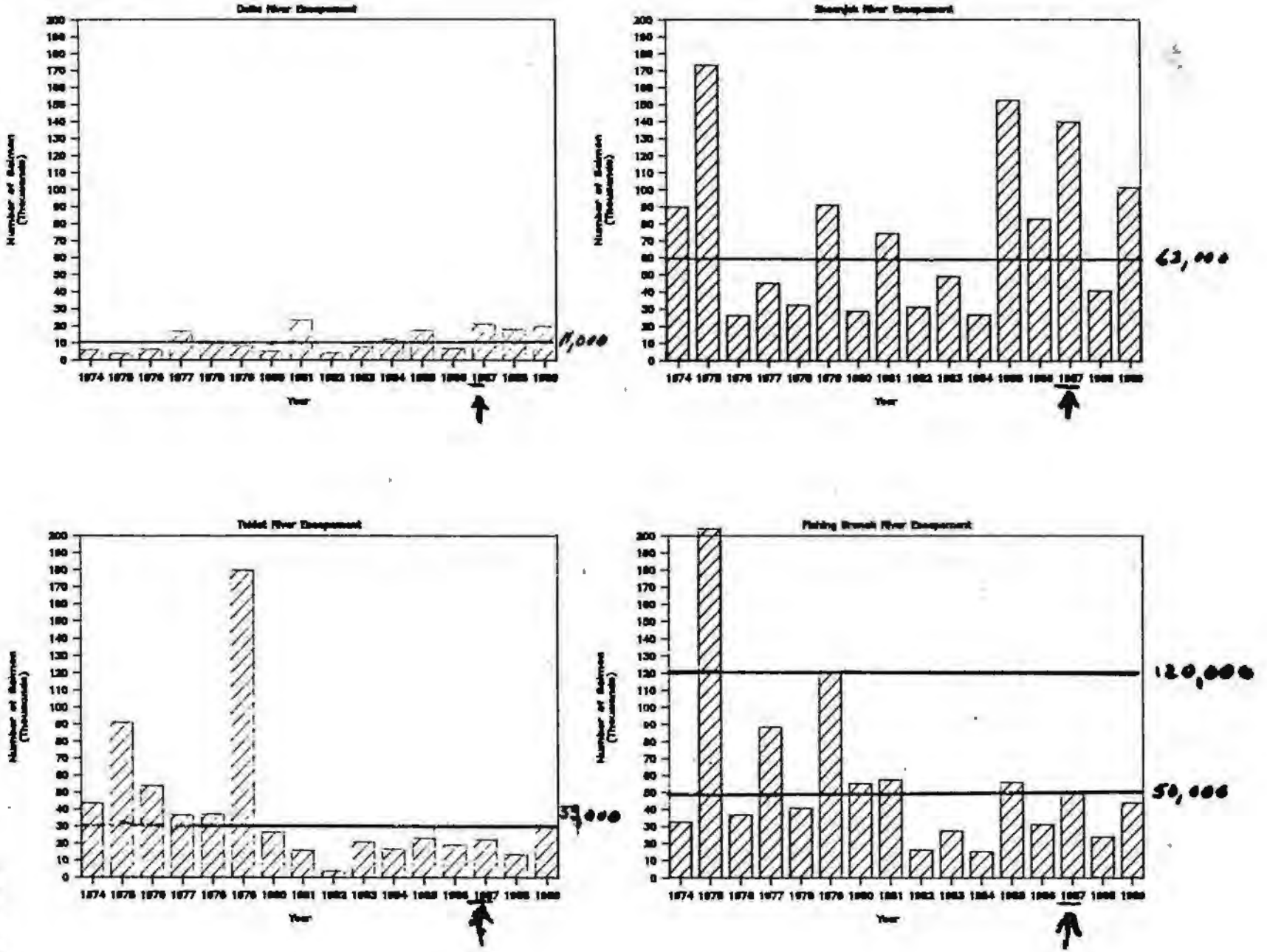
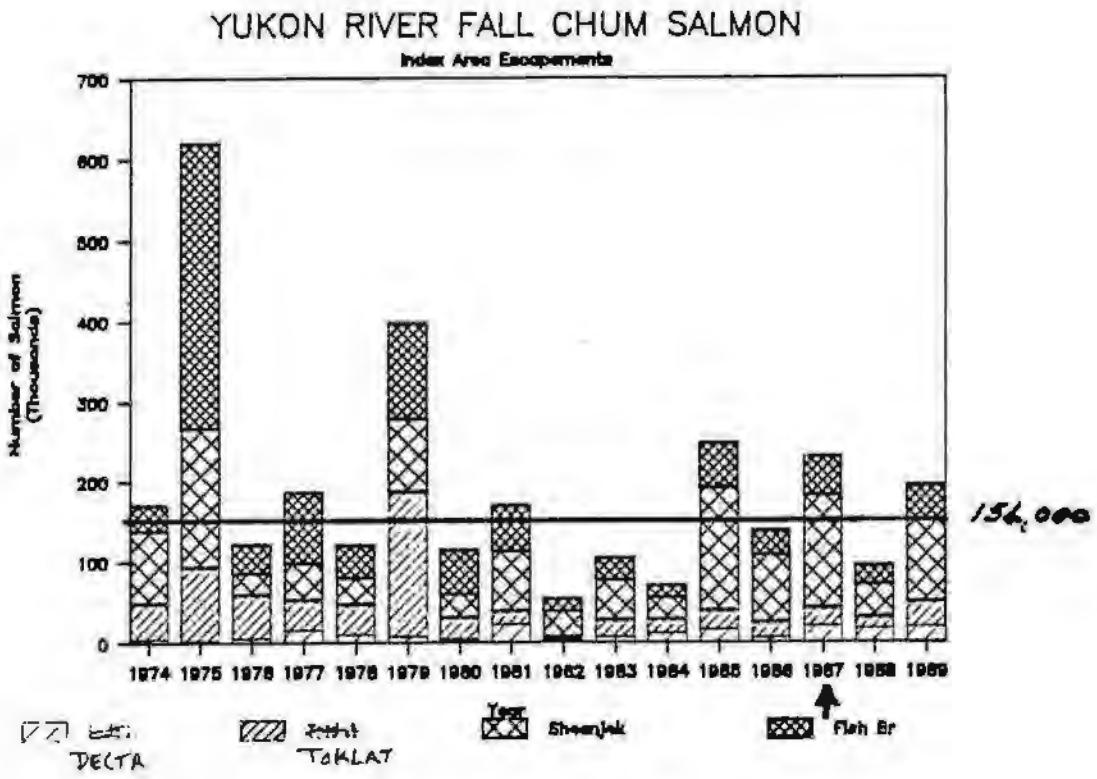


