

**PACIFIC
REGION
SALMON STOCK
MANAGEMENT
PLAN**



YUKON
TERRITORY

BRITISH
COLUMBIA

F

Bella Coola

Statistical Area - 8

**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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G	Rivers Inlet & Smith Inlet Statistical Areas - 9 & 10
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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

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**PACIFIC REGION SALMON STOCK
MANAGEMENT PLAN**

VOLUME F

STATISTICAL AREA 8

Department of Fisheries and Oceans

1986



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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 Bella Coola area.

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 Bella Coola area 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. Chanut
Director General
Fisheries - Pacific

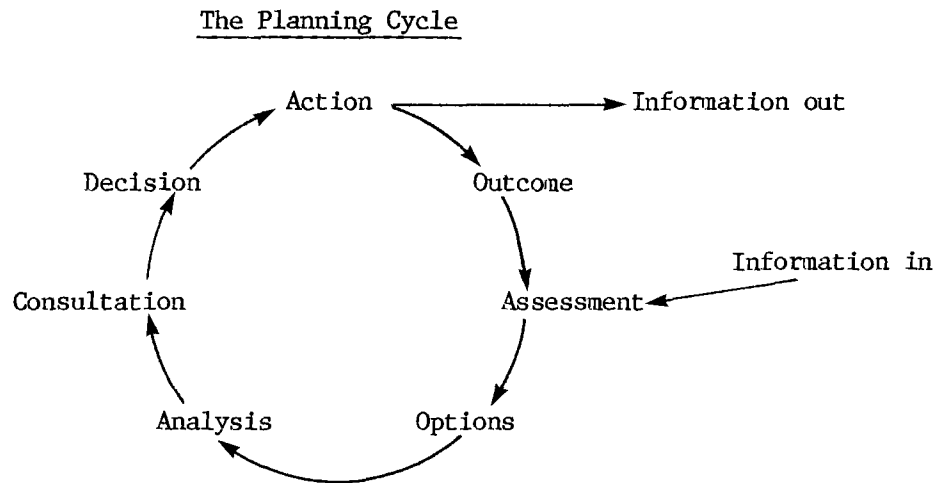
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FOREWORD

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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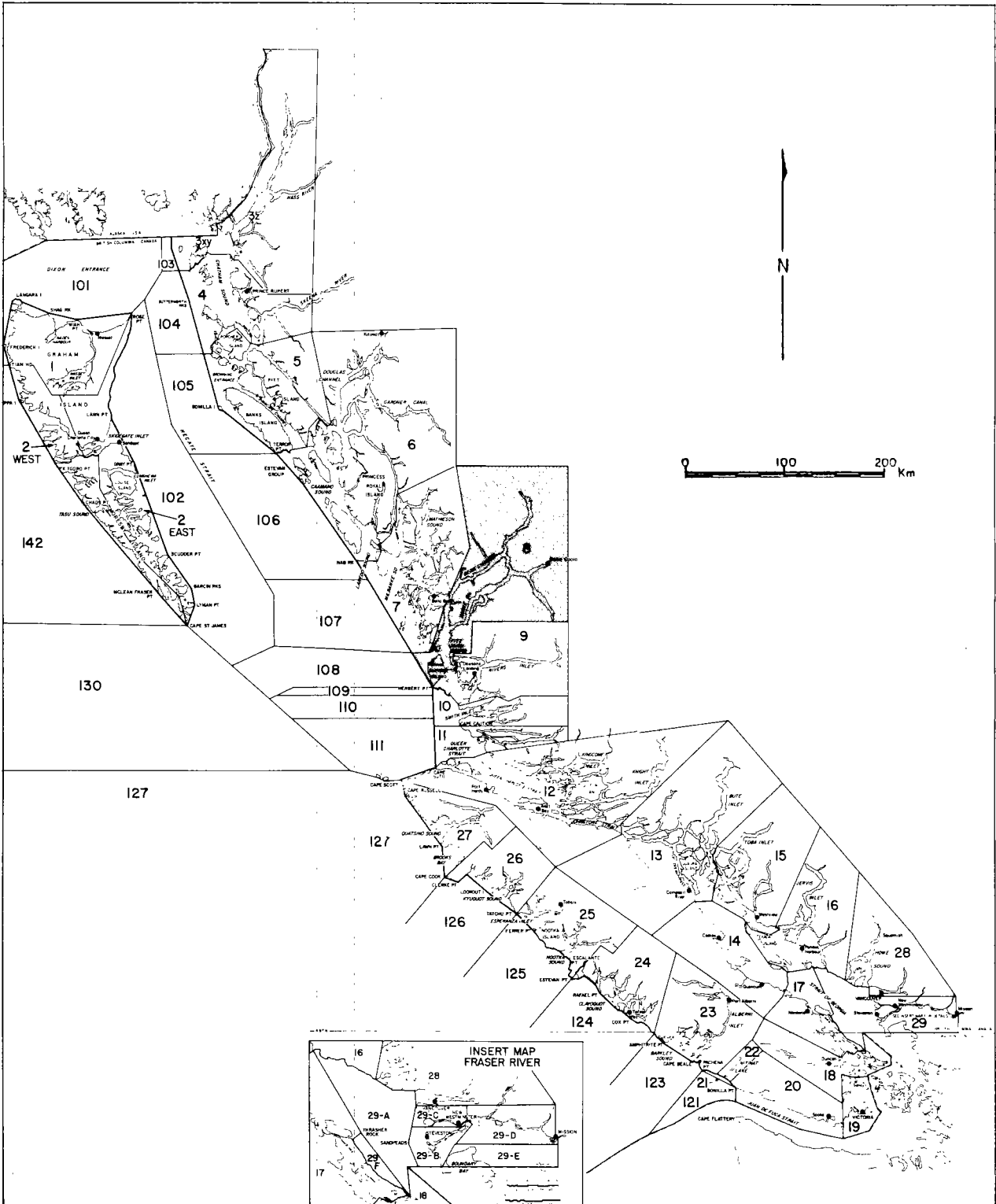


Figure 1. Department of Fisheries and Oceans Statistical Areas, British Columbia.

STATISTICAL AREA 8

Statistical Area 8 is located on the central coast of British Columbia north of Vancouver Island (Figure 1). The geography of the area is typical of the B.C. coast, with a complex of fjords and channels penetrating the coastal mountain ranges. Elevations range from 1500 m in the outer portion of the area, to over 3000 m at the headwaters of the inner streams. Much of the area is characterized by heavy rainfall, which, when coupled with the steep terrain, can result in unstable stream flows. For fisheries management purposes, Area 8 has been subdivided into the following six sub-areas:

1. North Bentinck Arm;
2. South Bentinck Arm;
3. Upper Dean Channel;
4. Dean Channel Closed;
5. Burke Channel; and
6. Fisher Channel and Fitz Hugh Sound (Fisher/Fitz Hugh).

The locations of these sub-areas and salmon-producing streams in Area 8 are shown in Figure 2 and Table 1. Detailed information with respect to stocks, current fishing patterns and habitat status in Area 8 is provided in the Appendices to this volume. The Fisher Channel and Fitz Hugh Sound sub-area were divided into separate Fisher Channel and Fitz Hugh Sound sub-areas beginning in 1985. However, since the data were previously compiled for six sub-areas, the following sections discuss these regions together.

