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DIVISION OF COMMERCIAL FISHERIES

STATUS OF YUKON RIVER FALL CHUM
SALMON STOCKS AND FISHERIES

Report to the
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INTROOUCION

The purpose of this report is to review available biological and fishery information concerning the management of Yukon River fall chum salmon stocks. Special emphasis is given to describing the 1982 fall chum fishery which because of below average run strength that was not detected in time resulted in disparate catches among various districts and poor escapements. Also presented in the report are several options for improved management of the fall chum salmon fishery. This report is prepared for presentation to the Alaska Board of Fisheries, December, 1982 meeting.

STATUS OF STOCKS

Description of Area and Fishery Resources

The Yukon River (Figure 1) is the largest river in Alaska flowing over 2,000 miles from it's source in British Columbia, Canada to it's mouth on the Bering Sea. It drains an area of approximately 330,000 square miles, two-thirds of which is in Alaska. The Koyukuk, Tanana and Porcupine Rivers are major tributaries, each with it's own important tributary streams. All five species of Pacific salmon are indigenous to the Yukon River drainage. Chum salmon are the most abundant. It is estimated that king, coho, pink and sockeye (red) salmon follow in order of abundance and importance.

Summer and fall chum salmon represent two major stocks in the Yukon River. Summer chums can be distinguished from fall chums by the following characteristics: 1) earlier run timing (early June-mid July in the lower main river); 2) rapid maturation in freshwater; 3) smaller body size (6-8 lbs.); 4) greater population size; and 5) nearly all spawning takes place in Alaska and primarily in run-off streams in the lower 500 miles of the drainage.

Fall chums have the following differentiating characteristics: 1) later run timing (mid July-early September in the main river); 2) larger size (7-9 lbs.) and robust body shape and bright silvery appearance in the lower river; 3) smaller population size; and 4) spawning occurs in the upper portions of the drainage (upstream of the village of Tanana) in streams that are spring fed, usually remaining ice free during the winter.

Yukon River chum salmon (both summer and fall runs) spend one winter incubating in the gravel and migrate to the Bering Sea soon after emergence in the spring. Adults return at between three and six years of age, although ages 4 and 5 generally account for over 90% of the return. Generally equal numbers of males and females are found in catch and escapement samples.

The coho salmon run overlaps with the fall chum salmon run. Cohos are taken incidentally during the fall chum salmon fishery in all fishing districts.

Escapement

The Yukon River drainage is too extensive for complete salmon escapement coverage during any given year. Consequently, low-level aerial surveys from single-engine, fixed-winged aircraft have been the primary method used on selected index streams to obtain escapement information. It is generally recognized that aerial escapement estimates are lower than actual salmon escapement, even when survey conditions are optimal. This phenomenon is probably even more real when surveying fall chum salmon spawning populations in the Yukon River drainage.

Spawning occurs from September through November, and, apart from the Delta River area, major spawning grounds are very remote. There is little daylight available during the fall chum salmon spawning season in which to reach and survey most major spawning areas. Even with favorable weather, the sun angle is less optimal for good light penetration into the water, hindering surveyor visibility.

Unfavorable weather and water conditions tend to generate the largest problem for obtaining accurate fall chum salmon escapement estimates. Frequent snowfalls not only limit available days for surveying but also cover salmon carcasses on river bars. Generally, rivers are running ice, which precludes making salmon counts in the mainstem river. Also most fall chum spawning streams are silty in nature or dark stained from tundra runoff.

Very little information regarding the abundance and distribution of fall chum salmon was available prior to 1972. Since that time, major fall chum salmon areas have been identified in the Porcupine River drainage (Sheenjek River in Alaska and Fishing Branch River in Canada) and the Tanana River drainage in Alaska (Toklat River, Delta River, and mainstem Tanana upstream from Fairbanks)(Figure 2). Other spawning areas include the Chandalar River in Alaska and the Kluane River in Canada. Minor or suspected spawning may occur in the Koyukuk River and upper Kantishna River drainage and in a few other upper Yukon River tributaries in Canada e.g., the Koidern River, Klondike River and Teslin River and the mainstem Yukon River near Carmacks.

Porcupine and upper Yukon River fall chum salmon are distinguished from Tanana River fall chum salmon by their earlier run timing and their orientation along the north bank of the Yukon River from Galena to Tanana (river mile 530-700), as opposed to south bank orientation of the Tanana River drainage populations.

Fall chum salmon spawning has been documented in approximately 30 Alaskan and 10 Canadian streams. However, the most complete data base (dating back to 1973) exists for only nine of those streams (or index areas) (Table 1).

Annual escapement trends in two Porcupine River tributaries, the Sheenjek and Fishing Branch Rivers, were very similar during the past 10 years (Figure 3). Fall chum salmon are predominately 4 years old, and these data reveal a strong apparent 4-year cycle occurring in 1975 and

1979 in these Porcupine River populations. Figure 3 shows a trend of declining escapements since 1980 in each of these streams, with 1982 observed escapements being the lowest ever recorded.

Figure 4 shows Tanana River drainage fall chum salmon escapement trends based on observed escapements at selected index spawning areas. Escapements of fall chum salmon to both the upper Toklat River and upper Tanana River appears to have been somewhat more stable from year to year than in the Porcupine River drainage, particularly from 1974 through 1978. From 1980 through 1982, the upper Toklat River exhibited the same dramatic annual decline in escapements as is apparent in both the Sheenjek and Fishing Branch Rivers. A similar trend can be seen in the upper Tanana River escapements, with the exception of 1981, when observed escapements were above average.

In summary, Tanana River fall chum salmon escapements appear to have been relatively more stable than Porcupine River escapements for the period 1974 through 1978 (Figure 5). One possible reason for large annual fluctuations in Porcupine River fall chum salmon escapements may be that these populations border on the northern edge of this species' range. Both Tanana and Porcupine River fall chum escapements have generally shown a marked decline over the past 3 years, with the lowest observed escapements occurring in 1982.

Estimates of Run Magnitudes

The magnitude of the runs, based on comparative catch and limited escapement data, have fluctuated sharply depending on brood year run strength. Very large runs were experienced in 1971, 1975, 1979 and 1981 while small runs occurred in 1973, 1976, 1978, 1980 and 1982. Use of tag and recovery data resulted in minimal population estimates (total run size) of 460,00 and 513,000 fish during 1977 and 1978, respectively. These population estimates indicate 73% and 67% exploitation rates, respectively. Minimum annual population estimates based on comparative documented harvests and escapement surveys range from 331,000 to 841,000 since 1975 (data not yet available for 1982) and are shown in Table 2.

STATUS OF FISHERIES

Subsistence Fishery

Alaska

Subsistence has been designated by the Alaska State Legislature (State Law 151) as the highest priority among beneficial users of the fish and game resources. Except in areas where intensive commercial fisheries occur, the subsistence fishery is subject to relatively few restrictions in order to give preference to subsistence users.

A comprehensive household survey is made annually by the Division of Commercial Fisheries to document subsistence catches. One or more members of 1,059 fishing families operated approximately 800 gillnet and 200 fishwheel units for subsistence fishing purposes in 1981. Often the same fishermen take salmon for both commercial and subsistence purposes while using the same unit of gear.

King and chum salmon are the most important species taken for subsistence

purposes. Only small numbers of pink and coho salmon are taken. King salmon are utilized almost exclusively for human consumption while chum salmon are also fed to sled dogs.

In recent years subsistence chum catches have increased moderately due to increased fishing effort as a result of development of the upper Yukon area commercial fishery, above average size runs and the increasing numbers of recreational sled dog teams. Approximately two-thirds of the chum salmon catch is composed of summer chums. Fall chums are of less importance than summer chums throughout the Yukon River drainage except upstream of the mouth of the Koyukuk River where it is estimated that fall chum comprise 60-75% of the total subsistence harvest.

Fall chum salmon subsistence catches in Alaska during the period 1961-1981 ranged from 36,002 to 233,347 annually. The recent 5 year (1977-1981) average fall chum catch is 153,200. Year to year fluctuations in the catch usually are attributed to variable run magnitudes. However, in 1979-1981, catches had increased drastically in the upper Yukon area, especially in district 5. The 1982 subsistence catch is expected to be below average, approximately 100,000 fish (preliminary data).

Canada (Yukon Territory)

The subsistence salmon fishery in the Canadian portion of the drainage is located primarily in the mainstem Yukon River from Dawson to Carmacks. Fishing also occurs in the Pelly, Stewart and Porcupine (Old Crow) River drainages. Fishing gear consists of primarily gillnets and a few fishwheels. Annual fall chum catches (taken mostly at Old Crow) have ranged from 1,200 to 25,000 for the period 1961-1981. The recent 5 year average is 9,912 fall chums. Canadian subsistence catches have not been adequately monitored and catches may be substantially greater than reported.