Figure 4.


YUKON RIVER FALL CHUM SALMON
Index Area Escapements
Number of Salmon (Thousands)
700
600
500
400
300
200
100
0
1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989
Year
Sheenjek
Fish Br
154,000
DELTA
TOKLAT

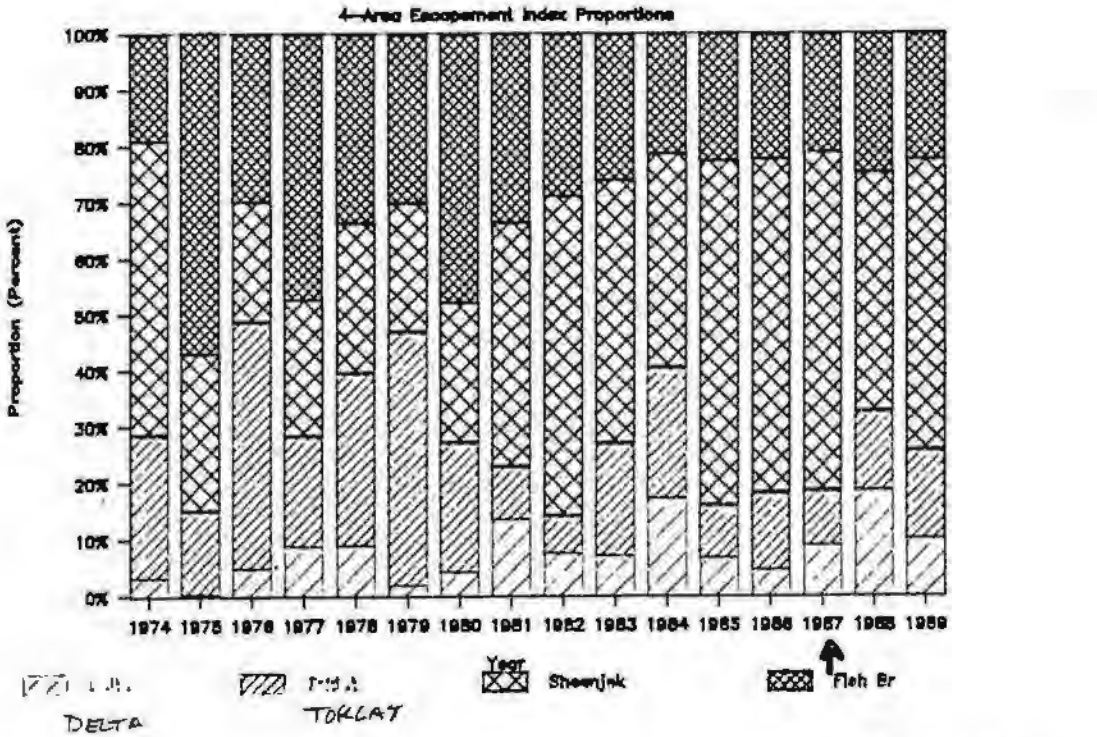

4-Area Escapement Index Proportions
Proportion (Percent)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989
Year
Sheenjek
Fish Br
DELTA
TOKLAT

Figure 5.

