

MEMORANDUM

STATE OF ALASKA

TO: Distribution

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FROM: Linda Brannian *LB*
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SUBJECT: 1986 Board of
Fisheries Yukon chinook presentation.

Attached is the graphic packet I ^{was to} ~~will~~ pass out to the BOF when I gave my presentation on the exploitation rates of upper and middle run chinook salmon on the Yukon river. I have also enclosed an outline of my talk which may help to explain the graphics.

Distribution: Randall, Arvey, Cannon, Whitmore, Buklis, Anderson, Barton, Bergstrom, Merritt, Thompson, Wilcock, Regnart.

BACKGROUND

Area and District Boundaries

The Kuskokwim Area includes the Kuskokwim River drainage and all waters of Alaska between Cape Newenham and the Naskonat Peninsula (Figure 1). Commercial salmon fishing takes place in four districts: District 1, the Lower Kuskokwim River consisting of the portion of the Kuskokwim River upstream of Eek Island to the north mouth of the Mishevik Slough near Tuluksak (Figure 2). District 2, the Middle Kuskokwim River upstream from the north mouth of Mishevik Slough to the Kolmakoff River (Figure 3.) District 4, Quinhagak consisting of Kuskokwim Bay waters between the mouth of Oyak Creek and the South mouth of the Arolik River (Figure 4); and District 5, Goodnews Bay consisting of the waters of Goodnews Bay (Figure 5).

Management Objectives and Strategies

The Division of Commercial Fisheries of the Alaska Department of Fish and Game is responsible for the management of commercial and subsistence fisheries in the Kuskokwim Area. The main objective of the Department's program is to manage both fisheries on a sustained yield basis in accordance with policies set forth by the Alaska Board of Fisheries, including assignment of subsistence as the highest priority among beneficial uses of the resources.

The area's commercial fishery has expanded during the last ten years as a result of increased participation by individual fishermen, improvements in fishing gear, and increased tendering and processing capabilities. Permit renewals have averaged 814 in the previous five years. In 1986, 837 permits were renewed and 789 permit holders made at least one landing. There are 831 salmon permits and 6 interim salmon permits authorized in the

Kuskokwim Area. Commercial harvest guidelines and gear restrictions in recent years have been promulgated to offset increases in fishing effort and efficiency so that adequate subsistence harvests and spawning escapements could be maintained.

In 1983, provisional spawning escapement objectives were established for the area's major spawning systems. Objectives were established based on the average escapement counts obtained in these systems since 1959. The objectives are considered to represent the escapement levels needed to maintain the salmon stocks at past levels of abundance. Continuing assessment of salmon returns may require future adjustment of the objectives to maximize salmon production.

The Kuskokwim River subsistence salmon fishery is one of the largest with over 850 families participating. Subsistence catches of chinook salmon in the Kuskokwim River often exceed the commercial catches of this species. Technological improvements in commercial fishing gear have increased efficiency of the subsistence fishery since the same units of gear are frequently used in both fisheries. The Division of Subsistence has prepared a special Board report on the subsistence salmon fishery in the Kuskokwim.

Commercial fishing time is adjusted during the season in response to return magnitude as indicated by commercial catch data, test fishing and spawning escapement monitoring. Evaluation of annual spawning escapements is accomplished through aerial surveys of "key" index streams and lakes throughout the area, a weir project in the Holitna drainage, sonar counters on the Aniak and Kanaktok Rivers and a counting tower on the Goodnews River.

Due to turbid water conditions and inclement weather, accurate estimates of escapements in all streams cannot always be obtained. Most spawning streams are located many miles upstream from the commercial fishing districts so that timely escapement

1986 BOF PRESENTATION ON YUKON CHINOOK EXPLOITATION RATES

I. INTRODUCTION

1. I would like to begin my presentation with a review of the complex nature of managing the Yukon chinook resource - drainage wide.

2. Figure 1. shows the Alaskan portion of the Yukon drainage.

- a. 6 commercial fishing districts - lower 3 gillnets
upper 3 fishwheels & gillnets
- b. subsistence fishing occurs through out the drainage

c. Canadian commercial fishery conducted below confluence of the Stewart river with the majority below Dawson. Subsistence also through out much of the drainage

4. The vast majority of the harvest is taken over a very short period of time in the lower Yukon yet most spawning occurs hundreds of miles away. and there are additional upriver harvest to be considered.

In Example

5. Fish that spawn in Canada undergo fishing pressure in 5 districts in Alaska and 1 in Canada.

6. Chinook from the Tanana- 4 mainstem districts and 1 in the Tanana

7. Koyukuk -4

8. Andreafsky and Anvik Rivers - only 3.

9. It is very difficult to exploit all spawning stocks at their optimum level. Each stock potentially passes through a different number of districts and undergoes a different exploitation rate.

10. As managers we are very interested in the timing of these different stocks and their contributions to the different fisheries. We want to know the total return drainage wide in order to attempt to optimally harvest all stocks.

11. Therefore when the US entered into negotiations with Canada over Canadian origin chinook and chum salmon in 1985 a forum was created for each country to share knowledge of status of these stocks of salmon

II. DATA SYNTHESIS :

1. Through the sharing of data from projects conducted by the Dept. and by the Canadian DFO we have been able to estimate stock specific total return and exploitation rates of Canadian origin chinook salmon.

2. This synthesis of data was from two major projects.

3. Figure 2 The first project involves stock composition modeling of mixed stock fisheries.

a. This project has been conducted by the Department since 1982 and has given us the ability to allocate commercial and subsistence catch in the mainstem Yukon to 3 major spawning groups based on differing growth patterns observed in the development of their scales.

b. The three major groups or runs are: Figure 2

Lower run chinook - Which spawn in the tributary streams that drain the Andreafsky Hills and Kaltag Mountains. In this figure major concentrations are noted for the Andrf, Anvik, Nulato and Gisasa.

Middle run chinook which spawn in the tributaries of the Tanana River and upper Koyukuk. In this figure major concentrations are noted for the Chena, Salcha, Jim, and S. Fork Koyukuk.

Upper run chinook spawn in tributary streams that drain the Canadian portion of the Yukon system and in this figure major spawning concentrations are noted for the Big Salmon, Teslin, Ross Rs.

c. Figure 3 presents the resulting allocation of catch to stock of origin for 82 - 85

i. 1st bar represents the catch of lower run fish made drainage wide in numbers of fish.

2nd = middle and

3rd = upper run chinook

ii. Upper contributes the greatest amount to drainage wide harvest middle run being the next important. then lower

iii. In the lower portion of the figure I have presented only harvests made in Alaska ie the Canadian harvest have been removed from upper run. In addition I have added together lower and middle run chinook. Therefore this graph shows the contribution to our fisheries of Alaska origin VS Canadian origin fish.

iv. The first bar for each year is the catch of Alaska origin fish in numbers and the second is Canadian origin fish. Here I want to emphasize just how important the Canadian stock is to our fisheries. On average Canadian origin fish have comprised 45% of Alaska's catch.

v. I have also included a Table after this figure in your packet which includes harvest by run for the years shown in this figure. This table corresponds to the upper figure and includes Canadian catch.

4. The second project is a tagging study conducted by the Canadian DFO

a. This tagging study was conducted in 1982 and 1983 and results were published in 1985.

b. Results from tagging conducted in 1985 and 1986 are only preliminary

c. Chinook and chum salmon were tagged and released just upstream of the US/Canada border and recaptured further upriver by the commercial fishery. An estimate of fish crossing the border was made based on the ratio of tag to untagged fish in the commercial catch. Escapement became the difference between the estimate crossing the border and all known harvests.

d. the Department is currently in the process of reviewing this project and to date we have not detected any major problems with the chinook escapement estimates.