Commercial Fishery

Alaska

The Yukon River commercial salmon fishery in Alaska dates back to 1918, although major commercial utilization of all species has only existed since 1961. Chum and king salmon are the primary species harvested. The majority of the salmon catch is processed as a fresh/frozen product.

The major commercial fisheries are found in the lower 150 miles, although commercial fishing is also widely dispersed over 1200 river miles in the mainstem upper Yukon and lower Tanana Rivers. In the lower river, set and drift gillnet gear are operated, while in the upper Yukon area fishwheels and set gillnets are used to take salmon. In 1976 the Commercial Fisheries Entry Program was implemented to stabilize the amount of fishing gear. Presently about 700 gillnet (drift and set combined) permits are issued yearly for the lower Yukon area. In the upper Yukon area about 75 gillnet (set gillnets only) and 170 fishwheel permits are issued each year.

The chum salmon commercial fishery has only recently developed as a result of the decline in the subsistence fishery for summer chums, establishments of new markets (especially in Japan) and expansion of the upper Yukon area fishery. Presently, the bulk of the commercial chum catch is composed of summer chum.

The commercial fishery for fall chums began in the early 1960's; however, the fishery has only recently expanded (since 1969). Commercial catches during the 1961-1981 period have ranged from 8,347 (1964) to 486,059 (1981) (Table 3). The recent 5 year average (1977-1981) harvest in Alaska is 327,800 fish. The value of the fall chum salmon catch to fishermen is 1.3 million dollars (1977-81 average). Because of their high quality which is related to upriver spawning destinations, fall chums are in great demand and are harvested in all fishing districts.

From the early 1960's through 1973 nearly all the commercial harvest of fall chums were taken in the lower Yukon area, primarily in district 1. In 1973, in recognition of the fall chum salmon fishery development, the Department established a maximum "harvest goal" of 250,000 fish. Effective for the 1974 fishery season the Board of Fisheries re-allocated the fall chum harvest by providing for a 200,000 fall chum quota for the lower Yukon area and allocated 50,000 fall chums to the upper Yukon area. In 1979 quotas were replaced by a flexible guideline harvest range concept and the Board further re-allocated an additional 30,000 fall chums to the upper Yukon area.

Coho salmon are of minor importance to the commercial (and subsistence) fisheries. Commercial coho catches in Alaska since 1961 have ranged from 350 to 38,021 and the recent 5 year average (1977-81) is 22,700. The commercial harvest of cohos is dependent upon fishing effort exerted on the more numerous fall chums. Consequently, no specific management strategy has been developed for coho salmon. Future expansion of the coho fishery appears unlikely at this time. Cohos are not counted against guideline harvest ranges in the lower Yukon area but are included in the upper Yukon area. Fishermen in the upper Yukon area do not distinguish between fall chums and cohos.

Canada (Yukon Territory)

The first recorded commercial salmon harvest in the drainage dates back to 1903 in the Yukon Territory. As in the past, the present commercial fishery occurs primarily near Dawson. Fishing gear currently consists of almost exclusively gillnets. Only a few fishwheels are operated and their use has declined sharply in recent years. Commercial fishing licenses have been "frozen" at 50 due to conservation considerations. Fishing (commercial and domestic) is normally allowed 6 days a week. Salmon are processed as a fresh and frozen product.

Fall chum salmon commercial catches have ranged from 435 to 15,260 fish for the 1961-1981 period. The recent 5 year average (1977-1981) catch is 6,400 fish. Commercial catches of fall chums have also increased sharply in recent years. The value of the fall chum catch to the fishermen is estimated at \$63,700.

MANAGEMENT AND RESEARCH

Management Objectives

The overall objective of the Yukon area research and management programs is to manage the various salmon runs for optimum sustained yield. The commercial fishery is regulated on the assumption that a harvestable salmon surplus, after providing for spawning and subsistence utilization

requirements is available. Achievement of commercial catch levels in each district is governed by guideline harvest ranges provided in current regulations.

Major Management Strategies and Regulations

In-season management in the past has relied primarily on the analysis of comparative commercial catch statistics to determine the relative run strength and appropriate management strategy for any given season. In the past few years test fishing data has been used to enhance this information, but less reliance has been placed on test fishing data due to its limited data base. Limitations inherent in the use of both commercial and test fishing catch data are discussed in a subsequent section of this report.

In order to satisfy both user group harvest allocations and conservation requirements, the commercial fishing area is divided into six districts and 13 subdistricts (Figure 1). Regulations vary between district and subdistrict. To illustrate the complexity of the regulations, there are 7 weekly fishing periods and 5 guideline harvest ranges in effect throughout the area for the fall chum fishery (Tables 4 and 5).

Regulation of both commercial and subsistence fisheries has become more restrictive in recent years as fishing effort and efficiency has increased. For example, fishing time has been sharply reduced in most of the fisheries. In districts 1 and 2 fishing time has been reduced from 4 to 2 days a week since 1973. In portions of the upper Yukon area fishing time has been reduced from 5 consecutive days to 4 days (2 - 48 hour periods) a week. Also other regulations and strategies necessary for conservation of fall chum stocks have been implemented such as delayed season openings in portions of the upper Yukon area (to afford additional protection for early run stocks which are subject to intensive fishing effort), split fishing periods (to spread out the harvest over a greater portion of the run and to afford additional protection to smaller stocks). Other restrictions imposed in recent years include guideline harvest ranges. During years of average abundance the midpoint of the guideline harvest range is sought. If the run is judged below average or above average in magnitude, then the lower or upper end of the guideline harvest range may be taken. Also, in-season fishing time reductions or season closures may be implemented.

Specific Management and Research Programs

The two major sources of information used to assess in-season fall salmon run magnitude and timing are derived from commercial catch and effort documentation and test fishing projects. Commercial catches and effort are monitored by crews stationed at key locations in the lower and upper Yukon areas. The crews responsible for tabulating fishery data from fish tickets, resulting in summaries by fishing period and statistical area. These data are compared to all prior fishing years to determine run status in relation to these years. Catch monitoring crews are stationed at Emmonak in the lower Yukon, and at Galena and Nenana in the upper Yukon. In addition to fishery information, the monitors sample commercial catches for age, sex and size data.

Test fishing is utilized by the Department in order to have a daily,

standardized data base to reflect salmon abundance and timing. The commercial fishery is normally closed for several days during the week, (the exact amount of closure time varies from year to year and has increased markedly over the past ten years) and changes in gear efficiency and effort distribution create the need for some kind of standardized catch statistics for comparison with commercial catch statistics.

In the lower Yukon area gillnet test fishing is conducted in the south, middle and north mouths. Set gillnets of 6" stretched measure are fished for 24 hours per day, seven days per week from mid July through August to monitor the fall chum and coho salmon runs. The test fishing program has been recently expanded to include the upper Yukon area where fishwheels are operated at Ruby (mile 581) from early August through mid September.

Escapement enumeration in tributary streams represents another important data source useful in both management and research. Escapements can be used to evaluate the effect of management actions taken during the season, and when compared to prior years data, trends can be detected, which indicate the need for changes in management strategy. Spawning escapements also indicate potential brood year production for future returns.

A side scan sonar salmon counter is operated on the lower Sheenjek River, tributary of the Porcupine River, for enumerating fall chum salmon. The sonar devices are particularly useful in streams where poor water visibility prevents visual counting with towers or from airplanes. Also sonar devices provide more accurate and timely escapement data.

A new type of sonar counter for use in large, turbid rivers is being tested by the Department. The counter, called "Biosonics," has the potential to enumerate salmon in the turbid mainstem of the Yukon River and is presently being tested near Pilot Station (river mile 122). Transducers are placed along each river bank and transmit sound beams horizontally through the water. It is hoped that this new sonar device will eventually result in either enumeration of the entire run in the main river or at least a more accurate description of run strength than current methods.

Management Problems

Some of the major management problems unique to fall chums are discussed below:

- 1) Intensive fishing occurs throughout 1500 river miles in the main Yukon and lower Tanana River. Thus stocks are subject to fishery exploitation for considerably greater amounts of time compared to most fisheries. Fall chums migrating to the Porcupine River spawning grounds may be exposed to 22 days of commercial fishing and 28 days of subsistence fishing. To prevent overharvest, severe fishing time restrictions are required.
- 2) Variable Run Timing. In the lower river fall chums exhibit very erratic, unpredictable run timing (i.e. large

numbers of fish entering the river during a span of 1-3 days followed by several days or weeks of low abundance). The timing and strength of these peak run segments vary considerably in-season and between years. These run segments, which may represent individual stocks, may be overharvested if scheduled fishing periods happen to be open during these peak runs. A run segment harvested in district 1 may also be intercepted during subsequent fishing periods in several upriver districts.