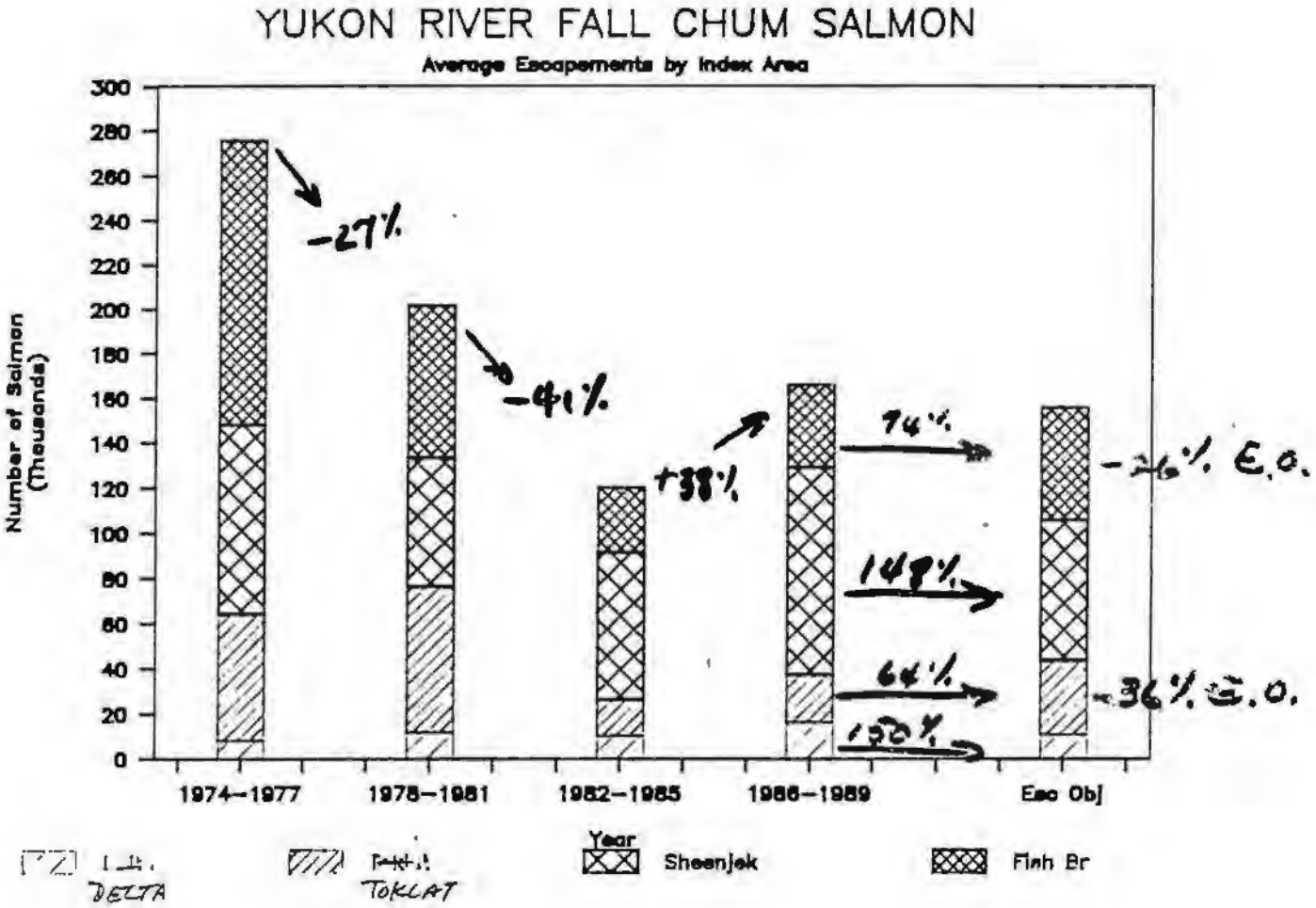

YUKON RIVER FALL CHUM SALMON
Average Escapements by Index Area
Number of Salmon (Thousands)
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
-27%
-41%
+38%
74%
-26% E.O.
148%
64%
-36% E.O.
192%
1974–1977
1978–1981
1982–1985
1986–1989
Esc Obj
Year
DELTA
TOKLAT
Sheenjek
Fish Br

Figure 6.