There is limited information on the migration of salmon stocks to the above sub-areas. However, the available data suggest that the stocks destined for North and South Bentinck Arm and Upper Dean Channel sub-areas use both Burke and Dean channels as migration routes, and cross through Labouchere Channel. For the purposes of this discussion, it has been assumed that an equal proportion of all stocks destined for these sub-areas migrate through Burke and Dean channels. Despite this assumption, the true proportions of stocks migrating through either route are unknown. It is emphasized that any departure from the equal proportions assumption will likely have a profound effect on management planning in Area 8.

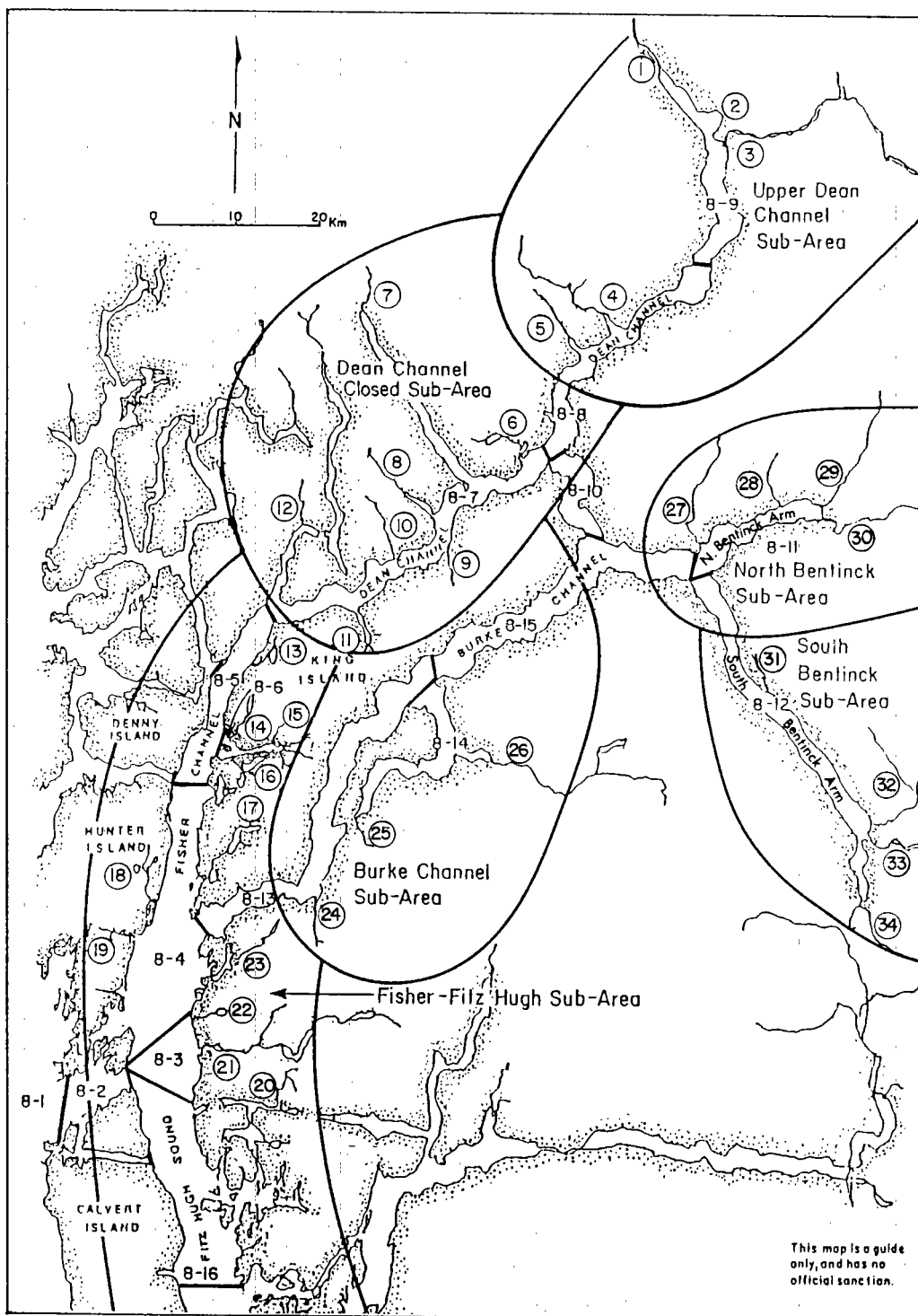


Figure 2. Statistical Area 8, showing Management Units and streams (for key to streams, see Table 1).

Table 1. Streams in Statistical Area 8, from Figure 2.

No.	Stream	Sub-Area
34.	Asseek River	S. Bentinck
30.	Bella Coola River	N. Bentinck
7.	Cascade River	Dean Channel Closed
22.	Cold Creek	Fisher-Fitz Hugh
3.	Dean River	Upper Dean Channel
18.	DeCosmos Lagoon Creek	Fisher-Fitz Hugh
5.	Deep Bay Creek	Upper Dean Channel
8.	Elcho Creek	Dean Channel Closed
15.	Evans Inlet Creeks	Fisher-Fitz Hugh
6.	Eucott Bay Creek	Dean Channel Closed
20.	Fish Egg Creek	Fisher-Fitz Hugh
13.	Four Lakes Creek	Fisher-Fitz Hugh
10.	Frenchman Creek	Dean Channel Closed
9.	Green River	Dean Channel Closed
14.	Hook Nose Creek	Fisher-Fitz Hugh
11.	Jenny Bay Creeks	Dean Channel Closed
19.	Kiltik Cove Creek	Fisher-Fitz Hugh
2.	Kimsquit Bay	Upper Dean Channel
1.	Kimsquit River	Upper Dean Channel
17.	Kisameet River	Fisher-Fitz Hugh
21.	Koeye River	Fisher-Fitz Hugh
26.	Kwatna River	Burke Channel
31.	Larso Bay Creek	S. Bentinck
12.	Martin River	Dean Channel Closed
23.	Namu River	Fisher-Fitz Hugh
29.	Necleetsconnay River	N. Bentinck
28.	Nieumiamus Creek	N. Bentinck
32.	Noeick River	S. Bentinck
27.	Nooseneck River	N. Bentinck
24.	Nootun River	Burke Channel
25.	Quatlana River	Burke Channel
16.	Sagar Creek	Fisher-Fitz Hugh
4.	Skonquiltz River	Upper Dean Channel
33.	Taleomey River	S. Bentinck

1. STOCK DESCRIPTION

An overview of the salmon stocks found in each sub-area within Statistical Area 8 is provided below.

1.1 North Bentinck Arm

The only actively-managed sockeye stock in North Bentinck Arm originates in the Atnarko system. The Atnarko sockeye stock is currently depressed, although it is being rebuilt and has a target escapement of 75,000.¹ There are no passively-managed sockeye stocks.

The Bella Coola system is by far the largest coho producer of the three streams in this sub-area, and also accounts for more than one-third of the total Area 8 production potential. Current escapements to the sub-area fluctuate from 10 - 50% of the target of 83,000 coho.¹

Atnarko River pinks are actively managed, and are the dominant stock in Area 8, with a target escapement of 1 million. In 1982, the even-year escapement was reduced to 150,000 as a result of floods in 1980, but then increased to 650,000 in 1984. The odd-year stock is at target escapement levels. Atnarko pinks are harvested by seiners and gillnetters in the Fisher/Fitz Hugh fishing area and by gillnetters in the Bella Coola gillnet area (Management Units 8-10, 8-11, 8-12 and 8-15). There are three passively-managed pink stocks in North Bentinck Arm. Both odd- and even-year stocks are depressed, and fluctuate considerably below the combined target of 36,000.¹ The timing of runs and migration routes of the passively-managed stocks are assumed to be similar to those of Atnarko pinks.