3) Changes in Commercial Fishing Effort and Efficiency.

- a) Fishing effort for fall chums has increased in recent years, especially in districts 2 and 3 where the number of fishermen has doubled since the early 1970's (Table 6). During the same period the fall chum catch has also doubled in districts 2 and 3 (from average of 51,300 during 1973-1977 to 111,400 during 1978-1982). The expansion of the fall chum fishery in the lower Yukon area, especially in district 2, has resulted in increased fishing pressure on fall chum salmon stocks. When the lower Yukon fall chum fishery was concentrated in district 1 a better distribution of escapements was probably realized. Presently fall chum stocks are subject to additional harvest in district 2 ("double jeopardy") after passing through district 1.
- b) The number of major processors engaged in the lower Yukon fall chum fishery has doubled (from 3 to 6) in the past 10 years. Tendering service during the same period showed a corresponding increase (approximately 50 tenderboats vs. 25 previously) allowing fishermen to more readily deliver their catch. During the past two or three years competition between processors has increased in that processors in district 1 are operating also in district 2. Competition between buyers has resulted in very high fish prices thereby providing fishermen greater incentive to fish. For example, prices paid to fishermen in district 2 in 1982 nearly doubled (to \$0.65-\$0.70 per lb.) during the season because of increased competition.
- c) Individual fisherman efficiency in the lower Yukon area has rapidly increased in the past few years. Although difficult to quantify, observations of the fishery indicate efficiency has increased through improved communications (fishermen now make extensive use of CB and single side band radios in addition to listening to Department broadcasts over public radio to learn the best fishing locations which change constantly during the season); increased mobility (instead of fishing the same area throughout the season most fishermen constantly are moving to the best locations); increasing use of drift gillnets (many set

gillnet fishermen are now operating more drift gill-nets which increase fishermen mobility and efficiency); entry of new fishermen (less efficient fishermen are being replaced by more efficient fishermen through permit transfers.

- 3) Usefulness of Commercial Catch Data. Due to the rapid changes in effort and efficiency in the lower Yukon area, current year catch and effort data may not be comparable and of limited value for in-season management. Large cumulative catches and high catch per unit effort (CPUE) data may not necessarily indicate correspondingly large run abundance but instead may reflect the efficiency or effectiveness of the commercial fishery in harvesting the available stocks (run segments). Accordingly, it is often difficult to assess the strength of the run in the lower river and therefore a greater "management risk" exists for overharvesting. Often the relative strength of the fall chum runs may not be evident until the stocks are fished in the upper Yukon area.
- 4) Limited Test Fishing Data Base. The test fishing program in the Delta area has been in operation 6 years in the South Mouth and only 3 years in the Middle and North Mouth areas. Only two sets are operated in the South Mouth and 2-3 nets in Middle - North mouth areas. Test fishing catches may not always reflect or indicate timing and relative run abundance due to changes in pattern of entry or distribution of fall chums in the Delta area. Also changes in fishing sites (eddies, currents, water levels, bank erosion and driftwood) may affect the "catchability" or efficiency of the gear. Similar problems may occur in the upper Yukon area where the test fishing program has been operated for only two years.

Research Needs and Data Gaps

There is a lack of basic biological information concerning the Yukon River fall chum salmon runs. The present limited data base on test fishing catches and escapement needs to be expanded. Additional years of catch and escapement information will improve the data base to better detect trends in run magnitude. Also additional test fishing set net sites and implementation of a drift gill program should be considered. Historical escapement data should be critically examined to develop numerical escapement objectives. Additional escapement index areas should be surveyed annually and new side-scanning sonar sites in key tributaries are needed.

In addition other aspects such as in-season run abundance, stock separation, escapement sampling and migratory timing need to be examined. Highest priority should be given toward developing an in-season estimate of run abundance in the lower main river. The use of "Biosonics" sonar, discussed previously, may prove feasible as a means to provide an index estimate of abundance (and timing). This information, in conjunction with the use of test fishing catch data, would be very beneficial for day-to-day management.

Stock separation information on fall chum passing through the lower river is needed. If major stocks such as Tanana (Toklat, Upper Tanana) and the Porcupine (Sheenjek, Fishing Branch) can be identified in respect to timing in the lower river then a better balanced harvest of stocks throughout the various fisheries can be obtained. Stock separation studies by scale pattern analysis or a tag recovery program should be initiated.

The age-sex-size composition of individual stocks should be intensified through a systematic annual escapement sampling program. This information is needed to complement ongoing catch sampling programs in the various fisheries. Exploitation of individual stocks is unknown and additional biological data on escapements is necessary to determine the effects of harvests on production.

The timing or pattern entry of fall chums into the lower river is highly variable and poorly understood. Historical catch and climatological data needs to be analyzed to better quantify migratory timing. This information is necessary for management in order to spread out the harvest over the duration of the run and to prevent overharvest of various run segments.

OTHER ISSUES

U.S. South Unimak - Shumagin Island Fishery Interceptions

During June - early July the United States domestic commercial fishery in the South Unimak - Shumagin Islands area intercept salmon destined for western Alaska. In recent years catches have increased sharply and nearly one million chums were taken in 1982. Tagging studies have indicated that both summer and fall chum salmon destined for the Yukon River are intercepted in this fishery. During years of below average returns of fall chum salmon, the South Unimak - Shumagin Islands fishery may have an adverse effect on Yukon River stocks.

U.S. - Canadian Salmon Interceptions

The subject of Yukon River salmon has been recently discussed during U.S. - Canada Salmon interception meetings. If a negotiated settlement is made then fishing restrictions on the Alaska fishery may occur since an unknown number of Canadian produced salmon are being intercepted in the Alaska fishery. Although Canada has not made a serious attempt to expand it's fall chum fishery in the upper Yukon, attempts to do so could seriously affect the conservation of these stocks.

REVIEW OF 1982 COMMERCIAL FISHERY

Lower Yukon Area

Fall chums began entering the Yukon River during the July 12-13 period when 12% of the district 1 chum salmon catch was estimated to be composed of fall chums. During subsequent fishery periods in district 1 the proportion of fall chums steadily increased. General run timing for the season was considered normal.

Commercial test fishing catch data through July 25 indicated at least an average run magnitude for the early portion of the fall chum run (upper Yukon population). Test catches began to lag after July 25, however through July 31 catches were still comparable to 1979 (an above average year). Through July 31 the chum salmon catch was 89,000 fish.

In retrospect, fishing restrictions (reduced fishery time or season closure) should have been implemented in early August to provide for increased upriver fishery and escapement requirements from the early portion of the run.

Test and commercial catches continued at a low level until August 12-13 when apparently large numbers of chums from the late run and very large numbers of cohos entered the river. Prior to August 12 the fall chum catch totaled 146,000 fish. Test fishing catch data and initial commercial landings in the south mouth and Kwiguk Pass area indicated that coho salmon were predominant. It was anticipated that the chum catch in district 1 (8/12-13) and district 2 (8/15-16) and district 3 (8/16-18) would result in a catch of only about 25,000 chums bringing the season's harvest to 170,000 chums, the midpoint of the guideline harvest range. However, chums were more abundant during this portion of the run than indicated and a commercial catch of 52,000 chums (and 25,000 cohos) were taken during August 12-16 in districts 1 and 2. The commercial fishery season was closed August 18 with the lower Yukon area fall chum catch totalling 199,900 (Table 5). Also a total of 29,400 coho salmon were taken incidentally which include a record 14,200 taken in district 2. Following the closure of the season, fall chum test fishing catches sharply declined while coho salmon catches were above average.

Upper Yukon Area

Fall chums began appearing in district 4 and the lower portion of district 5 in early August. A reconnaissance of the subsistence fishery in subdistrict 5-A, 5-B, and 5-C on August 12 revealed very low numbers of fall chums in those areas; a decision was made at that time to postpone the opening of the district 5 commercial fishery until run strength improved. Previously district 5 was closed in July when the king salmon guideline harvest ranges were taken. A second survey was made on August 19, and conversations with 10-12 fishermen from the "Rapids" area upstream to the pipeline bridge (river mile 820) indicated that run strength had still not improved. At this time, commercial catches in subdistrict 4-B were 78% below the recent 5 year average, and catch rates at the north-bank test wheel were running 74% below 1981 levels.

