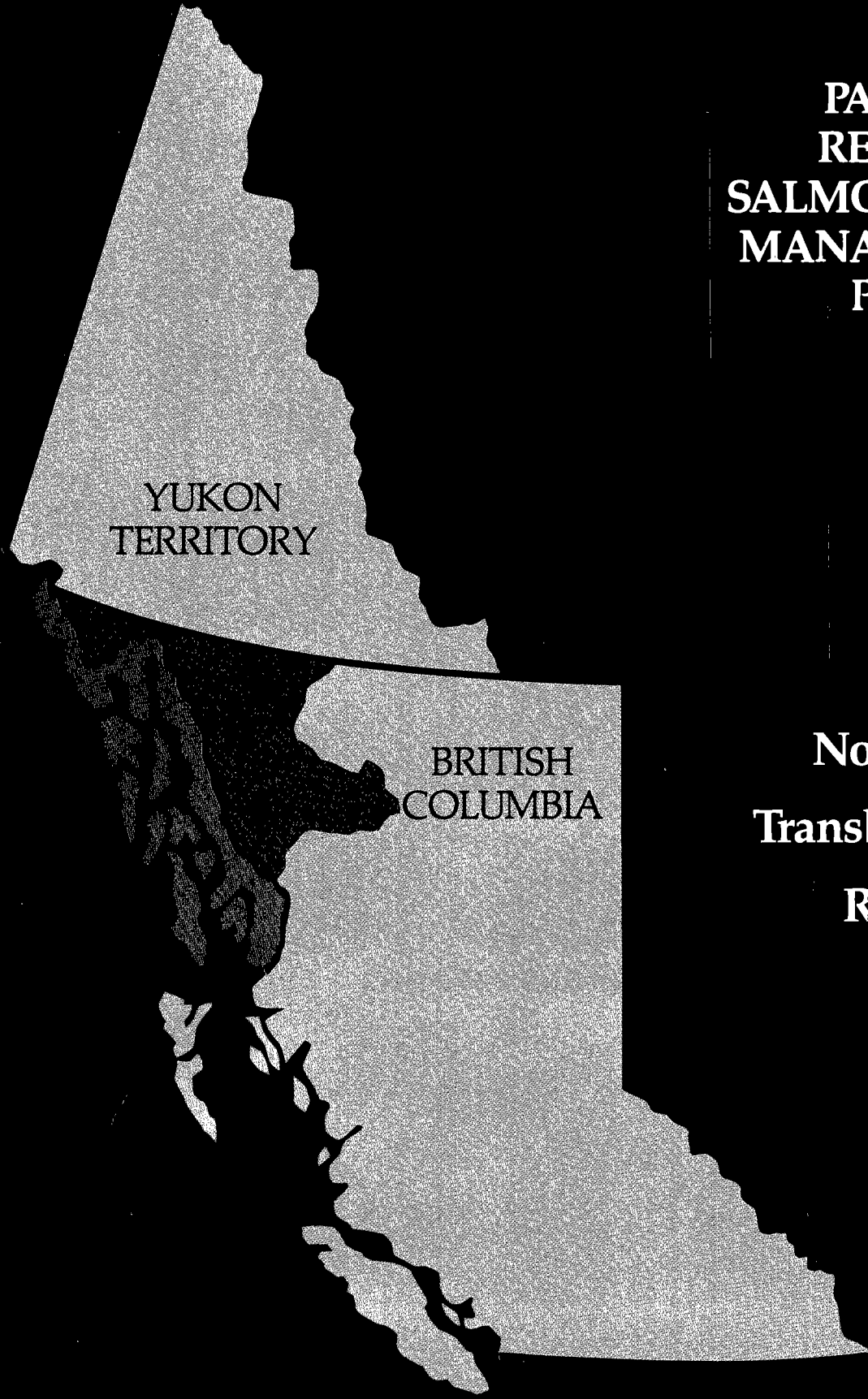


**PACIFIC
REGION
SALMON STOCK
MANAGEMENT
PLAN**



J

**Northern
Transboundary
Rivers**

**DISCUSSION
DOCUMENT**

1986

Fisheries
and Oceans

Pêches
et Océans

Canada

C O N T E N T S

A	Introduction & Computer Simulation Modelling
B	Queen Charlotte Islands Statistical Areas - 1 & 2
C	Nass & Skeena Rivers Statistical Areas - 3, 4 & 5
D	Butedale Statistical Area - 6
E	Bella Bella Statistical Area - 7
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I	Inner South Coast (Including Fraser River) Statistical Areas - 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 28 & 29
J	Northern Transboundary Rivers
K	Chinook
L	Coho

**PACIFIC REGION
SALMON STOCK MANAGEMENT PLAN**

VOLUME J

NORTHERN TRANSBOUNDARY RIVERS

Department of Fisheries and Oceans

1986



Fisheries
and Oceans

Pêches
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Your file Votre référence

Our file Notre référence

Summer 1986

TO: THE READER

This discussion document was prepared to replace the April, 1985, edition of the Pacific Region Salmon Resource Management Plan. This edition differs from the original in title, in format, and in the inclusion of additional management options.

The title has been changed to the Pacific Region Salmon Stock Management Plan to make clear the distinction between stock management and fleet management. This document contains options for managing salmon stock production and harvest to make best use of the salmonid resource. It is hoped that a first edition of a Salmon Fleet Management Plan will be published by mid-1987. That document will contain options for managing the salmon fishing fleet to make best use of the labour, capital and other resources that are employed in harvesting the salmonid resource.

This edition was prepared in a new format to encourage review and comment by area, and to facilitate a regular revision process. This volume is one of twelve dealing with salmonid stocks by geographical area (individual or small groups of Statistical Areas) and by species (for Chinook and Coho salmon). Discussed in this volume are the salmon resources of the Northern Trans-boundary Rivers.

This document contains information on the status of salmon stocks, habitat, and fisheries, and a detailed discussion of some of the management problems that exist. Its purpose is to present existing information to provide a context for some management and enhancement options that have been suggested to rebuild the salmon resources. The local and specialized knowledge of advisors and others familiar with the Northern Trans-boundary Rivers is vital to improving existing options, creating new ones if necessary, and to choosing the best possible combination of options to form the basis of our long-term management plans.

Pending such a review, no endorsement of the analysis or proposals contained in this document is implied or intended. Rather, I see a consultative process being applied to develop long-term management plans using the Salmon Stock Management Plan as a basis for discussion. Please approach this document constructively strengthening its weaknesses and building on its strengths. Working together, we can develop a plan to manage the Pacific salmon resource to the detriment of none and for the benefit of all.

Yours truly,

P.S. Chamut
Director General
Fisheries - Pacific

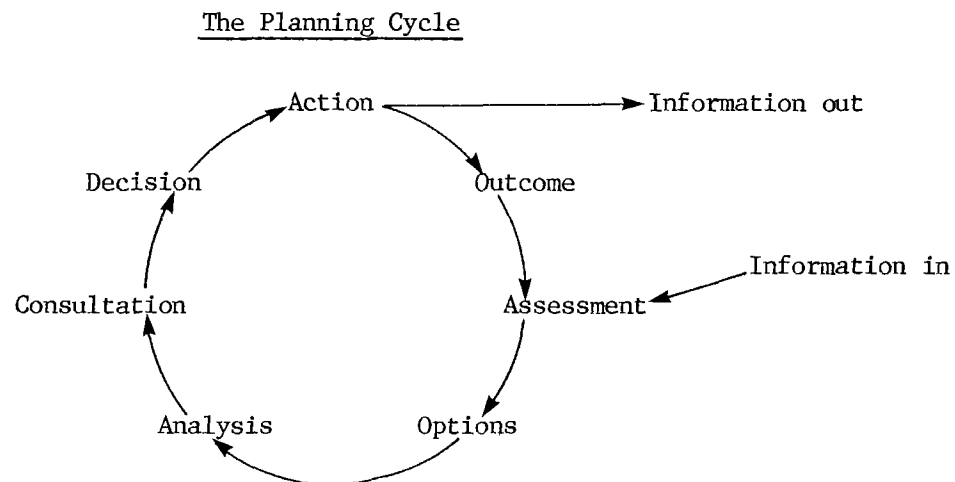
Canada

FOREWORD

This document contains plans for managing Pacific salmon fisheries. No decisions have yet been taken on these plans; they remain options from which to choose a direction for the future of Pacific salmon fisheries. Starting soon, but probably extending over a long period and subject to review and revision, decisions will be made in concert by all parties with an interest in the resource. The Salmon Stock Management Plan has been produced to motivate discussion and assist the decision-making process by identifying current strategies and problems, stating goals, and describing means by which they might be achieved.

The genesis of this document can be found on the first page of the Pearse Report, where the most serious criticism of the Department of Fisheries and Oceans was identified as, "the lack of cohesive, consistent, and forward-looking policies and programs with respect to fisheries management, enhancement, and environmental protection".* The Department has responded to this criticism, and to the subsequent recommendations made by Pearse,** by devoting considerable effort and resources, beginning in mid-1984 and continuing to date, to the production of the Salmon Stock Management Plan.

Nevertheless, this document is not finalized; in fact, it probably can never be finalized. The Salmon Stock Management Plan has been written as a discussion document that will evolve over time as the planning cycle, illustrated below, proceeds.



* P.H. Pearse, Turning the Tide: A New Policy for Canada's Pacific Fisheries, (Ottawa, Supply and Services Canada, (1982), p.1.

**Pearse, p. 39.

Past actions and outcomes of salmon management are documented and assessed in this report. New ideas and options for future management strategies are also analysed and will be the subject of informal and formal consultation. In this way, options can be transformed into decisions to take new and different actions leading to better outcomes. Because fisheries in general, and salmon fisheries in particular, are susceptible to rapid change, these outcomes will, in turn, generate renewed discussions as the cycle continues. The Salmon Stock Management Plan, then, is a record of management planning and action that is intended to motivate and facilitate this planning cycle.

This document contains information on the status of salmon stocks, habitat, and enhancement. As well, it discusses in some detail the fisheries that exist in each area, management problems, and options to rebuild our salmon resource by management and enhancement. The Salmon Stock Management Plan is a diverse document that will continue to evolve through annual updates to incorporate new information, assess performance, review objectives, identify problems, describe strategies, and analyse new options for managing salmon stocks. It should be read in this spirit. It is a document that is meant to stimulate thought and discussion with a view to generating interesting and useful new ideas that will find their way back into the document.

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NORTHERN TRANSBOUNDARY RIVERS

The northern transboundary rivers discussed in this document include the Yukon, Taku, Stikine and Alsek. All of these systems originate in Canada, but drain into Alaskan coastal waters. Other smaller transboundary rivers that are not included in this discussion are the Unuk, Whiting and Chilkat.

1. TAKU RIVER

The Taku River originates on the Stikine Plateau in northwestern B.C., but flows southwest through the Alaskan Panhandle and drains into Taku Inlet about 20 km east of Juneau, Alaska (Figure 1). It is formed by the merging of its two principal tributaries, the Inklin and Nakina rivers. The Taku River drainage area is approximately 16,000 km², of which 95% lies within Canada.

1.1 Stock Description

The Taku River supports all five species of Pacific salmon. There are several stocks of each species within the system which are harvested in a number of fisheries. However, separation of these stocks is hampered by inconsistencies in escapement data. Therefore, management is based on stock complexes rather than specific stocks. Virtually all spawning of chinook, sockeye and pink salmon occurs in the Canadian portion of the drainage basin. Pink salmon are the most abundant species within the Taku River, although sockeye is the most important commercial species. Next in order of economic importance are coho, chinooks, chums and pinks.

1.1.1 Sockeye Salmon

There are five principal sockeye stocks in the Taku River system, which spawn in the Little Trapper, Kuthai, and Tatsamenie lakes, and the Silver Salmon, Nahlin, Taku and Tatsatua Rivers.^{1,2} Results of radio-tagging studies conducted in 1984 suggest that the Little Trapper Lake stock arrives in the lower river during early July, while the other stocks arrive throughout July and August. Historic data indicate that 73% of Taku sockeye return as five-year olds, 18% as four-year olds and the remainder as three- and six-year old fish.³

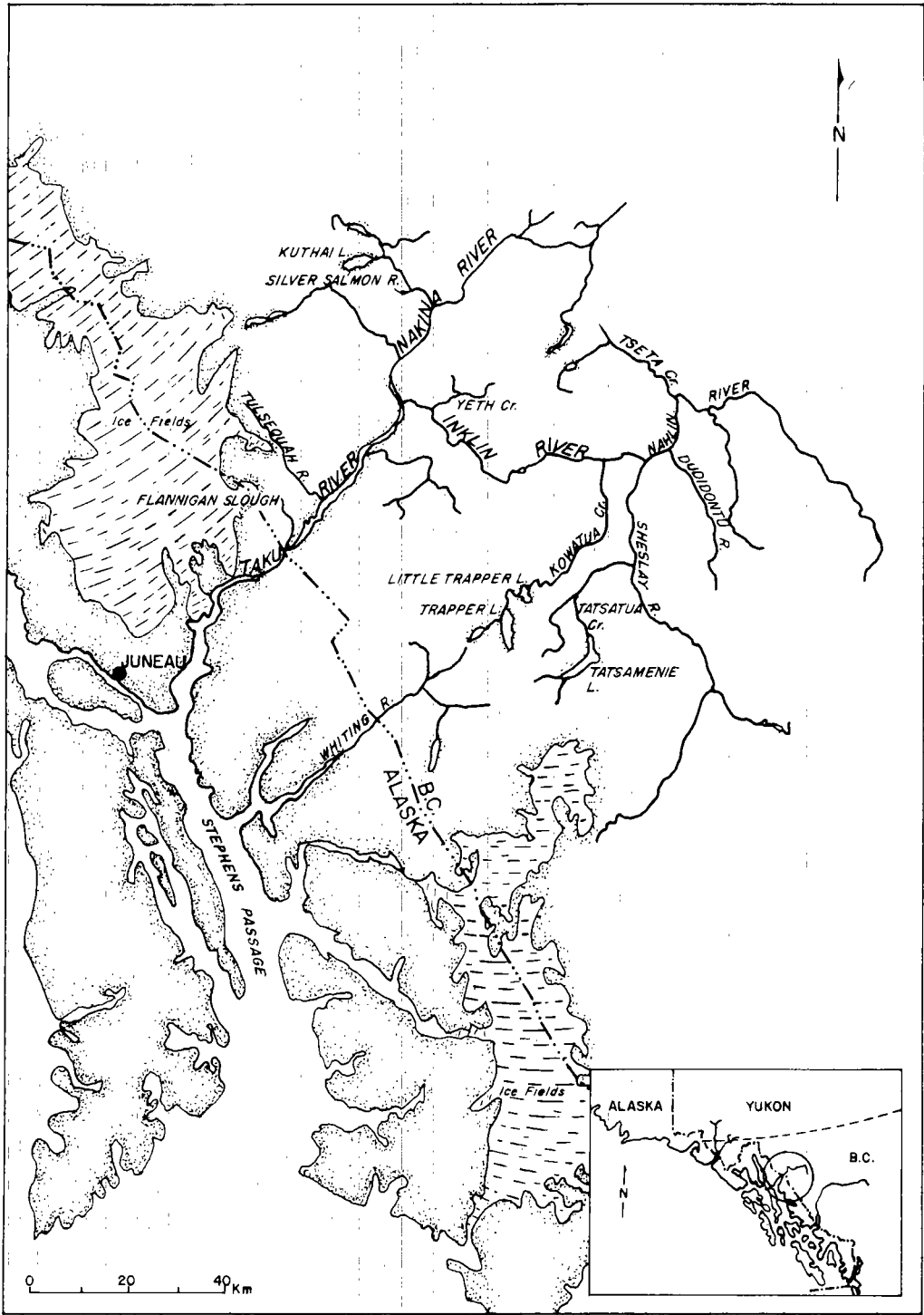


Figure 1. The Taku River system.

Estimated sockeye escapements to the Canadian portion of the Taku River and Little Trapper Lake, which is one of the major sockeye producers in the system, are shown below. The data are based on results of mark-recapture programs conducted since 1981 and represent escapements after the Canadian harvest. Spawning escapements of sockeye increased sharply between 1981 and 1983, but have been relatively stable since that time.

Year	Estimated Escapement ⁴	
	Taku System	Little Trapper Lake (at weir)
1981	25 - 33,000	-
1983	110 - 131,000	7,502
1984	107 - 108,000	13,084
1985	108,000	14,889

Escapement targets of 80,000 and 71,000 sockeye have been tentatively set by Canada and the U.S., respectively. Further information is required to confirm the validity of these targets.