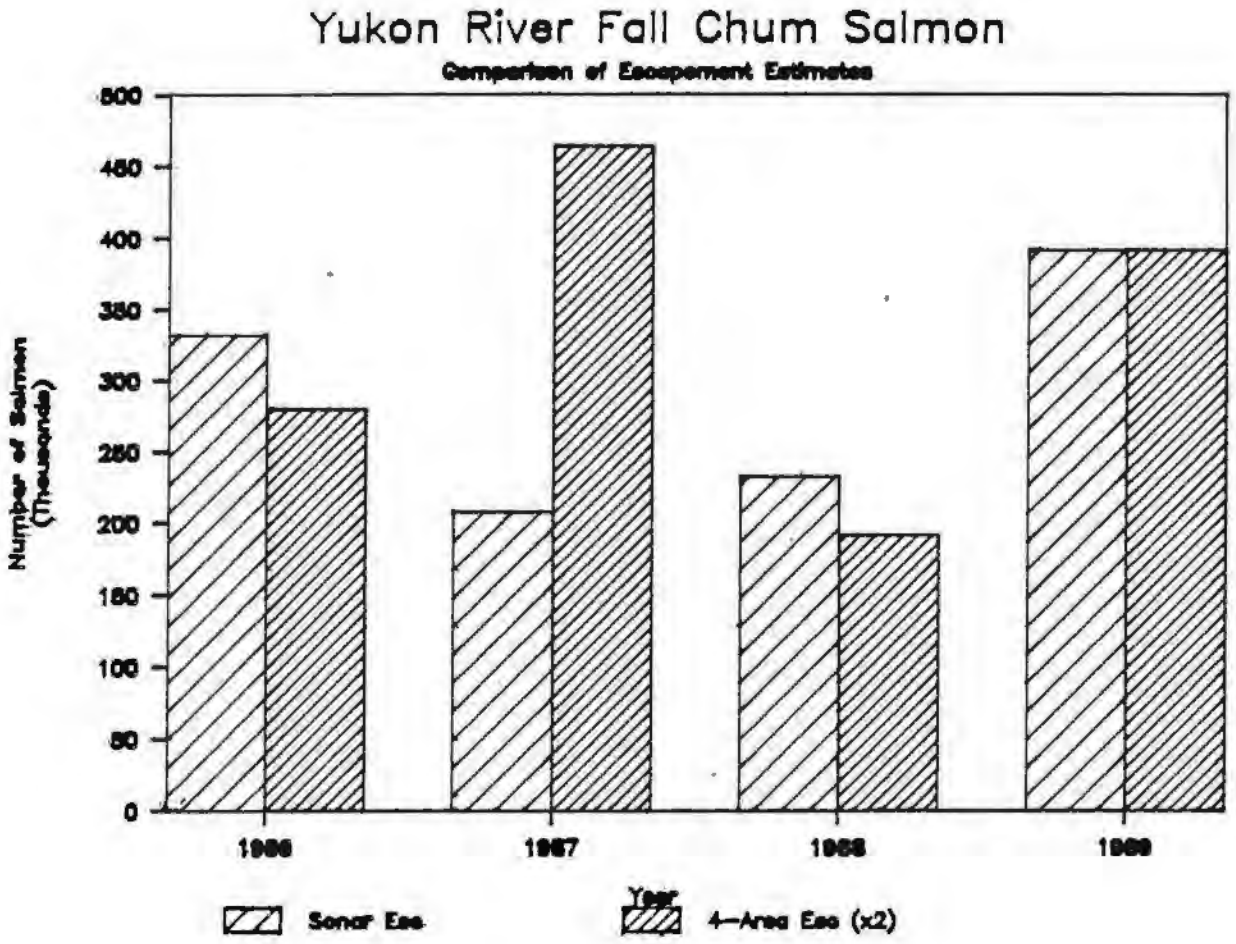
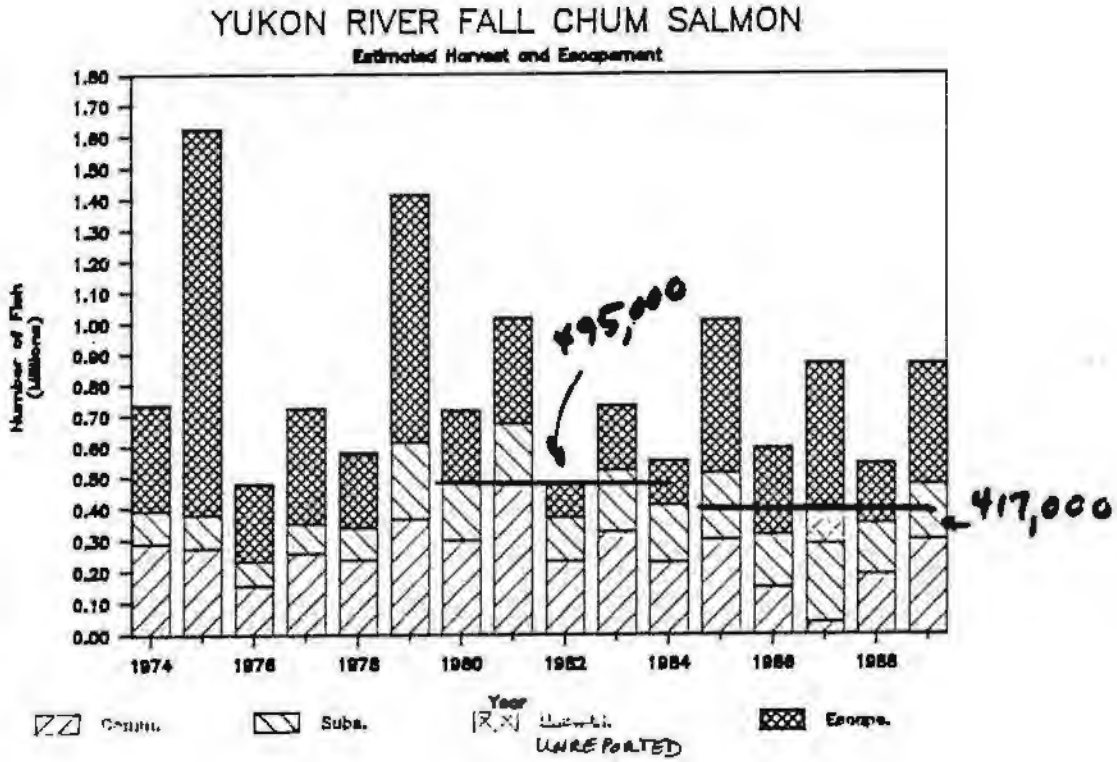