There are one actively-managed and three passively-managed chum stocks in the North Bentinck Arm sub-area. In addition, there are two components of the actively-managed stock: the Bella Coola summer chums with an escapement target of 60,000, and the Bella Coola fall chums with a target of 20,000.¹ Summer and fall chums are differentiated not only by migration timing but also by size. Summer fish are larger and have an average weight of about 7 kg, while fall fish have an average weight of 4.5 kg. The summer chum stock in the Bella Coola system is enhanced at the Snootli Creek facility. Collectively, the three passively-managed chum stocks are depressed, but remain stable at about 30% of the target escapement

of 15,500.¹ The timing of runs of the passively-managed stocks is similar to that of the Bella Coola summer chums.

The Bella Coola system is the only chinook producer in the sub-area, as well as the dominant source of chinooks in both Area 8 and the Central Coast. The stock appears to be responding to recent conservation measures, and is expected to reach the target escapement of 25,000 within one cycle with the aid of hatchery production. The target for the Bella Coola represents 59% of the overall escapement target for Area 8 total.

The Bella Coola/Atnarko system supports one of two major steelhead stocks in Area 8. There are three distinct peaks in what amounts to a constant migration of steelhead into the Bella Coola river. These peaks occur in April to June (Spring run), July to August (Summer run) and October to December (Fall run). The kelt migration is April to early July. Escapements are not well documented, but are assumed to be 3000 to 5000 spawners annually. There are three components to the catch of Bella Coola steelhead. These are the commercial fishery, the sport fishery and the Indian fishery. The annual commercial harvest of steelhead is in the order of several thousand, 10-20% of which are thought to be Bella Coola fish. The sport fishery kills about 400 fish annually, and the Indian fishery which averaged about 450 fish annually during the 1970's has ranged from 1000-5000 during the 1980's. There are no direct data available regarding productivity; however, it is likely that Bella Coola/Atnarko steelhead are less productive than Dean or Skeena River stocks. Therefore, overall harvest rates of 40%, and possibly less for certain run segments, may be considered excessive.²

1.2 South Bentinck Arm

There are no actively-managed salmon stocks in the South Bentinck Arm sub-area. In general, this is a very isolated area with highly turbid glacial streams, which makes it very difficult to undertake any reasonable assessment of stock strength. South Bentinck stocks are thought to have migration timings similar to those of the actively-managed North Bentinck Arm stocks. There are two passively-managed sockeye stocks, with a combined target escapement of 50.¹

The Asseek, Noeick and Taleomey systems produce most of the coho from this subarea. The Asseek is probably the most important of these streams in terms of coho production. However, current stock levels for all three streams are thought

to be only 5% of the target escapement of 6750. The sub-area coho production potential is also considered minor at about 3% of the area total target escapement for statistical Area 8.¹

There are four passively-managed pink stocks in the South Bentinck Arm sub-area. The even-year stocks are severely depressed, while the odd-year cycle is depressed but stable. The target escapement for these pink stocks is 45,500. In addition, there are four passively-managed chum stocks in the sub-area¹. Returns are depressed but stable at less than 10% of the combined target escapement of 21,250.¹

The Noeick and Taleomey are the only chinook-producing stream systems in the South Bentinck Arm sub-area, and stocks are believed to be depressed to about 10% of the target escapement of 1000. This target is only 2% of the overall total for Area 8.¹

1.3 Upper Dean Channel

There are two sockeye stocks in the Upper Dean Channel sub-area. The actively-managed Kimsquit sockeye stock is increasing in abundance and approaching the target escapement of 30,000.¹ In contrast, the passively-managed Dean sockeye is considered a very minor stock.

The Dean and Kimsquit are the largest producers of the four streams that support coho in the area. Current escapements are estimated at 8% of the area target of 51,100, which represents 24% of the total target for Area 8.¹

There are four passively-managed pink stocks in the Upper Dean Channel sub-area. Escapement of pinks is currently depressed and fluctuating far below the combined target of 71,500.¹

The actively-managed Kimsquit chum stock is depressed, but appears to be rebuilding towards a target escapement of 60,000. The four passively-managed chum stocks in this sub-area are very depressed and still declining in size. The target escapement is 25,100, although recent escapements of the entire group of stocks have been less than 1000.¹

The Dean River is the major chinook producer in this sub-area, while the Kimsquit River also contributes to the production of some chinooks. Recent stock levels have fluctuated from 5-25% of the target escapement of 16,000. This target is 38% of the Area 8 total for chinook salmon.¹

The Dean River is also the major producer of steelhead in this sub-area, as well as Area 8 and the entire Central Coast. It supports a world-renowned sport fishery highlighted by a wilderness setting and large fish which readily take a fly. Unlike the Bella Coola stock, the Dean River steelhead are a summer run fish, with the sport fishery occurring between 1 June and 30 September. The peak of the migration normally occurs from mid-July to mid-August. The kelt migration is similar to that in the Bella Coola River, and runs from April to early July. Escapement data are not well documented; however, the majority of guides and anglers practise catch-and-release fishing, which, coupled with relatively pristine habitat, maintains the stock in reasonably healthy condition. A major concern is the estimated 80-90% contribution from the Dean River to the several thousand steelhead intercepted annually in the commercial fishery.²

1.4 Dean Channel Closed

There are only two very small, passively-managed sockeye stocks in this sub-area. Escapements are currently low, but the target for the sub-area is only 200 sockeye.

As with sockeye, there are no actively-managed pink stocks in the Dean Channel Closed sub-area. The seven passively-managed stocks have a combined target escapement of 76,500. Even-year pink stocks in this area are depressed and declining further in size, while the odd-year stocks are slightly depressed and fluctuating.¹ Pinks are present in the Fisher/Fitz Hugh fishing area during the latter half of July.³

Coho are produced from six streams in the sub-area. Escapements are currently 10% of the 24,000 coho target, and this escapement represents 11% of the overall target for Area 8.

The six early-spawning chum stocks in the Dean Channel Closed sub-area are collectively and actively managed as one group. There are no passively-managed chum stocks in the area. The Martin chum stock is the only late-run or fall chum

stock and is also actively managed. Returns of the early-run stock group are moderately depressed but stable.¹ The Martin stock is increasing in size and supported a limited commercial fishery in 1985.⁴

Four chinook salmon were observed in Elcho Creek in 1980. However, there are no other records of chinook in the Dean Channel Closed sub-area.¹

1.5 Burke Channel

The only sockeye stock in the sub-area is the passively-managed Kwatna River sockeye, which has an escapement of less than 100.¹

The Kwatna is the major coho producer of the three streams in the sub-area. Current escapements are about 15% of the sub-area target of 17,600, which in turn represents about 8% of the overall target for Area 8.¹

There are no actively-managed pink stocks in the sub-area, although three stocks are passively managed. They have a relatively large combined escapement target of 115,000, and the Kwatna stock accounts for a large proportion (100,000 of this total). The even-year stocks are depressed as a result of the severe flooding in 1980, but escapements of odd-year pinks exceeded the target in 1983.¹ These stocks pass through the Fisher/Fitz Hugh fishing area at the same time as the Atnarko River pinks (see Section 1.1), and so are managed concurrently and passively with the larger Atnarko stocks.