III. Total return and exploitation of upper stock (Canadian)

1. Figure 4 The upper portion of Figure 4 represents total return of Canadian origin chinook salmon.

a. Here the number of fish is on the Y-axis for the yrs 82-85

b. The top part of each bar w/small red cross hatching represents escapements as estimated by the Canadian tagging study.

c. the next portion of each bar represents harvest taken in Canada - the med. green cross hatching

d. the lower portion of each bar represents Alaskan harvests allocated to upper run fish based on scale pattern analysis, from our stock composition modeling project.

e. run size has varied from 94,00 in 84 to 145,00 in 1983

2 Given an estimate of total return we can now estimate the level of exploitation undergone by this stock.

a. the lower portion of this figure presents the exploitation for Canadian origin stocks in 82-85

i. Y-axis is the proportion of total run that was caught. This exploitation represents the percent of total return harvested in the commercial, subsistence and sport fisheries combined.

ii. in 1982 84% of the total return was harvested leaving only 16% to spawn and reproduce.

iii. In 1983 78% of the Canadian origin chinook were caught.

iv. in 1984 67%

v. in 1985 there was a 90% exploitation rate or in other words 90% of that year's returning Canadian origin chinook were harvested allowing only 10% to reproduce.

b. These levels of exploitation are thought to be excessive

c. On this Figure a line of maximum allowable exploitation of 67% has been drawn. In other words, what we know about chinook stocks indicates that on average you can harvest 67% and still maintain the run size by allowing 33% to spawn.

3. Currently we do not have any estimates of return per spawner for the upper Yukon stock but using information on other chinook stocks we would expect a return per spawner of 3 to 1 over the long run and this translates into an exploitation rate of 67%

a. In other words we estimate that each spawning adult can produce enough offspring so that 3 will return as adults of which 2 can be caught allowing 1 to spawn and renew the cycle. This would maintain the current level of production. i.e. $\frac{2}{3}$ or 67% can be caught and $\frac{1}{3}$ escapes to spawn.

b. In contrast at recent levels of exploitation we are expecting a much different level of production in order to continue this level of fishing and maintain run size.

for Example:

at 75% expl. each spawner must produce 4 returning adults

at 90% expl. each spawner must produce 10 returning adults

c. In other words exploitation rates on Canadian origin chinook have been too high for 3 of the last 4 years and run size may decline as a result.

4. This analysis was completed in the spring of 1986 and the results were presented to the US delegates at the April negotiations with Canada.

a. These results were also made available to our management staff and were important elements underlying the development of our 86 management plan and execution of the 86 fishery.

IV Middle stock exploitation rates.

1. As we saw earlier the Can. origin chinook run is an important contributor to the Alaskan fishery though of equal importance are the combined Alaskan runs which contribute on average 54% of the Alaska catch.

Please recall that those are the:

- a. middle run - stocks of the upper Koyukuk and Tanana drainages
- b. lower run fish to Andref. Hills and Kaltag mts

2. Therefore we were interested in evaluating the status of these stocks and estimating the level of exploitation they were undergoing.

3. It was postulated that total return for the middle and lower runs could be estimated using the exploitation rate of upper stocks in the lower Yukon and harvests allocated as middle and lower run.

a. for example in 1982 52% of the upper run was harvested in the lower two districts (Y1 Y2) combined. Now if we assumed that the other stocks were well mixed and equally vulnerable they would also have undergone a 52% exploitation.

b. We also know in 1982 that 30,000 middle run chinook were harvested in y1 and y2 combined from scale pattern analysis.

c. Therefore we would estimate total return to be 30,000 divided by .52 or 57,000.

4. Before I present the resulting estimates of total return on exploitation for Alaskan run chinook I would like to show the timing of the stocks as they pass thru the lower Yukon and their size and age composition in order to see how well we meet our assumption of mixing and equal vulnerability to the gillnet fishery.

5. Figure 5 shows the entry pattern of the 3 runs thru the lower Yukon for 82 and 83

a. here test net CPUE were allocated to run of origin

b. our testnet project fishes 7 days per week at the mouth of the Yukon throughout the chinook run and forms our best index of abundance.

c. squares = Lower pluses = Middle diamonds = Upper

d. the Y-axis is proportion of a run gone by to date for example in 82 on June 15 21 % of the middle and 25% of the upper run had passed.

e. In 82 and 83 middle and upper run entered together and the lower run came sign. later.

f. In 1982 the point at which 50% of the run had passed differed be the lower and the other two runs by 8 days

g. In 1983 the the spread was some 20 days between the earliest and latest timed run. and 1 day between middle and upper run.

6. Figure 6 presents the same type of data for 84 and 85.

a. Both years the runs came in much closer together.

b. in 84 there was a 3.5 day spread between the earliest and latest timed run at the 50% point

c. in 1985 there was a 6 day difference between the earliest and latest timed run at the 50% point. Middle and upper differed by 3 days

7. I considered the timing of the lower run to be different enough from the upper in 3 of the 4 years not to be able to assume good mixing and did not estimate total return.

8. In contrast I did make the assumption that the upper and middle runs had similar enough timing and were adequately mixed. What is of special importance is what occurs the first 7 to 10 days of the run as the first commercial period is delayed until that time. If a greater proportion of one run passed during that time we could not assume good stock mixing. Even in 1985 the two stocks are very well mixed early in the run diverging only after June 25.

9 Next I wanted to make sure that the different stocks would be equally vulnerable to gillnets which select for certain sized fish. In other words I wanted to see if the age of return for the 3 runs were similar and therefore the size distributuion.

10 In Figure 7 I have graphed the age composition of chinook sampled on the spawning grounds in 1983 - 85.

a. the y-axis is % of total sample and across the bottom are the 4 major ages at which chinook return 4,5,6,7

b. the percent of the lower run sampled for each age is represented by the first bar in each group
middle by the second
upper by the third

c. In this figure we see large differences in the percent of each run that returns at a given age.

- i. a higher % of the lower run returns as age 4 and 5
- ii. upper run returns mostly as age 6 with equal #'s 5 and 7

d. only some of these differences can be explained by the fact that only gillnets are used to catch lower run fish and both gillnets and fishwheels are used upriver to catch Canadian origin and middle run chinook. Fishwheel select for age 4 and 5 while large mesh gillnets select for older larger age 6 and above

e. Again the lower run was found to differ enough from the upper run not to be able to assume equal size composition and vulnerability to gillnets. In contrast the middle run fish were determined to be similar enough.

11. Figure 8 presents the results of this analysis the top figure is total return in numbers of fish for middle run chinook in 82, 83 and 85.

a. Total return is estimated to be 58,000 in 1982, 134,000 in 1983 and 53,000 in 1985.

b. the bottom part of each bar with the blue slash represents total drainage catch from our stock composition project.

c. the upper part or red cross hatched is the difference between total return and catch our spawning escapements

12. The lower figure are the estimates of exploitation.

a. the y-axis represents the proportion of total run that was caught in 82-85

- i. in 82 - 72% of the middle run return was harvested
- ii. in 83 - 58%
- iii. 78% in 1985

b. again I have drawn in our estimate of maximum allowable exploitation the black line at 67% and we can see 2 of the three years exceed that level

VI CONCLUSION

In Summary let

1. Figure 9 again present the exploitation rates for the two stocks: Canadian origin in the upper portion of the figure and middle in the lower portion for 82-85. These 2 important stocks comprise on average 75% of the chinook harvest in Alaska.

- a. maximum exploitation has been exceeded:

3 of the last four years for Canadian origin chinook
2 of the three years analyzed for the middle run.