Yukon River Fall Chum Salmon
Comparison of Escapement Estimates
Number of Salmon (Thousands)
800
700
600
500
400
300
200
100
0
1986
1987
1988
1989
Year
Sonar Esc
4-Area Esc (x2)

Figure 7.


YUKON RIVER FALL CHUM SALMON
Estimated Harvest and Escapement
Number of Fish (Millions)
1.80
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1974
1976
1978
1980
1982
1984
1986
1988
Year
Subs.
Escape.
UNREPORTED
495,000
417,000

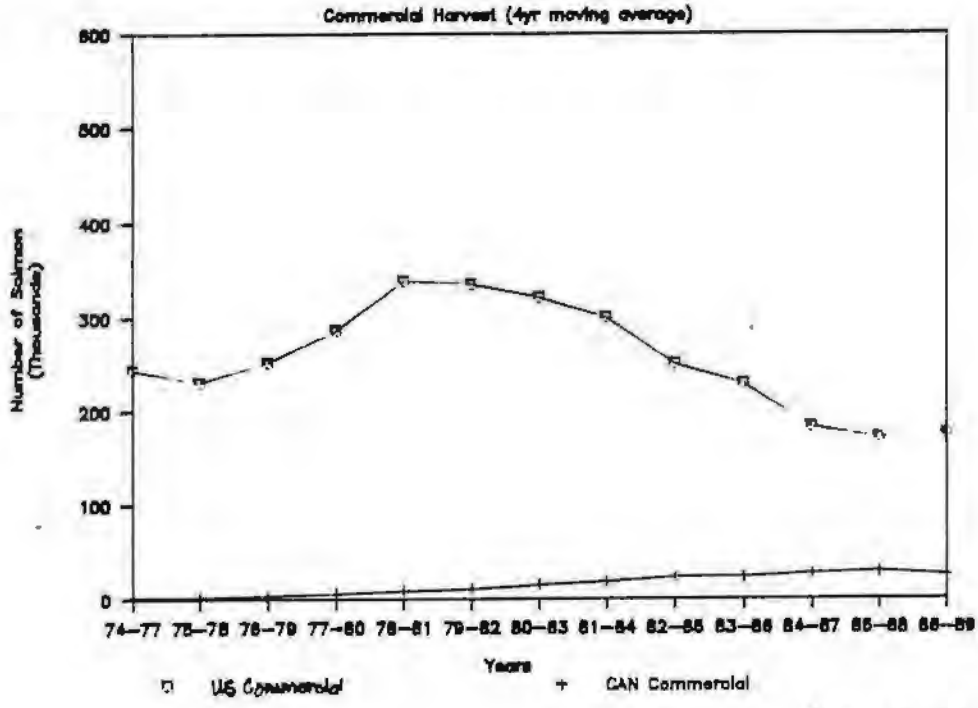

Commercial Harvest (4yr moving average)
Number of Salmon (Thousands)
800
700
600
500
400
300
200
100
0
74–77 75–78 76–79 77–80 78–81 79–82 80–83 81–84 82–85 83–86 84–87 85–88 86–89
Years
US Commercial
CAN Commercial

Figure 8.