As with sockeye and pink, there are no actively-managed chum stocks in the Burke Channel sub-area. The three passively-managed stocks have a combined escapement target of 35,000, but they are currently depressed and declining. The timing of runs through the Fisher/Fitz Hugh fishery is the same as indicated above for Burke Channel sub-area pink stocks.

The Kwatna River is a minor chinook producer; current chinook escapements are thought to be at about 10% of the target level of 500 fish.¹

1.6 Fisher Channel and Fitz Hugh Sound

This sub-area supports one actively-managed and four passively-managed sockeye stocks. The actively-managed stock is from the Koeve River, and is depressed but

stable at the present time. This stock is only harvested in local Indian food fisheries. Koeye sockeye are present in the Fisher/Fitz Hugh fishing area in June, prior to the commencement of commercial fisheries. The four passively-managed sockeye stocks are also depressed but stable.¹

The Koeye is the dominant coho producer of the eight streams in this sub-area. Current escapements represent about 5% of the identified target of 32,400 coho, which in turn is 15% of the Area 8 target.¹

As with sockeye, there is only one actively-managed pink stock, and this is also from the Koeye River. Koeye pink escapements are fluctuating near the target level in both cycles. There are six passively-managed pink stocks in the sub-area. The numbers of passively-managed even-year cycle pink are declining, while returns in the odd-year cycle have been greatly increasing.¹ Fisher/Fitz Hugh pinks migrate through Area 8 comparatively later than other pink stocks.³

There are no actively-managed chum stocks in Fisher Channel and Fitz Hugh Sound. Escapements of the seven passively-managed chum stocks in the sub-area are depressed and presently fluctuating at between 10% and 30% of the target level.¹

In 1983, ten chinooks were observed in the Koeye River. However, there are no other records of chinook salmon in this sub-area.¹

2. FISHERIES

There are three primary commercial fisheries in Area 8: the Fisher Channel/Fitz Hugh Sound seine and gillnet fisheries (M.U. 8-2, 8-3, 8-4, 8-5 and 8-16); the Dean Channel gillnet fishery (M.U. 8-8); and the Bella Coola gillnet fishery (M.U. 8-10, 8-11, 8-12, 8-15).⁵ The timing of the migration of stocks through these areas is illustrated in Figure 3.

The earliest fishery typically begins in mid-May and is directed at chinook stocks. This fishery employs large-mesh gill nets and is located in Fisher Channel/Fitz Hugh Sound, Dean Channel and Burke Channel. The chinook fishery in Area 8 has not operated in recent years due to low stock levels, although a surplus is considered possible in 1986 and a commercial test fishery is planned.⁵

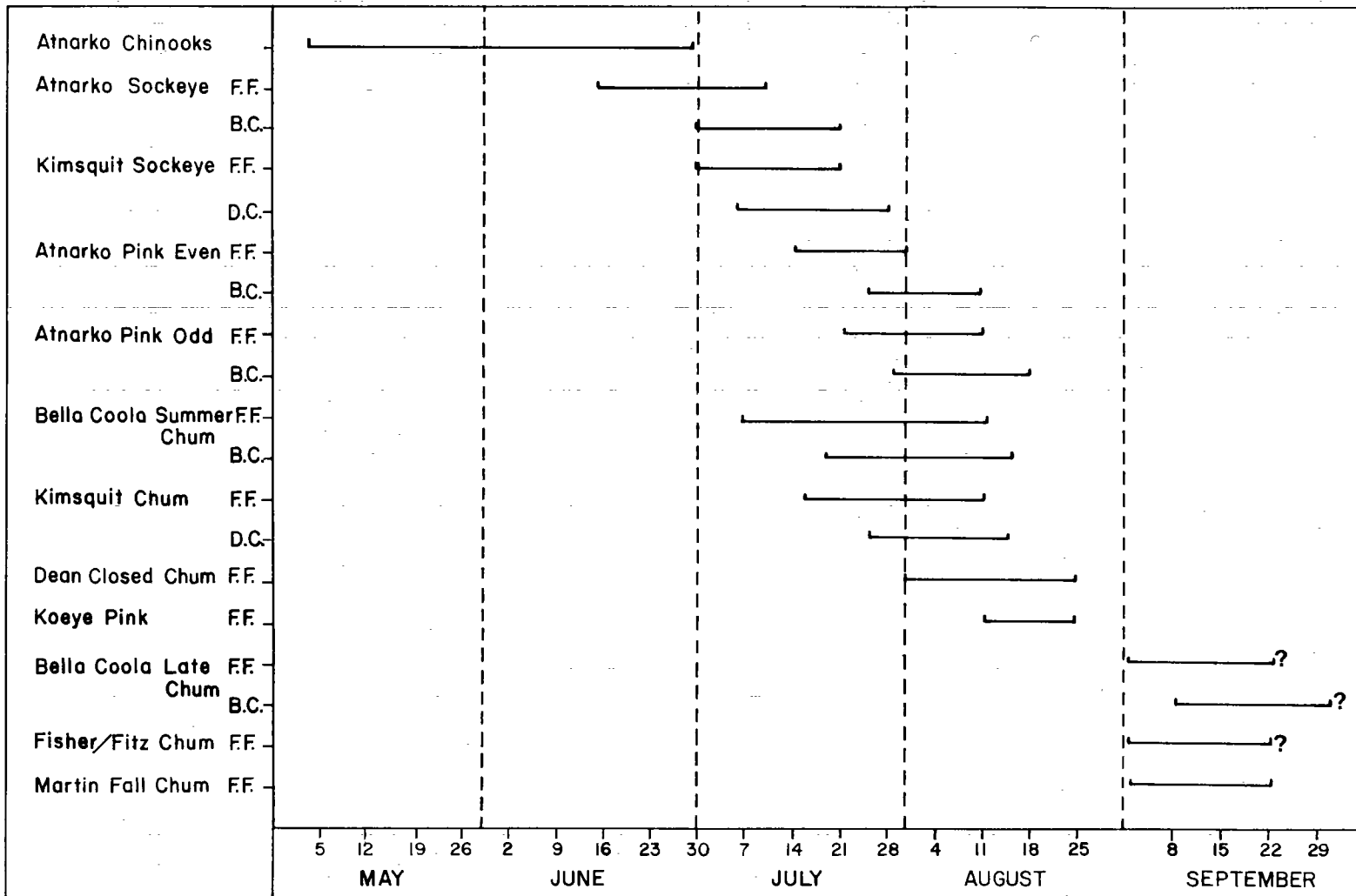


Figure 3. Stock migration timing through the Area 8 fisheries (F.F. = Fisher/Fitz; D.C. = Dean Channel gillnet; B.C. = Bella Coola gillnet).

