YUKON RIVER TECHNICAL REPORT,

1985

prepared by

The Joint Canada/U.S.

Yukon River Technical Committee

October 10, 1985

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1.0 Introduction

David Colson and John Davis, the respective heads of the U.S. and Canadian delegations to the Yukon River Negotiations, directed members of the Joint Canada/U.S. Yukon River Technical Committee to address the following issues:

i) compile and evaluate the relevant fisheries performance data including high seas and non-inriver catch data, relevant socio-economic information on the fisheries and determine the current status of Yukon River salmon stocks;

ii) make estimates of total allowable catches and possible management strategies for 1986 and thereafter including:

  i) escapement needs and how they will be determined,
  ii) run expectations and how they will be determined,
  iii) sampling design for stock separation studies including those for fisheries conducted outside the Yukon drainage which may harvest Yukon River salmon;

iii) provide an updated list of enhancement opportunities and their potential effect on natural Yukon River fish stocks;

iv) provide an updated list of research needs in order of priority;

v) review and interpret results from the 1985 biological programs;

vi) identify conservation concerns including required habitat protection.

A report outlining the results of the Technical Committees discussions is to be submitted to both parties by October 1, 1985.

Members of the Canada/U.S. Yukon River Technical Committee (Table 1) met in Vancouver on September 19 and 20, 1985. In dealing with the issues described above the Committee realized that several had been discussed and reported in their entirety in the Briefing Report on the Status of Salmon Stocks, Fisheries and Management Programs in the Yukon River (hereafter referred to as the Briefing Report) which was prepared on April 11 and 12 for the Yukon River Discussions held in Anchorage on April 23 and 24, 1985. In such instances, only brief mention is made of these

Table 1. Members of the Joint Canada/U.S. Yukon River Technical Committee.

Canada		U.S.	
M. Henderson (co-chairperson)	DFO, Vancouver	R. Regnart (co-chairperson)	ADF&G, Anchorage
S. Johnston	DFO, Whitehorse	L. Buklis	ADF&G, Anchorage
R. Harrison	DFO, New Westminster	D. McBride	ADF&G, Anchorage
G. Zealand	DFO, Whitehorse	M. Geiger	ADF&G, Anchorage
		D. Marshall	U.S. F&W, Anchorage
		A. Anderson	NMFS, Juneau

issues in the this report and the reader is referred to the Briefing Report for more details. The Technical Committee will update and integrate the two reports into a single volume prior to any future negotiating session.

The Technical Report contains the most current estimates for catch and escapement of salmon in the Yukon River. The reader should be aware however that at this time all 1985 chinook and summer chum statistics are preliminary in nature and those for fall chum and coho are incomplete. Fall chum fisheries generally continue through early October and escapement surveys are generally not completed before early November. Final 1985 catch and escapement statistics for all species of Yukon River salmonwill be available by March, 1986.

2.0 1985 Commercial Fishery - Alaska

In 1985 a total of 1,229,886 salmon was commercially harvested in Alaska. The catch was composed of 146,088 chinook, 1,028,437 chum (766,078 summer chum, and 262,359 fall chum), and 55,361 coho (Table 2). The chum catch was below the most recent 5-year average. The chinook catch was the fourth largest, while the coho catch was the second highest in history.

2.1 Chinook Salmon

Due to an extremely late ice breakup in the lower river and the delayed chinook salmon migration, the commercial fishing season in Districts 1 and 2 did not open until June 24-26, the latest in the history of the fishery. The run was very compressed with 114,300 chinook taken in Districts 1 and 2 between June 24 - July 4 with unrestricted mesh size gill nets ("chinook season"). Only six fishing periods (144 hours), the least amount of fishing time ever provided, were allowed in Districts 1 and 2 during the chinook season. The harvest of 114,300 chinook taken during the chinook season approached the upper end of the 60,000 to 120,000 chinook salmon guideline harvest range for Districts 1 and 2 combined. An additional 24,077 chinook was taken with 6 inch or smaller mesh gill nets in Districts 1 and 2. The run was judged average or better in magnitude based on in-season lower Yukon test fishing and commercial catch data. In the upper Yukon area a total of 5,123 chinook was taken.

2.2 Summer Chum Salmon

The summer chum run was considered exceptionally strong. The harvest in the lower Yukon area was below average as the summer chum run peaked during the "chinook salmon season" when most fishermen operate large mesh gillnets which are not efficient for

Table 2. Alaskan commercial catch of Yukon River salmon, 1985.

District Subdistrict	Chinook	Summer Chums			Fall Chums			Cohos	Total Salmon	
		Chums	Roe (lbs)	Equivalent 1/ Chums	Chums	Roe (lbs)	Equivalent 1/ Chums		Salmon	Roe (lbs)
1	90,012	247,486	0	247,486	129,930	0	129,930	27,669	495,097	0
2	48,365	188,099	0	188,099	40,490	0	40,490	17,125	294,079	0
Subtotal	138,377	435,585	0	435,585	170,420	0	170,420	44,794	789,176	0
3	2,588	1,792	0	1,792	5,163	0	5,163	171	9,714	0
Total Lower Yukon	140,965	437,377	0	437,377	175,583	0	175,583	44,965	798,890	0
4 A	0	5,130	227,279	232,409	0	0	0	0	232,409	227,279
4 B, C	663	1,692	20,783	22,745	19,744	2,340	22,084	628	46,120	23,123
5 A, B, C	2,884	700	5,817	6,517	23,345	0	23,345	0	32,746	5,817
5 D	434	0	0	0	1,815	-	1,815	-	2,249	-
6	1,142	66,913	117	67,030	39,308	224	39,532	9,768	117,472	341
Total Upper Yukon	5,123	74,705	253,996	328,701	84,212	2,564	86,776	10,396	430,996	256,560
Total Yukon Area	146,088	512,082	253,996	766,078	259,795	2,564	262,359	55,361	1,229,886	256,560
(5 Year Average 1980-1984)	140,692	-	-	902,888	-	-	305,485	32,972	1,382,182	-

1/ "Equivalent chums" includes numbers of fish converted from roe sales (e.g. one pound of chum salmon eggs equals one chum salmon).

capturing chums. A total of 437,377 summer chum was taken in the lower Yukon area. In District 4 a record 253,996 pounds of roe were sold by fishermen. A record catch of 67,030 summer chum was taken in District 6 (Tanana River).

2.3 Fall Chum Salmon

Fall chum began entering the river in mid-July. The fishing season in the lower Yukon area was closed by emergency order effective July 19 in District 1, July 22 in District 2 and July 16 in District 3. The mid-season closure was necessary to afford increased protection for the early run segment of fall chum. Prior to the closure, a total of 14,154 fall chum was harvested in the lower Yukon fishery. During the closure substantial numbers of fall chums entered the river based on monitoring of test fishing and subsistence catch data. The fishing season was reopened August 1-5 in Districts 1, 2 and 3. Weekly fishing periods during the remainder of the season consisted of two-24 hour periods in the Set Net Only Area along the coast in District 1 and in District 3. In the remainder of District 1 and in District 2, two 12 hour periods were allowed each week. The fishing season was closed effective August 13 in the lower Yukon area when the mid point (170,000) of the 120,000 to 220,000 fall chum guideline harvest range for Districts 1, 2 and 3 was approached. In District 1 a record single period catch of 65,337 fall chum was taken on the last fishing period (August 12-13). In-season lower Yukon test fishing and commercial catch data indicate that the fall chum run was of average magnitude. In the upper Yukon area a total of 86,776 fall chum was harvested, resulting in a total Alaskan harvest of 262,359 fall chum. This total is about 85% of the recent 5-year average annual harvest of 305,485 fall chum.

2.4 Coho Salmon

Test fishing and commercial catch data indicated an above average coho salmon run. Coho, which exhibit later run timing, are taken incidentally to the more abundant fall chum. District 2 was later reopened after the majority of the fall chum run had passed through the District in order to harvest surplus coho. A total 55,361 coho was harvested in Alaska.

3.0 1985 Commercial Fishery - Canada

As of October 5, 1985, the Canadian commercial fishery on the Yukon River had harvested 12,474 chinook and 30,917 chum salmon (Table 3). The chum catch is still incomplete although the final catch is not expected to exceed current estimates by more than 10%.

3.1 Chinook Salmon

The 1985 commercial chinook catch of 12,474 (Table 3) was above average (1980-84 average = 9,929) and second highest on record. Usually initial catches are recorded in late June or early July, however this year chinook did not appear in the fishery until the week of July 22-27. The fishery peaked during the second week of August, two weeks later than normal.

Fishery times remained consistent with previous years with the fishery downstream from Dawson City open five days per week (closed noon Tues. - noon Thurs.). The area upsteam to Tatchun Creek was open six days per week (closed noon Sat. to noon Sun.). A maximum of twenty-nine fishermen fished in any one week.

3.2 Fall Chum Salmon

The 1985 Canadian commercial chum catch (Table 3) is the highest on record exceeding the previous high of 25,990 (1983) and the recent five and ten year averages of 16,899 and 10,443 respectively. Catches peaked during late September and remained high through early October. Downstream of Garner Creek (located 40 km upstream from Dawson City) to the Canada-U.S. border the fishery was open five days per week (with the exception of week Sept. 22-28 which was open four days). Six day per week openings were permitted above Garner Creek to Tachum Creek. A maximum of 16 fishermen fished in any one opening. The fishery is scheduled to close for the season at noon, Oct. 16, 1985.