On this basis, a decision was made to close the commercial fishery in subdistrict 4-B on August 20. During the period August 20-23, a boat survey of the district 5 fishery was conducted, which revealed continued poor fishing in that area. Reported subsistence catches from subdistrict 4-B indicated that run strength was declining further, and subsistence fishing time was reduced in that area and in district 5 to 3 days per week effective August 25 to provide for increased escapements. A list of emergency orders affecting the fall chum salmon fisheries is shown in Table 7.

South-bank subsistence and test catches indicated average or better run (presumably Tanana River stocks) strength, and a limited commercial fishing season was opened on September 4 in subdistrict 5-A.

At that time it was determined that the majority of the fall chum run had passed through subdistrict 4-B, and the restriction on the subsistence fishery was lifted.

The late portion of the upper Yukon fall run showed unexpected (and sustained) strength, and on September 11 restrictions on the subsistence fishery were relaxed and two 24-hour commercial openings were announced for subdistrict 5-B and 5-C. During these openings, a total commercial catch of 5,392 fall chums were reported taken in subdistricts 5-B and 5-C. Restrictions on the subsistence and commercial fishery in subdistrict 5-D were gradually relaxed as this strong pulse of fish moved upriver.

Subdistricts 4-C and 5-A were closed September 14. Commercial fall chum catches from those areas were 3,083 and 8,286, respectively.

The commercial fishing season in the Tanana River (district 6) was opened on September 14 and closed on September 20 after 72 hours of fishing were allowed. The Tanana River fall chum appeared below average in magnitude which was supported by subsequent low escapements. A total of 7,416 fall chum and 7,780 cohos were reported taken in this fishery.

The coho run appears to be one of the strongest in recent years, as evidenced by their record numbers in the district 6 commercial fishery and by subsequent subsistence catches in subdistrict 6-C. It was not feasible to allow additional commercial harvest of this species because of the coincidental timing of the depressed fall chum run.

Yukon Territory

Due to the weak showing of the early portion of the fall chum run in the upper Yukon area allowable fishing time was reduced to three days a week in the Dawson commercial fishery by the Canadian government. During the early portion of the run catches in the Yukon Territory were at a low level. Later during the run, abundance increased. Final catch data is not available but a reported 11,000 fall chums were estimated taken in the commercial fishery.

Escapement

Fishing season closures and fishing time restrictions enacted in the upper Yukon area were necessary to bolster escapements. Without these restrictions escapements would have been at a much lower level.

Weather conditions adversely affected aerial survey coverage of index escapement areas. Limited aerial surveys and foot surveys were conducted and comparative fall chum escapement data are shown in Figures 3, 4 and 5, Table 1. The sonar escapement estimate for the Sheenjek River was 29,093, less than half the sonar estimate in 1981 (69,043). Overall, observed escapements in 1982 were substantially below average compared to recent years (refer to discussion on Status of Stocks).

MANAGEMENT RECOMMENDATIONS

Several options are presented in this section for improving management of the fall chum salmon fishery.

1. Decrease exploitation of fall chums through reductions in the commercial harvest. Several methods can be used to

decrease harvest rates as follows:

- a. Reduce present guideline harvests and harvest ranges either proportionately for all districts or for only some districts.
- b. Reduce present guideline harvests by the amount of recent increases in subsistence harvests in specific districts.
- c. Replace present guideline harvest ranges with a single "quota" that is smaller than the midpoints of present harvest ranges.

Based on recent escapement trends, it is suggested that commercial harvests will have to be reduced by 50,000 - 100,000 fish to insure adequate escapements are obtained from runs ranging from small to average magnitudes. Regardless of the method used to reduce harvests, the lower Yukon fishery (primarily districts 1 and 2) will probably have to bear the greatest burden of reduced catches since the majority of the catch (60%) occurs there. The lower Yukon fishery also contains the majority of fishermen and has undergone the greatest development in recent years. If the guideline harvest concept is retained in the regulations, it is further suggested that the present wide harvest ranges (for example, 120,000 to 220,000 in districts 1-3 and 10,000 to 40,000 in district 4) be reduced. The relatively wide ranges in the present harvest ranges represent a degree of flexibility not matched by present management capability to accurately estimate in-season run strength. Decreasing the overall harvest in addition to providing narrow harvest ranges or "quotas" will insure adequate escapements from average and below average returns but may result in underharvested surpluses from exceptionally large returns.

2. Reduce the length of weekly fishing periods and establish weekly fishing periods by emergency order. This is reviewed as a necessary companion to option 1 so that fishing effort can be "spread" throughout the run to prevent overharvesting of specific stocks or run segments. This option will also insure there is sufficient time to tabulate and analyze catch and early escapement data for estimating in-season run strength. A 25-50% reduction in the length of weekly fishing periods in the major fishing districts may be necessary to distribute the harvest throughout the run. Because subsistence fishing is allowed only during commercial fishing periods, extra subsistence fishing time may be requested for some districts. Establishing fishing periods by emergency order is required for maximum management flexibility.
3. Establish separate fishing season(s). Presently there is no "break" in the commercial fishing season between the king-summer chum fishery and the fall chum fishery in dis-

tricts 1-4 . Similar to the strategy used for management of the king salmon fishery, the fall chum season would be closed until the run is distributed throughout each district. This would prevent overfishing of the early portion of the run and also afford a greater amount of uninterrupted subsistence fishing early in the run. Consideration should also be given for establishing two separate fishing seasons each with separate guideline harvests for the early and late portions of the run which may be composed of upper Yukon-Porcupine and Tanana stocks, respectively.

4. Establish coincidental fishing periods in districts 1 and 2. During the past several years, the district 2 fishery has expanded greatly with the result that very intensive fishing for fall chums now occurs throughout the lower 190 miles of river. The current weekly fishing periods in these two districts are staggered (for example, a 6 PM Monday - Tuesday period in district 1 is followed by a 6 PM Wednesday - 6 PM Thursday period in district 2). Establishing identical or coincidental fishing periods for both districts will mean that run segments will be exposed to less fishing time which should enhance escapements to upriver spawning grounds.
5. Retain present regulatory framework and management strategies and issue necessary in-season fishing restrictions on a more timely basis when below average returns are indicated. This option presumes that past management errors will not be repeated and the data base on which management decisions are made will undergo substantial improvement. An argument against this option is that the fall chum commercial fishery will continue to develop at a greater rate than management capabilities.
6. Reduce efficiency of the fishery through reduction in amount of gear operated. Present regulations allow the operation of 150 fathoms of set gillnet, 50 fathoms of drift gillnet and one fishwheel per commercial fisherman. Only set and drift gillnets can be operated in districts 1-3 while only set gillnets and fishwheels can be operated in districts 4-6. It is believed that many fishermen do not operate the maximum gear amounts. Also fishermen can only operate 1 gear type at any time.

The amount of gear reduction to offset a specified decrease in "catchability" of any district fishery is not known. Also limitations would have to be imposed on all gillnet gear as district 1-3 fishermen operate set and drift gillnets under single "gillnet" entry permit.

Conclusions

The staff recommends that some combination of options 1-4 be considered as the basis for improving management of the fall chum salmon fishery. For example, a reduced harvest will have no beneficial conservation ef-

fect if fishing effort is allowed to concentrate on and overfish a particular stock. The aforementioned options and discussion by the staff deal primarily with conservation requirements of the fall chum salmon resource. The Board may also wish to address these and other options in light of social and economic concerns for the fishery.