The harvest of sockeye does not begin until the first week of July, when the area is opened to vessels equipped with small-mesh gill nets. This fishery extends over the Bella Coola, Dean Channel and Fisher Channel/Fitz Hugh Sound areas. Kimsquit sockeye runs are usually a week or more behind the Atnarko sockeye runs, which normally peak during the second week of July in the Bella Coola gillnet area. The Kimsquit sockeye returns peak a week later in the Dean Channel gillnet area.⁵

Atnarko sockeye are managed primarily using information that includes mean catch per drift in the Bella Coola Indian food fishery, and catch data from the Bella Coola and Fitz Hugh Sound commercial fisheries. The Kimsquit sockeye stock is managed in a similar fashion, although there are two notable differences. There is no directed Indian food fishery for Kimsquit sockeye, and in 1984, a charter test fishery program was initiated. In the future, this test fishery should provide accurate and timely in-season escapement information.³

Atnarko pinks and Bella Coola and Kimsquit chums are initially taken as incidental catches in the sockeye fishery during the second week of July. The third week of July is generally the first week that pinks and chums become the target of fisheries, and the first week that seiners are permitted in Fisher Channel/Fitz Hugh Sound. Management of the fishery is initially based on expected returns, but emphasis is shifted to use of catch and escapement data as the season progresses. Fish quality becomes an important consideration for chums and pinks in late July and early August, respectively. The Dean Channel charter test fishery will serve as an escapement index after it has been calibrated. The peak week for even-year Atnarko pinks and both Kimsquit and Bella Coola chums is 29 July - 4 August. The second week of August is the peak week for the harvest of odd-year Atnarko pinks. Chums from the Dean Channel Closed sub-area begin to appear in the Fisher Channel Fishery during the week of 5-11 August. During the following week (12-18 August), the inside pink and chum stocks decrease in abundance, and the fishery is then focused on outer Area 8 stocks. This is the peak week for Koeys pinks and for Dean Closed chums, both of which are managed first on the basis of expected returns, and later on the basis of catch and escapement data. By the last week in August, the fishery for pinks and summer chums is complete, unless there are large numbers of late summer or early fall chums. In such cases, the fishery would be extended into the week of 25 August - 1 September. However, seiners do not operate in Area 8 after 25 August.³

If a surplus of fall chums is available, the Bella Coola Gillnet Area may be opened during the first week of September. Fisher Channel, or possibly Cousins Inlet, can also open for Martin River fall chums in mid-September. The peak week for runs of both fall chum stocks is believed to be 16-22 September. The only situation when there could be a fishery during the week of 23-30 September is if escapement targets for fall chums have been achieved. If this is not the case, Area 8 is closed for the balance of the season.³

3. CURRENT ENHANCEMENT ACTIVITIES

There is a relatively long history of enhancement activities in Area 8. A pilot hatchery was constructed and operated in 1975 to rebuild the declining odd-year Atnarko pink stock. The objective of this project was to increase the escapement of odd-year pinks to over 100,000. The Atnarko pink stock recovered quickly, and the hatchery was closed and removed in 1979 because it was located in Tweedsmuir Park and the Park Use Permit was due to expire.

The only notable current enhancement activity in Area 8 is the Snootli hatchery on the Bella Coola system.⁶ This facility is a Japanese-style chum hatchery.* The original purpose of the hatchery was to produce sufficient numbers of summer chums to allow the pink fishery to continue at an efficient exploitation rate without adversely affecting the summer chum population. The hatchery also produces chinooks, coho and steelhead.

The summer chums for the Snootli hatchery are taken from all of the major stocks in the Bella Coola area including the Salloompt, Snootli, Neclletsconnay, Thorsen, Nuhalk, Fish, Klonnick and Airport Slough stocks. In 1983, 35-50% of the returns to some spawning areas were attributable to hatchery production. The hatchery has a total capacity of 110 million chum eggs. During the period from 1979-1981, the number of eggs actually collected ranged from 2 to 3 million; this has increased substantially since 1982. The 1982, 1983 and 1984 egg takes were 4.3, 7.9 and 9.5 million, respectively.⁶

* Japanese style chum hatcheries are incubation and rearing facilities patterned after the original Japanese design and modified for Canadian application. Principal departures from conventional Canadian hatcheries include use of bulk incubators and keeper channels.

4. HABITAT STATUS

Development in Area 8 has not been extensive but nevertheless has occurred, and has had some impacts on salmon habitat. Bella Coola/Hagensbourg and Ocean Falls have been the centres of development and are the only two permanent settlements in the Statistical Area. The main industry in the area is logging, which began with the first European settlement (in the 1890's) to meet local requirements. The forest-based industry expanded to include the Ocean Falls pulp and paper mill at the head of Cousins Inlet in 1912. Despite the closure of the Ocean Falls mill in the 1970's, logging continues in many portions of Area 8, largely to supply south coast processors.⁷ It has been estimated that approximately 60% of the salmon producing streams in Area 8 has been exposed to logging activity.⁷ Logging aside, the only other noteworthy development in Area 8 is the settlement of the Bella Coola/Hagensbourg area in the lower Bella Coola Valley. Accompanying this settlement has been diking, flood control, transportation facilities and agriculture, all of which may have some impact on salmon habitat.⁷

The dominant stream contribution to maximum recorded escapements are summarized by sub-area and species in Table 2.

4.1 North Bentinck Arm

As noted above, the lower Bella Coola Valley has been settled by Europeans since the 1890's. The development associated with this settlement, together with the large scale logging which began in the 1940's have no doubt had effects on the salmon habitat. While all species, especially coho, have probably suffered somewhat as a result of this habitat change, there is no evidence that any stock declines can be attributed directly to habitat losses.⁷

4.2 South Bentinck Arm

All drainages in the South Bentinck Arm sub-area were logged extensively in the 1960's and 1970's.⁷ Logging has aggravated the natural flow instability, and therefore has probably contributed slightly to the declines in stock size. All species have been affected.⁷

Table 2. Numbers of historically significant spawning streams by sub-area and species in Area 8.

Sub-Area	Sockeye			Coho			Pink			Chum			Chinook		
	Total streams ^a	Signif. streams ^b	% of MRE ^c	Total streams	Signif. streams	% of MRE	Total streams	Signif. streams	% of MRE	Total streams	Signif. streams	% of MRE	Total streams	Signif. streams	% of MRE
N. Bentinck Arm	1	1	100	3	1	100	4	1	95	4	1	90	1	1	100
S. Bentinck Arm	1	1	100	3	3	100	2	4	87	2	4	80	2	2	100
U. Dean Channel	2	1	90	4	2		4	3	95	5	4	96	2	1	
Dean Closed	2	0		6	4	80	7	6	98	7	6	93	1	0	
Burke Channel	0	0		3	2	99	3	1	80	3	2	90	1	1	100
Fisher Channel/ Fitz Hugh Sound	5	4	99	8	4	87	10	4	96	11	6	96	1	0	

^a Total streams = number of streams supporting the species in question.

^b Significant streams = the most important in terms of historical production.

^c % of MRE = the percentage contribution of the significant streams to the Maximum Recorded Escapement.

4.3 Upper Dean Channel

Despite at least three decades of logging activity in this sub-area, the impacts on salmon habitat have not been extensive; the major problem seems to have been siltation from disused roads. Logging has contributed slightly to declines in pink and coho; however, declines in other species cannot be attributed to habitat loss.⁷

4.4 Dean Channel Closed

Despite the pulp and paper installation at Ocean Falls, only about 40% of the salmon streams in this sub-area have been logged. The impacts of this logging have been relatively low, and habitat degradation resulting from logging is not considered to be a factor in stock declines.⁷

4.5 Burke Channel

The Kwatna River basin has been heavily logged since 1971, with moderate to heavy impacts on habitat. In spite of these impacts, stock declines in the pristine Nootum River system have been greater than on the Kwatna, suggesting that factors other than habitat degradation are responsible for the declines.⁷

4.6 Fisher Channel and Fitz Hugh Sound

The habitat in this sub-area is virtually pristine.⁷ There has been no industrial development, and the only settlement is the seasonal fishing camp at Namu.

5. MANAGEMENT CONFLICTS

As in most Statistical Areas in the Pacific Region, management conflicts are related to uncertainties in available data and problems associated with mixed-stock fisheries. Each of these areas is separately discussed below.