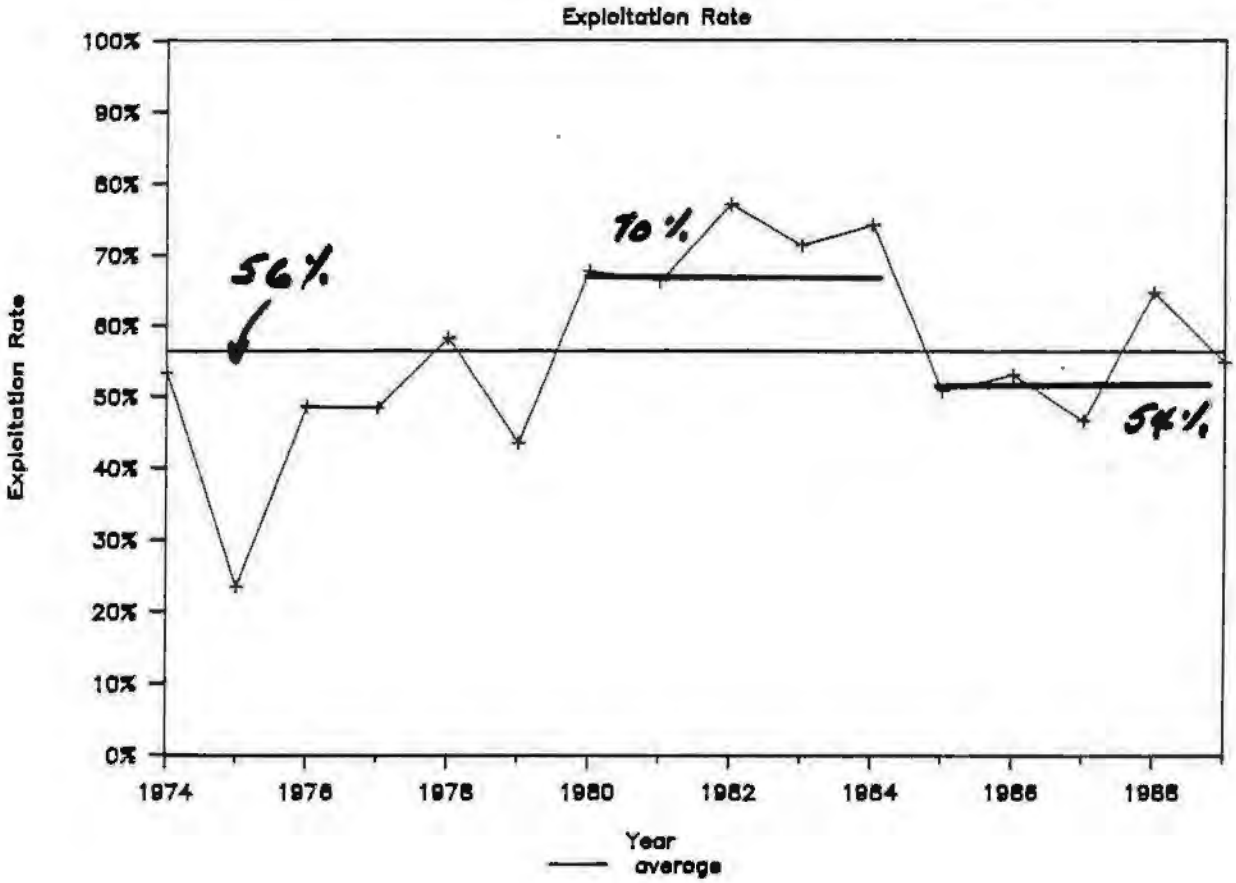

Exploitation Rate
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Exploitation Rate
56%
70%
54%
1974
1976
1978
1980
1982
1984
1986
1988
Year
average

Figure 9.