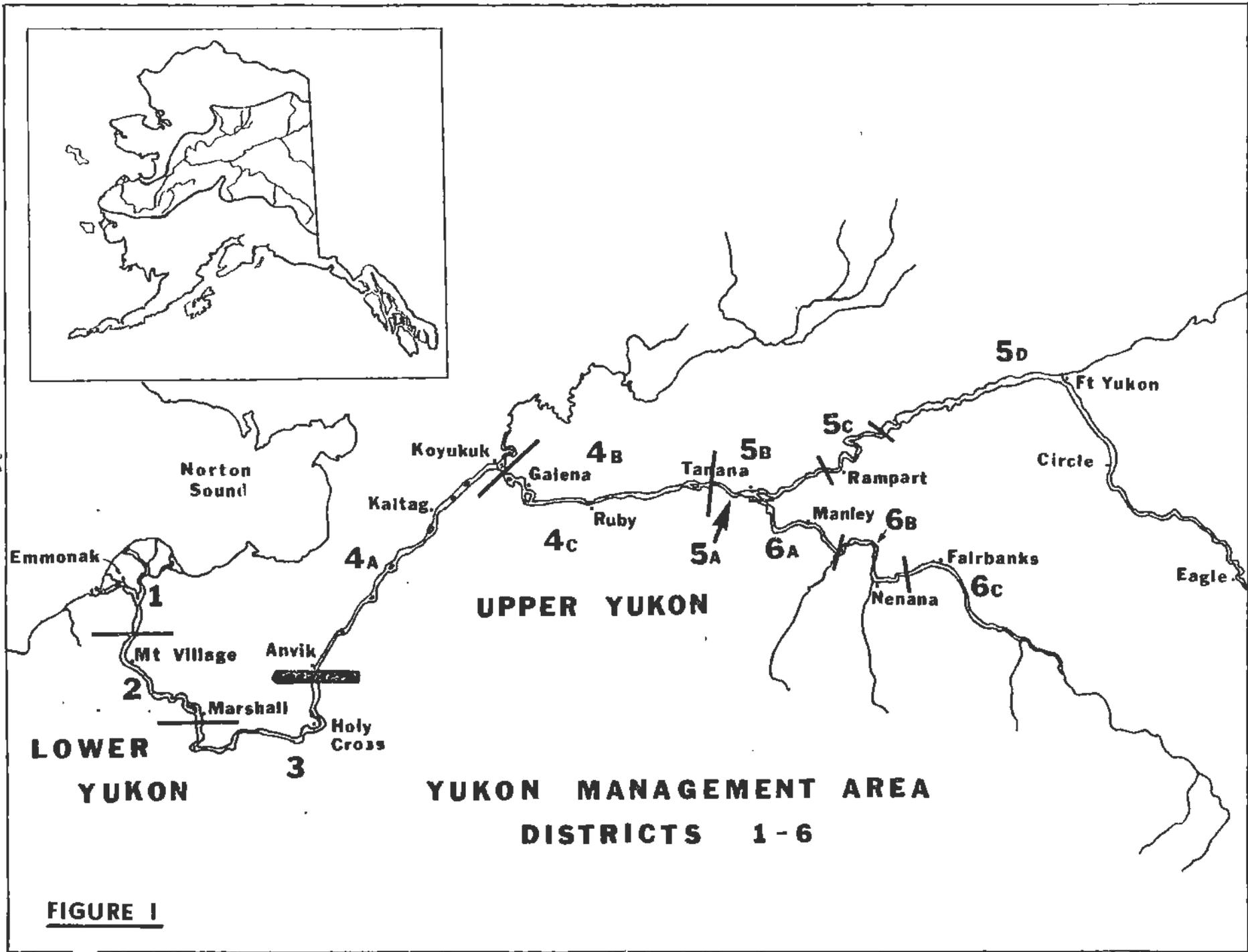
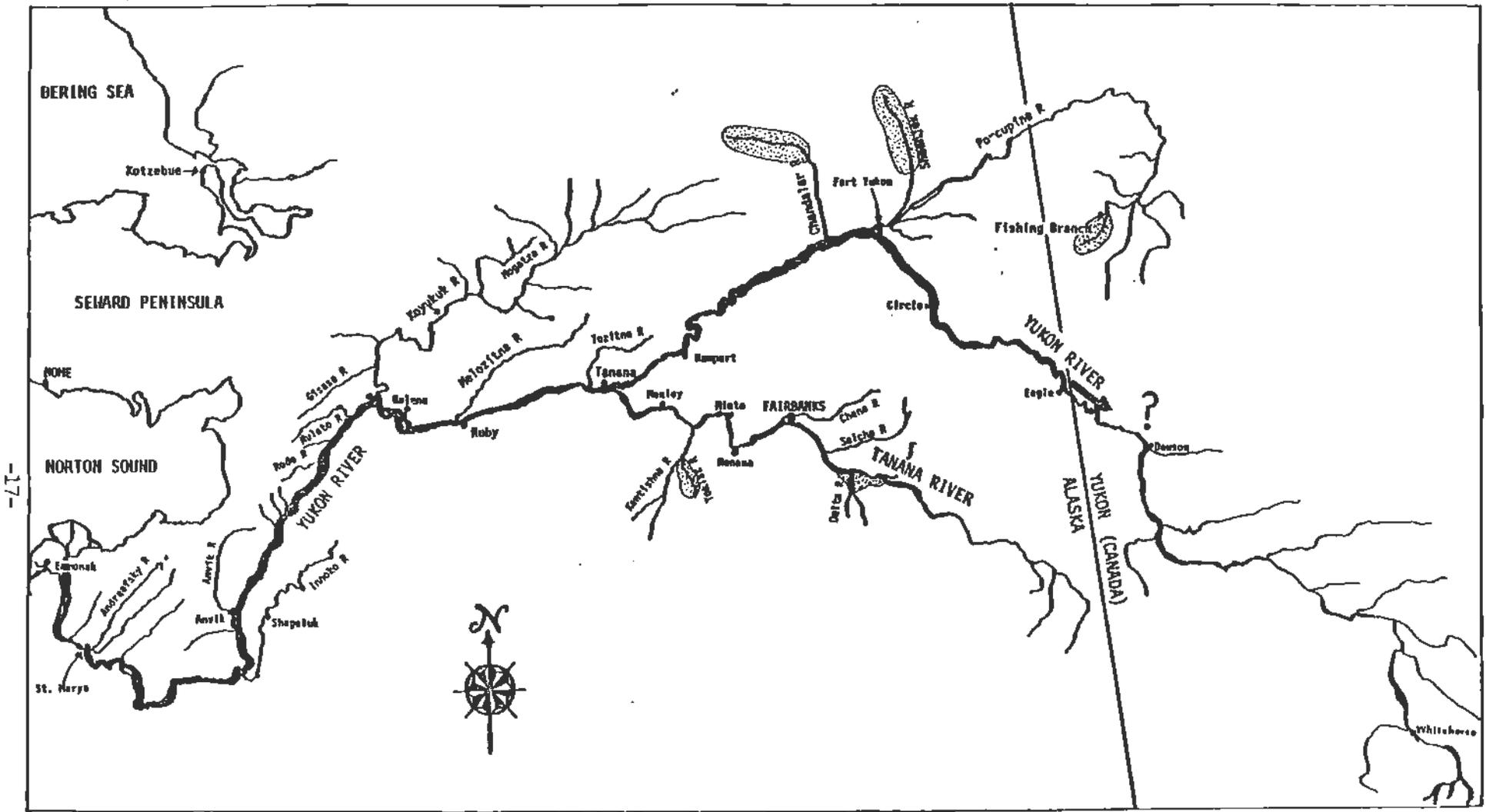


FIGURE 1



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FIGURE 2. MAJOR FALL CHUM SALMON SPAWNING AREAS IN THE YUKON RIVER.