The feasibility of marketing roe was examined in 1985. An estimated 3,900 kg of chinook and 5,000 kg of chum roe was processed in Dawson City and shipped to outside markets. Final results of this endeavour are not known.

4.0 1985 Subsistence, Domestic and Indian Food Fisheries

4.1 Alaska

Subsistence harvest information is unavailable at this time. Catch and effort data are being collected in each village from fishing families utilizing household surveys and catch questionnaires. Preliminary catch data should be available by December, 1985.

4.2 Canada

Catch information from the domestic and subsistence fisheries is not yet available. An extensive food fish monitoring program is being conducted this year. This will involve cooperating with

Table 3. 1985 Canadian commercial catches in the Yukon River.

WEEK ENDING	DAYS FISHED	NO. FISHERMEN	CHINOOK	CHUM
July 27	5	11	957	
Aug. 03	5	29	3,881	
10	5	28	4,515	
17	5	26	2,516	
24	5	12	485	
31	5	4	100	25
Sept. 07	5	4	10	150
14	5	9	10	3,300
21	5	16		
28	4	14	0	9,772
Oct. 5	5	15	0	8,934
12	5		0	8,736
TOTAL	59		12,474	30,917

the Council for Yukon Indians in collecting catch statistics through door to door surveys and on-site monitoring where possible. Preliminary catch information will be available by December 1985.

5.0 Status of Stocks

Documentation of total Yukon River salmon escapement has not been possible due to the vast size of the drainage and turbid water conditions. Estimates of total upper river Canadian Yukon escapements (excluding the Porcupine) will be made based on the 1985 tag and recapture program. Most available escapement information in 1985, as in previous years, was obtained by aerial surveys of selected index streams, although ground and boat surveys, weirs, tag and recapture studies, hydroacoustic counters, and the Whitehorse Dam fishway have also provided escapement estimates. Currently, comprehensive 1985 escapement data are available only for chinook and summer chum salmon. Fall chum and coho salmon escapement enumeration is still in progress.

5.1 Chinook Salmon

Chinook salmon escapements (Table 4) to spawning areas in the Alaskan portion of the Yukon River drainage were strong in 1985, exceeding escapement objectives in all areas for which objectives have been established. The escapement index for the Andreafsky River (both forks combined) of 3,865 chinooks was the largest ever recorded, as was the West Fork count of 2,248 fish. The Anvik River aerial survey count of 1,051 chinook was the largest since 1980, while a record 2,780 chinook was enumerated in the Nulato River (both forks combined). The Chena River count of 2,553 chinook equaled the record set in 1983, while the Salcha River escapement index of 2,035 fish met the escapement objective.

An effort was made in 1985 to extend knowledge of chinook salmon spawning distribution in the Alaska portion of the drainage by conducting exploratory reconnaissance surveys. Adult chinook salmon were documented for the first time by ADF&G in the Nageethluk, Charlie, Kandik, and Nation rivers. The U.S. Fish and Wildlife Service (USFWS) conducted surveys of selected tributary streams in the upper portion of the Yukon River drainage in Alaska. Adult chinook salmon were documented for the first time in the Kanuti, Chandalar, Coleen, and Christian rivers, and in the Salmon Fork of the Black River.

Chinook salmon escapements to spawning areas in the Yukon Territory were relatively weak in 1985 (Table 4). Aerial survey conditions were generally poor due to high water, turbidity, and cloud cover, but some surveys were conducted under fair

Table 4. Yukon River salmon aerial survey escapement indices, 1985[a].

Stream (Drainage)	Date	Survey Rating	Chinook	Summer Chum
Alaska Streams				
Archuelinguk River	7/20	Fair	54	505
Andreafsky River				
East Fork	7/23	Good-Fair	1,617	66,146
West Fork	7/23	Good-Fair	2,248	52,750
Atchuelinguk River	7/25	Fair	904	55,022
Nageethluk River	7/30	Fair	56	1,241
Bonasila River	7/30	Poor	43	1,925
Stuyahok River	7/30	Poor	74	375
Anvik River Sonar Count[b]	7/5-7/28			1,100,000
Anvik River Aerial Survey[c]	7/23	Fair	1,051	(426,195)
Rodo	7/31	Good		25,000
Nulato River Mainstem	7/31	Good	6	1,449
North Fork	7/31	Good	1,594	14,005
South Fork	7/31	Good	1,180	8,998
Charlie River	8/19	Fair	1	
Kandik River	8/19	Poor	1	
Nation River	8/19	Poor	5	
Koyukuk River Drainage				
Gisasa	7/30	Good	725	13,200
Hogatza River				
Clear Creek	7/30	Good		8,072
Caribou Creek	7/30	Good	1	14,494
Henshaw Crek	7/30	Good	393	3,724
North Fork Koyukuk	7/30	Good	23	23
Middle Fork Koyukuk	7/30	Good	113	2
South Fork Koyukuk	7/29	Good	351	677
Fish Creek	7/29	Fair	6	11
Jim River	7/29	good	184	265
Tanana River Drainage				
Kantishna River				
Barton Creek	8/09	Poor	128	
Clear Creek	8/09	Poor	12	
Bearpaw River	8/09	Fair	78	77
Nenana River				
Seventeenmile Slough	8/09	Good	57	50

Table 4. (cont'd) Yukon River salmon aerial survey escapement indices, 1985[a].

Stream (Drainage)	Date	Survey Rating	Chinook	Summer Chum
Clear Creek Weir			529	
Clear Creek Aerial	8/09	Fair	(77)	
Chena River	8/01	Good	2,553	1,005
Salcha River	8/06	Fair	2,035	3,178
Goodpaster River	8/06	Fair-Poor	132	
Beaver Creek	8-14-85	-	3	0
Black River	7-30	-	0	200
Grayling Fork	7-29	-	0	80
Salmon Fork	7-30	-	0	791
Salmon Fork	8/19	-	1	0
Hadweenzic River	7/30	-	0	10
Hodzana River	7/30	-	0	94
Dall River	7/30	-	0	5
Chandalar River	8/14	-	63	10
Coleen River	8/19	-	10	438
Sheenjek River	8/14	-	45	700
Christian River	8/19	-	1	4
Kanuti River	7/26	-	8	0
Yukon Territory Streams				
Tincup Creek	8/26	Poor	70	
Little Salmon River (DFO)	8/31	Fair	255*	
Big Salmon River Weir (DFO)	8/17-9/09		456	
Big Salmon River Ariel[d]	8/25	Fair	867	
Nisutlin River	8/25	Fair	646	
Wolf River	8/23	Fair-Poor	160	
Morley River	8/23	Poor	11	
Hoole River	8/24	Poor	17	
Whitehorse Fishway (DFO)	8/09-9/09		536	
North Big Salmon R. (DFO)	8/29	Fair	77*	
Tatchum Crk. (DFO-foot survey)	9/01	Good	190*	
Little Kalzas R. (DFO)	9/05	Poor	2*	
Big Kalzas R. (DFO)	9/05	Poor	22*	
Beaver R. (DFO)	9/05	Excellent	15*	
Mayo R. (DFO)	9/05	Fair	6*	

Table 4. (cont'd) Yukon River salmon aerial survey escapement indices, 1985[a].

Stream (Drainage)	Date	Survey Rating	Chinook	Summer Chum
Pleasant R. (DFO)	9/06	Poor	2*	
McQueston R. (DFO)	9/06	Good	9*	
Ross R. (DFO)	9/07	Poor	23*	
Earn R. (DFO)	8/31	Fair	84	
Glenlyon R. (DFO)	8/31	Fair	25	
Takhini R. (DFO)	8/31	Fair	157	
Yukon River Drainage Totals			19,915	1,374,526

[a] ADF&G peak aerial survey counts of live fish and carcasses combined unless noted otherwise. Data in parentheses not included in totals.

[b] Side-scanning sonar counters enumerate fish bound for both mainstem Anvik River and tributary spawning areas. Estimate is preliminary.

[c] Aerial survey count includes mainstem Anvik River and tributary streams.

[d] Aerial survey count includes counts from below weir.

* Helicopter survey. All other counts made by fixed wing except as noted.

conditions. Aerial survey indices for the Big Salmon (867 chinook), Nisutlin (646), and Wolf River (160) were similar to 1982 escapement levels, but well below the record escapements of 1980 and 1981. In some cases, spawning had already peaked and consequently the number seen was not a good indicator of total escapements to these systems. The delay in run timing evident in the various fisheries was therefore not always reflected in spawning time information.

Escapement indices for the East and West Fork of the Andreafsky River of 66,146 and 52,750 summer chum, respectively, were about 85% of the minimum objectives.

Surveys by USFWS resulted in documentation of adult summer chum salmon spawning populations in the Black, Coleen, Christian, Dall, and Hadweenzic Rivers for the first time. These streams are located in the upper portion of the Yukon River drainage in Alaska.