5.1 Management Uncertainties

The complexity of alternative salmon migration routes compounds the problems of interpreting in-season catch data for all the basic fishing areas within

Statistical Area 8. Salmon stocks return to the Dean and Bella Coola area streams through either Dean or Burke channels. The Atnarko pinks and sockeye, Bella Coola chums and Kimsquit sockeye and chums all migrate in unknown proportions through these two routes. This situation is further complicated by uncertainties regarding the migration routes of these stocks in the outside areas. Fisher Channel can be entered either through a variety of routes in Area 7 or via Fitz Hugh Sound. Salmon can enter Fitz Hugh Sound through Hakai Pass or Area 9 in the south or from the north through Fisher Channel. Better knowledge of migration routes could have a profound impact on the management of the fisheries in this area.

5.2 Mixed-Stock Harvests

There are incidental catches of Dean River chinooks during the early-season fishery directed at Bella Coola River chinooks. The present enhancement of Bella Coola chinooks increases the interception problem. There is also a minor overlap between the timing of returns of Bella Coola chinooks and Bella Coola sockeye, but because of the differences in gillnet mesh size in the fisheries for these two stocks, the only problem is a minor interception of chinooks in the early July sockeye fishery.

A slight overlap exists in the timing of Bella Coola and Kimsquit sockeye runs in mid-July, although there is little difficulty maintaining a separate harvest of the two stocks. The Kimsquit sockeye, Atnarko even-year pinks, Dean chums and Bella Coola chums are in the Fisher Channel/Fitz Hugh Sound area during mid- to late July. A serious impact on the Kimsquit sockeye stock could result if the Fisher Channel/Fitz Hugh Sound seine fishery targets on any of these stocks.

The mixed-stock fishery problem is more severe from late July to the third week of August. The mixed-stock conflicts are among Atnarko pinks, Bella Coola chums, Kimsquit chums and (to a lesser degree) the Dean Closed Area chums. Atnarko pinks are a productive stock and the exploitation rate of stocks in Fisher Channel/Fitz Hugh Sound has historically been dictated by the harvest of Atnarko pinks. In the past, the major conflict was with Bella Coola chums, although these stocks are now enhanced and should be able to sustain the high exploitation currently directed at Atnarko pinks. On the other hand, the remaining two stocks (Kimsquit and Dean Closed chums) are unable to sustain such high harvest rates.

The interception of Area 8 stocks in Area 7 was previously a major area of concern. It has largely been resolved by altering the fishing areas and by delaying the opening date of the Area 7 fishery. However, some degree of interception still occurs in the Seaforth fishery.⁸

6. STOCK REBUILDING POTENTIAL

The potential for stock rebuilding in each sub-area within Statistical Area 8 is summarized below.

6.1 North Bentinck Arm

Atnarko sockeye are responding slowly to current management actions. Rebuilding of this stock has been hampered by escapement losses to the commercial test fisheries that are used to assess abundance of sockeye.

The even-year Atnarko pink stocks were severely affected by flooding in 1980; returns from a brood year escapement of 1 million were only 150,000. Fortunately, the stock rebounded to an escapement of 650,000 in 1984. The escapement of the odd-year stock is at target, and no further actions are considered necessary to maintain or rebuild Atnarko pinks. There is no potential to actively manage the pink stocks that are currently managed passively in this sub-area, because of the vast difference in the size of these stocks compared to Atnarko pink returns.

The Bella Coola summer chums are enhanced stocks, and escapements from 1985 onwards are expected to be at target levels. The passively-managed chum stocks in the North Bentinck Arm sub-area are very minor, and will continue to be managed passively.

6.2 South Bentinck Arm

There are only two minor sockeye stocks in this sub-area, and they will continue to be passively managed. The four small pink stocks are passively managed, and there are no potential options for the rebuilding of these runs. At present, enhancement of these stocks is also not considered a viable option. The chum stocks from the South Bentinck Arm sub-area are harvested with the North Bentinck chums. Enhancement of these stocks has been recommended to prevent their

over-exploitation in the Bella Coola chum fisheries, and is considered the highest priority enhancement opportunity in Area 8.

6.3 Upper Dean Channel

Kimsquit sockeye stocks are intercepted to a slight degree in the fisheries for Atnarko pink. However, the potential to rebuild these sockeye stocks is limited by the present management which consists of commercial test fisheries to assess stock strength. The Upper Dean pinks will probably not be rebuilt unless their exploitation rate in the Atnarko pink fishery within the Fisher/Fitz Hugh area is reduced.

In recent years, Kimsquit chum escapements have benefited from the relatively low (because of flood damage) exploitation of Atnarko pinks and Bella Coola chums. However, the anticipated high harvest rates of these stocks in the future may reduce production of Kimsquit chums. The passively-managed chum stocks in the sub-area will remain passively managed and probably will not rebuild to historic escapements.

6.4 Dean Channel Closed

The two small, sockeye stocks will continue to be managed passively. The passively-managed pink stocks may benefit from fishery closures in Area 7. The Dean Channel Closed chum group is actively managed at present, and should slowly increase in abundance under the current management regime. Nevertheless, the achievable production is limited by problems associated with the concurrent harvest of the six stocks. No spatial or temporal separation of these chum stocks appears possible.

6.5 Burke Channel

The Kwatna sockeye stock is essentially extinct. The Kwatna pink stocks are passively managed, but conflicts are unusual because escapement trends tend to mirror those of the Atnarko pinks. Consequently, no active management strategy appears to be necessary. The odd-year stock is at target escapement levels and the even-year stock is recovering from the flood in 1980. Burke chums will probably decline as a result of the increased exploitation required to harvest Atnarko pinks and Bella Coola chums.

6.6 Fisher Channel and Fitz Hugh Sound

Koeye sockeye and the other passively-managed sockeye stocks in this sub-area remain severely depressed, although the stocks could be rebuilt if the Indian food fishery were reduced. Similarly, target escapements for Koeye pinks may be achieved if escapement losses to the commercial test fisheries could be reduced. The passively-managed pink stocks are severely depressed, and will probably remain at low escapement levels.

The passively-managed chum stocks in this sub-area have small escapements, despite the fact that there is no terminal area exploitation. The run timing of these stocks is sufficiently late that few mixed-stock harvest problems should exist, with the exception of fisheries for Martin fall chums or Bella Coola late chums.

7. MANAGEMENT STRATEGIES FOR STOCK REBUILDING

Rebuilding options for Area 8 salmon stocks are discussed below and include mitigating environmental impacts, reducing management uncertainties, controlling fishing effort, and reducing mixed-stock harvests.

7.1 Environmental Impact Mitigation

Options may exist to stabilize inconsistent production that has resulted from environmental factors. For example, Atnarko pinks are subjected to a severe flood on an average of once every ten years. The average time required to rebuild stocks after each flood is six cycles. The stock would be more productive if this rebuilding time could be reduced. To this end, a small stabilization spawning channel has been proposed for the Atnarko pink stock. This project is discussed in greater detail in Section 8.