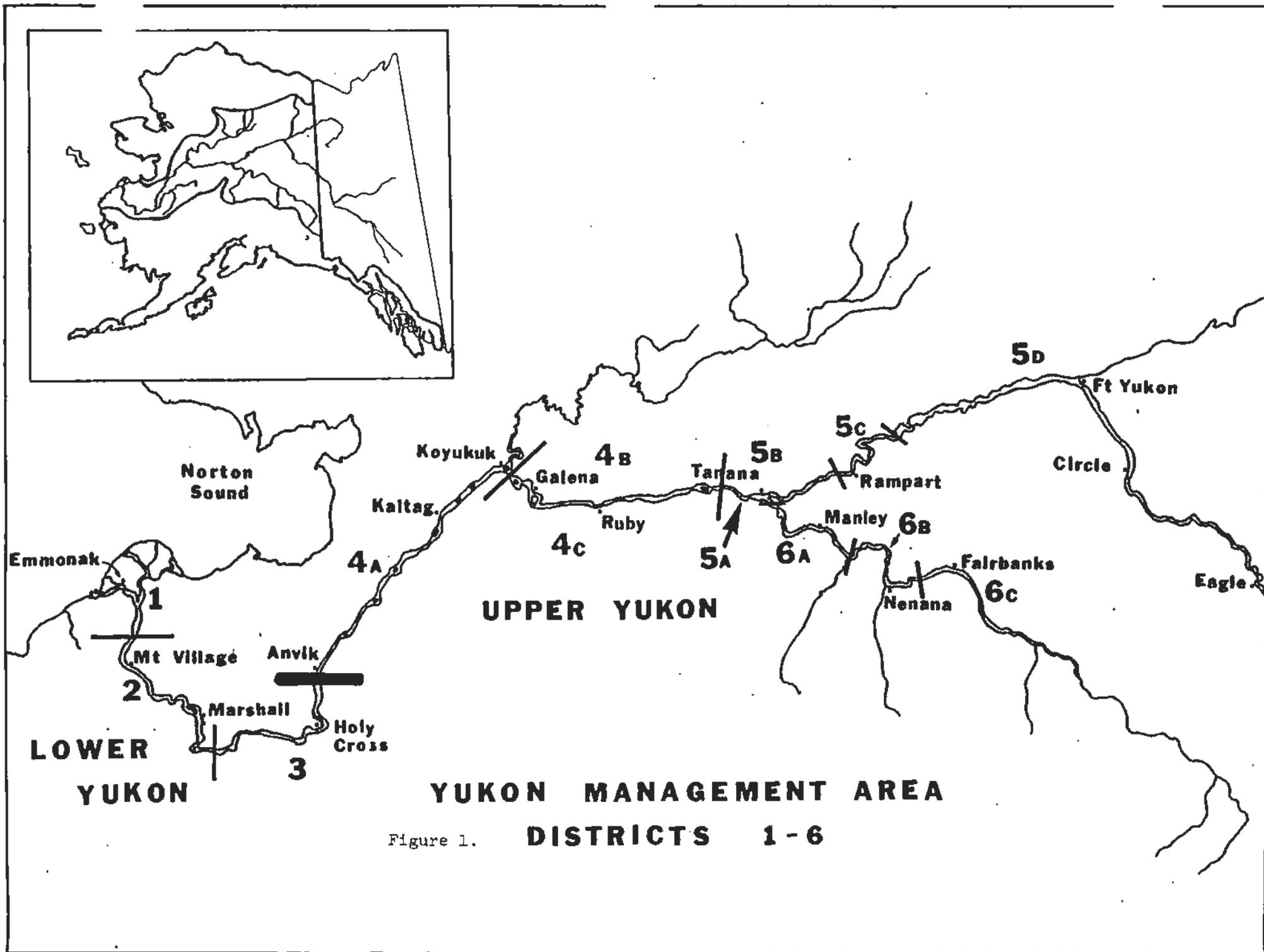
2. The analysis concerning Canadian origin fish was completed in the spring of 1986 and the results were presented to the US delegates at the April negotiations with Canada.

a. In addition preliminary results concerning middle run stocks were made available to our management staff after the negotiations:

b. I would like to emphasize that these results were important elements underlying the development of our 86 management plan and execution of the 86 fishery.

3. Lastly I would like the Board to consider the information presented here when considering public proposals:

- a. Those include proposals to increase harvest levels
- b. Direct the harvest to the earlier portion of the run
- c. and establish a regular fishing schedule with fixed number of hrs.



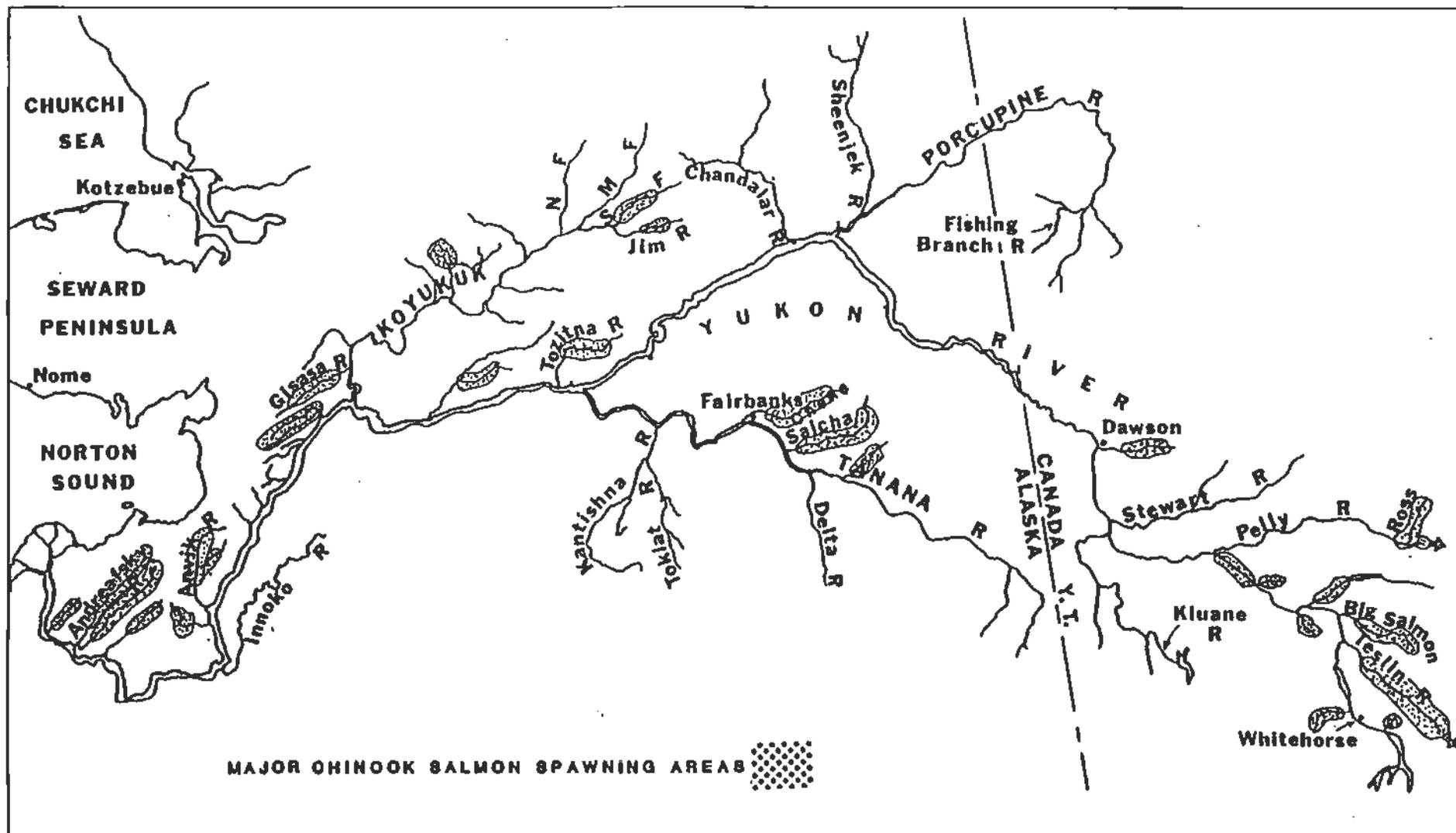
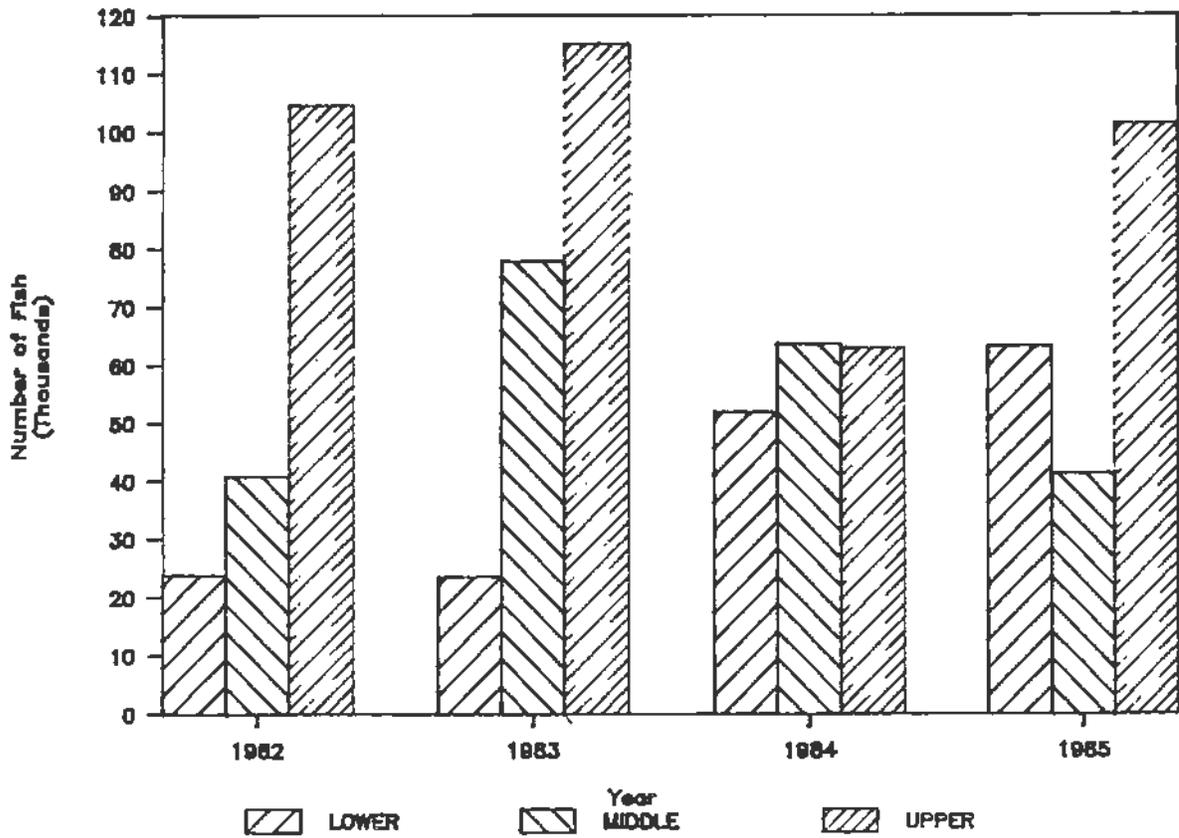