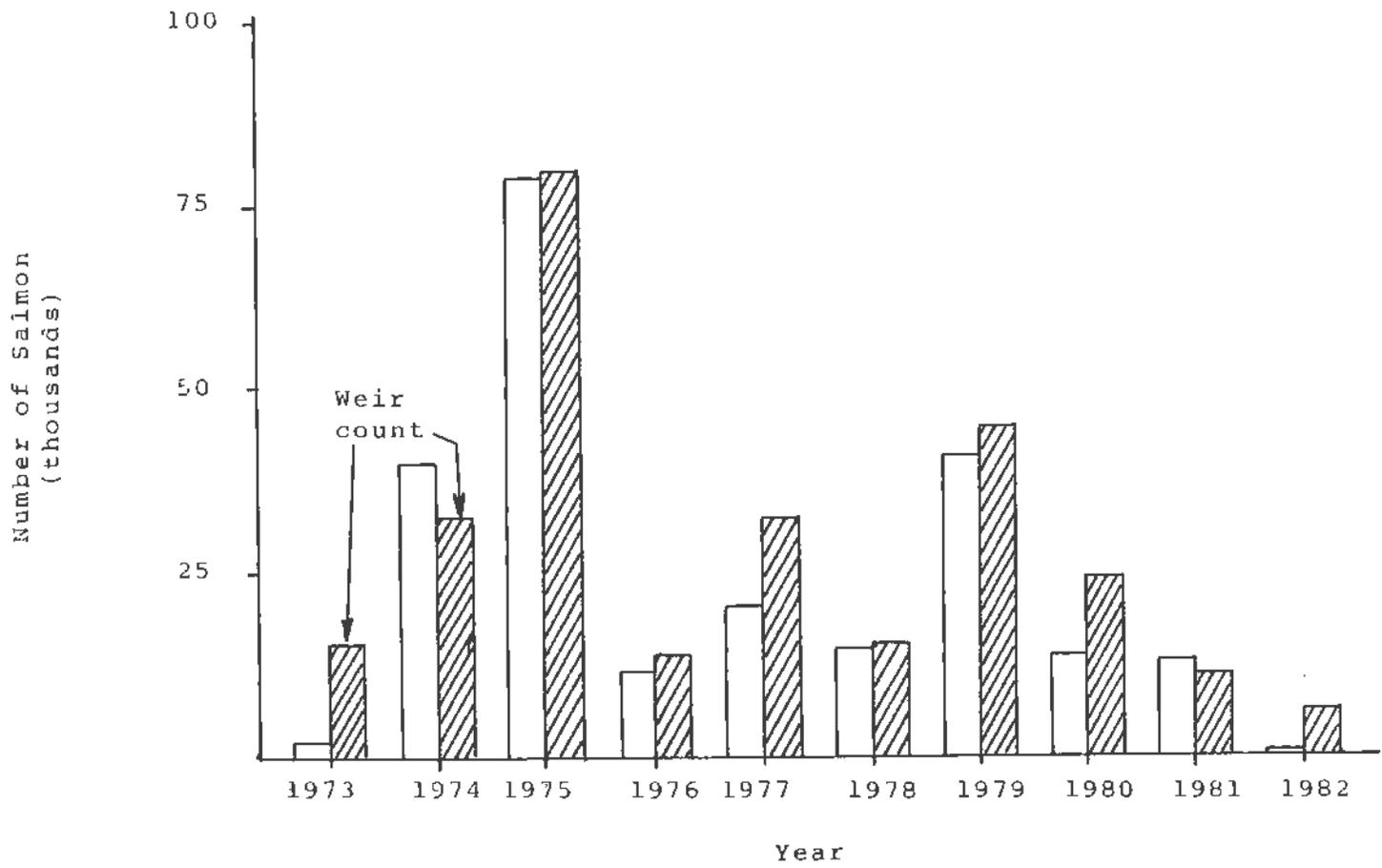


Figure 3. Fall chum salmon observed escapements in the Sheenjek River (open bars) and Fishing Branch River (hashed bars) based on aerial and ground surveys, 1973-1982.

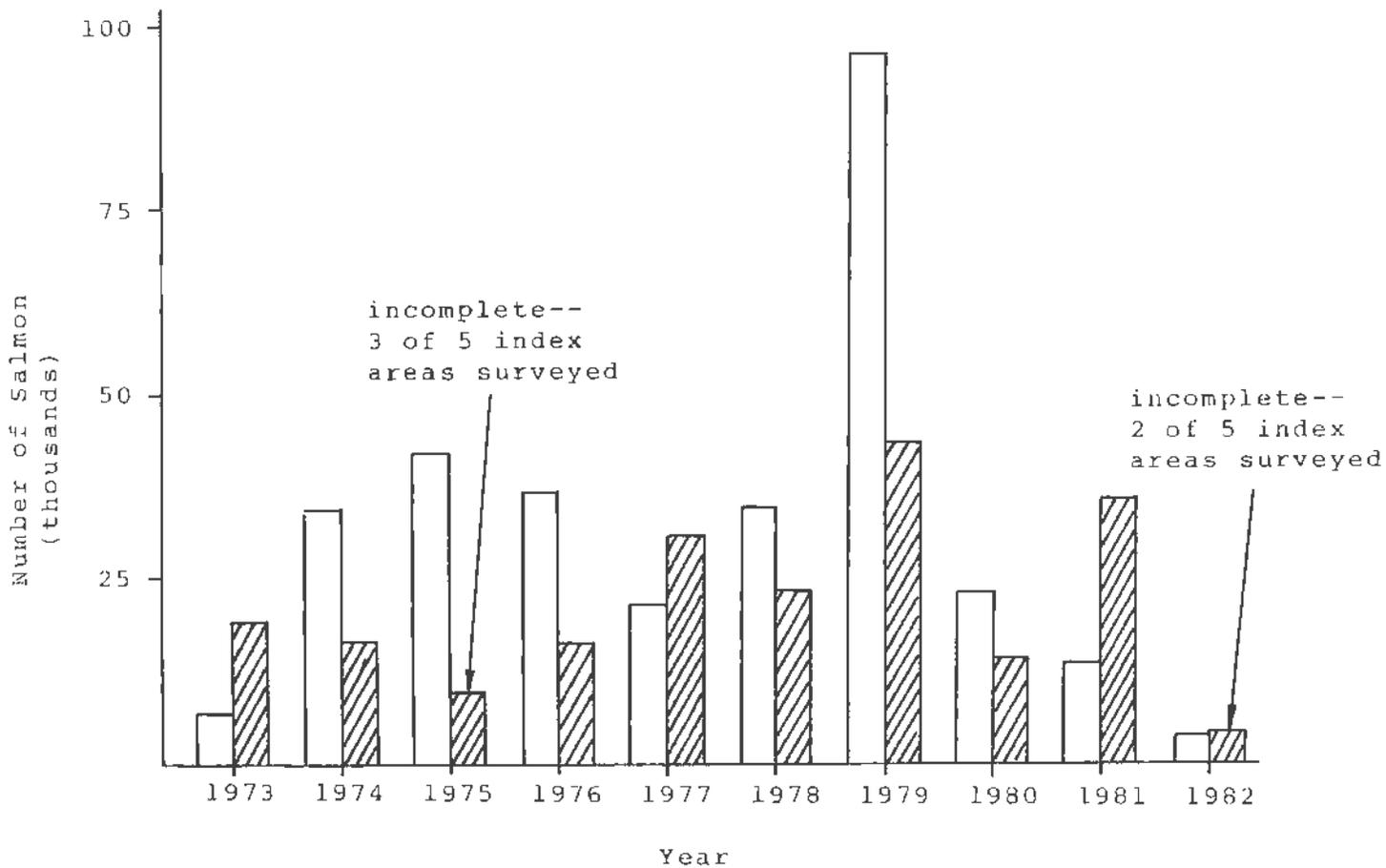


Figure 4. Fall chum salmon observed escapements in the upper Toklat River (open bars) and upper Tanana River (hashed bars) based on aerial and ground surveys of selected index areas, 1973-1982. Upper Tanana River index areas include Delta River, Benchmark 735 Slough, South Bank Tanana, Bluff Cabin Slough, and Onemile Slough.