The 1985 sockeye harvest in Alaska was unusually good; 87,000 fish were taken in the District 111 harvest, as compared with the 1979-84 average of 81,212 fish. The Canadian harvest was down by 22% from the five-year average and amounted to 14,244 sockeye.⁴

1.1.2 Pink Salmon

Historically, the highest escapements of pink salmon to the Taku River system have been even-year Nakina River stock, which peaked at 250,000 in 1980. Smaller stocks are known to spawn in the Nakina River during odd years, as well as in the Taku River during both even and odd years. However, an unusually high odd-year escapement was noted in the Nakina River during 1985, with returns estimated at more than 1 million fish.⁴ The mean escapement of pinks in the Taku system from 1971 to 1980 was estimated at 100,000 spawners, while the escapement in 1984 was estimated at 168,000 spawners.³ Pink escapements have generally been lower than the preliminary target level of 150,000 to 250,000 fish. Catch data suggest that

pink stocks are increasing in abundance, although it should be noted that District 111 catches include interceptions of other pink stocks. The mean catch of pinks in District 111 was 72,600 from 1969-1978 and 170,157 from 1979-1984.⁴ The Canadian commercial harvest of pink salmon from the Taku system averaged 12,018 during the period from 1979 to 1984. In 1985, 312,800 pinks were taken in the Alaskan harvest while only about 3,400 pinks were taken in the Canadian harvest.⁴

1.1.3 Chum Salmon

The size of fall chum runs to the Taku River system have been significant but variable over the years.⁴ Returns of summer chums are minor compared to those of fall runs. Although a few specific spawning areas in the system have been identified (e.g., Flannigan Slough), the spawning distribution and stock structure of Taku chums are generally poorly understood. Returning stocks are dominated (74%) by four-year old fish, with the remainder of chums returning as five-year olds.³ The mean escapement of Taku chums from 1971 to 1980 was 35,000.⁵ On the basis of mark-recapture studies, the 1981 escapement was estimated between 104,000 and 147,000 chums. However, the 1982 and 1984 returns were low, with catches and escapement estimates below average. Spawner escapement was estimated at about 23,000 chums in 1984 and about 41,000 in 1985.^{3,4} There is no accurate target escapement set for Taku chum stocks because of historically poor escapement and catch data, although a preliminary objective of 65,000 to 80,000 chums has been jointly set by the U.S. and Canada.⁴ Exploitation of Taku chum stocks has decreased slightly in recent years. The mean harvest of chums in District 111 was 61,700 from 1969-1978 and 78,204 from 1979-1984.^{3,4} In 1985, Alaskan catches were above average at 107,854. In addition to U.S. catches, the Canadian commercial fishery harvested an average of 8,767 chums from 1979-1984. Canadian catch of chums was only 136 in 1985 due to Treaty-imposed restrictions.⁴

1.1.4 Chinook Salmon

Six chinook stocks are used as an annual index of total escapement to the Taku system. The principal stock is from the Nakina River. The Kowatua, Tatsamenie, Dudidontu, Tseta and Nahlin rivers support the other five significant stocks. Chinooks enter the river between late April and mid-June, prior to the arrival of most sockeye. Taku chinooks return primarily as five- and six-year old fish.

The database for chinook escapements to the Taku system is more extensive than for other species in the region due to aerial enumeration and carcass weir programs that have been frequently conducted since 1951. These records indicate that chinook escapements declined from 1951 to 1970, but improved during the period 1971-1980. The mean escapement from 1971-1980 was estimated at 8,600 chinooks. The average escapement for 1979 to 1984 was 2222 while the total escapement for 1985 was 7209. Under the Canadian-U.S. Salmon Treaty, Taku chinook stocks are to be rebuilt to target levels by 1995. The current escapement goal for the Canadian section of the river, where virtually all chinook spawning occurs, is between 25,600 and 30,000 adults. Even the peak return of 9500, which occurred in 1958, is well below optimum escapement levels.⁵

There is no longer any commercial harvest in B.C. or Alaska that is directed at Taku chinook stocks. However, some fish are taken incidentally in sockeye gillnet fisheries. Delayed openings for the sockeye harvest have been imposed in an effort to reduce this incidental catch of chinooks. Numerous chinooks are also taken in the Alaskan sport fishery, primarily in the vicinity of Juneau.⁴

1.1.5 Coho Salmon

Coho spawn primarily in the smaller tributaries of the Taku River drainage. Stocks arrive at the river during August at which time they are intercepted in the fall chum fishery. Based on CWT data collected during the 1970's, Taku coho contribute significantly to several fisheries including the Alaskan terminal drift gillnet, outside troll and Canadian in-river gillnet harvests. In-river samples indicate that 53% of returning coho are three-year olds, while 47% are four-year old fish.³

Recent escapements of coho to the Taku River have been near the 1971-1980 average of 30,000. Conservative estimates of spawners in 1984 and 1985 were 30,529 and 36,653, respectively.^{3,4} Optimum escapement targets have not yet been finalized due to a lack of data on Taku coho catches in marine fisheries and low confidence in escapement estimates. Interim escapement targets have been set at 28,000 to 35,000 coho for the system. In 1985, spawner returns to the lower Taku River were satisfactory, but available information indicated that escapement to headwater areas was poor.⁴

Coho catches have been relatively stable since 1969. The mean harvest in District 111 from 1969-1978 was 35,000, compared to 28,000 during the period 1979-1984. A record catch of 52,329 coho was taken in 1985; however, the proportion of Taku coho in that catch is unknown.⁴ On the average, 5953 Taku coho were harvested in the Canadian fishery between 1979 and 1984. In 1985, the catch was only 1770 coho.⁴

1.2 Fisheries

Taku River salmon stocks are managed jointly by Canada and the United States. At present, there are four fisheries directed at Taku stocks that occur in Alaskan territory. These include the District 111 gillnet, offshore troll, sport and subsistence harvests. In B.C., there is a commercial gillnet fishery as well as sport and subsistence fisheries. The Alaskan commercial gillnet harvest has existed for about 80 years, whereas the Canadian fishery has only been in existence since 1979. The District 111 gillnet fishery is managed to control catches of both Taku and Snettisham salmon stocks.

The commercial gillnet fisheries are directed primarily at sockeye, chum and coho salmon. In summer, the fisheries are managed on the basis of sockeye run strength, and regulation decisions are based on in-season catch per unit effort (CPU) data.⁴ Under the Canada-U.S. Salmon Treaty, Canada may take 15% of the allowable sockeye catch, as well as incidental catches of other salmon species. Weekly contact between fishery managers in B.C. and Alaska is maintained to ensure that both Treaty allocations and sufficient escapement are met. In the fall, fisheries management is based primarily on chum abundance, and the commercial harvest occurs primarily in Alaska. Chum fisheries are managed on the basis of CPU data, and by comparing current catches and effort to historic data.⁴

Marine and freshwater fisheries are managed to minimize impacts on chinook and coho stocks. Regulations pertaining to sport and troll fisheries include delayed openings and mid-season closures. Special regulations may also be imposed on gillnet fisheries if there is concern regarding the incidental catch of chinooks and coho.

1.3 Current Enhancement Activities

Limited salmon enhancement activities have occurred in the Taku River system. A blockage removal program completed on the Nakina River by DFO in 1977 has increased the spawning distribution of pink salmon and has resulted in easier access by chinooks and sockeye to spawning areas.

Several Alaskan hatcheries are planned or are currently operating in the vicinity of the Taku River. Salmon production from these facilities is of concern where hatchery stocks are harvested in mixed-stock fisheries directed at wild Taku stocks. Management of these fisheries to levels of hatchery production could have a significant effect on wild Taku stocks.

Although operations at the Salmon Creek facility in Gastineau Channel were terminated in 1984, returns of the chum, coho and pink hatchery stocks are expected to contribute to common property fisheries through 1987. Many of the 30,000 coho produced from the Salmon Creek Hatchery were expected to return in 1985. However, most of these fish are thought to have been harvested in the offshore troll fisheries.⁴

The Kowee Creek and Sheep Creek hatcheries in Gastineau Channel have a combined permit for incubation of 50 million pink and/or chum salmon eggs. Gastineau Channel offers a large terminal fishing area in which hatchery returns can be harvested without adversely affecting natural stocks. However, contributions of fish to the District III gillnet fishery may be significant if chum production is expanded, or if the fleet targets on pink salmon in future years.

The large state-operated Snettisham Hatchery is located at the head of Speel Arm in Port Snettisham. The majority of production planned for this facility will be summer-run chums and an average return of 1.2 million adults is expected when the hatchery is operating at full capacity. Most of these chums are expected to be harvested by the District III gillnet fishery.⁴ Management of the fishery in the Taku Inlet and Stephens Passage area will continue to be based on the size of sockeye and/or pink salmon runs. This management approach requires careful monitoring to avoid overharvesting of Taku sockeye stocks. Speel Arm and, at certain times, outer Port Snettisham will be used as a terminal harvest area. The Snettisham facility will also produce chinooks and coho, many of which will be harvested in

distant troll fisheries. Chinooks that return to Port Snettisham will be harvested in the terminal area after the brood stock requirements are met. Since returning coho are expected to mix with natural Taku and Tikine river stocks, the hatchery contribution rate will have to be carefully monitored through a CWT program to ensure that wild stocks are not overharvested.

1.4 Habitat Status

To date, little assessment of salmon habitat in the Taku River system has been completed. However, available resources are presently fully committed to the acquisition of basic stock data that are essential for the management of annual fisheries. Nevertheless, the Taku drainage is not currently threatened by any major resource developments, and most habitats are in a relatively pristine state. A significant concern related to both habitat and stock status is increased access to remote areas that is provided by continued development of road networks. A detailed summary of habitat status in the Taku River system is provided in Appendix I.

1.5 Management Conflicts

1.5.1 Management Uncertainties

Historical estimates of stock sizes for the Taku River system are poor. With the exception of chinook salmon, escapement information for Taku stocks is incomplete and does not provide a consistent base with which to make annual comparison. Examination of stock composition of commercial catches in District 111 has recently been initiated and stock separation in fisheries was started in 1983, with sockeye as the species of concern. In the mid-1970's, Alaskan fishing effort shifted from major seine fisheries in approach waters to terminal gillnet fisheries, which made it more difficult to determine stock trends based on catch data. The degree of interception of Taku stocks by other commercial fisheries is unknown, although it is suspected that there is significant interception of Taku chinooks and coho in the Southeast Alaskan troll fishery. Excluding chinooks, catches of Taku stock in tidal and freshwater sport fisheries are also not documented. As a result of these uncertainties, run forecasts are poor, escapement requirements for the system are not accurately defined, and proper allocation schemes are difficult to derive.

1.5.2 Mixed-Stock Harvest

Taku River salmon are harvested in mixed-stock fisheries. The terminal and near-terminal fisheries in District 111 are directed at Taku, Speel and Whiting river stocks, but they also intercept chums and pinks that migrate through Stephen's Passage to other systems. Chinooks and coho are also intercepted by outside troll fisheries. The relative contribution of the Taku River salmon stocks to these mixed-stock fisheries is presently unknown.

1.6 Stock Rebuilding Potential

Because escapement requirements and the status of Taku stocks are poorly understood the potential for rebuilding these stocks is difficult to assess. Based on preliminary escapement objectives, a stock rebuilding program would most likely target on all salmon species, with the possible exception of coho. However, care would be required to ensure that coho stocks maintain escapement levels near the high end of the target range. Rebuilding of chinook stocks has already been initiated by minimizing their interception in commercial fisheries. A rebuilding program could increase sockeye and pink salmon production, as well as stabilize chum returns. Escapement goals may be derived with greater confidence once more reliable data become available on production and survival of Taku stocks.

1.7 Management Strategies for Stock Rebuilding

The development of stock rebuilding strategies ideally requires stock-specific information regarding abundance distribution, run timing, population composition and habitat utilization, as well as vulnerability of stocks to existing fisheries. Based on this information, the need for stock rebuilding can be evaluated, escapement targets can be established and management options can be developed and subsequently tested. At present, these baseline data are incomplete or lacking for the majority of Taku salmon stocks.

Unlike other species, there are some historical escapement and interception data for Taku chinook stocks. As a result of the Canada-U.S. Salmon Treaty, a program for rebuilding these stocks is already in place. The target escapement for the Canadian section of the Taku River has been set at 25,6000 to 30,000 chinooks and the target date for reaching this level is 1995.

Based on existing information, there appears to be an opportunity to manage discrete sockeye stocks within the Taku system and, therefore, rebuild depressed populations.⁴ Evidence from habitat and biological studies of Taku sockeye populations indicate that there are productivity differences between the stocks. Furthermore, results of mark-recovery programs, scale pattern analyses, parasite analyses and radio tagging studies indicate that significant differences in the timing of migration through the lower river exist between some sockeye stocks.⁴ The implementation of a pilot program to determine the degree of resolution possible between stocks and the relative costs and benefits of obtaining stock-specific data was recommended by the Transboundary technical committee.

1.8 Future Stock Enhancement Activities

Prior to implementing enhancement projects on the Taku River system, detailed surveys of spawning and rearing areas should be completed to determine whether existing habitat is underutilized. In the event that enhancement is warranted, the following projects should receive priority. The project number from Lill et al. (1983) accompanies each project title.⁶

1.8.1 Open Access to Trapper Lake (Project No. T-2)

Trapper Lake is somewhat larger than Little Trapper Lake and may contain potential spawning grounds for Taku salmon stocks. However, fish access is currently impossible. Construction of a steep pass fishway to open access may be feasible, although the costs associated with this type of construction have not been estimated. Additional research on potential spawning and rearing habitat for sockeye in Trapper Lake and studies of predator-prey relationships (lake trout currently inhabit the lake) must be conducted prior to the initiation of any such enhancement project.

1.8.2 Increase Tatsamenie Lake Production through Incubation Boxes, Fry Plants, and/or Lake Fertilization (Project No. T-4)

Taku sockeye are capable of reaching this large lake, but production appears to be limited by a lack of suitable spawning habitat. Limnological studies and preliminary investigations of current sockeye utilization of the lake are necessary before the feasibility of enhancement options can be adequately evaluated.

1.8.3 Open Access to King Salmon Lake (Project No. T-4)

Although sockeye have been reported in this lake recently, a blockage at the outlet currently limits access. Fry plants may be required to restore this run if access is improved. Stream rehabilitation would be relatively inexpensive and should be considered in the near future before the brood stock disappears.

1.8.4 Open Sockeye Access to Small Lakes (Project No. T-4)

Sockeye, coho and steelhead utilize the lower sections of the Hackett River, but beaver dams block salmon access to Kennicott and Hackett lakes. Removal of these migration barriers should be considered to increase access by sockeye to these lakes.

2. STIKINE RIVER

The Stikine River originates in the Stikine Plateau of northwestern British Columbia and drains an area of 51,200 km². The river flows for approximately 640 km before it reaches the Pacific Ocean near Wrangell, Alaska (Figure 2). Approximately 95% of the Stikine drainage basin is located within Canadian territory.⁵

2.1 Stock Description

All five species of Pacific salmon spawn in the Stikine River system, although sockeye, coho and chinook are the most abundant species. Chum and pink salmon production is minor in the Canadian portion of the drainage.⁵ Several stocks of each species have been identified, although separation of these stocks is difficult because escapement data are either lacking or inconsistent. Consequently, management of Stikine salmon has been based largely on a species-by-species basis, with the exception of Tahltan Lake sockeye. This population is the most abundant and economically important stock in the Stikine system. Some chinook populations are also considered index stocks and, therefore, are monitored more closely than other salmon stocks.

2.1.1 Sockeye Salmon

There are several sockeye stocks in the Stikine River system. In 1984, 42 spawning areas were identified during aerial surveys. Due to limited stock-specific data, Stikine sockeye are currently separated into only two stocks, the lower Stikine and the Tahltan Lake. Preliminary research indicates that these two groups can be separated through differences in scale patterns, egg diameter and the presence or absence of a protozoan brain parasite.⁴ Further analysis is under way to examine the possibility of identifying Chutine, Scud, Christina, Iskut-Verrett and Iskut-Bronson sockeye stocks. The majority (70.3%) of sockeye returning to the Stikine system are 5 year-old fish.⁴

There is limited information on sockeye escapements for most of the Stikine system, although an enumeration weir has existed at Tahltan Lake since 1959. Over the past 3 years, stock separation studies have shown that Tahltan Lake production accounts for about 40% of the total Stikine sockeye production.⁴ The long-term average (1959-1985) of sockeye returns to the Tahltan weir was 21,000, with recent 5- and 10-year averages of 40,000 and 31,000, respectively. Over the past 25

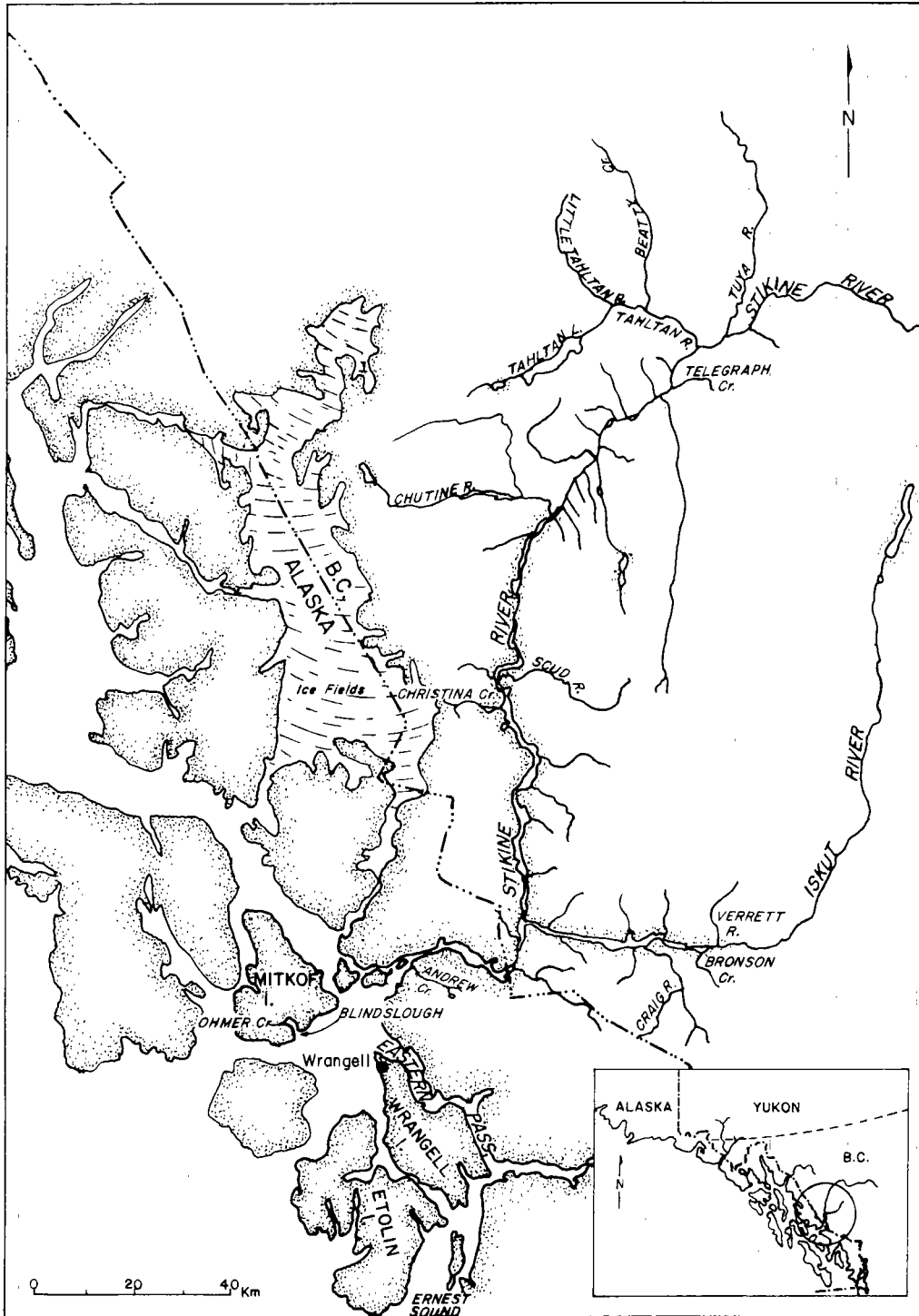


Figure 2. The Stikine River system.

years, sockeye returns to the Stikine system have followed an increasing trend, particularly those cycles that were traditionally less abundance (Figure 3).⁵ Available data for sockeye escapements are currently insufficient to evaluate spawner-recruit relationships. However, interim escapement targets for Stikine sockeye have been set at 58,000-65,000 spawners.⁴ In 1985, sockeye returns reached a record high of approximately 198,000 spawners.