Figure 2. Chinook salmon spawning areas in the Yukon River drainage.

Yukon River Chinook Salmon Harvests



ALASKAN HARVEST OF YUKON RIVER CHINOOK

Alaskan vs Canadian Origin

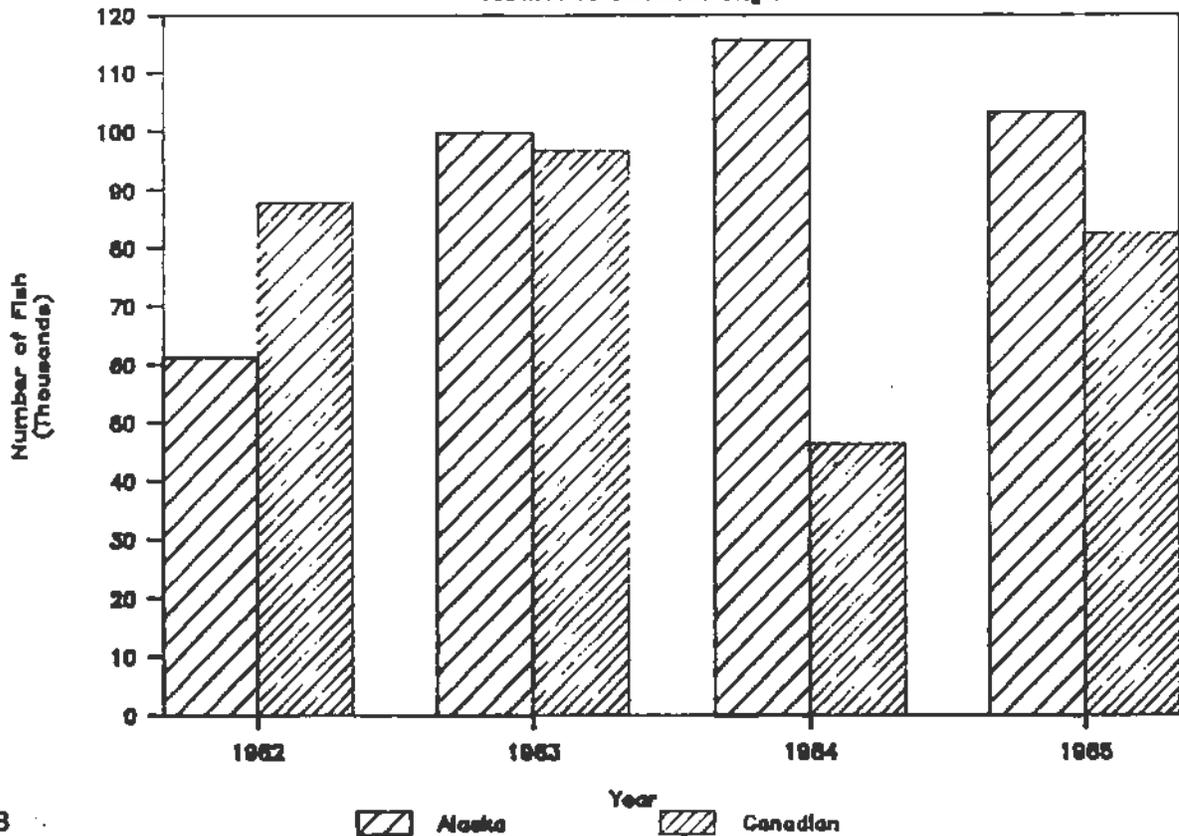


Figure 3

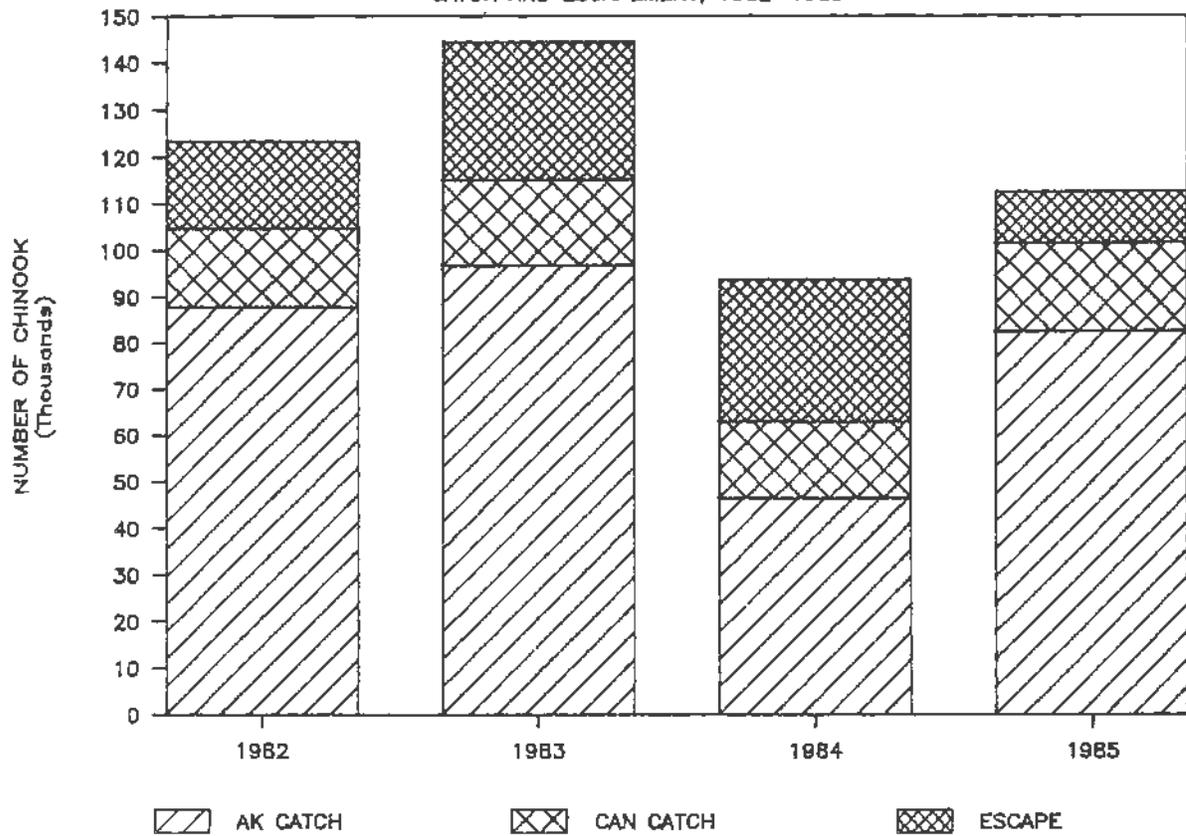
Table 1. Allocation by region of origin of chinook salmon from Yukon River commercial, sport, and subsistence catches, 1982-1985.

Location	1982		1983		1984		1985		Average
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.	Pct.
Lower	23,949	14.1	23,576	10.9	51,970	29.1	63,392	30.7	21.2