7.2 Management Uncertainties

Several options have been identified to reduce management uncertainties by improving or building on existing information. In general, improved accuracy in data used for fishery management will result in greater catches and escapements. Some of these options include the following:

1. Analyse in-season catch data: An analysis of the in-season use of catch data as an indicator of abundance would be useful for a number of fisheries. In order of priority, catch data analysis of the following fishery/stock combinations is considered desirable:

1. Fisher Channel/Fitz Hugh Sound seine fishery for pinks;
2. Fisher Channel/Fitz Hugh Sound gillnet fishery for chums;
3. Bella Coola gillnet fishery for chums;
4. Dean Channel gillnet fishery for chums;
5. Bella Coola gillnet fishery for sockeye;
6. Dean Channel gillnet fishery for sockeye;
7. Fisher Channel/Fitz Hugh Sound seine fishery for chums;
8. Bella Coola gillnet fishery for pinks; and
9. Bella Coola gillnet fishery for chinooks.

2. Conduct test fisheries: In 1984, a charter test fishery was initiated for Kimsquit sockeye and chum salmon. The program was considered a success and should be continued. Moreover, the usefulness of the information will increase as more data are obtained each season. In a similar manner, charter test fisheries would be particularly valuable in the Bella Coola gillnet area for chums, as would a charter test seine operation for Atnarko pink salmon in Fitz Hugh Sound.

3. Obtain migration and timing data for Kimsquit sockeye and chums: Although improved information on migration routes and timing is a general requirement on the B.C. Coast, the lack of data for Area 8 deserves special attention, since the proportion of Kimsquit sockeye and chums migrating through Burke Channel is of particular interest. In order to reduce the exploitation of Kimsquit sockeye and chums by the fisheries for North Bentinck stocks (Bella Coola chums and Atnarko pinks) in the Fisher/Fitz Hugh area, this fishery could be moved into Burke Channel. To evaluate the potential effectiveness of this action, data must be obtained on run timing, speed of movement and the proportion of Kimsquit sockeye and chums that use the Burke Channel - Labouchere Channel route. Therefore, a tagging study in Burke Channel and the Bella Coola Gillnet Area is recommended.

4. Monitor in-season Bella Coola hatchery chum marks: Some of the chums released from the Snootli hatchery on the Bella Coola River are fin-clipped as part of hatchery experiments. The proportion of marked fish in commercial fisheries can indicate the relative abundance of hatchery fish in the catch, as well as the

timing and migration pattern of the Bella Coola chums. This information is also important to evaluation of the potential for moving the Fisher/Fitz fishery into Burke Channel (see above). The data must be collected in a timely fashion (i.e., in-season) and, therefore, it is necessary to investigate the initiation of a sampling program for marks in the commercial catch and summarizing the results in-season.

7.3 Effort Control

Limitation of the number of vessels allowed to fish during commercial openings would permit the conduct of more controlled commercial test fisheries. This is a particular problem for potential late chum fisheries, specifically those for Martin River and Bella Coola fall chums. Discussions with industry should be initiated to explore options that would limit effort in those fisheries where only a small harvestable surplus is available.

7.4 Mixed-Stock Harvest

A number of options have been identified to improve escapements of minor stocks through reduction of the need for mixed-stock fisheries. In most cases, actively-managed stocks should be harvested in areas where there is less mixing of stocks. Often this implies a move to terminal fisheries, but would improve escapement and subsequent production of minor stocks. Some of the options regarding mixed-stock fisheries are described below.

1. Protection of Kimsquit sockeye and Dean steelhead: There are no serious mixed-stock problems associated with Atnarko sockeye stocks. They are presently harvested in both the Bella Coola gillnet area (M.U. 8-10, 8-15) and Fitz Hugh Sound (M.U. 8-3, 8-4). The exploitation could be restricted to the Bella Coola gillnet area with no significant loss of quality, if the interception of Kimsquit sockeye or Dean steelhead in Fitz Hugh Sound was identified as a problem. A more severe restriction would be to move the fishery to the inside portion of M.U. 8-15 and the outer portion of M.U. 8-11. This measure would only be considered if significant interceptions of Kimsquit sockeye or Dean steelhead occurred in Burke or Labouchere channels. This management option is considered extreme because the fleet would be crowded into a very small area, and there would likely be a significant loss in fish quality, particularly during the latter part of the run. The latter portion of the Bella Coola chinook run coincides with the timing of the

fishery for Atnarko sockeye, but because of the small mesh used for sockeye, the incidental catch of chinooks is thought to be minor.

2. Move Fisher Channel/Fitz Hugh Sound fishery closer to terminal areas: The harvest of Atnarko pinks dominates the Area 8 fisheries. The Atnarko pink stock is highly productive (mean return rate since 1950: 3.9 even-year; 2.5 odd-year), and the overall exploitation rate in Fisher Channel/Fitz Hugh Sound area is generally dictated by the harvest of the Atnarko pink stock. One commonly suggested solution to minimize the mixed-stock problem is to move the fishery into Burke Channel or the Bella Coola gillnet area. However, this option would be controversial because of the following problems it would create in the fishing industry:

1. Constraining the fleet within a much smaller fishing area;
2. Moving seiners into a non-traditional area;
3. Loss of traditional fishing areas;
4. Loss of associated local expertise; and
5. Loss of fish quality.

It is clearly apparent that a well-documented rationale would be required to justify such a move including adequate definition of the benefits of the change. In addition, studies of stock timing and migration patterns are required prior to any drastic changes in the exploitation pattern for Atnarko pink stocks.

3. Harvest increased production of Bella Coola chums in the Bella Coola gillnet area: Bella Coola chum stocks are enhanced in the Snootli hatchery. The basic enhancement strategy is to take brood stock from seven discrete areas in the Bella Coola system, and then release fry from the hatchery back into the areas where the brood stock is taken. This approach assures the optimum spawning population in the Bella Coola system, and increases overall productivity by adding enhanced production to the natural escapements. The enhancement of any of the seven chum stocks within the Bella Coola system could be adjusted in response to future changes in abundance. Straying studies are being conducted by the Snootli hatchery staff, and adjustments to operations will be made if the information indicates that some of the presently defined stocks are, in fact, not separate.

The harvest of these enhanced Bella Coola chums will require a higher exploitation rate, and this will cause a conflict with the South Bentinck Arm chums in particular. Any necessary increase in the rate of exploitation of Bella Coola chum

should take place in the Bella Coola gillnet area (M.U. 8-10, 8-15) rather than in the Fisher Channel/Fitz Hugh Sound area (M.U. 8-3, 8-4, 8-5). The best solution to minimize this area of conflict is to enhance the South Bentinck chum stocks, perhaps through the use of the Snootli hatchery.

4. Protect upper Dean Channel stocks: The option of moving the Atnarko pink and Bella Coola chum fisheries out of the Fisher Channel/Fitz Hugh Sound sub-area would benefit all Upper Dean Channel stocks (see above for a full discussion).

5. Protect Dean Channel Closed pink stocks: While there are no actively-managed pink stocks in the sub-area, the strategies employed for chum salmon will affect the passively-managed pink stocks. One such option is to restrict the Dean Closed fishery (i.e., Management Unit 8-5) to gillnets, since seine operations harvest pink and chum stocks at the same exploitation rate. However, it is emphasized that this option requires a change in the traditional catch allocation.

While conflicts arising from the harvest of the six actively-managed Dean Closed chum stocks cannot be resolved, as discussed earlier, a reduction in the exploitation rate of Atnarko pinks or Bella Coola chums in the Fisher Channel/Fitz Hugh Sound area would ultimately benefit the Dean Channel Closed chum stocks.

The Area 7 Seaforth Channel fishery in late July and early to mid-August is believed to intercept chum stocks from the Dean Channel Closed sub-area. A decrease in the magnitude of this fishery in favour of more discrete fisheries in Spiller Channel and Roscoe Inlet (see Volume E) would also be a benefit to the chum stocks in this sub-area.