Historical catch data suggest that sockeye returns to the Canadian section of the Stikine River have been increasing over the years. However, due to changes in management strategies and enumeration efforts, trends based on historic data must be interpreted with caution. Sockeye catches in the Canadian in-river harvest (commercial and subsistence) and estimates of sockeye escapement to the Stikine River for the period from 1971 to 1985 are provided below:

	Period		
	1985	1979-84	1971-78
Canadian commercial harvest	17,093	16,747	1,200
Canadian food harvest	7,287	4,221	2,875
Tahltan Lake weir escapement	67,326	25,718	22,508

Sockeye catches were unexpectedly good in 1985, with the Canadian in-river catch totalling almost 25,000 fish and the Alaska interception fisheries (District 6 and 8) totalling 44,500 Stikine sockeye.⁴

Results of age composition and scale patterns analyses have shown that Tahltan sockeye have a distinctive migration timing. Based on samples taken from the Summer and Clarence Strait harvests, Tahltan sockeye move through the Strait primarily in June, whereas most non-Tahltan sockeye pass through in July. It takes about two weeks for Tahltan stocks to migrate from this fishing area to the location of the Canadian in-river commercial fishery and approximately another two weeks to reach the Tahltan weir.⁴ The distinctive timing of Tahltan sockeye migration, in combination with in-season stock separation techniques, will most likely allow for stock-selective management of Tahltan and non-Tahltan sockeye.

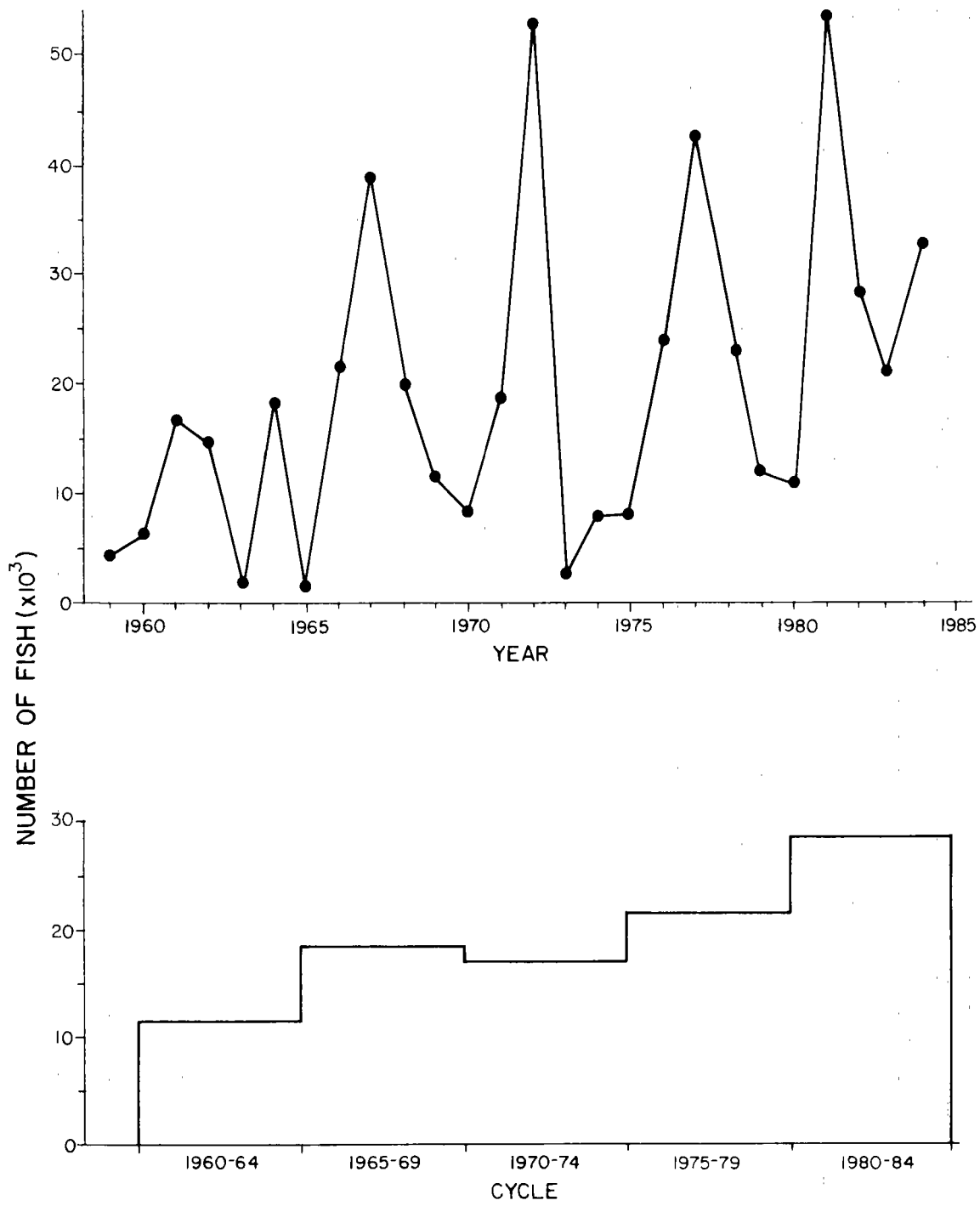


Figure 3. Tahltan Lake weir counts of sockeye (1959-84).

2.1.2 Coho Salmon

The distribution of coho spawners in the Stikine River is poorly understood, although spawners have been observed in the Chutine, Craig, Iskut and Verrett rivers. Because coho frequently spawn in areas that are relatively inaccessible, enumeration surveys have not been successful to date.³ Preliminary studies indicate that juvenile coho almost exclusively use tributaries and tributary backwaters.⁷ Due to the poor understanding of spawning and rearing distributions of Stikine coho, it is difficult to assess the proportion of Canadian and U.S. coho production from the Stikine River system. At present, escapement data are insufficient to assess whether Stikine coho stocks are healthy or depressed.⁸ The preliminary target escapement for coho in the Stikine system ranges from 38,000-50,000. Coho catches by the terminal fishery (District 108) have declined during the last three decades, while catches in the approach area (District 106) have increased. Nevertheless, the total combined catch from these areas has remained relatively stable during this time.⁵ Problems in analysing catch data are complicated by the fact that many stocks (including several hatchery stocks) contribute to the District 106 gillnet fishery.

The only indicator of coho run strength has been the size of the terminal area and in-river catches. Comparisons between current catches and historic catches since 1900 show considerable variation among the years, but also indicate that coho stocks are currently depressed.⁸ The apparent decline in Stikine coho abundance may be the result of overharvesting by outside troll fisheries, where the pressure on individual stocks is less conspicuous than in the terminal fisheries.⁵

2.1.3 Chinook Salmon

Extensive enumeration of chinook escapements to the Stikine watershed has not been completed. However, several years of data have been collected during aerial surveys and weir counts on the Little Tahltan River, which is the major index stream. Estimates from the Tahltan weir are thought to represent approximately 25% of the chinook escapement to the Canadian portion of the Stikine.⁴ Between 1979 and 1984, the total average escapement to the system was estimated at 16,473 chinooks. There was an above average escapement of 11,920 spawners recorded in 1985, but this is still well below the interim escapement target of 19,000-25,000 fish. No escapement target has been set for the U.S. portion of the river.

Limited CWT data for Stikine chinook stocks are available. However, information regarding chinook escapement is insufficient to estimate the contribution of these stocks to Alaskan fisheries.³ Similarly, data are insufficient to accurately forecast returns or set optimum targets for Stikine chinook stocks. Therefore, the conservative management approach that is presently in effect will be maintained until more information is available and chinook returns improve. Stikine chinooks have a relatively early run timing. Rebuilding efforts, therefore, have been concentrated on reducing incidental catches primarily by delaying the openings for Alaskan gillnet fisheries that target on other salmon species.

The commercial harvest of chinooks in Districts 6 and 8 have declined by approximately 50% in the last three decades, which is due in part to more restrictive management of terminal area fisheries.⁵ There is no longer a fishery directed specifically at chinooks in these areas, although the interception rates of Stikine chinook stocks in troll fisheries and high-seas net fisheries are presently unknown. Ongoing tagging programs for juvenile chinooks will provide information on the contributions of different stocks to various fisheries in the area, and will also allow assessment of the feasibility of stock separation based on scale analysis.

2.2 Fisheries

Stikine River salmon stocks are managed jointly by the U.S. and Canada. Management is directed at sockeye early in the fishing season, while management for pinks and coho occurs during mid-season and at the end of the season.⁴ Special management strategies are occasionally implemented to conserve Stikine chinooks and there are occasional openings in Alaska fisheries directed at summer chums.

Stikine salmon are taken in numerous fisheries. In Alaska, gillnet fisheries operate in Districts 6 and 8, and an offshore troll fishery and marine sport fisheries operate near Wrangell and Petersburg. Two in-river commercial fisheries occur in Canadian territory, one immediately upstream of the Alaska-B.C. border and the other near Telegraph Creek. A native food fishery also occurs near Telegraph Creek and some sport fishing occurs in headwater areas.

Historical catch data for the period 1940 to 1980 indicate that a reallocation of salmon harvest between District 6 and 8 has occurred in the Alaskan gillnet

fisheries.⁵ District 8 is a more terminal fishing area and salmon harvests have generally declined over the past 3 decades. Conversely, catches in District 6 have increased for sockeye, coho and chums. Declining harvests in District 8 reflect, in part, the more frequent closures in that area.⁵

In 1985, the District 6 gillnet fishery was open from June 6 to September 23. During 38 fishing days, over 1 million salmon were harvested. In comparison, the 1979-84 average catch during 28 fishing days was only 471,255 fish.

The District 8 gillnet fishery was open 2 days per week for 6 weeks in part of Frederick Sound. A one-week opening was held in late July to monitor the sockeye run, and openings from mid-August through mid-September were held to harvest a surplus of pinks and to monitor Stikine coho.

The Canadian commercial fishery for Stikine stocks began in 1975, but operated at a low level until 1979 due to limited market demands and a lack of processing and storage facilities in the area.⁵ Until 1979, the Canadian commercial fishery was located exclusively on the upper Stikine near Telegraph Creek. During 1985, the lower Stikine fishery was open for a total of 22.5 days between 24 June and 3 September. Fishing time was decreased by 53% from the 1979-83 average.⁴ The upper Stikine commercial fishery was open for six days and about 1150 salmon were taken during this time. The native food fishery began during the second week of June and lasted through August. The total catch for 1985 was increased to 8225 from the average catch for 1979-1983 of 5060 fish.

2.3 Current Enhancement Activities

At the present time, there are only limited salmon enhancement activities that occur in the Stikine watershed. Stream blockages on the Tahltan River and Beatty Creek were removed in 1965 and 1982, respectively, and a flow control on Tahltan Lake has been operating since 1959.

The potential for increasing sockeye production at Tahltan Lake through lake enrichment has been investigated since 1978. Based on results of this research, the lake was fertilized for the first time in 1985. For eleven weeks, between mid-June and mid-August, a solution of nitrate and phosphate compounds was introduced into the lake. Smolt enumerations in 1986 will provide a preliminary indication of the success of this experiment. If fertilization is successful and the enrichment

program continues, increased salmon production in Tahltan Lake will likely contribute significantly to U.S. and Canadian catches of Tahltan sockeye.

Apart from the Stikine watershed, there are several enhancement facilities that have been proposed and presently exist in the vicinity of the river mouth. Production from these facilities will contribute to mixed-stock fisheries directed at Stikine salmon and may potentially complicate the management of these stocks.

The state-owned Crystal Lake Hatchery is located on Blind Slough, which drains into Wrangell Narrows. Current activities at this facility are focused on chinook production. CWT data for chinook returns from the hatchery indicate that it will contribute significantly to chinook harvests in the central and northern inside waters of southeastern Alaska. Small numbers of summer chums are produced by the Crystal Lake Hatchery and should also be available for the District 6 gillnet fishery. Hatchery coho are also expected to be harvested in the District 6 gillnet fishery, as well as the troll fishery over an extensive area.⁴ There have been some releases of chinook and coho smolts to Ohmer Creek, which drains into District 8 on the southern end of Mitkof Island. Returns from these releases will be harvested in the District 6 and District 8 gillnet fisheries and also in a terminal area near Ohmer Creek. This facility is currently operating at its maximum capacity for smolt production, which is largely due to successful brood stock acquisition programs that have been conducted in recent years. The chinook donor stock was collected from Andrews Creek, a tributary to the Stikine River within Alaska.

The Burnett Inlet Hatchery is a private non-profit facility located on the west side of Etolin Island within District 6. The facility is producing brood stock, and there have been requests to increase its present capacity. The pinks and summer chums produced at this facility are expected to contribute significantly to the District 6 gillnet fishery. A portion of these fish will likely return from the south through lower Clarence Strait. Coho production from the hatchery will be harvested in distant troll fisheries, as well as in the District 6 gillnet fishery.

The Crittenden Creek Hatchery site is located in Eastern Passage near Wrangell, approximately 8 km from the Stikine River flats. The hatchery permit is held privately, but construction has not yet begun. Pink and summer chum production that is planned for this facility is expected to contribute to the gillnet harvests in Districts 6 and 8. Test fisheries conducted in 1983 indicated that the

portion of Eastern Passage that would be the location for special and terminal harvests is relatively free of natural stocks. As a result, a good segregated harvest area should be available if the hatchery is built.

The Santa Anna Hatchery is a private non-profit facility to be located in the Ernest Sound. Some of its pink and summer chum production would be harvested in the District 6 gillnet fishery. As in the case of the Burnett Inlet Hatchery, a portion of the production will probably return from the south through lower Clarence Strait. At this time, construction of the facility has not yet begun.

Hatchery operators have been notified that increases in the quantity of pink salmon eggs will not be permitted in facilities which produce adults that return through the District 6 gillnet area. This ceiling has been established to ensure that management of the mixed-stock gillnet fishery for pinks in District 6 during late July and August will not be complicated by the presence of additional hatchery stocks.⁴ However, the ceiling may be altered once the actual effects of permitted pink production on current management strategies are evaluated.

2.4 Habitat Status

Although some habitat assessment of the Stikine watershed has been conducted, more thorough and complete analysis is required. The Stikine River originates on the dry interior plateau of Northern B.C. and is fed primarily by snowpack meltwater. The river passes through the coastal mountains where it is joined by the Iskut and other minor tributaries. Contributions to flow are mainly from rainfall and glacial meltwater, the latter being most important during the summer months.⁷

A major physical feature of the Stikine River is the Grand Canyon, a long incision of up to 500 m in depth. The canyon is 40 km in length and poses a major barrier to salmon upstream of Telegraph Creek due to high water velocities. Due to slides and various natural barriers, the majority of the Stikine drainage is currently inaccessible to anadromous fish.⁷

Assessment of salmon spawning and rearing areas is incomplete and maximum recorded escapements for the system are presently unavailable. Sockeye are the most abundant and economically important species in the Stikine. Sockeye spawning occurs in the mainstem river, as well as tributary lakes.⁷ Juvenile sockeye have been found in a wide variety of rearing habitats, including lakes and turbid

slow-moving waters of sloughs, beaver ponds and back channels. Chinooks have been located in several areas throughout the watershed, but spawners are most abundant in the mainstem Stikine and Iskut rivers. Coho are widely distributed throughout the Stikine drainage.

Although some logging activity has occurred in the lower reaches of the watershed and further harvesting permits have been granted, development in the area has had a minor impact on salmon habitat.⁷ Investigations to determine the hydro-generation potential of the Stikine indicate that a hydro dam could be built in the Grand Canyon area. The potential impacts of such a development on Stikine salmon stocks, particularly the Tahltan sockeye, could be severe.