Middle	40,943	24.1	78,048	36.0	63,781	35.7	41,383	20.1	29.0
Alaska Total	64,892	38.2	101,624	46.9	115,751	64.7	104,775	50.8	50.2
Upper	104,806	61.8	115,239	53.1	63,037	35.3	101,541	49.2	49.8
Total	169,698	100.0	216,863	100.0	178,788	100.0	206,316	100.0	100.0

1/ The average contribution of upper run chinook to Alaskan fisheries is 45%

YUKON RIVER CANADIAN ORIGIN CHINOOK

CATCH AND ESCAPEMENT, 1982-1985



YUKON RIVER CANADIAN ORIGIN CHINOOK

HARVEST EXPLOITATION RATES, 1982-1985

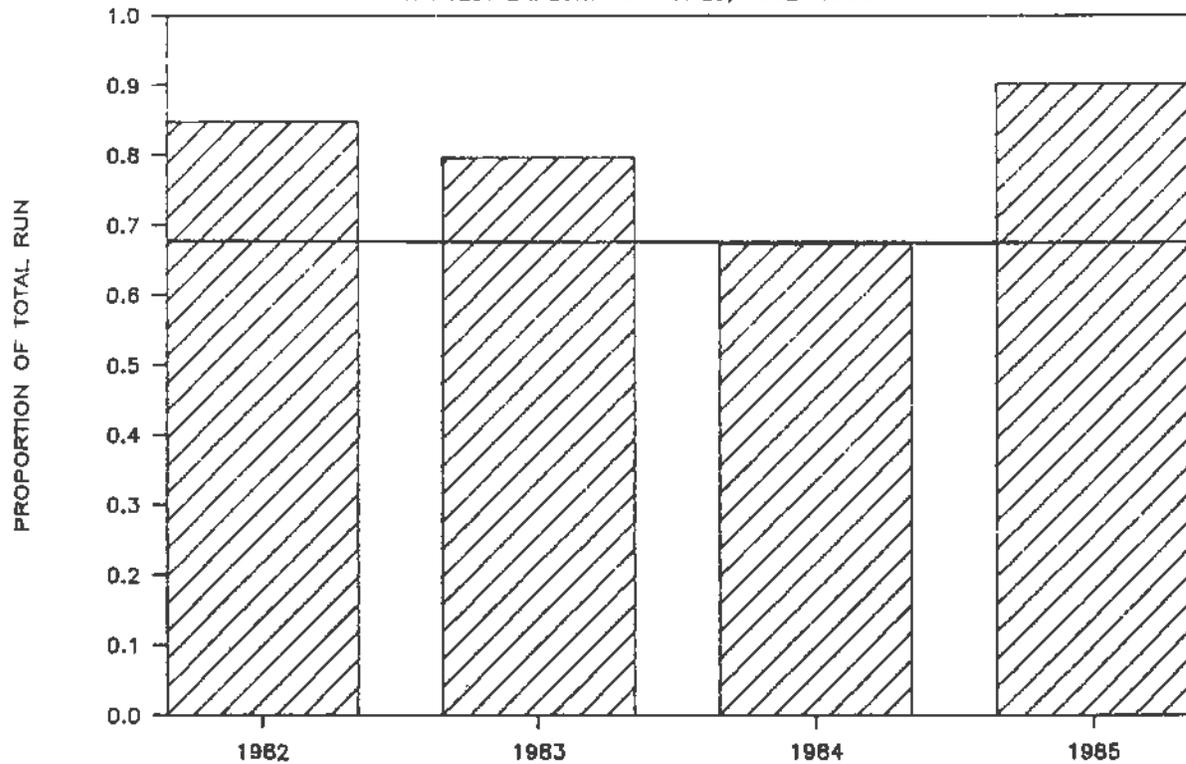
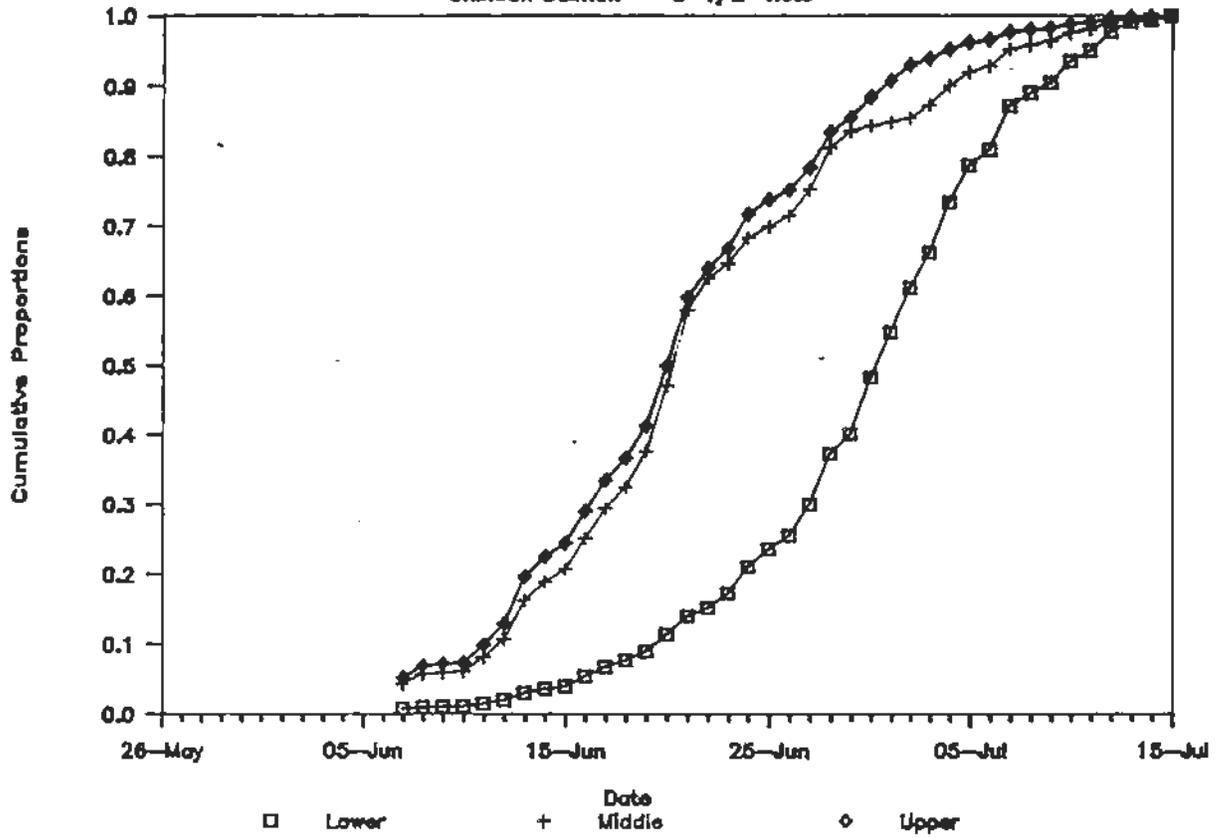