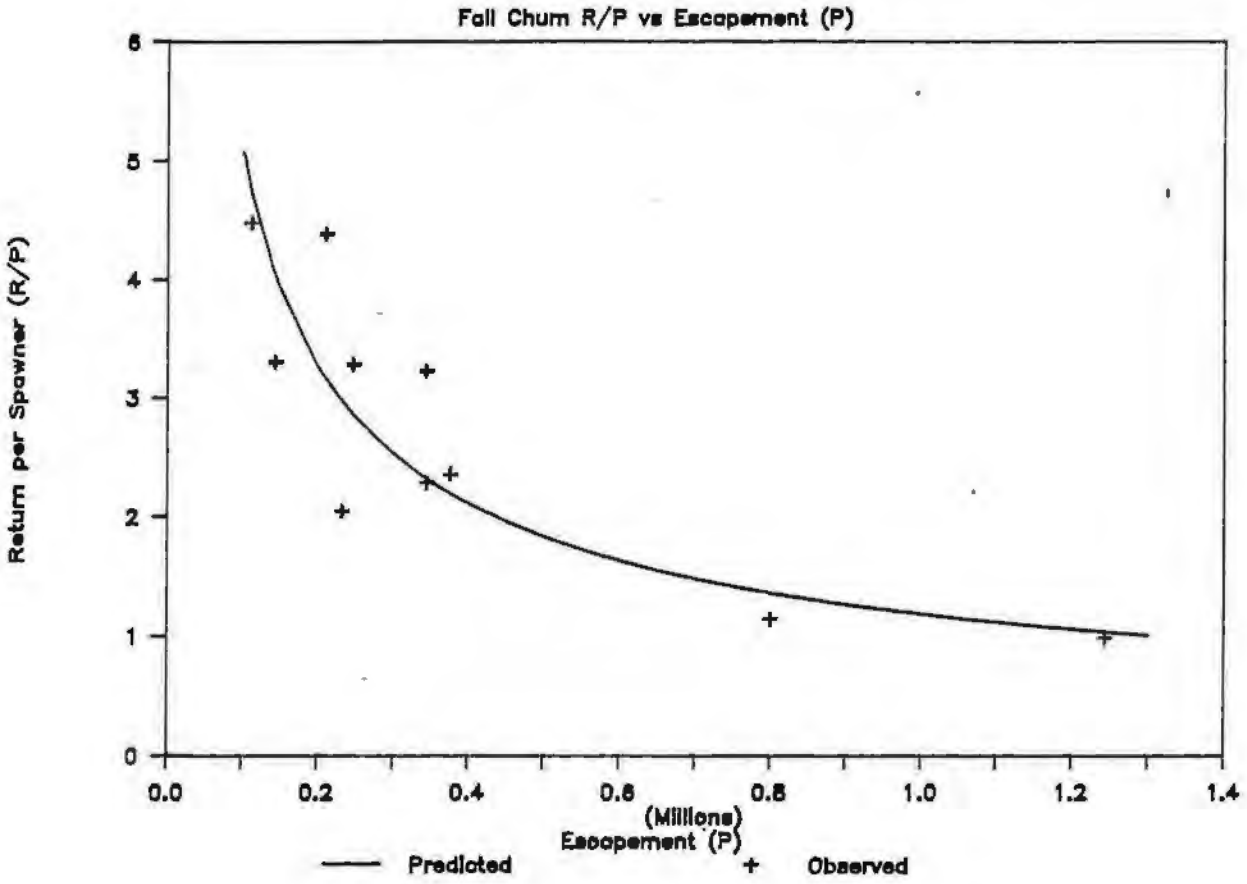

Fall Chum R/P vs Escapement (P)
Return per Spawner (R/P)
0
1
2
3
4
5
6
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
(Millions)
Escapement (P)
Predicted
Observed

Figure 10.