Detailed information regarding habitat status in the Stikine River is provided in Appendix I.

2.5 Management Conflicts

2.5.1 Management Uncertainties

Assessment and predictive capabilities necessary for the management of Stikine salmon stocks are limited by poor escapement estimates, an inability to separate stocks and unknown interception rates in various fisheries. Although Stikine sockeye can be separated from Alaska and Nass-Skeena socks, potential differences in exploitation rates between Tahltan Lake and the other Stikine sockeye stocks can not yet be evaluated. Fish counts taken at Tahltan Lake weir provide good escapement and run timing data for the Tahltan stock, but escapement and timing estimates for the lower Stikine stocks are inaccurate. Returns of coho salmon from the Stikine are poorly understood because escapement data are virtually nonexistent, spawner distributions are unknown, and the contribution of Stikine coho to the various fisheries is unknown. Similarly, chinook stocks within the Stikine can not be separated, and there are no reliable estimates of their rate of interception in troll and ocean net fisheries. The numerous information gaps in the current understanding of Stikine salmon stock greatly hamper the management of these stocks.

2.5.2 Mixed-Stock Harvest

Stikine River sockeye, chinook and coho stocks are harvested in several mixed-stock fisheries. The approach fishery in District 6 is directed at several stocks

of all five salmon species, including returns of hatchery stocks. In 1983, results of scale analysis indicated that Stikine sockeye stocks were also intercepted by upper Clarence Strait and Cape Fox fisheries.³ Stikine coho and chinook salmon are likely to be intercepted by numerous fisheries in southeastern Alaska.

2.6 Stock Rebuilding Potential

The rebuilding potential of Stikine stocks is difficult to assess due to management uncertainties and mixed-stock harvest problems described earlier. Although available escapement data indicate that some stocks are below even interim target escapement levels, no major disturbances to salmon habitat occurred in the Stikine watershed, and stock rebuilding potential appears to be good. With more reliable information on stock status, population characteristics and vulnerability to specific fisheries, a more accurate assessment of the rebuilding potential of Stikine stocks will be possible.

Cooperation between the U.S. and Canada is essential to a successful rebuilding program directed at Stikine stocks. Preliminary measures to reduce fishing pressures on these stocks have already been implemented under the Canada-U.S. Salmon Treaty.

2.7 Management Strategies for Stock Rebuilding

Stikine chinooks were identified as a priority concern in Canada-U.S. negotiations. The Salmon Treaty set target escapements of 19,800-25,000, which is expected to be reached by 1985.⁴ Because Stikine chinooks have an early run timing, rebuilding efforts have been focused on reducing incidental catches in the sockeye gillnet fisheries.³ This has been accomplished by opening the net fishery late in the season, and implementing closures and limitations on fishing and gear in both the U.S. and Canadian fisheries.

Escapement information for coho is so incomplete that interim escapement targets have not been set. The current management strategy is directed at preventing increased harvest of Stikine coho beyond current levels. The need for rebuilding Stikine coho stock may be more accurately assessed once reliable information becomes available.

The need to rebuild other Stikine salmon stocks has not been clearly identified, although fisheries are presently being managed to ensure that interim escapement targets are met. Results of stock identification programs for sockeye may assist in the management of Stikine sockeye groups. To date, a success rate of 79% has been achieved in separating Alaska, Nass/Skeena, Tahltan and Stikine (non-Tahltan) stocks based on scale characteristics.⁴ Most important, programs to address the major management uncertainties must be implemented before comprehensive stock rebuilding strategies are developed for Stikine salmon.

2.8 Future Stock Enhancement Activities

Prior to implementing enhancement projects on the Stikine River system, detailed surveys of spawning and rearing areas should be conducted to determine whether existing habitat is underutilized. If enhancement is warranted, the following projects should receive priority. The project number from Lill et al. (1983) accompanies each project title.⁶

2.8.1 Fry Plants to Supplement Low Cycle Years of Sockeye (Project No. S-18)

Potential enhancement opportunities exist through "satelliting" or remote sockeye fry releases. Two basic techniques could be used to increase the size of sockeye stocks: (1) the construction of incubating boxes in known spawning areas, or (2) the utilization of existing hatcheries to incubate eggs taken from spawning sockeye, with subsequent back-planting of fry. Preliminary examination of Tahltan Lake indicates that conditions are suitable to test remote incubation box design near the lake outlet. Colonization of the Tuya River by sockeye may be possible using a hatchery facility to supply fry for release into this system.

2.8.2 Tuya Blockage Removal (Project No. S-1A)

A blockage in Tuya River drainage restricts migration of salmon to the upstream reaches of the river. SEP personnel evaluated the possibility of removing this obstruction, and concluded that it would be feasible but quite costly. Small numbers of chinooks, sockeye, steelhead, and coho currently return to the mouth of the Tuya River. However, the capacity of existing habitat should be assessed before expansion of available habitat is given further consideration. It may be possible to colonize the upper Tuya watershed, although sockeye may have difficulty becoming established in lakes occupied by other competing fish species.

As a result, further investigation is required before enhancement strategies are implemented.

2.8.3 Stream Improvement

The Northwest Enhancement Society developed a catalogue that lists all of the Stikine tributaries that currently have obstructions that impede fish passage. Based on field assessments completed in 1984, several small enhancement projects for stream improvement were identified.

3. ALSEK RIVER

The Alsek River originates in the southwestern Yukon and flows through northwestern British Columbia, where it is joined by its major tributary, the Tatshenshini River. It then flows southwest through the Alaskan panhandle and empties into the Pacific Ocean about 80 km south of Yakutat, Alaska (Figure 4). The Alsek River is about 200 km in length and drains approximately 16,200 km², with 95% of the drainage basin located within Canadian territory.²

3.1 Stock Description

Sockeye, chinooks and coho are the principal salmon species found in the Alsek River system.² Chum and pink salmon are not abundant in this drainage. There are several stocks of each species, which occur primarily in the Tatshenshini River and its tributaries. Salmon migration in the Alsek River is limited beyond about 20 km upstream of its confluence with the Tatshenshini River. The quality of escapement and productivity data for all salmon species is poor. Escapement data for 1959-1976 are limited to information collected during occasional aerial and ground surveys. In 1976, a weir was installed on the Klukshu River and has provided an index of species abundance through the system since that time. The most abundant salmon stock in the Alsek system is the Klukshu sockeye stock.²

3.1.1 Sockeye Salmon

The three major sockeye stocks in the Alsek drainage basin are from Klukshu and Neskataheen lakes and Blanchard River. The Klukshu stock accounts for approximately 60% of the total sockeye escapement to the system and, therefore, is used as an indicator stock.⁴ The mean sockeye escapement to the Alsek from 1976-1984 was estimated at 25,718, while the 1985 escapement was estimated at 29,000. The interim target escapement is between 33,000-58,000 sockeye, which is above recent returns. The catch of sockeye salmon in the Alaskan commercial fishery located in Dry Bay averaged 26,600 from 1976-1985. Catches have been relatively stable over the past 4 decades, although this may indicate there has been a decline in stock abundance since fishing efficiency has generally increased over this period.² An average of 4000 sockeye were harvested in the Canadian in-river Indian food fishery from 1976 to 1985. Alaskan and Canadian sport fisheries for sockeye are minor. Over the past 10 years these harvests have averaged only 100 and 55 fish, respectively.

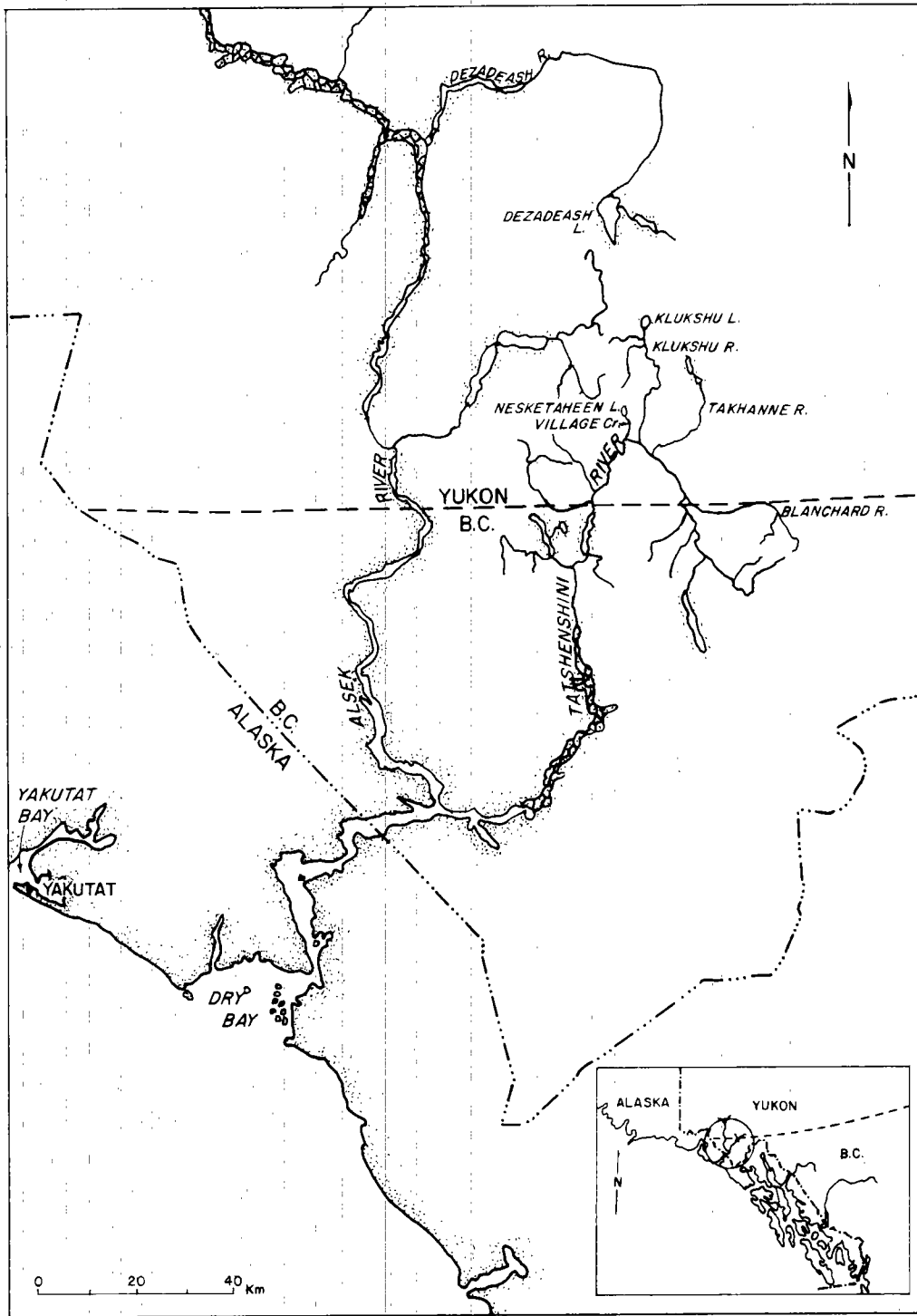


Figure 4. The Alsek River system.

3.1.2 Coho Salmon

Information on escapement and spawner distribution for coho salmon in the Alsek River system is generally poor. Prior to 1976, limited aerial surveys of coho spawners were conducted. Since that time, enumeration has been conducted at the Klukshu weir. However, due to the late returns of coho, counts are usually disrupted because of icing problems with the weir. Klukshu coho are thought to account for about 30% of the total escapement to the Alsek River.⁵ The average number of coho counted at the Klukshu weir from 1976-1984 was 950. The 1985 count was only 350 coho. Despite incomplete data, an interim escapement target of between 5400 and 25,000 spawners has been set.

Catches of coho salmon in the terminal fishery in Dry Bay are used as another indicatory of coho run strength. In the past four decades, catches have declined significantly from an average of 28,400 in the 1940's to 6400 in the 1970's. Recent harvests (1975-1984) have increased slightly to 7700 coho. The average catch in the Canadian subsistence and sport fisheries from 1976-1980 was only 200 coho.

3.1.3 Chinook Salmon

Information on escapement and spawner distribution is also limited for Alsek chinook stocks. The major Tatshenshini chinook spawning areas are located in the Klukshu, Blanchard and Takhanne rivers and Goat Creek-upper Tatshenshini River. Escapements to the Tatshenshini tributaries are currently monitored by the Klukshu weir. The relative contribution of the Klukshu run to the overall Alsek River chinook escapement is estimated to be 50%.⁵ Based on weir counts, escapement for 1976-84 averaged 2600, and declined to only 1300 spawners in 1985. Estimated chinook escapement has been substantially lower than the interim escapement target of 7200-12,500 for the system.

Catches of chinook salmon in terminal areas have decreased significantly in the last four decades. However, this is not a reliable indicator of chinook abundance in the Alsek River because recent management efforts have been focused on commercial harvest of these stocks. Canadian sport and native fisheries have also been restricted to allow increased escapement to the system. The primary management concern for chinooks is the uncertainty regarding interception rates of the troll and other fisheries on Alsek stocks. If outside interception is minimal,

recent production of chinook salmon should have significantly exceeded the estimated stock size determined from terminal catches and escapements.

3.2 Fisheries

The Alsek salmon stocks are generally managed on the basis of comparisons between current and historical fishery performance (catch per unit effort data), as well as the Klukshu weir counts; the Klukshu run being used as an indicator stock. The ability to establish and meet spawning and allocation goals is currently low. Management for Alsek stocks could be greatly improved if information on total escapement to the system as well as the in-season escapement data from Alaskan fisheries were available.⁴ Management of the various fisheries directed at these stocks is controlled by the U.S. and Canadian governments, and stock rebuilding efforts have been under way since 1983.

The Alaskan gillnet fishery in Dry Bay is directed primarily at Alsek sockeye salmon, although some coho are also harvested. Since 1983, the opening of the fishing season has been delayed by two weeks and restricted to limited openings for the remainder of the season in an effort to rebuild the early run sockeye and chinook escapements. In 1985, the season was only open for a total of 33 days from the 1976-1984 average of 46 days. There is presently no Canadian commercial fishery on the Alsek River, although subsistence and sport fisheries exist in the Klukshu River and other Tatshenshini tributaries. This area supports one of the most intensive and popular sport fisheries in the Yukon.

Alsek sockeye and chinook salmon are harvested in the Canadian fisheries. Chinooks and coho are thought to be intercepted in other offshore fisheries, although harvest rates are presently unknown.⁴

In the Canadian fisheries, effort in the Klukshu area has been reduced prior to 15 August in order to rebuild early sockeye runs. The subsistence fishery that operates at the outlet of Klukshu Lake harvests sockeye that have already been counted at the weir. Canadian sports fishery regulations in the Alsek system prohibit harvesting of sockeye prior to 14 September and limit the catch of chinooks. In 1985, the opening of the Indian food fishery was delayed until 21 July.

3.3 Current Enhancement Activities

There are currently no salmon enhancement activities in the Alsek River system. Implementing enhancement programs will require full cooperation between the U.S. and Canada to ensure recovery of enhancement costs in the form of increased harvest to the nation responsible.

3.4 Habitat Status

A thorough assessment of salmon habitat in the Alsek drainage system has not been conducted to date, although information regarding available habitat, quality of habitat and habitat utilization is required for the management of Alsek salmon stocks. At the present time, available resources are fully committed to the acquisition of basic stock data that are essential to management of annual fisheries. No major resource developments currently threaten habitat within the Alsek system. A detailed summary of habitat status in the Alsek River is provided in Appendix I.

3.5 Management Conflicts

3.5.1 Management Uncertainties

Present information systems provide limited data on escapement, catch and population composition of Alsek stocks. However, further information on total escapements, offshore interceptions and contribution to catches by specific stocks is required for the management of fisheries directed at sockeye, coho and chinooks. The current lack of reliable data severely limit the ability to:

1. establish realistic escapement targets;
2. forecast run returns;
3. develop and implement management strategies that ensure adequate escapement and proper catch allocations; and
4. conduct post-season stock assessments and run reconstruction.

In order to perform these tasks adequately, escapement enumeration must be expanded beyond the Klukshu weir to assess total escapement to the Alsek drainage and to accurately evaluate the proportional contribution of stocks from the Klukshu drainage above the weir. Tagging programs and stock separation studies are

required to assess stock contributions to offshore and terminal fisheries. Coded wire tagging has been recommended for chinook and coho stocks. In-season assessment of sockeye stocks that escape the Alaskan terminal gillnet fishery would also assist in regulating fisheries to meet escapement targets and catch allocations.

3.5.2 Mixed-Stock Harvest

The harvest of sockeye and coho in the Alaskan terminal fishery in Dry Bay is the major fishery directed at Alsek stocks. However, salmon originating in the Alsek River may also be harvested in adjacent fisheries around Yakutat Bay, the Copper River and the Bering River in Prince William Sound. Interception of Alsek chinooks and coho in outside gillnet and troll fisheries is also suspected.

3.6 Stock Rebuilding Potential

The rebuilding potential of Alsek salmon stocks is difficult to assess due to the management uncertainties and mixed-stock problems described previously. Until better information is available, current efforts to rebuild early sockeye and chinook stocks through restrictions on terminal and in-season fisheries should be continued. Declines in coho catches and in chinook returns suggest that troll fisheries are overharvesting these stocks. The success of rebuilding programs will depend on assessment and control of outside interception fisheries.