5.2 Summer Chum Salmon

The strength of summer chum salmon escapements was variable in 1985, exceeding objectives in the Anvik and Hogatza Rivers, but below objectives in the Andreafsky and Salcha Rivers. The Anvik River is the largest summer chum producer in the Yukon River drainage. The 1985 escapement of 1.1 million summer chums was more than double the escapement objective of 487,000 fish, and second only to the record 1981 escapement of 1.5 million fish. The Andreafsky River is the second largest summer chum producer.

5.3 Fall Chum Salmon

As discussed above, fishery harvest data indicates that fall chum salmon run strength in 1985 was average or better in magnitude. Fall chum escapement data for 1985 are available only from the Sheenjek River sonar project (ADF&G) and the Fishing Branch weir project (DFO) at this time. Peak aerial surveys of the other major spawning areas have yet to be flown. However, preliminary estimates of approximately 112,000 fall chums for the Sheenjek River (through project termination on 9/30) and 50,000 for the Fishing Branch River (as of 10/10) indicate that escapements may be better than have been documented in recent years.

5.4 Coho Salmon

Coho salmon escapement data for 1985 are not yet available. Fishery harvest data indicated that the run was very strong. Given the historical performance of the fishery, coho salmon escapements are anticipated to be strong as well.

6.0 Marine Harvest of Yukon River Salmon

6.1 High Seas Salmon Gillnet Fisheries

Recent studies indicate that chinook salmon taken in Japanese high seas gillnet fisheries are composed of a high percentage of fish from western Alaska (including Canadian Yukon). The reported chinook salmon catch made by the Japanese mothership fishery in 1985 was 66,000 fish. This is the smallest catch since 1961 and is considerably below the recent five and ten year average annual catches of 214,000 and 184,000, respectively. Catch data for the Japanese landbased fishery is not yet available.

The United States and Japanese governments met on two occasions during 1985 to discuss high seas gillnet salmon fishery issues. These government to government meetings were called by the United States in an attempt to further reduce or eliminate interception of North American salmon in high seas gillnet fisheries. To date the Japanese have made no concession to this demand.

6.2 Foreign, Joint-Venture and U.S. Groundfish Trawl Fisheries

The incidental harvest of salmon in foreign trawl fisheries operating in the northern Gulf of Alaska and Bering Sea has decreased in recent years. The reported 1985 salmon harvest in the foreign trawl fishery as of August 31 totaled 1,400 fish of all species.

A joint-venture trawl fishery operating in southeastern Bering Sea waters in 1984 captured 60,400 salmon. New information indicates the majority of the catch was composed of chum salmon. Preliminary information indicates fewer chum salmon were encountered in 1985 and the catch of all salmon species may not exceed 10,000 fish.

A domestic factory trawl fishery has been recently initiated in the southeastern Bering Sea. There are approximately twelve trawlers operating in 1985 and they are expected to take up to 90,000 metric tons of groundfish. Unlike foreign and joint-venture trawl fisheries, there are no observers associated with the domestic trawl fleet and the incidental salmon catch is unknown.

6.3 Other Fisheries

A total of 426,000 chum salmon was taken during June 1985 in the South Unimak-Shumagin Island domestic salmon fishery. Previous studies have indicated that the majority of chum salmon

taken in this fishery during June are bound for other terminal fisheries including the Yukon River. The previous five and ten year average annual chum catches made in this fishery are 664,000 and 416,000 fish, respectively.

A record commercial chinook salmon harvest of 18,000 fish was made during 1985 in the southern Norton Sound domestic salmon fishery where interception of Yukon River stocks is known to occur. This large catch was influenced by a large return of local Norton Sound stocks as indicated by escapement surveys.

7.0 1985 Project Summaries

7.1 Harvest Monitoring and Apportionment

7.1.1 Commercial Catch Monitoring

Commercial salmon catches in Alaska were monitored on an in-season basis by the collection and analysis of harvest sales receipts from processors. Data were keypunched on microcomputers in the Emmonak field office for the Lower Yukon area and in the Fairbanks office for the Upper Yukon area, immediately following each commercial fishing period. Tabular summaries of catch and effort data by district and statistical area were then generated for each fishing period and for the total season to date. These catch summaries allowed ADF&G managers to make timely in-season adjustments to harvest regulation in response to performance of the fishery. Catch data for 1985 are presented in the fishery description section of this report.

The majority of the Canadian commercial catch data was compiled on a weekly basis from daily catch return cards collected by the local Fishery Officer from individual fishermen in the Stewart River to U.S./Canada border section of the Yukon River. Daily catch records were submitted by commercial fishermen located further upstream (approximately 10 fishermen) on a monthly basis.

7.1.2 Commercial Catch Sampling

Commercial salmon catches in Alaska were sampled for age-sex-size data at Emmonak, St. Marys, and Marshall in the lower Yukon Area, and at Galena, Nenana, Fairbanks, and the Haul Road Bridge area in the upper Yukon Area. Samples collected in District 1 (Emmonak) were processed during the field season, while those collected in the other districts are being processed at this time.

Chinook salmon taken in District 1 during the three large mesh fishing periods were approximately 80% age 6, 11% age 7, and

only 8% age 5. Data are not yet available for the small mesh season. Both summer and fall chum salmon commercial catches were predominantly age 4, and the strength of the age 4 component increased steadily as the runs progressed. Fall chum age composition ranged from 75% age 4 on July 18-19 to 90% on August 12-13. Coho salmon were predominantly age 4.

Catch sampling for age, size and sex composition data was also conducted in the Canadian commercial fishery. Samples were obtained (100-200 per week per species) from the Han Fish Plant in Dawson throughout both the chinook and chum fisheries.

7.1.3 Subsistence Fishery Surveys

Alaskan subsistence fishery catches are estimated after the season by conducting interviews with fishermen in selected villages and contacting others with mail-in questionnaires. Data are compiled and expanded for those areas for which catch information is not obtained. Funding was made available in 1985 for expanding the village interview component of the subsistence fishery survey program. Data are still being collected and compiled at this time. It is anticipated that the expanded interview program will result in more accurate subsistence catch data than have been collected in recent years.

A baseline study of resource utilization is being conducted in the villages of Holy Cross, Anvik, Grayling, and Shageluk in the lower portion of the Yukon River drainage, and at Beaver in the upper portion of the drainage. An indepth study of salmon fishing patterns in the village of Kaltag is being conducted in cooperation with the University of Alaska.

A socio-economic profile of communities dependent on Yukon River salmon is underway in the Alaskan portion of the drainage, and photo documentary leaflets will be produced for several of the fisheries.

Canadian subsistence catch data will be compiled from in-season, on-site monitoring programs and post-season interviews with the various Bands. In-season catch information was collected from the Teslin and Old Crow subsistence fisheries. Door to door interviews in each fishing community are planned for the fall to establish contact with each fishermen.

7.1.4 Sport Fishery Surveys

The chinook salmon sport fishery was monitored by ADF+G in the Chena and Salcha Rivers in Alaska and in the Tatchum Creek area in the Yukon. Harvest data are still being compiled and are not available at this time.

7.1.5 Chinook Catch Apportionment

Analysis of scale patterns, age composition, and geographic distribution of 1984 Alaskan Yukon River chinook salmon catches and escapements were used by ADF&G to apportion commercial and subsistence harvests to geographic region of origin. These data were not available at the April 23-24, 1985 meeting of the US/Canada delegations, and are therefore briefly summarized here. Geographic contribution to total Yukon River utilization of chinook salmon was estimated at 63,781 (35.7%) middle Yukon, 63,037 (35.2%) upper Yukon, and 51,970 (29.1%) lower Yukon fish. Results for 1984 indicated that the fraction of District 1 and 2 commercial catches (which comprised 62.6% of total drainage utilization) apportioned to the lower Yukon generally increased during the period of the analysis while the fraction apportioned to the middle Yukon generally declined.

This program was continued in 1985. Age and sex composition were calculated inseason for District 1 catches, and results were supplied to fishery managers. Scale samples were also collected from harvests in Districts 3, 4, 5, and 6 by ADF&G, and in Yukon Territory by DFO. These data are processed after the season. Escapement scale samples were collected from all tributaries sampled in prior years as well as a small number of scales collected from the mainstem Yukon River in Canada. Additional samples were collected by DFO personnel stationed at the Big Salmon River weir and at the Whitehorse fishway (brood stock carcasses for the Whitehorse Hatchery).

All catch and escapement samples will be processed by the project biologist. Age, sex, and size summaries will be produced and included with similar data on chum and coho salmon for publication in a catch and escapement Technical Data Report. Scale samples will be digitized and scale measurements used to build stock identification models for apportionment of the Yukon River fisheries to geographic area of origin. These data will be published in a separate Technical Data Report.

7.1.6 Fall Chum Catch Apportionment Feasibility Study

Fall chum salmon were sampled by ADF&G from test fishing catches in the Yukon River delta, and will be sampled from the Sheenjek, Toklat, and Delta River escapements in Alaska and in mainstem Yukon, Kluane, Teslin and Fishing Branch escapements in Canada. Additional samples will be provided by DFO from Yukon Territory commercial catches in the Dawson area. Each fish is sampled for heart, liver, eye, and muscle tissue, which is frozen and shipped to the laboratory for analysis. The feasibility of separating chum stocks on the basis of electrophoretic comparisons is being examined this year under direction from the

Pacific Biological Station in Nanaimo. The purpose of the study is to determine whether tissue protein characteristics are sufficiently different between known stocks to allow apportionment of mixed stock catch samples. This is the first year this study has been conducted in the Alaskan portion of the drainage.