Figure 4

1982 Lower Yukon Testfish CPUE

Chinook Salmon - 8-1/2" nets



1983 Lower Yukon Testfish CPUE

Chinook Salmon - 8-1/2" nets

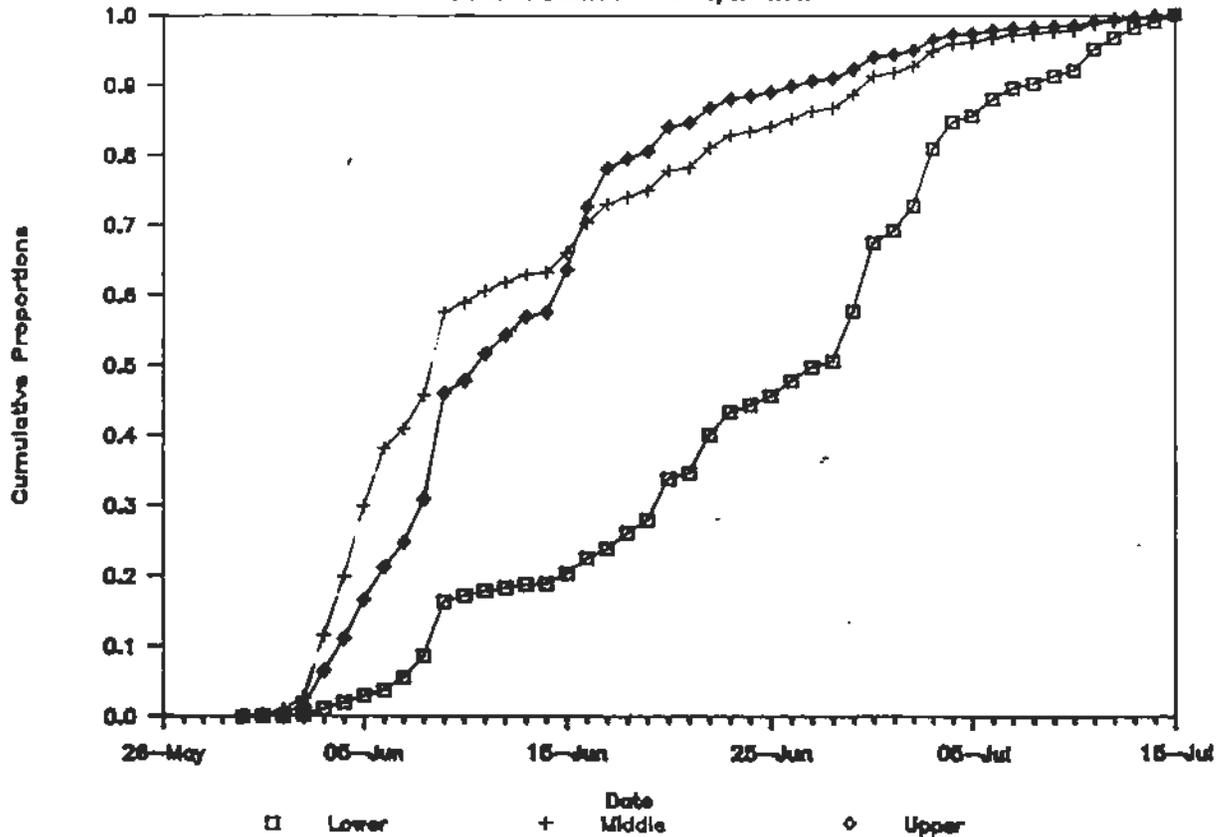
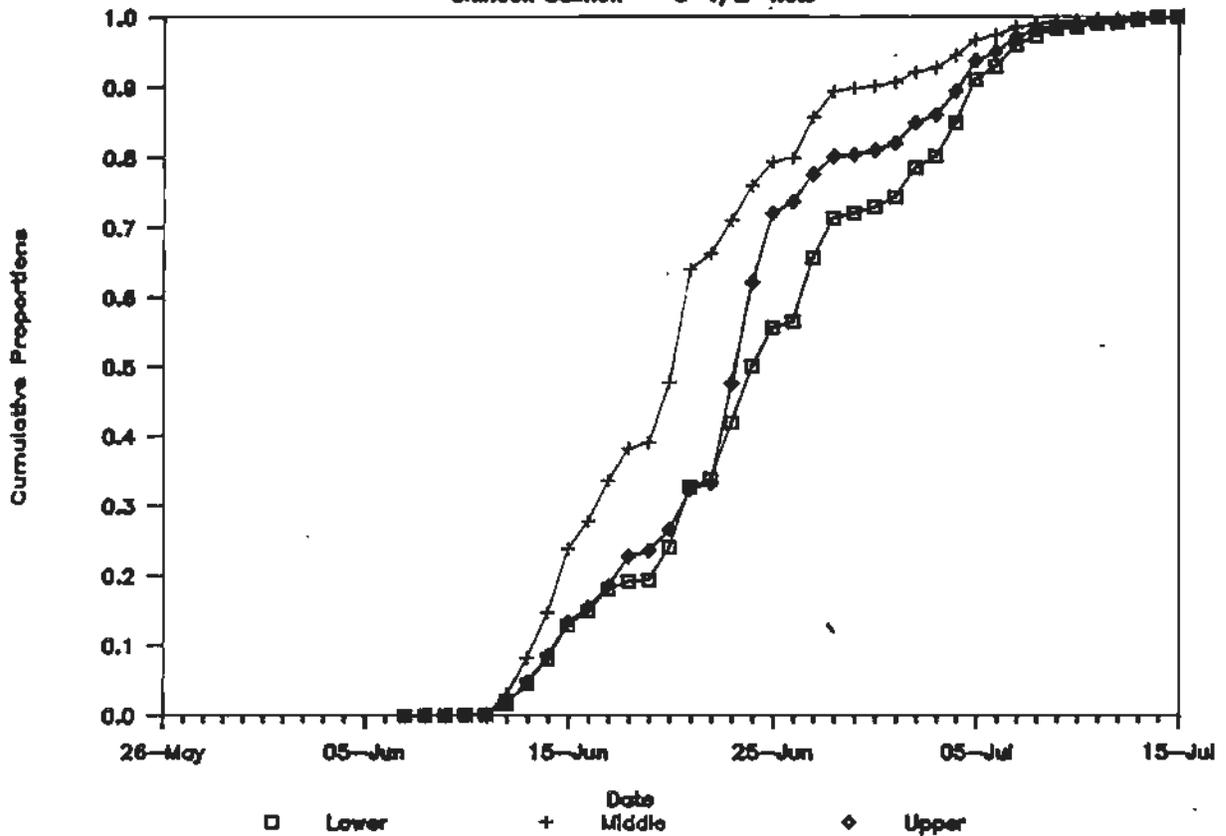