3.7 Management Strategies for Stock Rebuilding

The development of stock rebuilding strategies ideally requires detailed stock and fisheries information. Based on this information, the need for stock rebuilding can be evaluated, escapement targets can be established and management options can be developed and subsequently tested. At the present time, this information is incomplete or lacking for Alsek stocks. Although some rebuilding strategies have already been initiated, refinement of these strategies and development of a more comprehensive plan will require that detailed stock and fisheries information be acquired.

Current efforts are directed at rebuilding early sockeye and chinook stocks in the Alsek system. Stock rebuilding measures have already been initiated for coho, largely because the database for Alsek coho is so poor that stock status can not be properly evaluated.⁴ Rebuilding strategies have been reflected in management

action directed at the Alaskan gillnet fishery and Canadian sport and subsistence fisheries. The gillnet harvest has been subject to delayed openings, limited fishing times and in-season closures. Delayed openings have also been implemented in the Canadian subsistence fishery. In 1985, the harvest of sockeye was prohibited in the sport fishery before 14 September.

Despite rebuilding efforts, significant increases in Alsek salmon populations have not yet been demonstrated. This is particularly true for chinook stocks. The reason for this may be due to the interception of these stocks in offshore fisheries.

3.8 Future Stock Enhancement Activities

Prior to implementing enhancement projects on the Alsek River system, detailed survey of spawning and rearing areas should be conducted to determine whether existing habitat is underutilized. In the event enhancement is warranted the following project should receive priority. The project number from Lill et al. (1983) accompanies each project title.⁶

3.8.1 Klukshu Lake Fertilization (Project No. A-2)

Preliminary feasibility studies conducted in the mid-1970's indicated that Klukshu Lake would be an excellent candidate for nutrient enrichment. Limnological conditions of the lake appear to be suitable and easy road access makes this project feasible. However, the rearing capacity and potential predators of sockeye, as well as the feasibility of obtaining an out-migrant smolt count at the outlet of Klukshu Lake, should be examined.

3.8.2 Smolt/Fry Plant - Dezadeash Lake (Project No A-1)

Salmon runs to the Dezadeash Lake drainage have been restricted over the past century by glacial advances into the Alsek River. It is presently unknown if the hydraulic regime of Turnback Canyon represents a velocity barrier to upstream salmon migration. This could be determined through the transplant of sockeye, chinook and coho smolts or fry to Dezadeash Lake and subsequent monitoring of adult returns both above and below the canyon.

3.8.3 Fry Plant - Howard Lake (Project No. A-4)

The Howard Lakes are drained by the Takhanne River. Although access by salmon to these lakes is currently blocked, the potential rearing areas may be used to sockeye fry that are being planted in the lakes. Chinooks, sockeye and possibly coho currently ascend the Takhanne River to the base of Million Dollar Falls. Planting of coho and chinook fry is also considered possible, but specific recommendations for this activity should not be made until the outcome of ongoing experiments is determined.

3.8.4 Remote Incubation Box Enhancement

Several available chinook, sockeye and coho spawning areas are easily accessible and could be potential sites for installation of incubation boxes. However, studies to determine the proper design of the boxes and to test designs under severe climate conditions that are prevalent in these areas would be required prior to their installation.

4. YUKON RIVER

The Yukon River is the fifth largest river in North America in terms of its drainage area and mean discharge.¹ It originates in northern British Columbia and flows for 3680 km to the Bering Sea. The Yukon River drains an area of approximately 854,700 km², of which 41% is located within Canadian territory (Figure 5). There are six major sub-basins within the Yukon drainage, which include the Stewart, Pelly, White, Teslin, Yukon (mainstem) and Porcupine rivers. The Fishing Branch River flows into the Porcupine.

4.1 Stock Description

All five salmon species are found in the Yukon River, although only chinooks and fall chums utilize the Canadian section of the river in abundance. Escapement estimates for these two species are based on index streams. In Canadian territory, salmon spawn in the Porcupine River system, but information on the abundance of this species is limited.

4.1.1 Chinook Salmon

Chinook spawning is widely distributed throughout the watershed in both Canada and Alaska. Within Canada, the major chinook spawning areas are the mainstem Yukon, Teslin, Pelly, Stewart and White River drainages. Major Alaskan spawning areas are the Andreafsky, Anvik and Nulato rivers (lower drainage) and the Chena and Salcha rivers (middle drainage).

Since escapements are based only on index streams, it is difficult to assess the relative contributions of the Canadian- and Alaskan-origin chinooks to the overall Yukon River chinook production. Scale pattern analysis has provided some information regarding stock separation. In 1982, the composition of the chinook harvest for the entire Yukon River system was estimated at 38% Alaskan and 62% Yukon origin, while for 1984 it was estimated at 65% Alaskan and 35% Yukon origin.⁹ As a result of these and other analyses, 50% of the harvested chinooks are considered to be of Canadian origin.⁹

The Whitehorse fishway was constructed in 1959 and has provided the most consistent escapement information for Yukon chinook stocks. However, the fishway counts may not be entirely representative of chinook escapements in other spawning

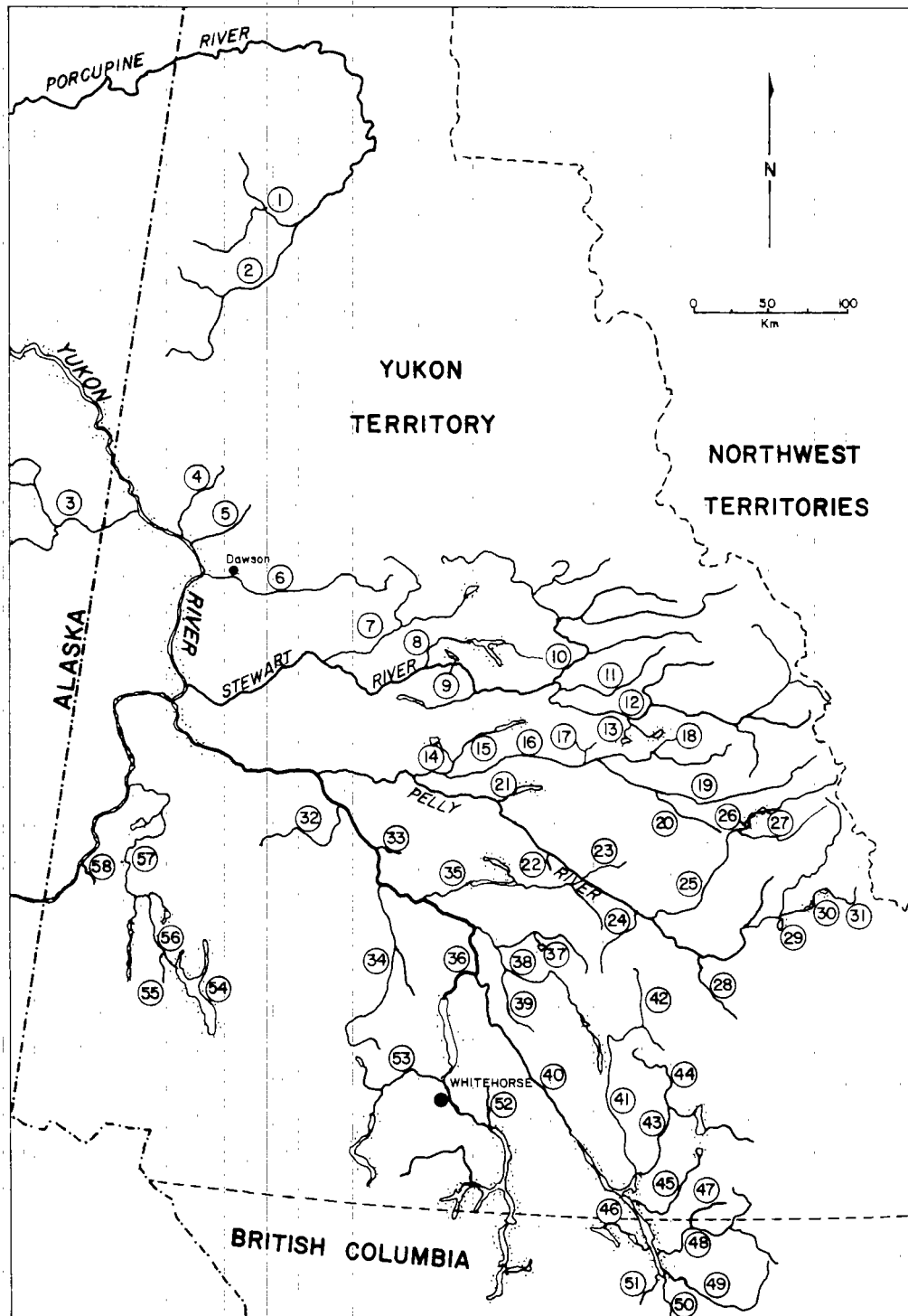


Figure 5. The Yukon River system (Canadian section). (For key to streams, see Table 1.)

Table 1. Key to streams in the Yukon River watershed, from Figure 5. (Upper-case names are from gazetteer, those in parentheses are local names.)

32. BIG CREEK	19. SOUTH MCMILLAN RIVER
38. BIG SALMON RIVER	42. MCNEIL RIVER
39. SOUTH BIG SALMON RIVER	7. MCQUESTEN RIVER
23. BLIND CREEK	8. MAYO RIVER
5. CHANDINDU RIVER	52. MICHIE CREEK
57. DONUEK RIVER	2. MINER RIVER
21. EARN RIVER	45. MORLEY RIVER
4. FIFTEEN MILE RIVER	41. NISUTLIN RIVER
1. FISHING BRANCH RIVER	34. NORDENSKIOLD RIVER
29. FORTIN CREEK	37. NORTHERN LAKE
3. FORTY MILE CREEK	13. (Ollie River and Lake)
46. GLADYS RIVER	30. PELLY LAKES
22. GLENLYON RIVER	31. PELLY RIVER
51. HAYES CREEK	11. PLEASANT CREEK
12. HESS RIVER	44. RED RIVER
28. HOOLE RIVER	20. RIDDEL RIVER
18. HUSKY DOG CREEK	25. ROSS RIVER
9. JANET CREEK	17. RUSSEL CREEK
49. JENNINGS RIVER	27. SHELDON LAKE
15. KALZAS RIVER	47. SMART RIVER
6. KLONDIKE RIVER	10. STEWART RIVER
54. KLUANE LAKE	55. SWEDE JOHNSON CREEK
56. KLUANE RIVER	48. SWIFT RIVER
58. KOIDERN RIVER	53. TAKHINI RIVER
24. LAPIE RIVER	33. TATCHUN RIVER
26. LEWIS LAKE	40. TESLIN RIVER
14. LITTLE KALZAS RIVER	50. (Upper Teslin River)
35. LITTLE SALMON RIVER	43. WOLF RIVER
16. MCMILLAN RIVER	36. YUKON RIVER

tributaries, since the number of outmigrant juvenile mortalities at the Whitehorse dam and bypass may not be the same from year to year. Since 1966, aerial surveys have been conducted on seven other Yukon tributaries to provide an index of chinook salmon escapement. These tributaries are the Big Salmon, Takhini, Tatchun, Little Salmon, Nisutlin rivers and Michie Creek. In 1985, a temporary weir was also placed in the Big Salmon River to assess spawner abundance.

As indicated by index areas, spawning escapements of chinooks in the Canadian section of the Yukon River basin were relatively low in the early and mid-1970's, and then increased gradually until 1981.¹⁰ Since that time, there has been a decline in the number of chinook spawners in the river, although some improvement was evident in 1984. Estimates of spawning populations were derived by subtracting the number of chinook catches from the estimated total number of chinooks entering the Canadian section of the river. Results indicated that there were about 20,000 spawners in 1982 and about 31,000 spawners in 1983.¹⁰ The ratio of survey index escapements to total estimated escapements for 1982 and 1983 were 0.1% and 0.06%, respectively. The current escapement target of 55,000 (for index streams) was calculated using the average index value for the two years (0.0881) applied to the total estimated escapement for the Canadian section of the Yukon River basin.¹⁰ Escapement to the Porcupine system was not included in this estimate, and a target has yet to be calculated.

4.1.2 Fall Chum Salmon

The spawning distribution of fall chum salmon in the Yukon River is much more restricted than that of chinooks. Major chum producers include the Porcupine, White, Teslin and mainstem Yukon rivers. Major spawning areas in Alaska are in the Sheenjek River (Porcupine River drainage) and the Tanana River system. Porcupine River and upper Yukon River fall chums have earlier migrating timing than Tanana River chums and are oriented along the north bank of the Yukon River. The migration of Tanana chums tends to be oriented towards the south bank in the vicinity of Galena.¹¹

There are insufficient data to accurately determine the proportion of Yukon River fall chums spawning in Canadian territory. However, based on the spawning distribution of chums, it is estimated that about 50% of these spawners are of Canadian origin.¹ Further research is necessary to precisely determine the proportion of Canadian- and Alaskan-origin fish.

Historical information on chum escapement to the Yukon River is currently unavailable. However, data from various projects conducted since the early 1970's indicate that chum escapement has recently declined.¹ This is especially true for the Fishing Branch River, which is one of the main chum spawning areas in the Yukon Territory. A comparison of data collected during surveys conducted between the periods 1976-1979 and 1980-1983 indicates that chum escapement has declined by 54%.¹¹ Peak spawner abundance was recorded in 1975, when an estimated 353,000 adults passed through the fishwheel. In comparison, the lowest spawner abundance of 5600 chum was recorded in 1984.¹¹

In recent years, there has been an increased effort in the enumeration of chum populations within the mainstem Yukon and Kluane systems; however, data are still limited. Results of mark-recapture surveys conducted in the early 1970's and early 1980's indicate that fall chum populations in the mainstem Yukon River follow a pronounced cyclic trend, similar to that of Fishing Branch chums.¹¹ Estimates of chum escapement for the Canadian Yukon basin, excluding the Porcupine sub-basin, ranged between 11,200 and 92,300 over the period 1972-1983. Surveys conducted in 1983 indicate that there were approximately 8600 spawners in the Kluane River and 7600 spawners in the Yukon mainstem.

Based on historical catch data and estimated exploitation rates, optimum chum production for the entire Yukon River drainage has been estimated at 1 million fish.¹⁰ Assuming that 60% of the chums produced in the region are required to spawn to maintain that optimum level, the escapement target for the basin was set at 600,000.¹⁰ This results in a target of 150,000 spawners for the Canadian sections of both the Porcupine and Yukon drainages.

4.2 Fisheries

Yukon River salmon stocks are managed jointly by the U.S. and Canadian governments. The principal fisheries that are directed at Yukon stocks are the inriver U.S. and Canadian gillnet and subsistence fisheries. Yukon River stocks are also intercepted in several offshore fisheries, which include the U.S. nearshore seine and gillnet harvests, the groundfish trawl fishery and the Japanese high-seas fishery.¹¹ Sport fisheries also operate along the river in Alaska and the Yukon.

Chinooks and chums in the Canadian section of the Yukon River have been harvested predominantly in subsistence fisheries, although an in-river commercial fishery has existed since the late 1800's.¹¹ Most of the commercial activity has occurred in the vicinity of Dawson City. Although the industry declined during the 1920's, fishing activity increased and harvest levels improved in 1979. The average catch of Yukon chinooks for 1975-79 was 4100, compared to the average catch in 1980-84 of 9929 fish. During the same period, the five-year average for chum catches were 4000 and 16,899, respectively.¹⁰ A fish processing plant was established in Dawson City during 1982 and the additional opportunity created by this new facility stimulated further commercial interest.¹¹ By 1985, the chinook catch was 12,474 and a record harvest of 30,917 chum was reported.

Reliable information on subsistence fisheries is available from 1959 to the present time. Since 1959, harvest levels have varied significantly over the years. During the early sixties (1960-64), the average chinook catch was 7500 and the average chum catch was 12,000.¹¹ Chinook catches then declined to less than half of this level but rebounded during the 1980's to an average of 7600 fish (1980-84). Harvest levels for chums also declined and the 1980-84 average catch was estimated at only 5500, with most of the catch taken at Old Crow on the Porcupine River.¹¹

In addition to commercial and subsistence fisheries, a small domestic fishery occurs in the Yukon. Domestic licences were removed in 1961, but were re-established in 1974.¹¹ The average catch of chinooks for the period 1975-79 was 610 fish and increased during the period 1980-84 to 966 fish. Chum catches have declined but have been variable over the years. The 1975-79 average catch was 1965 chum, with a peak catch of 4600 occurring in 1975. The harvest of chums between 1980 and 1984 averaged 1426, with the lowest recorded catch of 300 occurring in 1983.¹¹

Participation in the sport fishery for Yukon chinooks has increased over the years, most likely because of improved road access to remote areas. The average catch from 1980 to 1984 was estimated at 500 fish, or 2.6% of the total chinook harvest in the Yukon Territory.¹

Following a 15-year average catch of 6530 chinooks, the total catch of chinooks from all Canadian fisheries averaged 18,482 during the period from 1980 to

1984. The average chum harvest increased to 23,869 in 1980-84 from 13,986 during the previous five-year period.¹¹

Major commercial and subsistence fisheries operate throughout the Alaskan section of the Yukon River and a large tributary, the Tanana River. Commercial fishing is concentrated in the lower 250 km of the river, while most of the subsistence catch is taken from the upper Yukon River. The commercial fishery has operated since 1918, but has undergone major expansion in recent years. Commercial harvest levels for chinooks increased sharply to 120,000 in 1961, fluctuated between 64,000 and 130,000 until 1979 (average 100,000) and then increased to 154,000 in 1980. The 1980-84 average catch was 141,000 chinooks.