7.2 Run Abundance Indicators

7.2.1 Upper Yukon Tag and Recovery Program

A spaghetti tag and recovery program was conducted by DFO on upper Yukon chinook and chum salmon in 1985. The basic objectives of this study are to obtain estimates on total population size and escapements, determine Canadian exploitation rates, and to assess migratory timing and behaviour.

As of Sept. 30, 1,887 chinook and 3,774 chum had been tagged and sampled for age, size and sex composition data. Fish were live-captured through the use of three fishwheels located in Canada within 25 km of the Canada-U.S. border. Tag recoveries were made in commercial, domestic and subsistence fisheries.

Tagging operations are expected to terminate in mid-October and data analysis will commence shortly thereafter. Results should be available by early January, 1986.

7.2.2 Upper Yukon Test Fishery (Canada)

The feasibility of utilizing the DFO fishwheel catch data (from the tagging study) as a run index is being examined this year. The fishwheels which operate seven days per week, are identical in dimensions to those used in 1982 and 1983; two of the fishwheels are fishing in similar locations as previous years. Sampling for age, size and sex composition data is also being conducted as per past studies.

The timing of the chinook run was later than normal this year. Chinook did not appear at the fishwheel sites until the third week of July whereas usually they are present by late June or the first week of July. Peak catches were recorded July 27 - Aug. 3. The halfway part of the chinook run as evidenced by the fishwheel catches occurred between July 29 and August 2 this year whereas in 1983 it occurred between July 15 and July 23. In 1982, 50% of the run had passed prior to July 27.

Based on comparative test fishwheel catches, the chinook run strength this year appeared to be about two times as strong as 1982 but one half the 1983 return. This observation has yet to be confirmed by the 1985 tagging results.

Fishwheel catches of chum salmon peaked during the period Sept. 18-22, 1985, similar to the 1982 and 1983 seasons. Preliminary projections based on cumulative catch data suggest the run strength to be substantially better than 1982 (population estimate = 47,000) yet somewhat less than the 1983 return of 118,000.

7.2.3 Lower Yukon Test Fishing

Salmon run timing, abundance, and entry patterns are indexed by ADF&G with set gillnets in the Yukon River delta. Samples are collected from test net catches during commercial fishery closures to determine age-sex-size composition of salmon escaping the fishery.

Test catches indicated that the chinook run was very late and about average in magnitude. Run strength was similar to that of 1983 and 1984, but less than the record runs of 1980 and 1981. Peak catches occurred on June 28 and July 8. The summer chum run was very late and above average in magnitude. Catches were better than any year since the record parent year run of 1981. Peak catches occurred on June 25 and 30. Fall chums exhibited the unpredictable pulse-type entry pattern that is typical of this run. Peak catches were made on July 29-30, August 7, 13, and 20-21. Abundance indices were variable between net sites, but overall run magnitude appeared to be about average. Catches were greater than those of 1980, 1982, and 1984, but less than those of the 1981 and 1983. Coho salmon run timing was early and abundance appeared to be better than any other year except the record run of 1984. Peak catches occurred on August 7, 13, 16 and 20.

7.2.4 Upper Yukon Test Fishing (Alaska)

ADF&G indexes run timing and abundance in the upper Yukon by fishwheel test fishing at Kaltag for summer chums and at Ruby (north and south bank) and Manley Hot Springs (Tanana River) for fall chum. Catches are sampled for age-sex-size data. The Kaltag fishwheel indicated that the summer chum run to the upper Yukon was very late and the strongest documented since the project was initiated in 1981. Peak catches occurred on July 11 and 14. Fall chum salmon test fishing is currently in progress at Ruby and Manley Hot Springs. Catches at Ruby north bank (primarily upper Yukon-Porcupine stocks) indicate average run strength, better than 1982 and 1984, but less than 1981 and 1983. Peak catches occurred on August 25, 29, and September 1. Ruby south bank catches (primarily Tanana drainage stocks) indicate that a very strong run is in progress. The total catch is almost double the previous best season catch, which occurred in 1984. Peak catches occurred on August 17 and September 1.

The Manley Hot Springs test fishwheel project has only been operated since 1984.

7.2.5 Main River Sonar

Hydroacoustic counters were operated by ADF&G on the mainstem Yukon River near Pilot Station (River Mile 122) to enumerate salmon passage from June 22 through August 26. Sonar counts were apportioned to species based on test fishing catches using drift gillnets of several different mesh sizes. Data were entered into a microcomputer in the field camp for spatial and temporal expansions, and relayed to the Emmonak field office within 24 hours. This was the first year in which daily counts by species were available in a timely manner. Preliminary data indicate a total passage of approximately 1.5 million summer chums, 150,000 chinooks, 330,000 fall chums, and 110,000 cohos. Expansion factors are being refined on a post-season basis and results compared to other indicators of run abundance to assess the accuracy of the daily and total season counts. The daily pattern of the counts indicates a 3 to 5 day lag between the test nets at the mouth of the Yukon River and the sonar site.

7.3 Escapement Studies

7.3.1 Andreafsky River Sonar (Summer Chum)

Summer chum salmon escapement to the East Fork Andreafsky River has been enumerated by ADF&G using side-scanning sonar since 1981. The hydroacoustic equipment was operational from June 25 through July 28 in 1985. Unfortunately, extremely high water, inadequate transducer deployment methods for the conditions encountered, inadequate sonar counting range, and a late escapement that developed quickly combined to frustrate attempts to obtain accurate daily escapement counts. An aerial survey count of 66,146 summer chum on July 23 under fair conditions indicates that the season sonar count should have probably been on the order of 100,000 fish. Only about 15% of this total was actually enumerated by the sonar equipment. Improvements to the project design for 1986 will allow for accurate daily escapement enumeration even if the extreme conditions encountered in 1985 are repeated. Approximately 600 summer chum and 600 chinook were sampled by beach seine and carcass survey for age-sex-size composition data. Samples have not yet been analyzed.

7.3.2 Anvik River Sonar (Summer Chum)

Summer chum salmon escapement to the Anvik River has been enumerated by ADF&G using side-scanning sonar since 1979. The hydroacoustic equipment was operational from June 26 through July

28 in 1985. Escapement timing was the latest ever documented, with substantial numbers of fish not present until July 5. Peak passage occurred during the period July 12-14. Total passage of approximately 1.1 million summer chum salmon was second only to the 1981 parent year escapement of 1.5 million. Approximately 630 chum and 40 chinook were sampled by beach seine and carcass survey for age-sex-size data, which has not yet been analyzed.

7.3.3 Sheenjek River Sonar (Fall Chum)

Fall chum salmon escapement to the Sheenjek River has been enumerated by ADF&G using side-scanning sonar since 1981. The hydroacoustic equipment was operational September 2 through 30. Preliminary sonar counts total approximately 112,000 fall chum salmon. This is the largest escapement documented since sonar enumeration was initiated in 1981. Samples were collected by beach seine for age-sex-size data.

7.3.4 Escapement Surveys

Salmon escapement abundance is indexed at selected spawning areas throughout the drainage by aerial surveys from fixed wing aircraft. Results from those surveys conducted to date are presented in the stock status section of this report.

Fall chum salmon escapements to the Toklat, Delta, and Kluane Rivers will be estimated by ground surveys in October and November. Repeated surveys of the Delta River population at various stages of the spawning migration may allow expansion to a total season escapement estimate. Carcasses will be sampled from each spawning area for age-sex-size data.

Coho salmon escapement abundance will be estimated in the Delta Clearwater River by boat survey in late October or early November.

7.3.5 Whitehorse Fishway Chinook Enumeration

The Whitehorse fishway count of 508 was below the recent ten year average of 795 (1975-84) and well below the 1980-84 average of 1,072 and peak count of 1,555 in 1981. Daily counts are shown in Table 5. The first fish was observed on Aug. 9, the second latest on record; fish have appeared as early as July 21 (1983). Fifty percent of the run did not pass until Aug. 22, roughly seven days later than average. The peak count of 47 chinook was recorded on August 20.

7.3.6 Big Salmon Chinook Weir

Pre-season plans to construct a chinook enumeration weir on

Table 5. Daily Whitehorse Fishway escapement counts.

		Male	Female	?	Total	Cumulative Total
August	9	3	0	0	3	3
	10	2	1	0	3	6
	11	2	3	0	5	11
	12	4	1	1	6	17
	13	9	1	1	11	28
	14	10	5		15	43
	15	8	3		11	54
	16	21	6	1	28	82
	17	11	9		20	102
	18	24	19		43	145
	19	8	6		14	159
	20	21	26		47	206
	21	22	22		44	250
	22	14	7	2	23	273
	23	20	14		34	307
	24	17	8		25	332
	25	24	12		36	368
	26	11	15		26	394
	27	26	18		44	438
	28	13	5		18	456
	29	16	7		23	479
	30	5	3		8	487
	31	2	4		6	493
September	1	0	0		0	493
	2	5	5		10	513
	3	2	2		4	507
	4	0	0		0	507
	9	0	0	1	1	508
		300	202	6	508*	

* - 92 taken for hatchery brood stock.

the Nisutlin River were revised as a result of site inspections conducted in May and June. At this time, it was assessed that given the above average snow depths and projected above-average summer flows in the Nisutlin, chances for successfully holding the weir in place would be extremely risky. An alternate site was subsequently chosen on the Big Salmon River (just upstream from Bat Creek) which:

a) had relatively easy access via float plane, and;
b) was located downstream of the areas of highest known spawning concentrations in this system.