Figure 5

1984 Lower Yukon Testfish CPUE

Chinook Salmon - 8-1/2" nets



1985 Lower Yukon Testfish CPUE

Chinook Salmon - 8-1/2" nets

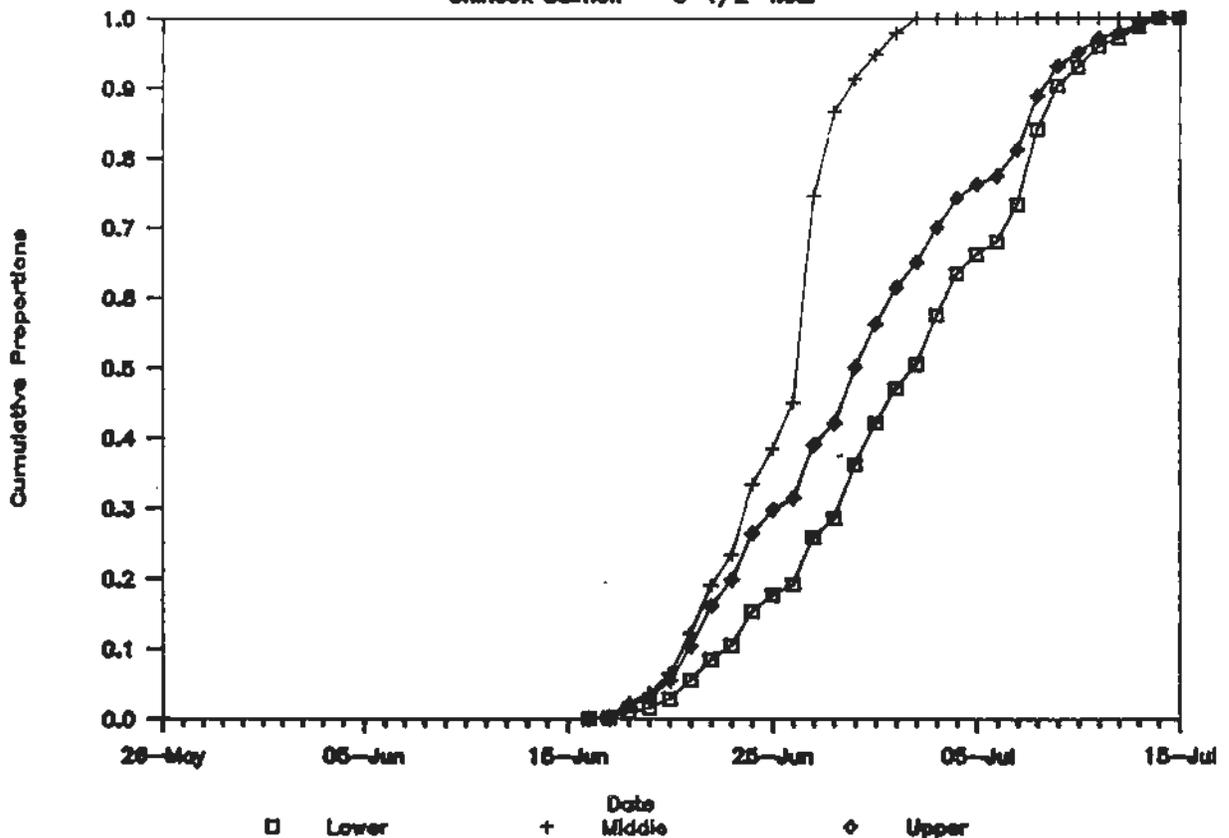


Figure 6

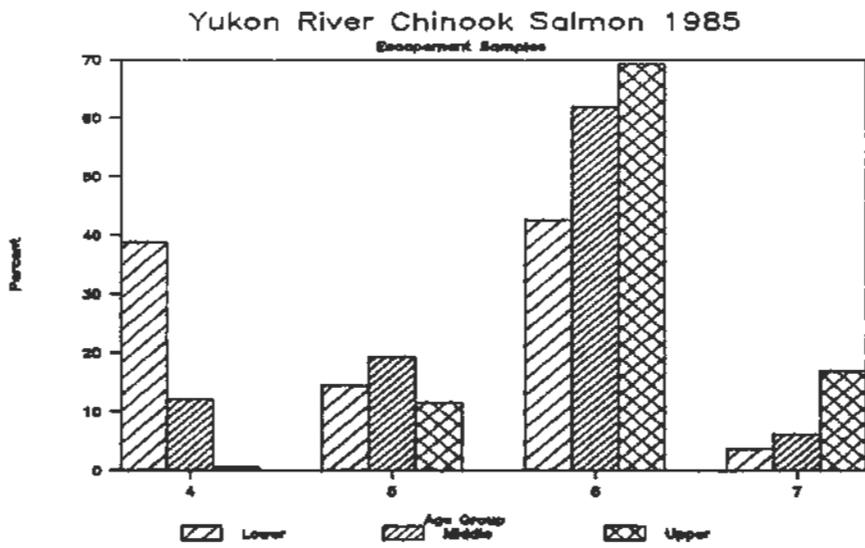
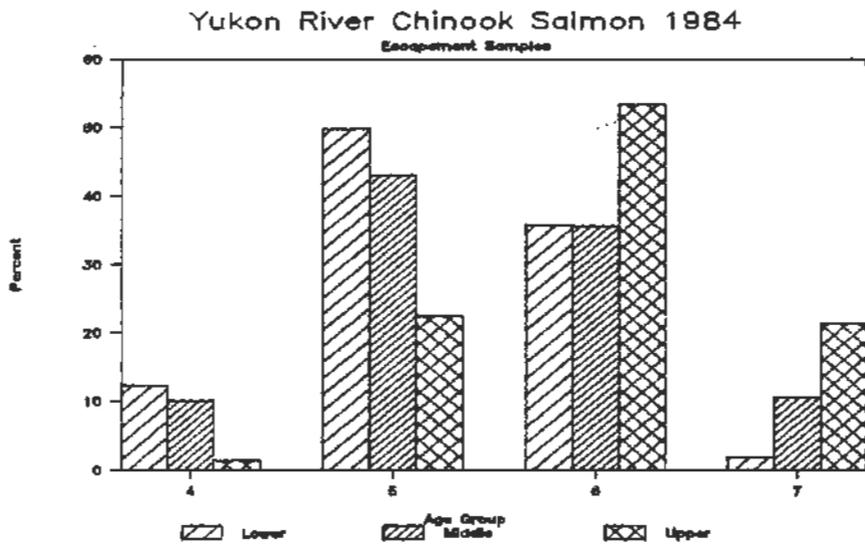
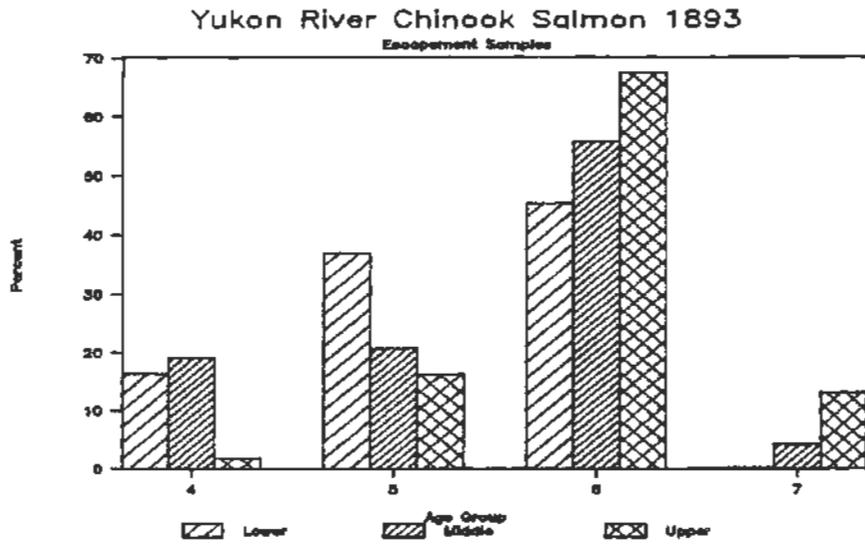
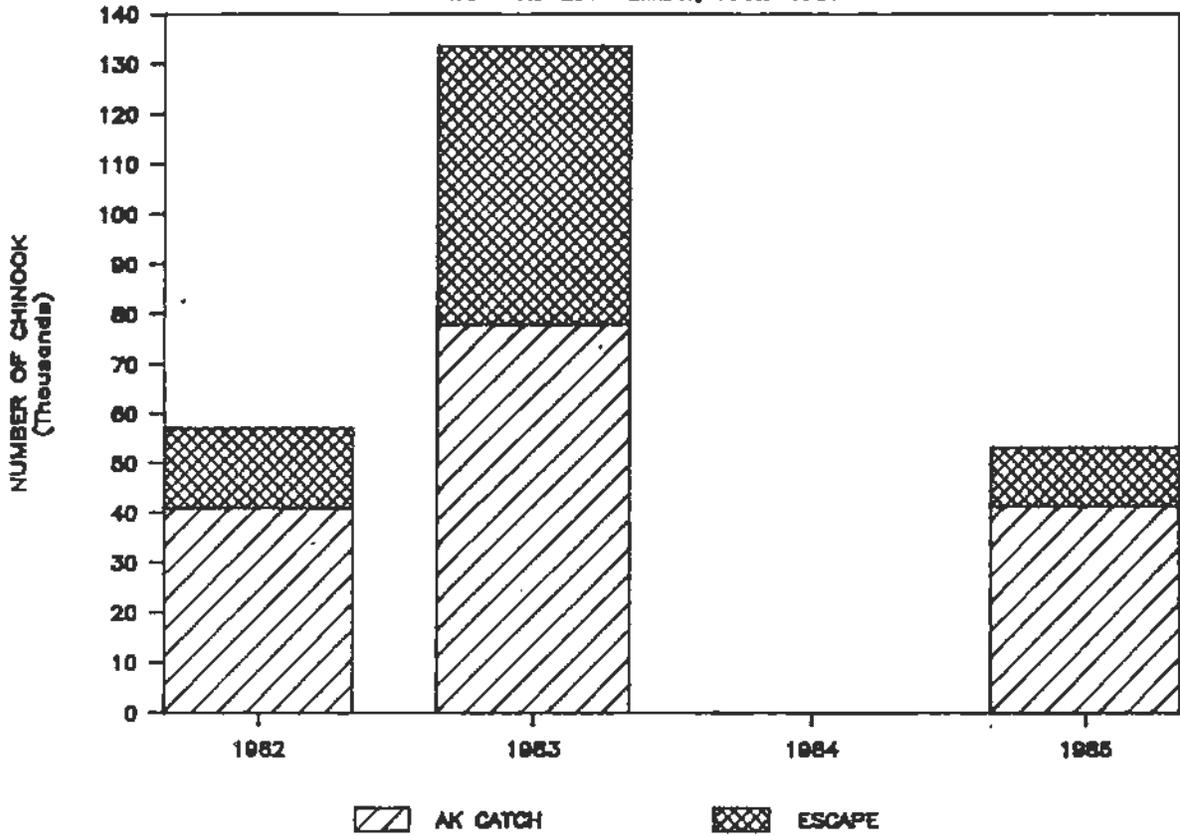


Figure 7