Commercial catches of fall chum salmon increased in 1969 to 131,000 from the previous five-year average of 34,000, and continued to increase, reaching 466,000 chums in 1981.¹¹ The 1980-84 average catch was 299,000 chums. The subsistence catch averaged 38,000 chinooks and 172,000 fall chums over this 5-year period. The estimated total catch of Yukon chinooks and fall chums by Alaskan harvests averaged 179,000 and 471,000, respectively. The Alaskans also harvest an average of more than one million summer chums in commercial and subsistence fisheries;¹¹ however, few of these fish are of Canadian origin.

In combination, the average Alaskan and Canadian in-river harvests total 195,000 chinook and 493,000 chum salmon.

4.3 Current Enhancement Activities

The only enhancement facility within the Canadian portion of the Yukon River system is located at Whitehorse. In 1958, the river was blocked near Whitehorse due to construction of a hydro dam. Migrating chinooks were transported past the barriers that year. In 1959 fishways were put in place to allow upstream fish passage. A hatchery was later built with a rearing capacity for 500,000 chinook eggs. In 1984, the first eggs were taken for enhancement purposes.¹¹ Egg collection for 1986 is projected to be 300,000-400,000 chinook eggs.⁹ Other small-scale rehabilitation and enhancement projects along the Yukon River are currently being evaluated.

4.4 Habitat Status

To date, very little assessment of salmon habitat in the Yukon River drainage has been done. Current resources are fully committed to the acquisition of basic stock data that are essential for the management of annual fisheries. Although such information would be beneficial to fisheries management, there are no major resource developments that threaten the habitat at the present time, and the vast majority of the drainage is still relatively undisturbed.

4.5 Management Conflicts

4.5.1 Management Uncertainties

The major concern regarding management of Yukon River salmon stocks is the equitable allocation of harvestable stocks to Canadian and U.S. fisheries. Without such allocations, overharvesting of these stocks will most likely continue. Consultations between Canada and the U.S. have been under way since 1985 to arrive at suitable allocations and to coordinate management and research efforts. The working committee to the negotiating delegations has identified major information gaps that have implications to the management of fisheries directed at these stocks. Two of the most important requirements are stock production and composition data. Estimates of salmon production from each country, based on reliable figures for escapement and rearing capacity of the Yukon River, are required to determine suitable allocations. Very little data on escapement and rearing are currently available for the Yukon River system. Stock composition data are necessary to determine the proportion of Yukon and Alaskan stocks that are harvested in the various river and offshore fisheries. Some stock identification studies have been initiated to address this latter problem.

In addition, there is also a need for reliable documentation of Yukon salmon catches in the subsistence, Indian food and domestic fisheries in the region.

4.5.2 Mixed-Stock Harvest

The Canadian Yukon River chum and chinook stocks are harvested in several mixed-stock fisheries. Subsistence and commercial fisheries in the Alaskan section of the Yukon River harvest Canadian- and Alaskan-origin salmon. The contribution

of Canadian chinook stocks to these fisheries averaged about 50% between 1980 and 1983.¹ The contribution of Canadian chum salmon has not yet been assessed.

Interception of Canadian-origin Yukon salmon stocks in other fisheries has not been evaluated. In addition to the in-river catch, fall chums from the Yukon River are harvested in the U.S. South Unimak and Shumigan Island fisheries in June. Tagging indicated that a portion of these fish originated from the Yukon system. The 1979-83 average catch in these areas was 602,000, with a high of over 1 million in 1982.¹ The exact proportion of Yukon River chums taken in this fishery is presently unknown.

In addition to those chinooks that are taken in the river, Yukon chinooks are also intercepted in the Japanese high-seas fishery. Recent reductions in this fishery, as a result of the 200-mile limit, should result in additional fish entering the river.

4.6 Stock Rebuilding Potential

Current harvests of both chinook and fall chum salmon in the Yukon River need to be reduced to achieve adequate spawning escapements.⁹ To reach a harvest allocation which is more closely representative of production by each country, significant reductions in Alaskan harvests are also necessary. The success of a stock rebuilding program is contingent upon international cooperation.

4.7 Management Strategies for Stock Rebuilding

Preliminary actions to rebuild Yukon chinooks and fall chums have been initiated. Chum returns to the Yukon River have been erratic over the past decade, but have been declining in recent years despite increased catches. As a result, the technical committee has recommended that more restrictive harvests are implemented in 1986. These preliminary conservation measures are directed primarily at reducing Alaskan catches of fall chums to achieve target escapements.

The recent harvest rates for chinooks were estimated to be as high as 80%.⁹ Canadian representatives to the joint technical committee concluded that this harvest rate was excessive and exploitation must be reduced. Rebuilding strategies developed from this premise, therefore, require more restrictive management of fisheries in Alaska and the Yukon that harvest Yukon chinooks. The acquisition of

stock-specific data is necessary for the development and subsequent evaluation of more comprehensive management strategies for rebuilding of Yukon salmon stocks.

4.8 Results of Simulation Modelling

Management options for rebuilding were investigated using a computer model. Harvest rates in the various fisheries were varied to determine the reductions necessary to facilitate rebuilding of Yukon chums and chinooks. Results should be interpreted with caution as stock data available for input to the computer simulations were limited. Population abundance levels were based primarily on index systems and productivity of stock was estimated. For chinooks, the high value from a range of productivities was used to determine the impact of harvest regimes under optimal conditions.

4.8.1 Chum Salmon

Results of simulation modelling indicated that changes to the current management regime in Alaska and the Yukon are necessary to facilitate rebuilding of Canadian stocks of Yukon River chums (Table 2). Forecasts indicated that serious declines in escapement of mainstem Yukon River chums would occur if present harvest rates continued (Figure 7). Coincident with declining escapement were significant decreases in commercial and subsistence catches of chums (Figure 6).

Rebuilding Yukon chum stocks to the target abundance depends primarily on reductions in downstream U.S. fisheries. Results of modelling indicated that complete elimination of Yukon commercial and subsistence fisheries was insufficient to rebuild stocks. However, a reduction in the Alaskan commercial harvest rate by approximately 86% would permit total recovery of Canadian stocks.

Two other management strategies that would facilitate rebuilding of Yukon chum stocks to target level include a 60% reduction to Alaskan and Yukon commercial fisheries (Figure 9) and a 50% reduction to both commercial and subsistence fisheries (Figure 11). Relative to the current management regime, both of these options would result in increased trends in the Canadian commercial and subsistence harvest levels, as well as increased net present values (NPV)* (Figures 8 and 10).

* NPV = net present value of the projected 20 years of harvest, discounted at 10% per year.

Table 2. Projected catches and escapements of Yukon chums under current management and five management options.

Management Options	Harvest Rate by Fishery ^a						Escapement				Catch Trend ^c			Total NPV(10%) ^d (x1000)
	Outside	U.S.	U.S.	Can	Can	FB	FB Chum		Yukon R. Chum		Can	Can	FB	
		Com	Subs	Com	Subs	Subs	Trend	%Target ^b	Trend	%Target	Com	Subs	Subs	
Current management	(0)	(0.56)	(0.24)	(0.25)	(0.07)	(0.04)	stable	6	decline	5	decline	decline	stable	6042
Elimination of Canadian fisheries	(0)	(0.56)	(0.24)	(0)	(0)	(0.04)	stable	8	stable	29	0	0	stable	7006
Elimination of Fishing Branch fishery	(0)	(0.56)	(0.24)	(0.25)	(0.07)	(0)	stable	9	decline	5	decline	decline	0	6087
Reduction of U.S. commercial fishery	(0)	(0.08)	(0.24)	(0.25)	(0.07)	(0.04)	Increase	100	increase	100	increase	increase	increase	7823
Reduction of U.S. and Canadian commercial fisheries	(0)	(0.28)	(0.24)	(0.13)	(0.07)	(0.04)	Increase	87	increase	100	increase	increase	increase	9759
Reduction of all fisheries	(0)	(0.28)	(0.12)	(0.13)	(0.04)	(0.02)	Increase	100	increase	100	increase	increase	increase	10527

^a Ordering of fisheries: Outside, U.S. Commercial, U.S. Subsistence, Fishing Branch Subsistence, Canadian Commercial, Canadian Subsistence.

^b Percent of target reached at year 20 or at level of stabilization. If target reached or exceeded, percent of target is recorded as 100.

^c Canadian fisheries include Canadian commercial (Can Com), Canadian Subsistence (Can Subs) and Fishing Branch Subsistence (FB Sub).

^d NPV = net present value of the projected 20 years of harvest, discounted at 10% per year.

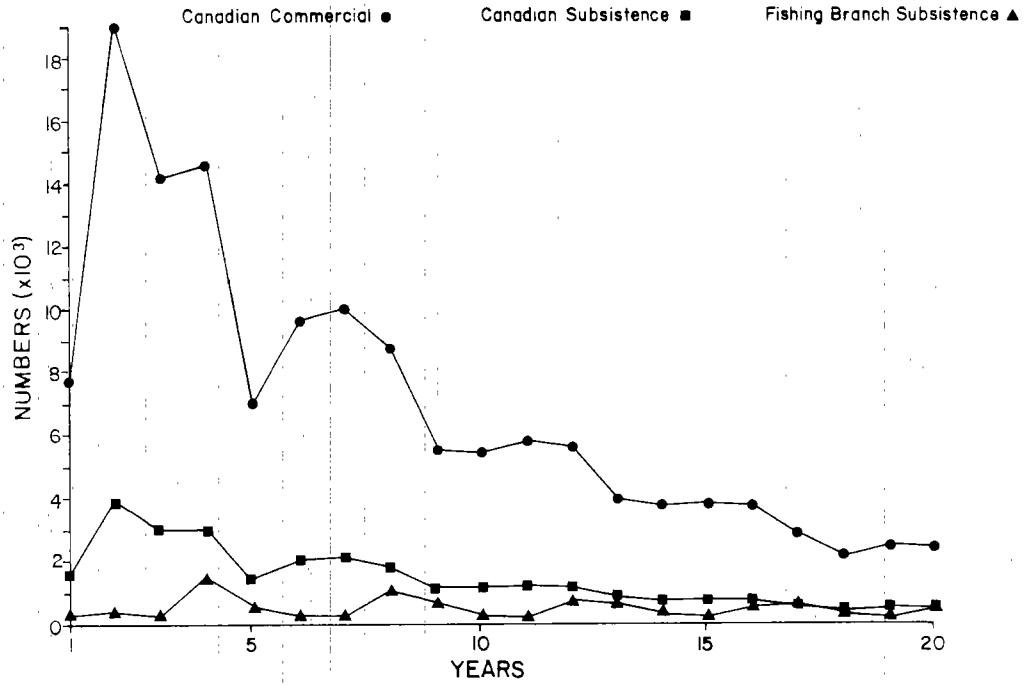


Figure 6. Projected catches of Yukon chums under the current management regime.

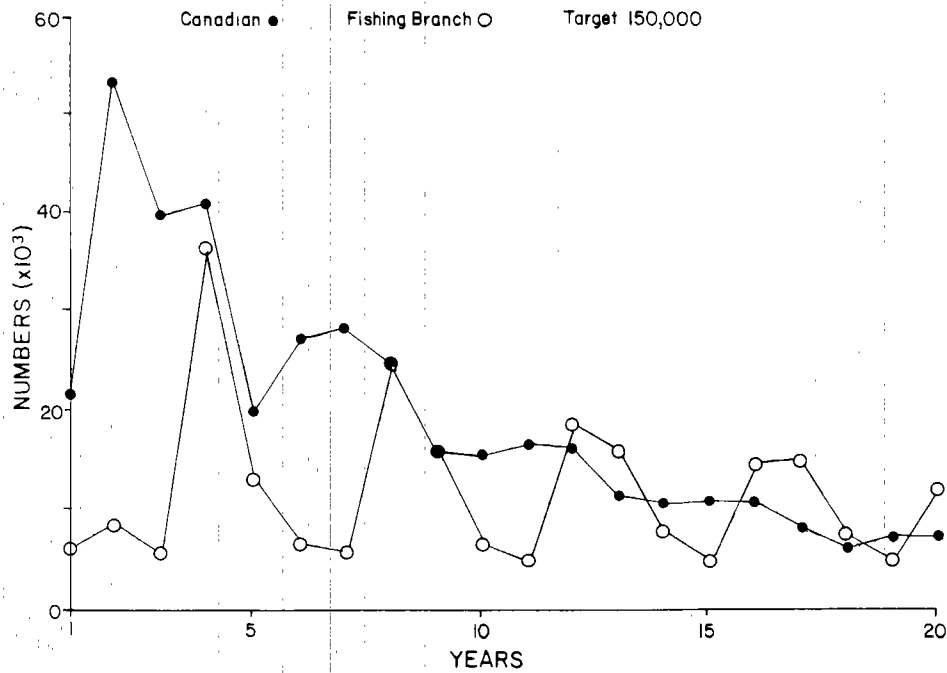


Figure 7. Projected escapements of Yukon chums under the current management regime.

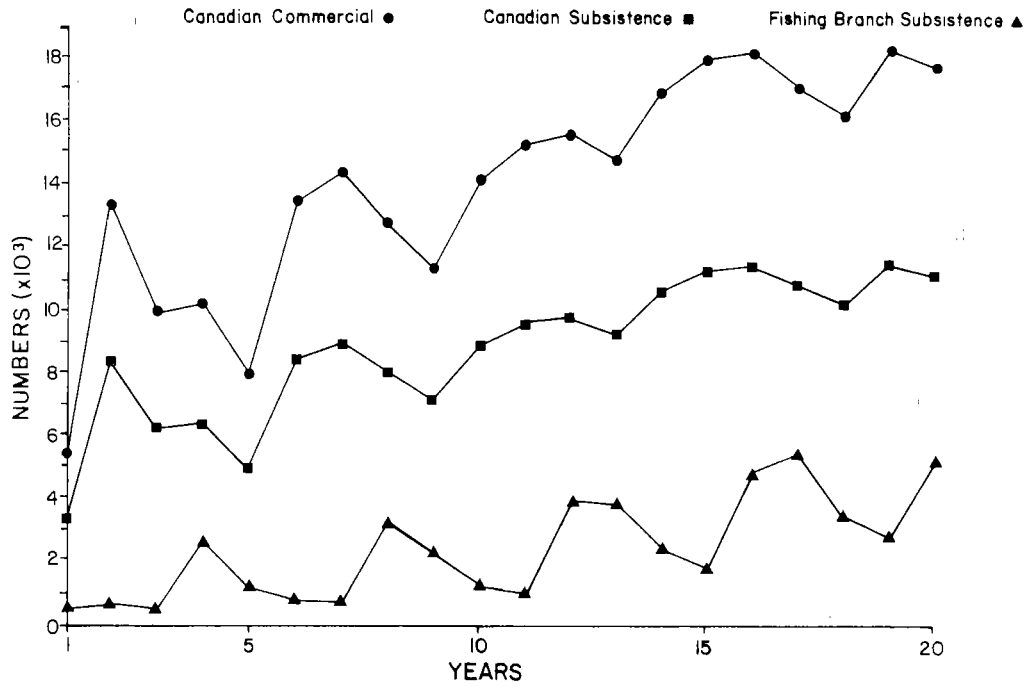


Figure 8. Projected catches of Yukon chums under the Management Option of reduced U.S. and Canadian commercial fisheries.

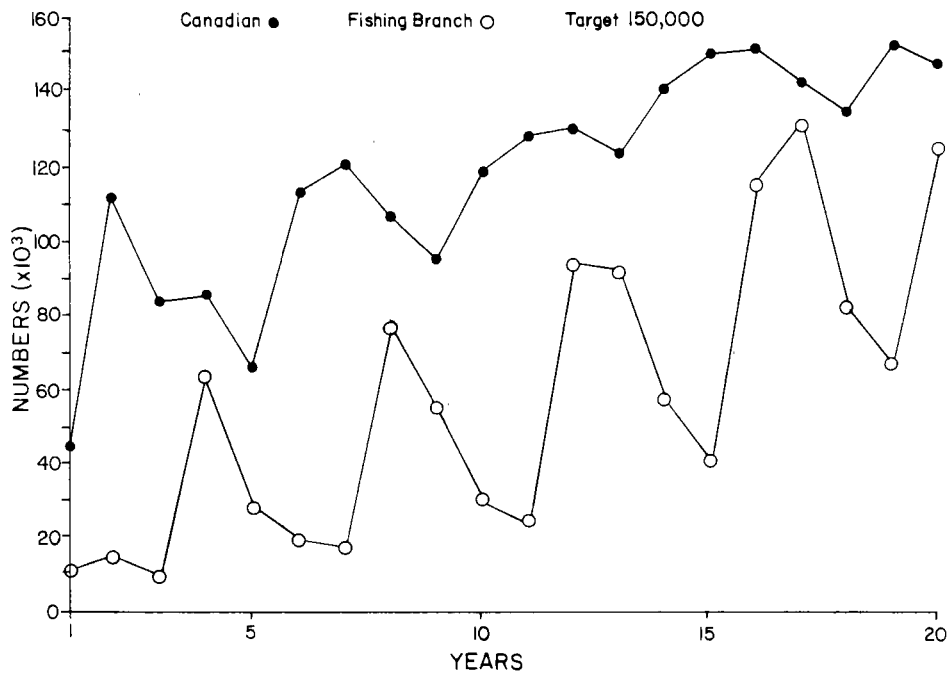


Figure 9. Projected escapements of Yukon chums under the Management Option of reduced U.S. and Canadian commercial fisheries.