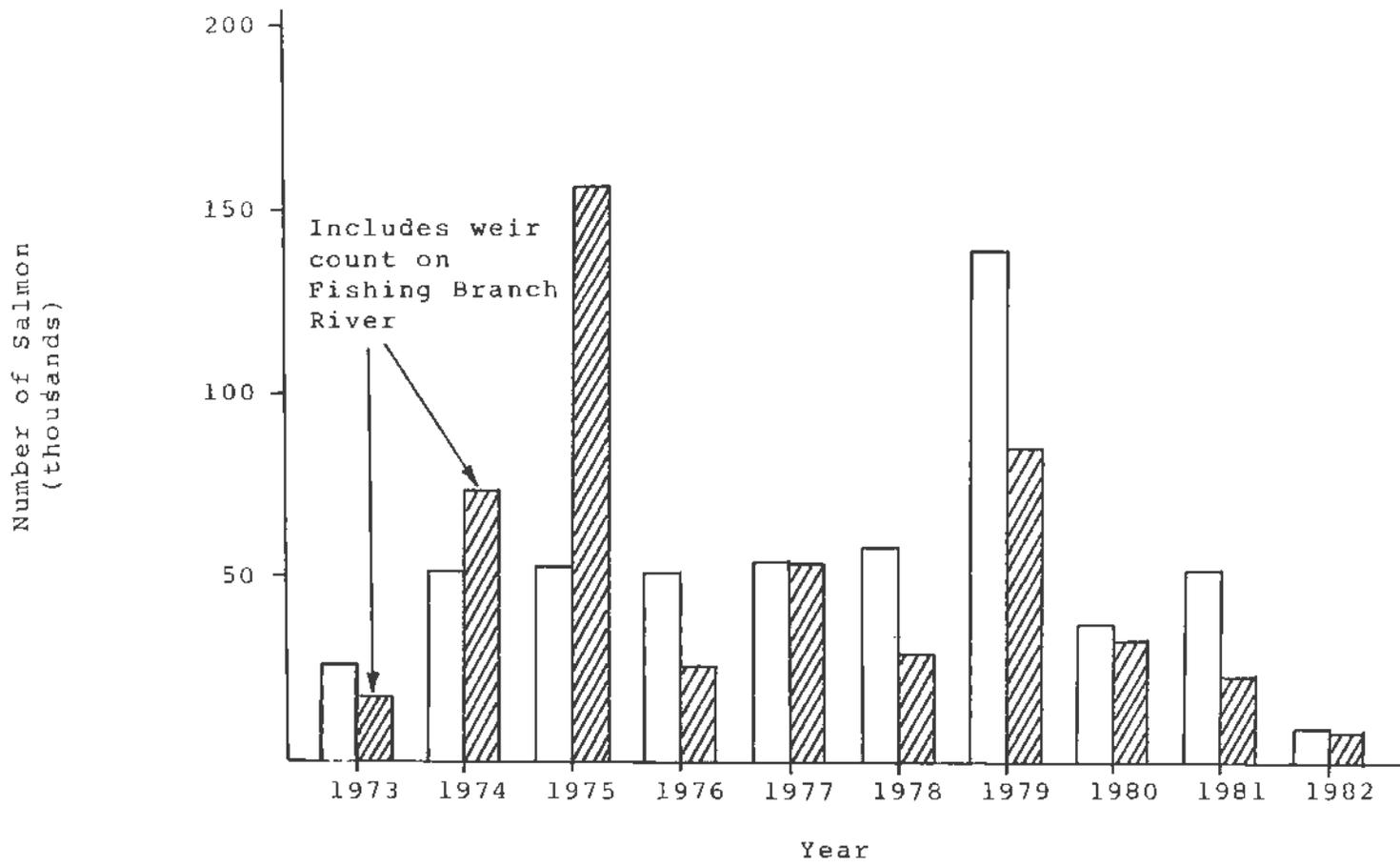


Figure 5. Fall chum salmon observed escapements in the Tanana River drainage (open bars) and Porcupine River drainage (hashed bars) based on aerial and ground surveys of selected index areas, 1973-1982. Porcupine River index areas include Sheenjek and Fishing Branch rivers. Tanana River index areas include upper Toklat and Delta rivers, and four upper Tanana River sloughs near Delta.

Table 1. Yukon River drainage fall chum salmon aerial survey spawning escapement estimates for selected index streams, 1973 through 1982.^a

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
<u>TANANA RIVER DRAINAGE</u>										
Toklat River ^b	6957	34310	42410 ^c	35190	21800 ^c	35000	96550 ^d	23054	13907	3209 ^e
Upper Tanana River										
Benchmark #735 Slough	127	1450 ^c	--	336	1270	1705 ^c	2714	1900 ^e	168 ^c	--
Delta River	7971 ^f	4010	3089 ^e	5498	17925	10051	8125	4637	10664 ^p	3433 ^e
South Bank Tanana River ^g	5635	4567 ^f	--	4979	3797	5700	20820	3444	7063	--
Bluff Cabin Slough	3450	4840 ^f	5000 ^{c,d}	3197	6491	5340	6875	3190	6120	1156 ^e
Onemile Slough	1720	1235	745 ^d	1552	1900	475	3850 ^c	885 ^c	632	--
Subtotal	18903	16102	8934 ^c	15562	31383	23271	42384	14056	36358	4589
TOTAL TANANA INDICES	25860	50412	51252 ^c	50752	53183	58271	138934	37110	50265	7798 ^c
<u>PORCUPINE RIVER DRAINAGE</u>										
Sheenjok River	1175 ^f	40507	78060	11866	20506	14610 ^c	41140	13027	12625 ^{c,h}	717 ^{c,i}
Fishing Branch River (RT)	15987 ^j	32525 ^j	78615 ^k	13450	32500	15000	44080	20319 ^c	10549 ^{c,r}	6000
Total Porcupine Indices	17162 ^l	73032 ^l	156675	25316	53006	29610	85220	33346	23174 ^c	6717
<u>UPPER YUKON TRIBUTARIES</u>										
Chandalar River	--	17455	6345 ^c	58 ^c	4183	--	--	2607	4906 ^m	1145 ^m
TOTAL PORCUPINE AND UPPER YUKON TRIBUTARY INDICES	17162 ^{c,l}	90484 ^l	163020	25374	57189	29610 ^c	85220 ^c	35953	28080	7862

^a All surveys rated fair-good unless indicated otherwise. Only peak estimates are listed. 1982 figures are preliminary.

^b Includes following areas: Toklat River in vicinity of roadhouse; Sushana River; Geiger Creek.

^c Poor or incomplete survey estimates.

^d Combined aerial and ground surveys.

^e Foot survey.

^f Survey rating not given.

^g Richardson Highway bridge to Blue Creek.

^h Sonar-estimated escapement was 69,043.

ⁱ Sonar-estimated escapement was 29,093.

^j Weir count.

^k Total escapement through weir was 353,282.

^l Figure includes a weir count--not comparable.

^m Fair to poor survey

^p Ground count was 22,375.

^r Surveyed only half of index area--many more chum salmon present.

Table 2. Approximate total utilization and estimated index of total run strength for Yukon River chum salmon, 1975-1982.

Year	Commercial catch	Subsistence Catch					Total catch	Observed escapement index			Index of total run strength
		Yukon ^a	Koyukuk ^b	Tanana ^c	Porcupine ^d	Total		Porcupine ^e	Tanana ^f	Total	
1975*	267,656	65,065	2,190	35,709	6,572	109,536	386,192	156,675	51,252 ^g	207,927	594,119
1976*	164,282	53,975	1,817	29,623	5,452	90,867	255,149	25,316	50,752	76,068	331,217
1977	252,729	49,842	1,725	30,604	6,160	88,331	341,060	53,006	53,183	106,189	447,249 ^h
1978	247,093	62,318	1,992	30,557	5,000	99,867	346,960	29,610	58,271	87,881	434,841 ⁱ
4-year average	232,940	57,800	1,931	31,623	5,796	97,150	332,340	66,151	53,364	119,516	451,857
1979	372,564	177,300	4,281	51,766	11,000	244,347	616,911	85,220	138,934	224,154	841,065
1980	307,123	116,081	6,248	40,828 ^j	6,000	169,157	476,280	33,346	37,110	70,456	546,736
1981	501,319	159,753	2,140	23,450 ^k	3,000	188,343	689,662	23,174 ^g	50,265	73,439	763,101
3-year average	393,669	151,044	4,223	38,681	6,666	200,615	594,284	47,246	75,436	122,683	716,967
1982 ^m	235,980		1,438					6,717	7,798 ^g	14,515	

* Subsistence catch of fall chum salmon in these areas in these years was estimated from average percentages calculated from 1977 and 1978 data; i.e., the average percent of total summer and fall chum subsistence catch which was fall chum and average percent of fall chums subsistence catch by river area. Data from 1979-1981 were not included in calculations since fall chum salmon subsistence utilization increased dramatically in those years.

a Mainstem Yukon River villages, including Innoko River and Chandalar River villages.

b Koyukuk River villages.

c Includes only towns of Manley, Nenana, and Fairbanks.

d Includes only the village of Old Crow.

e Includes observed escapements on Sheenjek and Fishing Branch rivers.

f Includes observed escapements in upper Toklat River and 5 index areas in upper Tanana River near Delta.

g Incomplete survey coverage.

h Fall chum population estimate from tagging at river mile 540-601 was 513,000.

i Fall chum population estimate from tagging at river mile 601-725 was 460,000.

j An additional 9,500 fall chum salmon were taken by Minto residents.

k An additional 3,182 fall chum salmon were taken by Minto residents.

m The 1982 data are preliminary.

Table 3. Commercial salmon catches, Yukon area, 1961-1982.

Year	King	Summer Chum	Fall Chum	Total Chum	Coho	Total
1961	120,260	-	42,577	42,477	2,855	165,692
1962	94,374	-	53,160	53,160	22,926	170,820
1963	116,994	-	-	-	5,572	122,566
1964	93,587	-	8,347	8,347	2,446	104,380
1965	118,098	-	23,317	23,317	350	141,765
1966	93,315	-	71,045	71,045	19,254	183,614
1967	129,706	11,179	38,274	49,453	11,047	190,206
1968	106,526	14,470	52,925	67,395	13,303	187,224
1969	90,223	60,569	131,291	191,860	14,981	297,064
1970	80,269	137,368	209,356	346,724	12,245	439,238
1971	110,507	100,090	189,594	289,684	12,203	412,394
1972	92,840	135,668	152,176	287,844	22,233	402,917
1973	75,353	285,844	232,090	517,934	36,641	630,029
1974	97,919	604,210	273,158	877,368	16,240	993,402
1975	63,740	728,156	265,156	993,312	2,346	1,050,945
1976	88,671	598,227	163,282	761,509	5,197	855,377
1977	96,414	548,958	248,739	797,697	38,021	932,096
1978	97,602	1,045,092	243,737	1,288,829	25,960	1,412,391
1979	129,056	803,500	362,480	1,165,980	17,110	1,312,146
1980	155,088	1,057,761	298,123	1,355,884	8,741	1,519,713
1981	157,607	1,191,812	486,059	1,677,871	23,702	1,859,180
1982	123,658	614,166	225,021	839,187	37,176	1,000,021
5 year average (1977-81)	127,153	929,425	327,828	1,257,253	22,707	1,407,113

Table 4. Summary of important fall chum and coho salmon commercial fishing regulations, Yukon area, 1982.