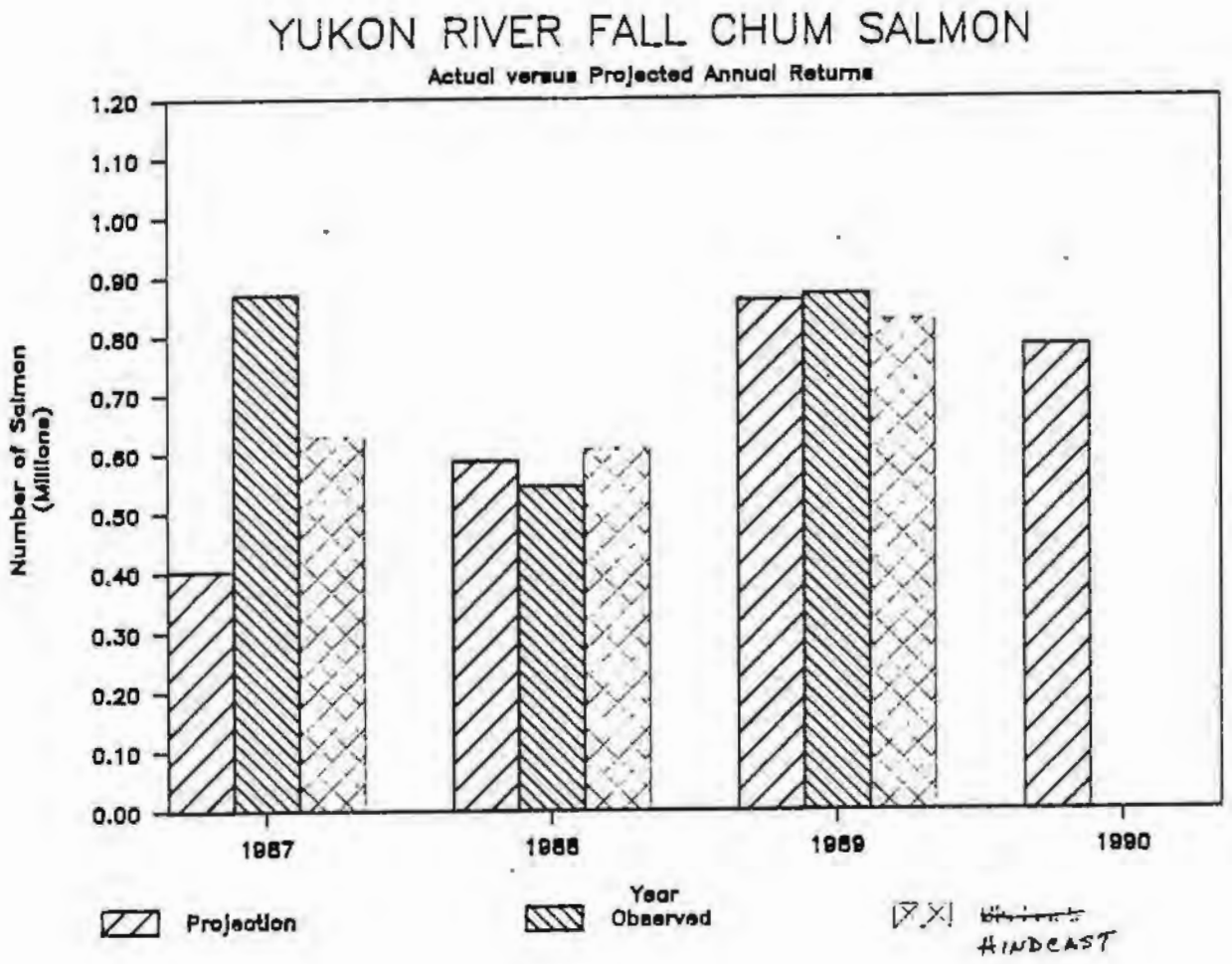

YUKON RIVER FALL CHUM SALMON
Actual versus Projected Annual Returns
Number of Salmon (Millions)
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1987
1988
1989
1990
Year
Projection
Observed
HINDCAST

Table 1.

YUKON RIVER FALL CHUM SALMON

Escapement, Brood Year Returns, Return Rates (1974-1984).

| Year | Escapement | Brood Year Return | Return/ Spawner |
|---|---|---|---|
| 1982 | 110,000 | 495,000 | 4.50 |
| 1984 | 142,000 | 471,000 | 3.32 |
| 1983 | 210,000 | 924,000 | 4.40 |
| 1980 | 231,000 | 475,000 | 2.06 |
| 1978 | 243,000 | 374,000 | 1.54 |
| 1976 | 246,000 | 810,000 | 3.29 |
| 1981 | 342,000 | 1,107,000 | 3.24 |
| 1974 | 344,000 | 786,000 | 2.28 |
| 1977 | 375,000 | 882,000 | 2.35 |
| 1979 | 799,000 | 913,000 | 1.14 |
| 1975 | 1,243,000 | 1,223,000 | 0.98 |

Table 2.

YUKON RIVER FALL CHUM SALMON

1990 RUN PROJECTION

| | Brood Year | Escapement | | Estimated R/S | | Percent Age Composition | Age | | Return |
|---|---|---|---|---|---|---|---|---|---|
| | 1984 | 142,404 | x | 4.06 | x | 0.39% | 6 | = | 2,000 |
| | 1985 | 497,898 | x | 1.83 | x | 23.77% | 5 | = | 217,000 |
| ** | 1986 | 279,952 | x | 2.64 | x | 72.92% | 4 | = | 539,000 |
| | 1987 | 464,726 | x | 1.91 | x | 2.92% | 3 | = | 26,000 |
| | | | | | | | | | 784,000 |