Equipment and personnel were flown into the site on August 14. The weir was constructed during the period August 15-19 and was "fish tight" August 20, 1985. During the construction period, chinook were observed migrating upstream past the weir site. Records of these observations were made and included with the ensuing weir count (Table 6).

A total of 456 chinook was enumerated with a peak count of 104 recorded on August 20, the first day of weir operation. This result indicates the likelihood of significant numbers of chinook already having migrated into the upper river prior to August 20. On August 25, ADF&G flew an aerial survey on the area upstream of the weir. A total of 663 chinook was counted. The weir count after August 25 was 87 suggesting a minimum escapement of 750. No estimate of the efficiency factor associated with aerial observations has been made.

Age, size, and sex composition data were collected from 43 live samples (27 males and 16 females) and 359 carcasses.

7.3.7 Fishing Branch River Chum Weir

A weir to enumerate chum salmon was operated from 1972 to 1975 to gain some insight into the magnitude and fluctuations of escapements in the upper Porcupine system. Counts during this period ranged from 16,000 to 353,000 chum salmon.

The Fishing Branch weir was re-established this year with personnel and equipment flown in on September 3. Weir construction was completed by September 6 at which time enumeration commenced. From Sept. 6 to Sept. 10, a total of 341 chum was counted. High water conditions prevailed thereafter for a period of 72 hours during which time the weir was damaged and partially undermined. Counting was not possible during this period and an unknown number of chum likely migrated upstream. Daily counts immediately following this period were less than 1,000 fish. As of October 10, the total count was 50,000 with 1,000-2,000 being enumerated per day. The count is expected to

Table 6. Daily weir counts of Big Salmon River Chinook Salmon, 1985.

DATE	DAILY COUNT	CUMMULATIVE	COMMENTS
Aug. 17	10	10	Counted during construction of weir.
18	6	16	
19	36	52	
20	104	156	Weir completed and fish tight Aug. 20.
21	48	204	
22	71	275	
23	31	306	
24	42	348	
25	21	369	
26	22	391	
27	21	412	
28	17	429	
29	9	438	
30	3	441	
31	5	446	
Sept. 01	1	447	
02	5	452	
03	1	453	
04	0	453	
05	1	454	
06	0	454	
07	1	455	
08	0	455	
09	1	456	
----------weir pulled Sept. 15/85----------			

continue until mid-October, weather permitting. Live sampling for age, size and sex composition is also being conducted at the weir.

8.0 Enhancement

A discussion of salmon enhancement issues was included in the April 23-24, 1985 Briefing Report (pages 21-22). Large supplemental production facilities (e.g. hatcheries) are not recommended at this time based on the current knowledge of the mixed stock nature of the runs and the inability to identify stocks for selective management. Large numbers of supplementally produced salmon could lead to over harvest of intermixed wild stocks and exacerbate current fishery management problems.

The desirability of implementing small scale enhancement or rehabilitation projects is being examined. Some of these projects may include: 1) removal of migration barriers (water velocity barriers like rapids or waterfalls, beaver dams or man-made dams) or provision of fish passage around these barriers; 2) habitat improvement and restoration to include improvement of natural side channel spawning areas and restoration of previously mined areas; and 3) mitigative measures for replacing lost salmon production through unavoidable man-made habitat alterations to include habitat improvements in adjacent areas or production of hatchery fish equivalent to lost wild stock production.

8.1 Whitehorse Hatchery

Approximately 126,000 chinook fry (1984 brood year) averaging 1.7 g were transported from the Whitehorse Hatchery and released upstream into Michie and Wolf Creek during May 22 to 25, 1985. All of the 10,500 fry released into Wolf Creek were unmarked while the Michie Creek release of 115,300 consisted of 96,700 coded wire tagged/adipose fin clipped fish (1,600 with adipose fin clips only) and about 17,000 unmarked fish.

The 1985 brood egg take was approximately 200,000 eggs from chinook captured as they migrated through the fishway over the hydroelectric dam at Whitehorse. Unfortunately one batch of eggs, comprising about half the total eggtake, was subject to abnormal development which has resulted in the mortality of these eggs. The problem is currently under investigation by the Research Branch of DFO.

8.2 Clear Hatchery

Approximately 90,500 chinook, 1.5 million fall chum, and 277,000 coho salmon juveniles were released from the Clear

Hatchery by ADF&G in the spring of 1985. Some of the cohos were stocked in Interior lakes to support existing sport fisheries, while the majority of the cohos and all of the chinooks and fall chums were released in Wood Creek, a tributary of the Nenana River (Tanana River drainage). A weir was operated on Wood Creek in 1985, and 529 adult chinook salmon were enumerated. Included in the escapement were 80 hatchery fish (all males), the first return of chinook produced at Clear Hatchery. A total of 253,000 chinook salmon eggs were taken in 1985 for hatchery brood stock. In addition, 1.7 million fall chum and 500,000 coho salmon eggs were taken.

9.0 Escapement Targets for the Yukon Drainage

Per the Joint Technical Committee Terms of Reference in 3(i), we have addressed escapement needs and means to determine them. Following is a discussion of: (1) the importance and use of assessing spawning escapements; and (2) the methods by which escapements are being assessed in the Yukon drainage. This section complements information presented in the April 1985 Briefing Report.

9.1 The Need to Assess Escapements

The rational estimation of optimum escapement is a very involved process which is built upon many years of stock - recruitment data combined with numerous other considerations such as availability of spawning habitat, spawner densities, rearing and over-wintering capacities and other mortality factors. In a vast system such as the Yukon River, one can appreciate the problem not only by looking at the wide distribution of spawning areas throughout the 855,000 sq. km drainage, but also by examining the distribution of the catch both within and outside of the river. Accurate historical records of total catches and escapements simply do not exist nor do comprehensive inventories of spawning and rearing habitats. The accounting of the production from any specific brood stock is complicated by our poor understanding of high seas interceptions and mixed stock harvests in the major in-river fisheries. With these factors in mind, any estimate of escapement targets and/or production targets should be viewed with caution and only considered to be very preliminary. They are subject to revisions as our knowledge becomes more extensive.

The Joint Technical Committee has recognized that assessment of salmon spawning populations (i.e. escapement) is a crucial step in the management of the Yukon salmon resource. We recommend that the goal of this assessment is the determination of an escapement objective that has the highest probability of optimizing yield in the long term and the resulting formulation of a management strategy to insure that objective.

We strongly recommend that future management of the Yukon salmon resource not solely consist of monitoring and assessment of harvests. This recommendation stems from the general experience of Pacific salmon management that harvest policies that fail to address escapement requirements usually result in a substantial decline, often a crash, in harvest levels. We also stress the importance of directly measuring escapement in some manner. We recognize that various aspects of escapement can, and should, be modeled out of catch data. However, the reliability of these models can best be verified through direct assessment of escapements.

Escapement assessment and resulting objectives are most often associated in salmon management with classic "terminal" fisheries. In these types of fisheries, the fishery occurs in a limited area such that fish that go through this area are not subjected to further harvest and "escape" the fishery. Also, escapement is usually measured on a "real-time" basis such that the harvest is adjusted during the course of the fishery to achieve an escapement objective. This concept does not completely apply to the situation in the Yukon where migrating fish are subjected to harvest in a series of fisheries extending over an area 2,000 miles in length. Therefore, fish that escape one fishery cannot necessarily be included in the spawning population as they may be vulnerable to fisheries further upstream. This situation makes it difficult, if not impossible, to measure actual spawning escapement on a real-time basis for many of these fisheries. This problem is reflected in the Yukon salmon escapement data base where virtually all of the escapement information is collected well after the occurrence of the fisheries in question (i.e. on a post-season basis as opposed to a real-time or in-season basis).

Regardless of whether we can develop the ability to directly assess spawning escapement such that the Yukon fisheries can be adjusted in-season to achieve an escapement objective, the committee cannot over emphasize the need to evaluate spawning escapements on a post-season basis. This evaluation is critical to measuring the success of whatever harvest policy is implemented. Post-season evaluation of spawning escapement allows us the ability to adjust long term management strategies prior to major, and perhaps irreversible, depletions in stock size and resulting crash of the fishery. We feel that this point is best illustrated by examining the current situation of the Yukon fall chum resource. Based on the assessment of both catch and post-season escapement data, we have identified an overall trend of increasing catches and declining escapements. There is little doubt that continued increased exploitation on declining stock size will result in a dramatic crash in the fishery. It is important to note that without a post-season evaluation of

escapement, we would not recognize this situation as catch levels are currently being maintained. We feel that our ability to monitor escapements, even on a gross basis, should enable a change in harvest policy such that the trend in declining escapements can be arrested and future harvests ensured.