YUKON RIVER MIDDLE RUN CHINOOK

CATCH AND ESCAPEMENT, 1982-1985



YUKON RIVER MIDDLE RUN CHINOOK SALMON

HARVEST EXPLOITATION RATES, 1982-1985



Figure 8

YUKON RIVER CANADIAN ORIGIN CHINOOK

HARVEST EXPLOITATION RATES, 1982-1985



YUKON RIVER MIDDLE RUN CHINOOK SALMON

HARVEST EXPLOITATION RATES, 1982-1985

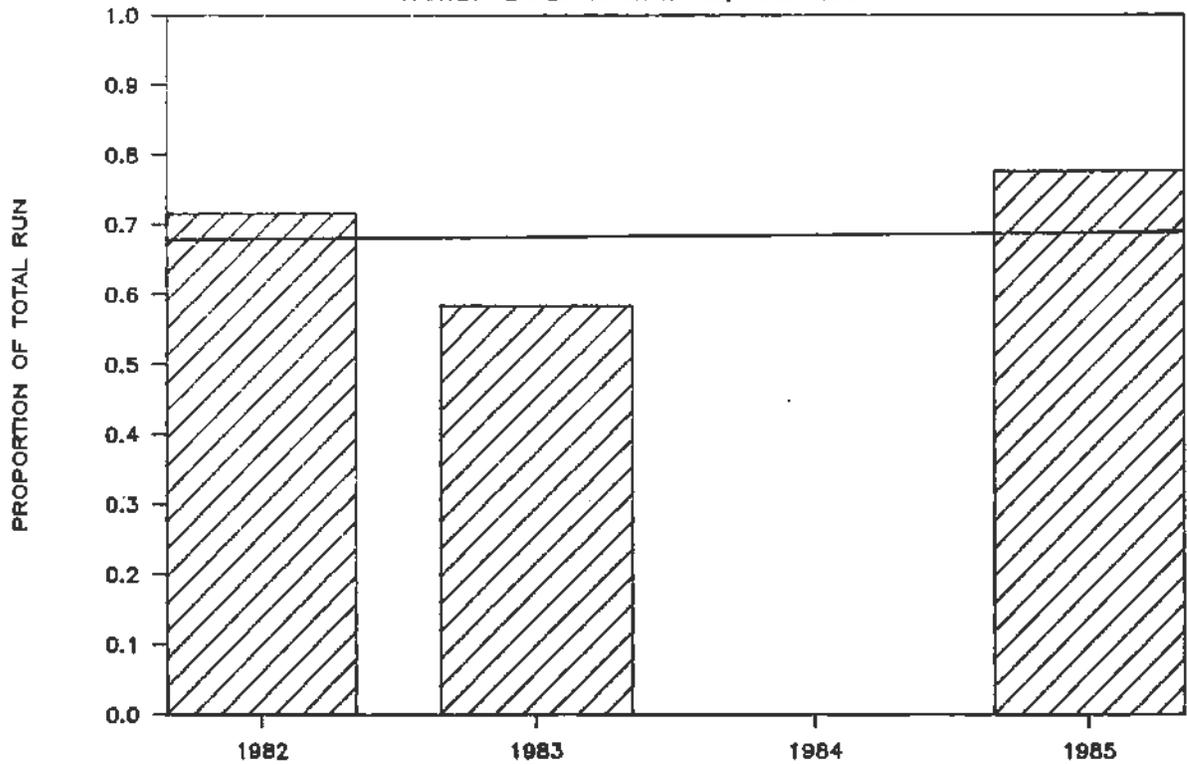


Figure 9