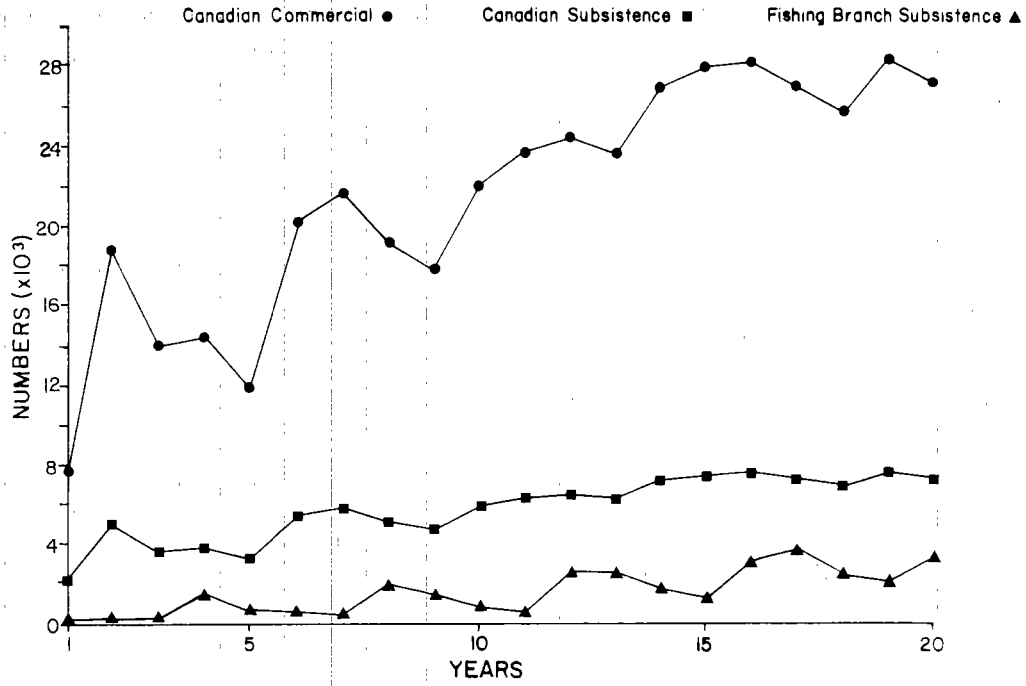


Figure 10. Projected catches of Yukon chums under the Management Option of 50% reduction of all fisheries.

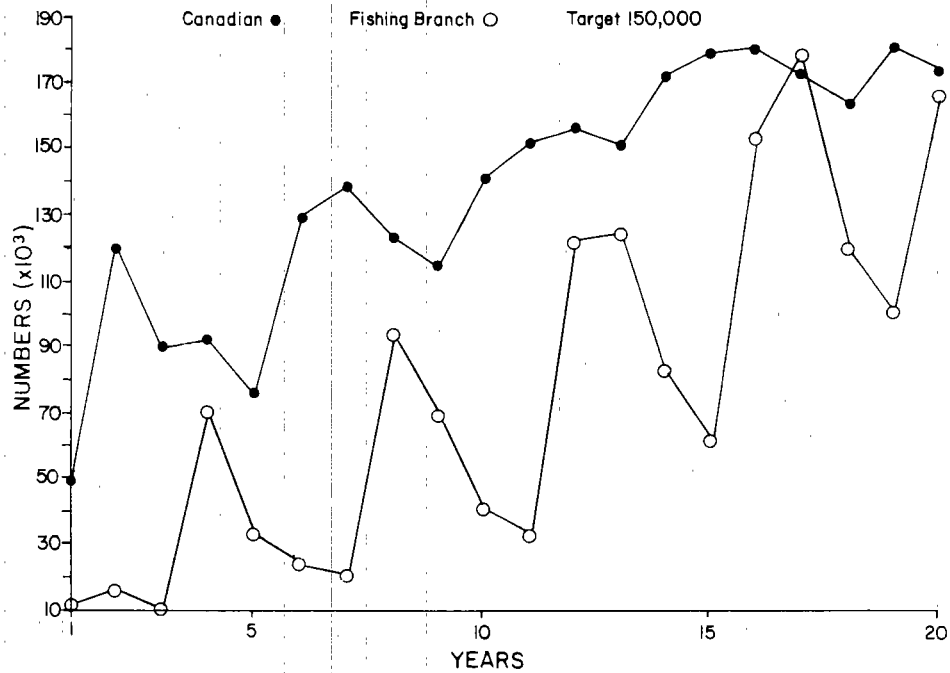


Figure 11. Projected escapements of Yukon chums under the Management Option of 50% reduction of all fisheries.

The NPV* of the simulated fisheries for the latter option exceeded that of current management by approximately 50 percent.

Modelling indicated that the Fishing Branch River chum stocks were sensitive to both Canadian and U.S. fisheries. Rebuilding stocks to target levels was achieved under various scenarios, which included elimination of the U.S. commercial fishery and the Fishing Branch subsistence fishery, and 50% reductions in harvest rates to all fisheries.

4.8.2 Chinook Salmon

The model indicated that the need for conservation is more important for Yukon chinook stocks than for Yukon chums (Table 3). Even at maximum potential productivity (6 recruits per spawners), the current management strategy resulted in major declines of Canadian chinook stocks (Figures 12 and 13). The elimination of commercial and subsistence fisheries in the Yukon was insufficient to rebuild stocks. Similarly, the elimination of the Alaskan commercial harvest did not allow Yukon chinook stocks to reach target levels. However, a reduction in commercial harvest rates in Alaska and Canada by at least 85% promoted stock recovery (Figure 15). Chinook catches in subsistence fisheries increased, and the total NPV* of this fishery exceeded that of current management by approximately 22% (Figure 14).

Rebuilding of Yukon chinook stocks also occurred when harvest rates in all fisheries were reduced by 50% (Figure 16 and 17). The NPV* of the harvest resulting from this scenario was slightly less than that of the previous scenario involving an 85% reduction in Canadian and Alaskan commercial harvest rates.

* NPV = net present value of the projected 20 years of harvest, discounted at 10% per year.

Table 3. Projected catches and escapements of Yukon chinooks under current management and four management options.^a

Management Options	Harvest by Fishery ^b				Escapement		Catch Trend ^d		Total ^e NPV(10%) (x1000)
	U.S. Com	U.S. Subs	Can Com	Can Subs	Yukon R. Chinook Trend	% Target ^c	Can Com	Can Subs	
Current management	(0.62)	(0.62)	(0.36)	(0.36)	decline	7	decline	decline	7094
Elimination of Canadian fisheries	(0.62)	(0.62)	(0)	(0)	stable	27	0	0	7759
Elimination of U.S. commercial fisheries	(0)	(0.62)	(0.36)	(0.36)	stable	33	stable	stable	7798
Reduction of U.S. and Canadian commercial fisheries	(0.08)	(0.62)	(0.05)	(0.36)	increase	100	increase	increase	8643
Reduction of all fisheries	(0.31)	(0.31)	(0.18)	(0.18)	increase	100	increase	increase	8037

^a Productivity of 6 recruits per spawner used in computer simulations.

^b Ordering of fisheries: U.S. Commercial, U.S. Subsistence, Canadian Commercial, Canadian Subsistence.

^c Percent of target reached at year 20 or at level of stabilization. If target reached or exceeded, percent of target recorded as 100.

^d Canadian fisheries include Canadian Commercial and Canadian Subsistence.

^e NPV = net present value of the projected 20 years of harvest, discounted at 10% per year.

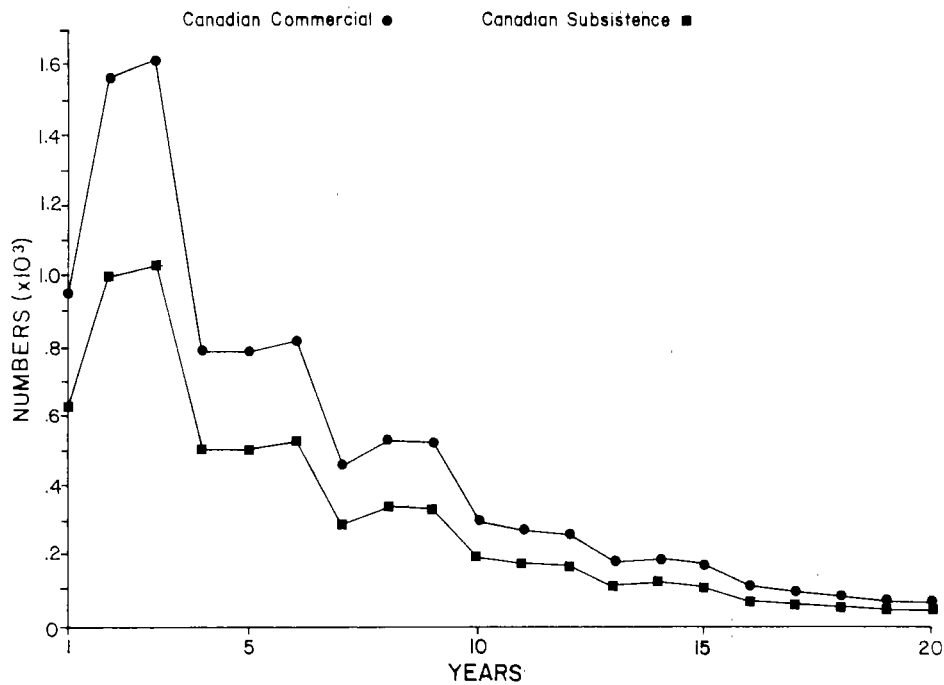


Figure 12. Projected catches of Yukon chinooks under the current management regime.

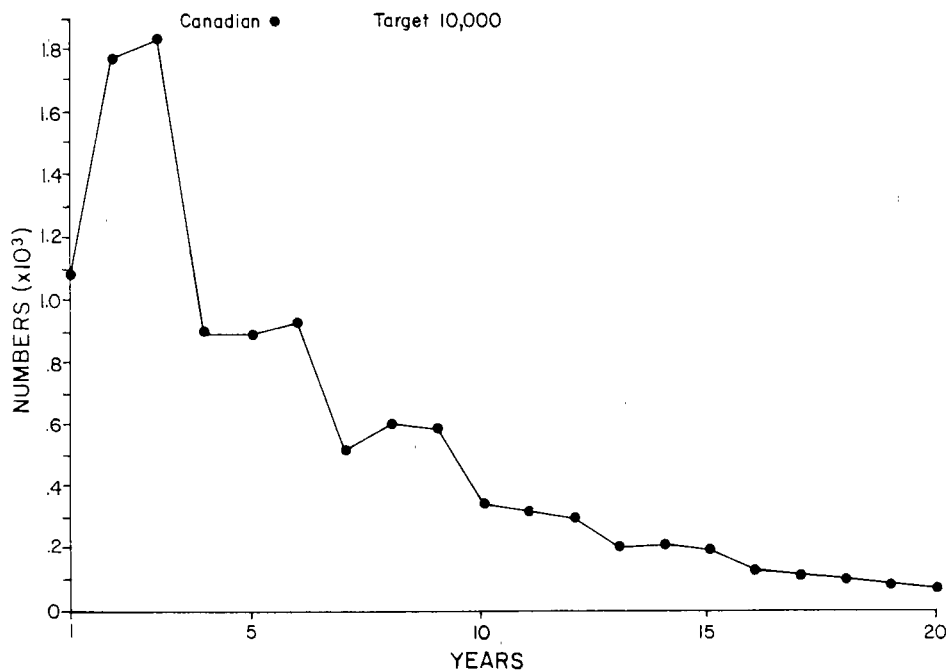


Figure 13. Projected escapements of Yukon chinooks under the current management regime.

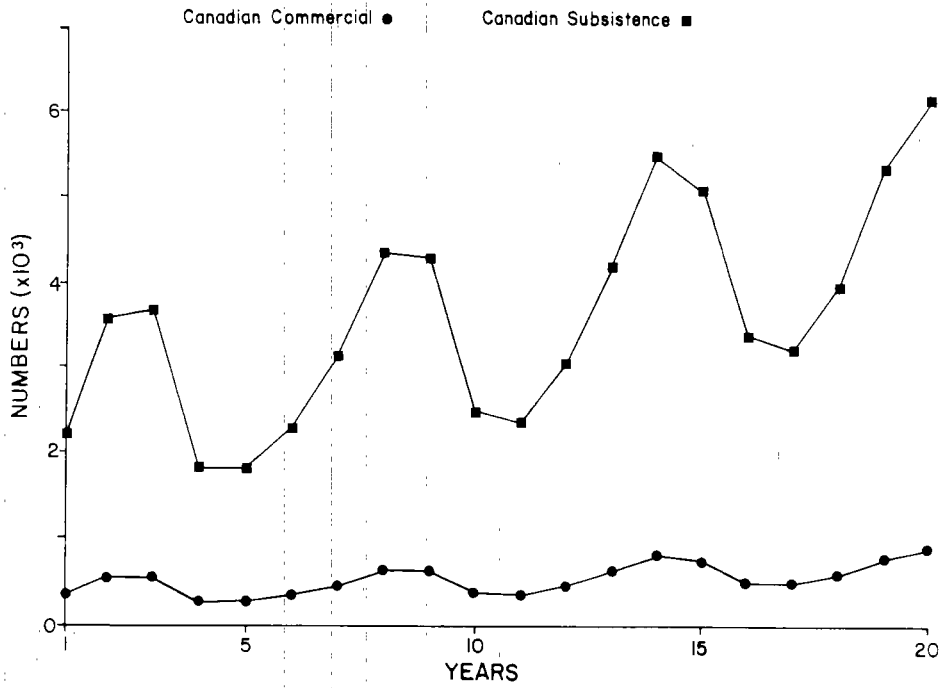


Figure 14. Projected catches of Yukon chinooks under the Management Option of reduced U.S. and Canadian fisheries.

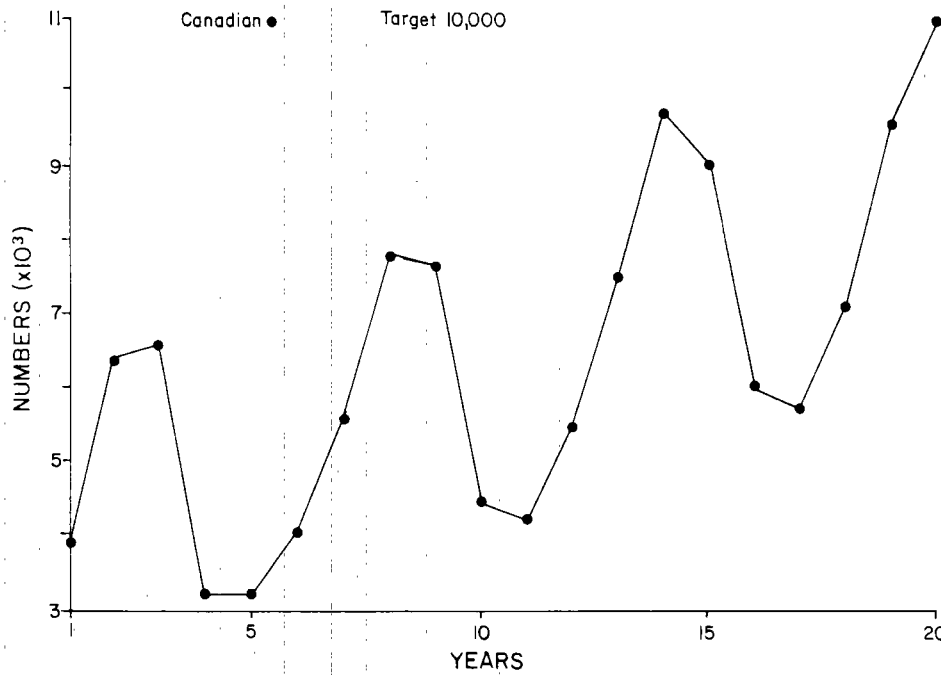


Figure 15. Projected escapements of Yukon chinooks under the Management Option of reduced U.S. and Canadian fisheries.

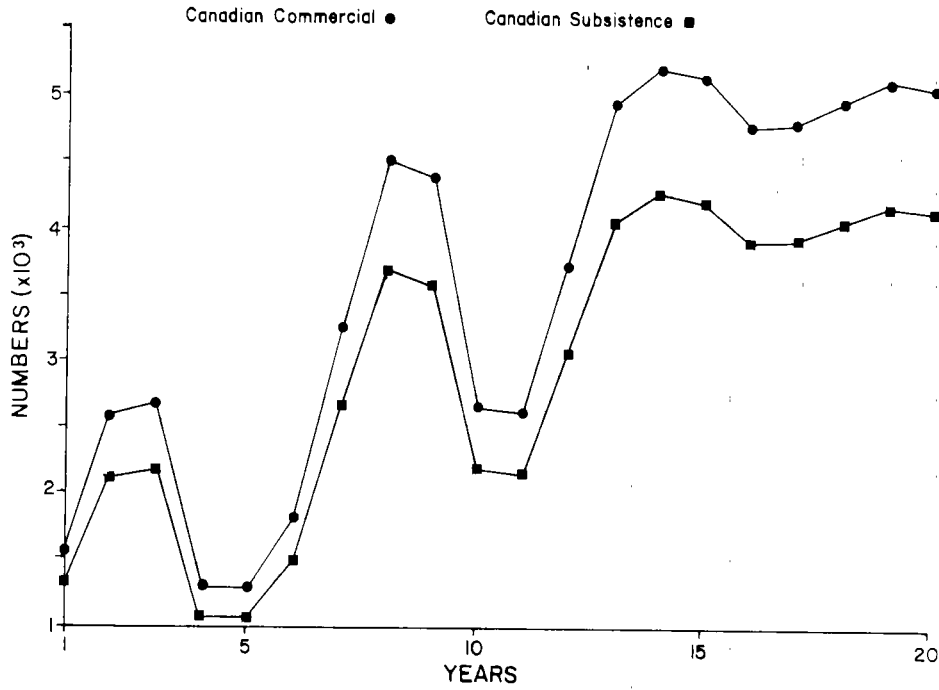


Figure 16. Projected catches of Yukon chinooks under the Management Option of 50% reduction of all fisheries.