9.2 Considerations for Assessing Escapements

It is generally recognized that there are three broad considerations to address in direct assessment of spawning populations of Pacific salmon: (1) total abundance; (2) distribution; and (3) composition. The above considerations are not necessarily listed in order of importance and clearly, the relative value of any individual piece of information is diminished without the other pieces. Therefore, resulting production from an escapement is largely a function of abundance, distribution, and composition. Also, we recognize that other considerations, quantity and quality of spawning and rearing habitat for instance, are also important. However, these types of assessment are indirect measures of the resulting production from a parent population.

There is currently no data base that addresses total drainage escapement. Limited data exists on total escapement to selected portions of the drainage (the Whitehorse dam for instance). Extensive research and development has been undertaken to expand this concept to larger portions of the drainage. The most notable examples are the tagging program below the Dawson fishery to estimate total escapement into Canada and the hydro acoustic program at Pilot Station to estimate total escapement past the lower river fisheries. Continuation of this work is necessary to successfully estimate total spawning escapement to the Yukon River.

Aerial, boat, and foot surveys provide information on both spawner distribution and relative abundance for selected spawning areas throughout the Yukon drainage. This data base is the most extensive escapement information available for the Yukon River as this program has been in effect for over 20 years. It is important to note that despite the quantity of data, problems still exist in the comparability of the data between systems and years. A major effort is needed to standardize methods and analytical procedures.

In recent years, a major effort has been undertaken to develop a comprehensive data base of age, sex, and size composition of Yukon salmon escapements. The current program consists of sampling major spawning populations throughout the drainage. This information is important in determining the "quality" of a particular escapement. For instance, an

escapement that consists of an extremely high proportion of males would not be expected to produce at the same rate as an escapement of equal abundance but a larger proportion of females. This data base needs to be expanded, particularly for fall chums.

Although large gaps exist in our ability to assess escapements, we strongly recommend that interim escapement objectives based on existing information be established. It is important to stress that these goals are always subject to refinement as additional information becomes available.

9.3 Escapement Targets - Canada

9.3.1 Chinook Salmon

Index escapement records based upon aerial surveys of spawning chinook salmon in the Big Salmon and Nisutlin rivers appear in Appendix Table 7, page 62 of the Briefing Report. Generally, escapements have been increasing over the past decade. For example, the 1975-1979 average escapement index (Whitehorse Fishway and Big Salmon River and Nisutlin River combined) was 1261 compared to the 1980-1984 average of 3713. It should be noted however that the earlier aerial counts were plagued with poor conditions resulting in minimal or inaccurate counts. Therefore, the escapement index values which resulted in the good catches and escapements for the period 1980-1984 are unreliable.

For the purpose of generating a preliminary escapement goal, it is assumed that the 1980-1984 escapements will produce better than average returns. This, unfortunately, will not be known until the returns (catches and escapements) from these brood years have been analysed. The three peak index values in this period were as follows: 1980 index = 4803; 1981 index = 6139; and, 1984 index = 3264. The three year average value is 4735.

Although data are limited, it is possible to gain some insight into the relationship between index escapement and total escapement by comparing aerial survey results with the total Canadian escapement estimates produced by the 1982 and 1983 tagging studies (Milligan et. al. 1985). The results are as follows:

YEAR	TOTAL ESCAPEMENT ESTIMATE (A)	SURVEY INDEX ESCAPEMENT (B)	RATIO B/A
1982	20,000	2,009	0.100
1983	31,000	2,348	0.076

Recognizing that the data base is small, if it is assumed that on average the index escapements represent 0.0881 (i.e. [0.10045 + 0.07574] / 2) of the total Canadian escapement (Porcupine excluded), the three year peak average index value of 4735 potentially translates into a total escapement of 53,746 or rounded off, 55,000 spawners. A preliminary escapement target of 55,000 chinook salmon in the Canadian portion of the drainage (excluding the Porcupine River system), therefore does not seem unreasonable. Using similar analyses, the 1981 index value of 6139 may have reflected an escapement of close to 70,000. A target for the Porcupine River has not yet been established.

9.3.2 Fall Chum Salmon

The exploitation of fall chum salmon has been steadily increasing since the early 1960's. The five year average total in-river catch has increased from 117,000 (1960-1964), to 285,000 (1970-1974), to 495,000 (1980-1984). During the past decade, fall chum escapement indices on the Sheenjek, Fishing Branch and Toklat rivers have been declining by about 50% per cycle. This situation has given rise to conservation concerns for fall chum.

Chum stock - recruitment research has been conducted on some British Columbia stocks (Beecham, pers. comm.). It has been determined that these stocks can sustain production while being subjected to a harvest rate of approximately 40%. Higher levels of exploitation result in declining population sizes. If a similar capability exists for Yukon fall chum, and given the apparent declines in escapement and increases in total catch, it is likely that the overall exploitation rate has become excessive. Assuming that a 40% harvest rate would produce equilibrium in Yukon chum stocks, the 50% decline in index escapements over the past two cycles is indicative of a 70% harvest rate. For example, at a 40% harvest rate, for every 100 spawners, 167 adults would be produced allowing a subsequent harvest of 67 fish and an escapement of 100. With regards to Yukon fall chums, the 50% decline in escapement suggests that from a total production of 167 adults only 50 adults are escaping resulting in a catch of 117 and an exploitation rate of 70% (117/167).

Assuming that the overall exploitation rate over the period 1981-1984, has been 70%, the 1981-1984 average in-river catch of 471,000 reflects a total stock size (excluding catches in approach waters to the Yukon River) of 675,000. Peak production likely occured in 1981 when a total catch of 677,000 was recorded; at a 70% harvest rate the total stock would have approached 970,000. Given the declining status of fall chum stocks, an optimum production of 1.0 million does not seem unreasonable. In order to maintain this type of production and

Table 7. Yukon River (Alaska) escapement index objectives for chinook and chum salmon.

	Escapement Objective[1]	
	Minimum	Optimum
CHINOOK SALMON		
Andreafsky River		
East Fork	1,100	1,600
West Fork	700	1,000
Anvik River (Mainstem Yellow River to McDonald Creek)	300	500
Nulato River		
North Fork		500
South Fork		500
Gisasa River		650
Chena River (Flood Control Dam to Middle Fork)	1,000	1,700
Salcha River	1,500	3,500
SUMMER CHUM SALMON		
Andreafsky River		
East Fork	76,000	109,000
West Fork	62,000	116,000
Anvik River (Mainstem Goblet Creek to McDonald Cr.)	209,000	356,000
Sonar		487,000[2]
Nulato River		
North Fork	37,000	53,000
Hoqatza River		
Clear Creek	5,000	8,000
Caribou Creek	5,000	9,000
Salcha River		3,500

Table 7. (cont'd) Yukon River (Alaska) escapement index objectives for chinook and chum salmon.

	Escapement Objective[1]	
	Minimum	Optimum
FALL CHUM SALMON		
Upper Tanana River Drainage		
Delta River		7,900
Bluff Cabin Slough		5,200
Upper Toklat River		
Peak Years[3]		69,000
Non-Peak Years		22,000
Sheenjek River		
Peak Years[3]		60,000
Non-Peak Years		19,000

[1] Escapement objectives in numbers of fish are preliminary and are subject to change as additional data becomes available. Unless otherwise indicated, escapement objectives are based on aerial survey index estimates which do not represent total escapement, but do reflect annual spawner abundance trends when using standard survey methods under acceptable survey conditions.

[2] Optimum number calculated from escapement-return relationships.

[3] Four year cycle in 1971, 1975, 1979, etc.

assuming 60% of the total stock is required for spawning, a preliminary system-wide escapement goal of 600,000 is suggested. Of this, the preliminary Canadian escapement goals of 150,000 upper Yukon and 150,000 Porcupine are proposed acknowledging that these are somewhat arbitrary at this time. Population estimates for the upper Yukon and Fishing Branch Rivers have fallen within range of these targets in the past; ie. 118,000 for upper Yukon, 1983 (Milligan et. al., in prep.) and 350,000 Fishing Branch, 1975 (Elson, 1976).

9.3.3 Coho Salmon

Our very limited understanding of the distribution and productivity of coho salmon in the Canadian portion of the Yukon River drainage precludes the development of escapement targets at this time.

9.4 Escapement Targets - Alaska

Escapement objectives for tributary streams in the Alaskan portion of the drainage were presented in the April 1985 Briefing Report and are presented again in this report for convenience (Table 7). The following discussion centers around the rationale behind the methodology used in establishing these objectives.

Establishment of escapement objectives anywhere in the Alaskan Yukon is difficult as there are no reliable estimates of total abundance. However, it is felt that existing survey data provide an index to escapement abundance when considered in aggregate. Therefore, the approach has been to establish escapement objectives for a wide range of major spawning populations.