District/ Subdistrict	Fishing Season	Weekly Fishing Periods	Legal Gear	Guideline Harvest Range	(Effective Date)
1	July 16 through August 31 1/	Two-24 Hour Periods	Set and Drift Gillnets	120,000 to 220,000 Chums in Districts 1,2 and 3 combined	After July 15
2	July 16 through August 31 1/	Two-24 Hour Periods	Set and Drift Gillnets		After July 18
3	July 16 through August 31 1/	Two-36 Hour Periods	Set and Drift Gillnets		After July 21
4b, 4c	Through September 30 2/	Two-48 Hour Periods	Set Gillnets and Fishwheels	10,000 to 40,000 Chums and Cohos Salmon Combined	After August 15
5a, 5b, 5c	Through September 30 2/	Two-48 Hour Periods	Set Gillnets and Fishwheels	8,000 to 36,000 Chums and Cohos Salmon Combined	After August 15
5d	Through September 30 2/	Seven Days a Week	Set Gillnets and Fishwheels	2,000 to 4,000 Chums and Cohos Salmon Combined	After August 15
Total District 5				10,000 to 40,000 Chums and Cohos Salmon Combined	
6a, 6b, 6c	Through September 30 3/	Two-48 Hour Periods	Set Gillnets and Fishwheels	5,000 to 20,500 Chums and Cohos Salmon Combined	After August 15

1/ Fishing season usually closed by Emergency Order prior to August 31.

2/ Fishing season usually opened by Emergency Order in mid-August and usually closed by Emergency Order prior to September 30.

3/ Fishing season usually opened by Emergency Order in early September and usually closed by Emergency Order prior to September 30.

Table 5. Commercial fall chum guideline harvest ranges, catch and effort, and value to fishermen, Yukon Area, 1974-1982.

District and Subdistrict	Fall Chum Commercial Guideline Harvest	Fall Chum Salmon Catch 1/	Number of Fishermen 1/	Total 1/ Fishing Hours	Average Earnings Fall Chums 1/	All Species 1/
<u>1, 2, & 3 Combined</u>						
1974-78	200,000	193,521	585	800	\$ 801	\$4,065
1979	120,000 to 220,000	229,403	710	612	1,632	9,787
1980	120,000 to 220,000	204,229	650	468	606	8,449
1981	120,000 to 220,000	341,760	723	396	2,079	12,704
1982	120,000 to 220,000	199,866	700	600	1,319	8,616
<u>4</u>						
1974-78	10,000	9,947	26	293	539	733
1979	10,000 to 40,000	50,375	31	312	3,640	4,858
1980	10,000 to 40,000	32,031	33	432	2,019	5,708
1981	10,000 to 40,000	19,447	30	240	1,678	3,813
1982	10,000 to 40,000	4,061	15	96(48) 384(4C)	568	2,996
<u>5</u>						
1974-78	25,000	20,570	34	451	853	1,627
1979	10,000 to 40,000	56,668	44	288	2,885	4,062
1980	10,000 to 40,000	42,343	43	192	2,059	3,165
1981	10,000 to 40,000	95,844	50	240	4,965	7,166
1982	10,000 to 40,000	13,678	24	144(5A) 48(58,5C,5D)	1,197	2,763
<u>6</u>						
1974-78	15,000	19,090	32	336	\$ 841	\$1,502
1979	7,500 to 22,500	34,316	37	96	2,078	3,327
1980	7,500 to 22,500	19,520	26	96	1,562	3,427
1981	5,500 to 22,500	29,008	30	96	2,504	5,049
1982	5,500 to 22,500	7,416	25	72	623	3,165

1/ Annual averages for 1974-78 period

Table 6. Number of participating fishing vessels, fall chum salmon fishery, Yukon area, 1971-1981. 1/

Year	Lower Yukon Area				Upper Yukon Area			
	District 1	District 2	District 3	Total	District 4	District 5	District 6	Total
1971	352	-	-	352	-	-	-	-
1972	353	75	3	431	-	-	-	-
1973	445	183	-	628	-	-	-	-
1974	322	121	6	449	17	23	22	62
1975	428	185	12	625	44	33	33	110
1976	422	194	28	644	18	36	44	98
1977	337	172	37	546	28	34	32	94
1978	429	204	28	661	24	43	30	127
1979	458	220	32	710	31	44	37	112
1980	395	232	23	650	33	43	26	102
1981	462	240	21	723	30	50	30	110

1/ Actual number of fishing vessels refer to those boats which made at least one delivery. Data presented shows the number of vessels that operated in each district. Some individual fishing vessels may have operated in more than one district during the year.

Table 7. List of Emergency Orders issued in 1982 affecting the Yukon area fall chum salmon commercial and subsistence fisheries.

Emergency Order No.	Effective Date	Action Taken	Comments
3-Y-15-82	July 26	Reopen commercial fishing season in District 3.	Fall chum salmon are present in harvestable numbers.
3-Y-18-82	August 15	Close commercial salmon fishing season in Districts 1, 2 and 3.	The midpoint of the 120,000 to 220,000 fall chum salmon guideline harvest range was exceeded.
3-Y-19-82	August 20	Close commercial salmon fishing season in subdistrict 4-B.	Early portion of Upper Yukon fall chum appears too weak to allow continued commercial harvest.
3-Y-20-82	August 25	Reduce subsistence fishing time to 3 days a week in subdistrict 4-B and District 5.	Early portion of Upper Yukon fall chum run continues to appear weak and subsistence fishing restrictions are necessary to provide for increased escapements.
3-Y-21-82	September 4	Increase subsistence fishing time to 5 days a week in subdistrict 5-A.	Subsistence and test fishing catches indicate that the fall chum run (Tanana River origin) is average to above average in magnitude.
3-Y-22-82	September 4	Reopen commercial salmon fishing season in Subdistrict 5-A.	Subsistence and test fishing catches indicate that the fall chum run (Tanana River origin) is average to above average in magnitude.
3-Y-23-92	September 4	Increase subsistence fishing time to 5 days a week in subdistrict 4-B.	Majority of fall chum run has passed through the subdistrict and restricted subsistence fishing time is no longer required.
3-Y-24-82	September 11	Increase subsistence fishing time from 3 to 5 days a week in subdistrict 5-B & 5-C.	Late portion of fall chum run (Upper Yukon stocks) showed unexpected run strength based on subsistence catch monitoring.

Emergency Order No.	Effective Date	Action Taken	Comments
3-Y-25-82	September 11	Reopen commercial salmon fishing season for one week and allow two-24 hour periods in subdistricts 5-B and 5-C.	Late portion of Upper Yukon fall chum run showed unexpected strength and a limited ed.
3-Y-26-82	September 14	Close commercial salmon fishing season in subdistricts 4-C and 5-A.	The majority of the fall chum and coho salmon run has passed through the area.
3-Y-27-82	September 14	Reopen commercial salmon fishing season in District 6.	The fall chum and coho run is well distributed through the the District and a reopening of commercial fishing season is warranted.
3-Y-28-82	September 14	Correct errors in Emergency Order 3-Y-25-82.	Corrected errors regarding fishing period schedule in subdistricts 5-B and 5-C.
3-Y-29-82	September 17	Increase subsistence fishing time to 5 days a week in that portion of subdistrict 5-D upstream to 12 Mile Island.	Late portion of Upper Yukon fall chum run shows unexpected strength.
3-Y-30-82	September 20	Close commercial salmon fishing season in District 6.	The midpoint of te 5,500 to 20,500 fall chum and coho salmon guideline harvest range has been exceeded.
3-Y-31-82	September 22	Increase subsistence fishing time to 5 days a week in that portion of subdistrict 5-D from 12 Mile Island to U.S./ Canada border.	Late portion of Upper Yukon fall chum run shows unexpected strength.
3-Y-32-82	September 23	Reopen commercial salmon fishing season for one week and allow two-24 hour fishing periods in subdistrict 5-D.	Late portion of Upper Yukon fall chum run showed unexpected strength and a limited commercial harvest is warranted.