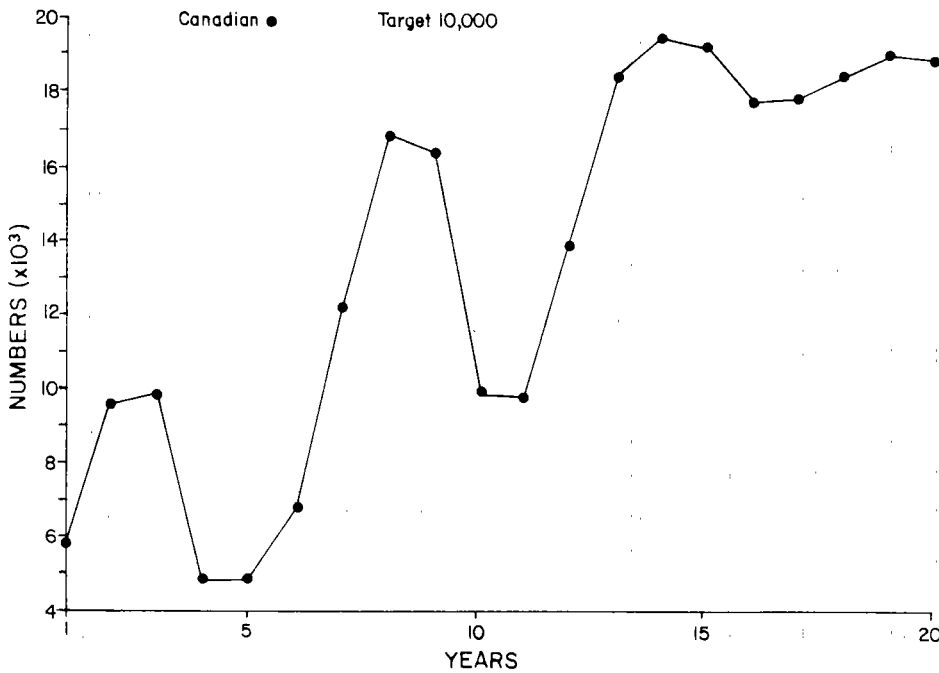


Figure 17. Projected escapements of Yukon chinooks under the Management Option of 50% reduction of all fisheries.

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6. GLOSSARY

Actively-Managed Stocks - salmon stocks that receive priority with regard to management decisions governing the fisheries; that is, they will cause a fishery to be altered if conservation measures are required. Actively-managed stocks are usually abundant, economically valuable stocks.

Backplanting - returning artificially-propagated fry/smolt to site of origin (see "satelliting").

Bar fishery - a fishery from a sand bar in a river.

Beach tie-off - securing the end of a seine net by tying the end to a tree or rock on a beach while the net is fed out from the seine boat.

Boat-day - one boat involved in fishing for one day or portion thereof.

Box boundaries - boundaries of an area in an inlet or strait between which fishing is not permitted, to protect pre-spawning adult fish. See also "Stream Boundaries".

Bunt mesh - the bottom strip of mesh in a seine net. Regulations govern the size of the bunt mesh so that (in theory) small fish can escape as the seine is pursed.

Buy-back program - a publicly-funded purchase of existing fishing licences and associated boats for the purpose of retiring the fishing capacity of the vessel from the fleet.

By-catch - catch of non-target species.

Carcass weir - device, usually a fence, across a stream or channel where drifting or spent fish accumulate and can be enumerated and removed.

Cassette incubator - container consisting of numerous compartments, each large enough for one or a few salmonid eggs, enclosed with a porous cover to permit water flow. Used for incubating eggs in a river or lake environment.

Catch ceiling - a regulatory constraint on the maximum number of fish which can be caught by a particular fishery.

Catch per drift - catch during one drift of a gillnet.

Catchability coefficient (q) - the fraction of a fish stock caught by a defined unit of fishing effort.

CEDP - Community Economic Development Project.

Clean-up fisheries - usually terminal, single-stock fishery intended to take fish surplus to escapement requirements at the end of the run.

Closures - termination of a fishery in a specified area during a specified time.

Counting weir - device, usually a fence, used to temporarily stop migrating adult salmonids to permit enumeration.

Cycle - refers to life cycle of salmon from egg to spawning adult.

Cyclic dominance - the tendency for each sockeye spawning area to produce larger numbers of fish in some years and not in others. The dominant cycle years are repeated every four years in the Fraser River. Others have 5 year cycles.

Dead pitching - pitching salmon carcasses on to stream banks to count them and/or recover tags.

Directed fishery - commercial fishery directed at a specific stock by time or space.

Discount rate or social discount rate - a factor that is used like an interest rate to reduce values occurring in the future to their equivalent value in the present. Discount rates are used in the calculation of net present values (NPV).

Diversion rate - the proportion of returning salmon (generally referring to sockeye salmon) that returns, for example, to the Fraser via Johnstone Strait.

Donor stocks - particular population of salmonids from which eggs and/or milt are taken for the purpose of enhancing the same population or for transplanting to other streams.

Drifted gill net - a gill net fished without anchor or attachment to shorelines.

Effort response - a change in the number of active fishermen (effort) in response to a change in catch success.

Emergence - stage in salmonid's life when incubation is complete and young fish emerge from the gravel and begin to swim actively in search of food.

Enhancement - techniques used to increase the production of salmonid stocks through intervention by man. May pertain to fish culture techniques, stream improvements, etc.

Enumeration fence - see "counting weir".

Environmental loss - loss of potential escapement causing failure to meet target escapement, because of environmental variability affecting survival rates (ocean processes, flooding, freezing, etc.).

Enzootic - of a disease, peculiar to or constantly present in a locality.

Epizootic - of a disease, temporarily prevalent.

Escapement - number of fish which survive all fisheries and are estimated to be on the spawning grounds.

Exploitation rate - the probability that a fish will die from fishing during a specified period. Also, the proportion of a group of fish (usually total stock) that are removed by fishing during a period.

Exploratory opening - see Test Dip Fishery.

EXPO '86 - transportation and communications exposition to be held in Vancouver in 1986. It is expected to attract large numbers of tourists to British Columbia.

Fishery - a fish harvesting activity that is defined by some combination of gear, area, time and/or target species.

Fixed catch approach - management strategy used in a mixed-stock fishery where the catch is held to an absolute number (catch ceiling). The underlying assumption is that stock abundance is increasing or stable, otherwise the ceiling has to be adjusted. (The latter strategy then resembles the fixed harvest rate approach.)

Fixed harvest rate approach - management strategy used in mixed-stock fishery. It is assumed that harvest rate can be fixed at a constant level (proportion of the available stocks) by constraining time spent fishing or the amount of fishing gear used in a given area for a given time.

Flow storage works - dam or works to store water during high-flow periods for release during low-flow periods.

Forgone catch - fish in excess of those expected to return to spawn in a given stock, and therefore not caught, resulting in escapement higher than target.

Fry - a stage in the life of a fish from the time it starts actively swimming and feeding to age 14 days.

Gurdie - a winch that is used to raise and lower trollers' lines.

Hails on the grounds - counts made by Fishery Officers on patrol vessels or charter patrolmen hailing commercial fishermen while on fishing grounds.

Hanging lakes - lakes formed by glacial scour, frequently above valley bottom or fjord.

Harvest rate - the harvest proportion of a particular group of fish in a specified area over a specified time (also defined by species, sex, cohort, harvesting fishery, etc.).

Incidental catch - catch of fish other than the target species.

Incubator - a unit constructed to hold fertilized eggs until hatching or emergence.

Index stock - salmon stock deemed to be representative of adjacent salmon stocks. High quality data are usually gathered for this stock.

Indicator stock - see "index stock".

Inside/Outside - refers to inside (e.g., Johnstone Strait) and outside (West Coast and Juan de Fuca Strait) of Vancouver Island.

Interception fishery - a fishery which captures (intercepts) fish from a number of stocks (i.e., is not stock-specific). This term is often used to refer to international interceptions, but in this report it is often defined synonymously with mixed-stock fishery. Although mixed-stock problems may result from interception fisheries the two are not really synonymous. The tentative understanding of interception fishery is that it differs from terminal fisheries in that stocks are intercepted before reaching their natal streams. It could be possible to have an interception fishery on a single stock.

IPSPC - International Pacific Salmon Fisheries Commission.

Key stock - a large or otherwise important salmon stock for which better quality data are available or will be obtained in the future, equivalent to an indicator or index stock.

Key stream - a stream in which one or more key (index) salmon stocks spawn.

Known-stock fishery - commercial fishery targeted on a specific stock of salmon.

Mainstem - principal course of river.

Management to escapement - management of fisheries in a manner that ensures (within technical limits) that the target escapement reaches the spawning area.

Management uncertainty loss - loss of potential escapement to a fishery causing failure to meet target escapement, because of inaccurate estimation of run size or escapement.

Mean return rate - a measure of average spawning yield, (yield may be in juvenile/adult/spawner/juvenile/adult catch, etc.). See also productivity.

Migrant releases - release from hatchery of salmonids that are smolted and will migrate downstream.

Mixed-harvest loss-failure - loss of potential escapement to incidental harvest in mixed-stock fishery. This can only be considered a loss if it results in less than target escapement.

Net present value (NPV) - abbreviation for "present value of net economic benefits". Future streams of project benefits and costs are estimated and the difference is the future stream of net economic benefits. This stream is translated into a present value by discounting future values by the social discount rate. The resulting figure is called the "net present value". In the Salmon Stock Management Plan the future stream of benefits and costs are calculated over a period of 40 years. The only costs considered are those for harvesting and processing (management, capital and operating costs are not included).

Objective - a statement of intent about resource use that is specified with respect to species, area, fishery, or resource uses.

Odd/Even - refers to discrete pink runs which occur in either odd or even years.

Open sets - refers to seine sets where a skiff or running line is used to bring the end of the net back to the boat rather than tying off at the shore.

Opening - date and time set by DFO for the commencement of a specific fishery.

Optimum escapement - an estimate of the numbers of spawners that will meet (but not exceed) the capacity of the river system.

Outplanting - see "transplanting".

Passively-managed stocks - salmon stocks not directly managed but affected incidentally as the result of active management of other stocks. The fishery will not be altered to protect these stocks, by definition.

Pathogenesis - the origin and development of a disease.

Pieces - individual fish (in a commercial catch).

Pink corridor - this is a boundary regulation in Johnstone Strait to conserve Johnstone Strait and Strait of Georgia pink stocks while fishing for Fraser River sockeye. A ribbon boundary closes the shore on the mainland side of the strait in a half mile wide strip from tidewater. The ribbon strip switches to the Vancouver Island side of the Strait at Chatham Point, and continues to end of fishing area. This regulation is usually in place during the first three weeks in August.

PIP - Public Involvement Project.

Policy - a statement of intent about resource use that has a national or regional scale.

Pre-migrant - young salmon prior to migration downstream to marine environment.

Presmolt - usually pertains to salmonid species that rear for extended periods of time (one year or more) in fresh water; the stage during which the fish is a yearling but has not yet smolted.

Production - the number of fish produced, often used in a stock-specific sense or for a particular enhancement project.

Production release - release of salmonids, usually high numbers, from an enhancement facility, that have been raised using standard fish culture techniques (as opposed to experimental releases).

Productivity - the rate of production, usually in terms of returning adults per spawner (stock specific).

Qualla - refers to external chum colour (and therefore quality). Falls between brights (high quality) and darks (low quality). Also known as semi-brights.

Raceway - rectangular fish-rearing containers with high exchange rates of water and vertical walls.

Rack fisheries - commercial fishery targeted on excess hatchery stock. This may occur at the hatchery, and does not necessarily require boats.

Ribbon boundary - a specified boundary parallel to a shore of an inlet or pass which is closed to fishing to protect a portion of the migrating salmon.

Satelliting - an enhancement strategy whereby eggs and milt from a particular salmonid stock are incubated and reared in a central facility or different stream, then returned to donor stream.

Scale pattern analysis - analysis of the patterns on scales of fish to distinguish between stocks and to identify age composition.

Sea pen - net enclosures suspended in sheltered saltwater bays containing salmon for rearing purposes.

Semi-bright - see "qualla".

SEP biostandard - criteria used to estimate production of salmonid reproduction in the wild or in various types of enhancement facilities. Includes estimates of fecundity and survival during each life stage for each species.

Shaker abundance - numbers of undersized salmon available for capture by sport and commercial fishermen.

Shaker catch - numbers of undersized salmon caught and released by sport and commercial fishermen.

Shaker mortality - shakers which do not survive the catch and release process.

Silver bright - type of mature salmon (chum) which has a silvery appearance, and is classified as top quality in the fishing industry.

Smolts - a juvenile salmon that has undergone or is undergoing physiological and behavioural changes in preparation for migration from fresh to salt water.

Spawning channel - an artificial channel constructed for returning adults to spawn in, with ideal gravel and flow conditions.

Squishers - undersized fish caught by commercial seine fishermen which are gilled in the net, and then crushed as the net is wound onto the drum.

Stock - fish of a single species that spawn in a particular geographical area at the same time.

Strategy - a collection of management actions for meeting an objective.

Straying - returning adults which stray from normal migration route and spawn in an area different from the one in which they originated.

Stream boundaries - boundaries of an area around the mouth of a river within which fishing is not permitted, to protect pre-spawning adult fish. See also Box Boundaries.

Subdominant year - the second highest production year of a stock (see "cyclic dominance").

Subyearling - stage in salmonid's life during the first year of rearing prior to the end of the calendar year (see "yearling").

Surplus to escapement - the number of returning salmon beyond estimated optimum or target escapement. These fish are available for harvest and therefore constitute the allowable catch.

Systemic - of the bodily system as a whole.

Target - refers to the level of escapement at which management plans are aimed. It is the best estimate of "optimum" currently available.

Terminal fisheries - fishery conducted near the head of inlets or mouths of rivers where discrete stocks can be fished.

Test dip fishery - one-day opening of commercial fishery to assess stock strength.

Test harvest loss - loss of potential escapement causing failure to meet target escapement, because of test fishery operation conducted to estimate run size.

Total stock - catch plus escapement.

Transplanting - releasing hatchery-raised juveniles in a stream other than the one in which the parent stock originated.

Upwelling gravel box - box filled with gravel for incubating salmonid eggs with water flowing through from bottom to top.

Voluntary emergence - pertains to incubation of fish eggs in an artificial container where fry swim out of incubation media of their own volition. In non-voluntary systems, fry are manually transferred from incubating container.

Window - a period of time during which an activity occurs.

Yearling - a stage in a salmonid's life reached when a new calendar year begins during juvenile rearing period (a subyearling becomes a yearling on January 1st).

APPENDIX I

HABITAT INFORMATION TABLES

HABITAT INFORMATION TABLE

STOCK GROUP Taku River

<u>STOCK DATA</u>	Maximum	Target/	Current	<u>MANAGEMENT</u>	Active
	Recorded	Optimum	Average		<u>STYLE</u>
	Escapement	Escapement	Escapement		
Thousands					No. of Streams _____
					No. of Significant Streams _____
					(_____ % of MRE)

HABITAT NOTES

Historic Status	95% of watershed in Canada. A virtually pristine system. Natural turbidity.
Current Status	Pristine.
Future Outlook	Possible mining developments - low impacts.
Natural Habitat Production Potential	At historic level.
Improved Production Potential	Obstruction removal possibilities.

SUMMARY

Current Target Achievability	Current Status	Current Outlook	Natural Production Potential	Improved Production Potential
	High	High	High	Medium-Low

Good example of historic stock declining despite pristine habitat with no impacts.

HABITAT INFORMATION TABLE

STOCK GROUP Stikine River

STOCK DATA	Maximum	Target/	Current	MANAGEMENT	Active
	Recorded	Optimum	Average		STYLE
	Escapement	Escapement	Escapement		
Thousands					No. of Streams _____
					No. of Significant Streams _____
					(_____ % of MRE)

HABITAT NOTES

Historic Status	95% of watershed in Canada. Virtually pristine. Natural turbidity. Some small-scale logging in B.C. and Alaskan portions - low impacts.
Current Status	Minor headwater settlement. Transportation and mining impacts.
Future Outlook	Probably unchanged except for potential low impact mining. Longer range potential for hydro development with uncertain impacts. Lead time exists for flow planning that could help mitigate hydro impacts.
Natural Habitat Production Potential	At historic level.
Improved Production Potential	Potential for major fishway on Tuya River and other fishway and/or obstruction removal possibilities.

SUMMARY

Current Target Achievability	Current Status	Current Outlook	Natural Production Potential	Improved Production Potential
	High	High	High	High

Good example of historic stock declining despite pristine habitat with no impacts.

HABITAT INFORMATION TABLE

STOCK GROUP Alsek and Tatshenshini River

<u>STOCK DATA</u>	Maximum	Target/	Current	<u>MANAGEMENT</u>	Active
	Recorded	Optimum	Average		Passive
	Escapement	Escapement	Escapement	<u>STYLE</u>	
Thousands					No. of Streams
					No. of Significant Streams
					(___ % of MRE)

HABITAT NOTES

Historic Status	93% in Canada. Historic glacial barrier on Upper Alsek. Pristine - natural turbidity.
Current Status	Pristine.
Future Outlook	Possibility of mining - low impacts.
Natural Habitat Production Potential	At historic level.
Improved Production Potential	Some SEP proposals.

SUMMARY

Current Target Achievability	Current Status	Current Outlook	Natural Production Potential	Improved Production Potential
	High	High	High	High

Good example of historic stock declining despite pristine habitat with no impacts.