Determination of an escapement objective for any individual tributary is based on a crude evaluation of returns from different brood sizes. Because of the lack of complete data bases for total return, contribution to the fisheries, and age-at-return, this analysis consisted of simple comparisons of spawner-return relationships based on the predominant age-at-return (six years for chinook salmon and four years for chum salmon). In addition, the overall trend of the species in question was given major consideration. For example, Yukon chinook salmon stocks appear to have rebounded from low levels observed in the late 1960's and early 1970's and are now in a healthy state. Conversely, fall chum salmon stocks appear to be declining in abundance in recent years. Based on this information, our goal for chinook salmon is, as a minimum, to maintain the level of returns that we are now experiencing. Our goal for fall chum salmon is, as a minimum, to arrest the declining trend in abundance; ultimately reverse it; and

determine the level of harvest that will maintain the run at relatively constant levels.

Tributary escapement objectives were then set at a level that, we feel, will produce the long term trend in stock abundance that we wish to establish.

For chinook salmon, the desired long term trend is to maintain the resource at its present level which we assess as healthy. Therefore, escapement levels from the historical data base were selected from the time period in which the resource was assessed as healthy (the late 1970's and early 1980's). In an attempt to discount the effect of extremes in production, extremely high and low escapement levels during this time frame were discounted. The remaining, intermediate, escapement levels during this time frame were then averaged to establish an escapement goal that should produce returns of the level that we have observed in recent years. These proposed escapement objectives are, therefore, above levels observed during years of depressed returns.

For fall chum salmon, the desired long term goal is to increase abundance above the present level. Extremes in production were again not included in the final calculatior. The remaining escapement levels during the pre-decline time frame were then averaged to establish an escapement objective that, on the average, should produce returns above the present levels. These escapement objectives are, therefore, above levels observed during the past cycle.

Clearly, these escapement objectives will be subject to change as additional information is obtained. Record escapement levels for chinook salmon were observed throughout the drainage in 1980 and 1981. The majority of the offspring from these parent years will return in 1986 and 1987. This information should be very instructive in determining spawner-return relationships. Total return estimates for some species, particularly fall chum salmon, may be possible soon as a result of such programs as the hydro acoustic assessment at Pilot Station. We expect to significantly increase our ability to predict returns from various levels of escapement with these data. Finally, the returns from parent year escapements that were sampled for age, sex, and size composition will begin to return in 1985. We also expect to significantly increase our ability to predict returns from various compositions of escapements with these data.

10.0 Proposed New Studies

We agreed that there is a need to develop a common US/Canada

data base for Yukon River salmon catch, effort and escapement statistics, along with common methodologies and data recording formats. The following research studies have been identified by the Technical Committee as necessary for the effective management and conservation of the Yukon River salmon stocks. They are, in order of priority:

A) Catch, Escapement and Total Run Size Statistics

i) improve documentation of subsistence, Indian food and domestic fishery harvests.

ii) improve chinook, fall chum, and coho salmon tributary escapement estimates by: a) expanding aerial and ground survey coverage of spawning tributaries in terms of both the number of streams surveyed and the number of surveys conducted for each stream each year, and b) intensively studying selected index streams using weirs, counting towers, or hydroacoustic counters, and comparing results to survey estimates to obtain survey adjustment factors.

iii) refine estimates of abundance for chinook and fall chum salmon using tagging and hyrdoacoustic techniques in the mainstem of the Yukon River.

iv) develop and further refine escapement objectives for the major spawning tributaries to better assess stock status and adjust fisheries management strategies.

B) Stock Separation

i) examine the feasibility of using scale pattern analysis, electrophoretic studies or other means for estimating the interception rate of Yukon River chinook salmon in fisheries ouside the Yukon River. This includes documentation of salmon catches in domestic trawl fisheries.

ii) refine the existing in-river chinook stock apportionment study to obtain better estimates of catch by stock of origin using scale pattern analysis.

iii) examine the feasibility of using tag and recapture, scale pattern or electrophoretic analysis for estimating the interception rate of Yukon River fall chum salmon in marine fisheries.

iv) estimate stock composition of in-river harvest of Yukon River fall chum salmon using tag and recapture, electrophoretic, or scale pattern analysis methods.

C) Historical Data Base Analysis

i) conduct a rigorous review of historical data sets to evaluate the utility of these data for the purpose of stock assessment.

ii) develop techniques for in-season run assessment and modelling.

D) Optimum Production Studies

i) expand both catch and escapement sampling of chinook, chum, and coho salmon for more comprehensive assessments of the age, sex, and size composition of returns.

ii) define spawning and rearing habitat requirements for each salmon species, and inventory these critical habitats, especially in areas with a high potential for resource development.

iii) estimate juvenile salmon distribution and abundance for selected spawning stocks. Conduct a coded wire tag and recovery study to determine both wild stock and hatchery stock contribution to mixed stock fishery catches and total return.

11.0 Proposed Sampling Design for Stock Separation Studies

Determination of stock structure is an important question in the management of several fisheries in which Yukon River chinook and fall chum salmon are harvested. A wide range of fisheries conducted in the United States FCZ by Japanese and U.S. fishermen are known to harvest salmon of Yukon River origin. In addition, salmon of Yukon River origin also contribute to several fisheries conducted in U.S. territorial waters, outside of the Yukon River, by U.S. domestic fishermen. An important consideration in all of these fisheries is the level of interception of salmon returning to the Yukon River basin. Determination of area-specific stock structure is also an important consideration in the management of the fisheries which occur in the mainstem Yukon River in Alaskan waters. In both the marine and inriver fisheries, stock structure information is needed to determine if viable time, area, or gear restrictions exist such that selective harvest policies for different stock groupings can be enacted.

11.1 Chinook Salmon

Several fisheries conducted in the North Pacific and Bering Sea waters of the U.S. FCZ are known, or suspected, to harvest Yukon River chinook salmon. These fisheries include Japanese

trawl, mothership, and landbased gillnet; and U.S. joint-venture and domestic trawl fisheries. Recent studies of the Japanese fisheries conducted by Fisheries Research Institute (funding provided by Alaska Department of Fish and Game, National Marine Fisheries Service, and North Pacific Fisheries Management Council) using scale patterns analysis (SPA) showed that the interception of chinook salmon of western Alaskan/Canadian origin were significant, and often the major, contributors to these fisheries. The actual contribution of Yukon River fish was not computed in these studies. We recommend that the feasibility of computing Yukon River-specific contribution rates for these fisheries be investigated.

Reported chinook salmon catches in the joint-venture trawl fishery are extremely small and probably do not pose a measureable impact on the Yukon salmon resource. Therefore, we do not perceive the need to quantify stock composition in this fishery.

The occurrence and species composition of salmon in domestic trawl catches is unknown at this time. We believe efforts should be made to obtain this information. Until these parameters are known, there is little point in pursuing stock structure studies of this fishery.

Analysis of tagging data has shown that chinook salmon destined for the Yukon River contribute to the set gillnet fisheries in southern Norton Sound. Because of the small size of these fisheries, the impact of these interceptions is probably small. We feel that it is important to fully understand the entire harvest pattern of Yukon River chinook salmon and recommend that the feasibility of estimating contribution rates through SPA be investigated.

Mainstem Yukon River commercial and subsistence fisheries in Alaskan waters harvest chinook salmon destined for natal streams throughout the drainage. An important consideration in the management of these fisheries is the country of origin of these fish. ADF&G has computed estimates of contribution for these fisheries since 1980, largely through SPA. DFO first released code wire tagged (CWT) fry in 1985 from hatchery stocks upstream from the hydroelectric dam at Whitehorse. To fully evaluate whether sufficient time, area, or gear restrictions exist to differentially harvest various stock groupings of Yukon River chinook salmon requires additional catch allocation data. Therefore, we recommend that the SPA study be continued. Because of the complexity of recovering such a small number of CWT's from a cross section of the Yukon River mainstem fisheries, we do not recommend that this type of limited CWT deployment on a small, single spawning population be used to compute stock contribution

rates. We do however recommend examining the possibility of expanding the CWT program so that stock contribution may be estimated.

11.2 Fall Chum Salmon

It is not known to what extent foreign high seas fisheries affect western Alaskan/Canadian Yukon Territory fall chum salmon stocks. Preliminary SPA conducted by the Fisheries Agency of Japan indicated that chum salmon of U.S. (i.e. North American) origin were significant contributors to North Pacific fisheries. We recommend that the feasibility of computing contributior rates for western Alaskan/Canadian Yukon Territory chum salmon in Japanese North Pacific and Bering Sea fisheries be investigated. Catch levels in the joint-venture trawl fishery are probably not sufficient to warrant a catch allocation study. Total salmon catch and species composition data of the U.S. domestic trawl fishery are not well documented and efforts should be focused on improving this data prior to addressing the issue of stock contribution.

Concern has been expressed in recent years over interceptions of western Alaskan chum salmon in Alaska Peninsula fisheries. SPA (conducted by ADFG) of samples collected from the 1983 South Unimak and Shumagin Island June fisheries showed that the majority of these catches were of western Alaskan origin. The discriminant models used in the study were not of sufficient precision to differentiate Yukon River fall chum salmon as a separate stock grouping. Concurrent with this study, ADFG also conducted an analysis of gear selectivity in this fishery and demonstrated that gear restrictions could be imposed that would reduce the level of chum salmon catches without compromising the fleet's ability to harvest sockeye salmon, the target species. We recommend that: (1) stock structure of the June fishery continue to be examined through SPA; (2) stock structure of the Peninsula chum salmon harvests in July and August be initiated; (3) the feasibility of specifically identifying Yukon River fall chum salmon in these harvests be investigated; and (4) time, area, and gear restrictions to reduce the harvest of western Alaskan chum salmon in these fisheries be investigated.

Mainstem Yukon River commercial and subsistence fisheries in Alaskan waters harvest chum salmon destined for natal streams throughout the drainage. An important consideration in the management of these fisheries is the country of origin for which these fish are bound. Determination of stock structure of the lower river fisheries, Alaskan fishing Districts 1 and 2, is most important as the majority of the harvest occurs in these fisheries and little is known of the temporal entry patterns of the various stocks. ADF&G has conducted preliminary

investigations into the feasibility of SPA methodology to examine stock structure of these fisheries. Previous tagging studies have shown that differential bank orientation of Tanana River stocks and Porcupine River and Canadian Yukon Territory stocks occurs in the mainstem fisheries immediately below the confluence of the Tanana River (Alaskan fishing District 4). In an effort to identify stock groupings and compute contribution rates for the various mainstem fisheries, a private contractor (funded by DFO) first investigated the applicability of electrophoretic methodology to this problem during 1984. This work was expanded upon during 1985 and samples have been and are currently being collected from a wide range of spawning stocks and mainstem fisheries. We recommend that the feasibility of electrophoretic and SPA techniques to determine stock structure of the mainstem fisheries be continued.

12.0 1986 Run Outlook

12.1 Chinook Salmon

In most years age 6 is the dominant age class, however, 5 and 7-year-old fish also contribute to the run. The 1980 brood year (6-year-olds in 1986) was judged above average in abundance as indicated by comparative catch and escapement data. The return of 5-year-olds (1981 brood year) is expected to be significant based on above average run strength in 1981. Seven-year-olds may contribute significantly to the run in 1986 based on the above average return of 6-year-olds in 1985. In summary, based on evaluation of brood year run size data and assuming average survival, it is expected that the 1986 Yukon River chinook salmon run will be above average in magnitude.

12.2 Summer Chum Salmon

Normally Yukon River summer chum salmon runs are predominately composed of 4-year-old fish, although in some years 5-year-old fish are present in large numbers. The return of 4-year-olds in 1986 will be dependent on the strength of the 1982 brood year and the survival of the resulting cohort. Based on available catch and escapement data, the magnitude of the 1982 summer chum salmon run was judged below average to average in abundance. The return of 4-year-olds in 1986 is expected to be of similar run magnitude. The return of 5-year-olds in 1986 is expected to be significant based on the strong return of 4-year-olds in 1985. 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 run in 1986 will be average in magnitude.

12.3 Fall Chum Salmon

Similar to the summer run, the majority of the fall chum returning each year are 4-year-old fish. The magnitude of the 1982 run (4-year-olds) was judged very poor based on comparative catch data and escapements which were the lowest ever recorded in some streams. The return of 4-year-olds in 1986 is expected to be of similar magnitude. The return of 5-year-olds (1981 brood year) may contribute to the run based on the apparent average to above average return of 4 year-olds in 1985. In summary, based on evaluation of the 1982 brood year escapements and assuming average survival, a poor return is expected in 1986.

12.4 Coho Salmon

Four-year-old fish (1982 brood year) are the dominant age class. Adequate escapement information for coho salmon is lacking, but escapement surveys in the Tanana River system indicated above average run strength in 1982.

13.0 1986 Management Plans

13.1 Alaska

13.1.1 Chinook and Summer Chum Salmon

Prior to the opening of the commercial fishing season in the lower Yukon (Districts 1-3), subsistence and test fishing chinook salmon catches will be closely monitored as indicators of run timing and abundance. Since 1981, the fishing season has been delayed for 7-10 days while the chinook run is in progress. This action is intended to increase escapement of early run fish, which are subject to intensive exploitation throughout the entire drainage. Fishing seasons in each district are opened by emergency order on a staggered basis: District 1, followed by District 2 and then District 3.

Weekly commercial fishing periods are established by emergency order. Fishing time may be altered by emergency order depending on in-season assessments of run magnitude.

During the commercial fishing season subsistence fishing may occur only during commercial fishing periods, which provides for escapement requirements and facilitates fisheries enforcement. Thus, reductions in commercial fishing time made for conservation purposes in recent years also impact subsistence fishing. As a result, special subsistence fishing periods are now provided every other weekend through July 19.

Regulations provide for a 60,000 to 120,000 chinook salmon

guideline commercial harvest range for Districts 1 and 2 combined which includes incidental chinook salmon catches taken with 6 in. (15 cm) or smaller mesh gill nets late in the run.

The midpoint of the guideline harvest range (90,000) should be the expected catch if the run is of average magnitude. The upper end of the guideline harvest range (120,000) should not be exceeded unless a very large run can be substantiated. A 1,800 - 2,200 chinook salmon guideline harvest range is in effect for District 3.

A key regulation for providing appropriate separate commercial harvest of chinook and summer chum salmon, which occur simultaneously, is the date when gillnets of maximum 6 in (15 cm) stretched mesh must be used. This gillnet mesh requirement is accomplished by emergency order during late June and early July. The smaller mesh gillnet fishery has been effective in reducing the chinook catch during the late run, including that of large fecund females, and increasing the harvest of the more abundant summer chums.

If a very large run of summer chum salmon is evident early in the season as indicated by test fishing and commercial catches (taken with unrestricted mesh size gill nets), then the use of only 6 in. (15 cm) maximum mesh size gillnets during special fishing periods early in the season may be implemented if chinook salmon escapement requirements are not jeopardized.

The upper Yukon area commercial chinook salmon fishery is primarily regulated by a combined 5,550 - 6,950 fish guideline harvest range which is apportioned to Districts 4, 5 and 6. Once the chinook salmon guideline harvest range is taken the fishing season in each district is usually closed until the fall season.

Commercial and subsistence fishing is allowed for two 48-hour fishing periods per week in most of the upper Yukon area. These split fishing periods help spread the harvest over a greater portion of the run and afford additional protection to smaller stocks which are more susceptible to overharvest than the larger, more productive stocks.

If the chinook salmon guideline harvest range is taken before July 10 in District 4, the commercial fishing season will be closed by emergency order. The season would be reopened during the period July 10 - 31 to fishing with gillnets of six inch (15 cm) or smaller mesh and fishwheels. This action would minimize additional harvest of large chinook salmon and still allow continued commercial fishing for the more abundant summer chums.

If subsistence catches of summer chum after the chinook

salmon season closure are above average in magnitude in District 6, a reopening of the early commercial salmon season will be considered for this district.

13.1.2 Fall Chum and Coho Salmon

In response to poor escapements documented in recent years, difficulties in assessing in-season run strength and increasing fishing effort and efficiency of the fleet, the Alaska Board of Fisheries in 1983 adopted several important regulatory restrictions to reduce and distribute the fall chum harvest throughout the run.

Due to expected low returns beginning in 1986, ADF&G is proposing additional fishery restrictions to the Alaska Board of Fisheries. If adopted these restrictions will initiate the conservation program whose objective are to:

1) Immediately arrest the decline in escapements which has been evident for most spawning areas since 1980.

2) Build up spawning population abundance for all major stocks to the level of existing escapement objectives.

3) Reassess existing escapement objectives in terms of spawner-return relationships and redetermine optimum escapement objectives.

The lower Yukon River commercial fishery should be closed from July 15 to 30 to protect the early portion of the fall chum run. If test fishing catches, hydroacoustic counts, and performance of the subsistence fishery indicate a very poor return, commercial fishing will be further restricted or not opened at all. If the return is normal or strong in 1986, U.S. commercial in-river fisheries should be managed for a total harvest of between 70,000 and 160,000 fall chums. This is a reduction of about 50% from the present guideline harvest range. We agree that the benefits of this conservation program should primarily accrue to the spawning stocks.

Reopening of the lower Yukon area commercial fishing season for coho salmon may be allowed only if it is apparent that the fall chum salmon run is at least average in magnitude. This special coho salmon fishing season would occur in late August (after August 20).

The upper Yukon fall chum and coho salmon commercial fisheries have been regulated by scheduled weekly fishing periods and guideline harvest ranges (presently 25,500 to 100,500 fall chums and cohos combined for Districts 4, 5 and 6). In Districts

5 and 6 the opening of the fall season will be delayed until the strength of the fall chum run has been assessed, and the run has been distributed throughout the major fishing areas of both districts. This strategy has been endorsed by the Alaska Board of Fisheries and will result in better balanced harvests and escapements throughout the districts.

A management plan is in place to ensure adequate subsistence salmon harvests and escapements in that portion of the Tanana River drainage upstream of the Wood River (subdistrict C of District 6). Subsistence salmon harvest quotas in the subdistrict are 750 chinook and 5,000 chum salmon taken through August 15, and 5,200 chum and coho salmon combined taken after August 15. When the various salmon quotas have been taken the subsistence salmon fishing season in this subdistrict will close. The commercial fishing season in the subdistrict will be closed by emergency order when the subsistence quotas have been taken.

Development of a final management plan for the Yukon River salmon fisheries in Alaska will be delayed pending Alaska Board of Fisheries action.