6. Protection of Burke Channel stocks: Since the passively-managed Kwatna sockeye are essentially extinct, there are currently no plans to rebuild this stock. On the other hand, the passively-managed pink stocks appear to be productive, and no further action is required to assure their recovery. The Burke Channel chum stocks will probably decline as a result of the anticipated high exploitation rates of Bella Coola chum and Atnarko pink stocks. The option of moving the Atnarko pink and Bella Coola chum fisheries out of the Fisher/Fitz Hugh sub-area could benefit the Burke Channel chum stocks if they were moved beyond the mouth of the Kwatna Inlet.

7. Protection of Fisher Channel/Fitz Hugh Sound stocks: The only management option in the Fisher Channel/Fitz Hugh Sound sub-area is to rebuild Koeye River sockeye through restrictions to the Indian food fishery. A mixed-stock fishery conflict does not exist for pinks in this area. The current minimal terminal harvest of chum will be maintained.

8. FUTURE STOCK ENHANCEMENT ACTIVITIES

The following is a description of future enhancement projects that are compatible with current management practices, including their project number from Lill et al. (1983).⁹

All of the projects for Statistical Area 8 are tentatively proposed for Phase II of SEP, and have been categorized as either approved (Category 1), or of high priority but requiring further study by fisheries management personnel (Category 2). The Category 1 projects include:

1. Atnarko Channel;
2. Atnarko Fence; Bella Coola Hatchery Expansion; and
4. Stream Counting Fence - Dean Channel Closed Sub-area (8.8.6).

The remaining projects all require further study.

8.1 Bella Coola Hatchery Expansion (Project No. 8 - 9A)

This project involves expansion and modification of the existing Snootli Creek Hatchery to serve as a central incubation and early rearing facility for Atnarko chinooks. Chinook fry would be out-planted or transported back to a channel on the Atnarko River for rearing to release size. This channel could be constructed in conjunction with a spawning channel for Atnarko pinks.

The expansion project could start with 2 million eggs in 1986/87 (40,000 total adult production) with only slight modifications to the existing facility. However, an interim upper limit to chinook production at 2 million smolts has been set for at least one cycle to evaluate the success of the project.

8.2 Atnarko Channel (Project No. 8 - 8)

A small, flood-proof spawning channel for Atnarko pinks would assist in stabilizing the production of this stock. The total adult production from this channel has been tentatively set at 250,000. The project is necessary to assist in stabilizing the average annual return of Atnarko pink salmon, rather than to boost production.

8.3 Atnarko Fence

A permanent fence on the Atnarko River is proposed to allow accurate counts of chinook and pink salmon. This project will improve the data base required by fisheries management personnel, but is not intended for use as an in-season escapement indicator.

8.4 South Bentinck Pilot (Project No's. 8 - 12, 8 - 13A)

It is considered desirable to increase production of chum in South Bentinck Arm, both to offset additional fishing pressure associated with the harvest of Snootli Hatchery summer chum returns, and to expand the fishery into South Bentinck Arm. However, this is a difficult area in which to work because access is tenuous, the Noeick River is subject to disastrous flooding, and stock abundances are hard to estimate. Biological reconnaissance programs conducted to date suggest that eggs could be taken from the Noeick and Taleomey tributary chum stocks, although access to these streams is likely to be a problem. Eggs could be incubated at a small facility located at either Tarrant Creek or Larso Bay Creek, but there are logistical problems associated with both sites because of poor access, especially in winter. A logistically more attractive alternative is to incubate eggs at the Snootli hatchery, and then return the fry to sea pens for rearing. Larso Bay has potential as a seapen site. A third proposal would be to transfer Bella Coola chums to these sea pens in order to divert a directed fishery for summer chums into an area where incidental catches will be reduced. Further discussions with the local subdistrict staff, fishermen and the Bella Coola Indian Band are required to more clearly define the requirements in this area.

8.5 Ocean Falls Facility (Project 8 - 3A)

This site has an excellent physical potential for development of a large production facility, since it can take advantage of the infrastructure of the closed pulp mill and small remaining community. Link Lake would provide an adequate water supply through the existing pipeline. The donor species for this facility would be sockeye and chinooks. Martin River fall chums could also be a potential stock for the facility, although manageability studies are required to evaluate this option.

The proposed production levels are about 120,000 adult sockeye and 24,000 adult chinooks. Chum production levels can not be set until the results of the manageability studies are available.

8.6 Stream Counting Fence - Dean Channel Closed Sub-area

The construction of a counting fence or tower on one of the summer chum spawning streams in this sub-area is considered desirable. This project would provide the accurate escapement data needed to improve in-season management and the existing data base. Reconnaissance and discussions with subdistrict staff are necessary to determine the best site for such a facility.

8.7 Kwatna Channel (Project 8 - 7)

If required in the future, an opportunity exists to construct a small-scale stabilization spawning channel on the Kwatna system, similar to that proposed for the Atnarko River. As noted earlier, Kwatna pinks are passively managed in conjunction with Atnarko pinks, because they generally tend to mirror the Atnarko stock in terms of escapements and rate of return. However, the Kwatna stock appears to recover more quickly than the Atnarko stock after a flood event. In addition, the Kwatna system itself seems to be less susceptible to devastating floods. Based on these characteristics, the preferred approach to future development in the Kwatna system is to wait until the Atnarko stabilization channel has been evaluated in terms of its success and effects on the Kwatna stocks. If this project proceeds, total adult production will likely not exceed 30,000 pinks.

8.8 Koeye River Hatchery (Project No. 8 - 6A)

The Koeye River supports the only actively-managed sockeye stock in the Fisher Channel/Fitz Hugh Sound sub-area, as well as the only actively-managed stock of pink salmon. This river also supports chums and coho. Because of differences in run timing, it should be possible to temporally separate Koeye stocks from others in Area 8. Enhancement opportunities for Koeye stocks are considered good, and there appears to be physical potential for location of a facility on the system. However, there may be logistical advantages to having such a facility at Namu instead (Project No. 8 - 4). Namu appears to have outstanding physical potential, and comparable to that present at Butedale or Ocean Falls. Hooknose Creek (Project No. 8 - 5) may also be suitable for a facility in this sub-area. Although Namu appears to be the most attractive site at present, additional reconnaissance is required to determine which of these sites would be most suitable in the long term.

9. RESULTS OF SIMULATION MODELLING

To predict the potential results of the various management scenarios and enhancement options described in the preceding sections, a model was used to project catches and escapements of various stocks for a forty-year period. The major fishery is the mixed pink and summer chum fishery that occurs throughout the months of July and August in the three main fishing areas. Since pink and summer chum stocks are harvested at the same time, it is appropriate to discuss these stocks as a group. The only other known mixed-stock situation involves the fishery for Kimsquit and Atnarko sockeye. Fall chums tend to be sufficiently discrete in run timing that mixed-stock fisheries are not a concern.

Two computer simulations were completed for the sockeye fishery in Area 8. The simulation of current management represents the existing management regime where Atnarko sockeye are harvested in Fitz Hugh Sound and the Bella Coola Gillnet Area, and the Kimsquit stock arrives in the Fitz Hugh fishery area about a week later. As noted earlier, it was assumed that the migration route of Kimsquit sockeye is equally distributed between Dean and Burke channels and, therefore, the Kimsquit stock is subjected to fishing pressure in the Bella Coola Gillnet Area. In the simulation of an alternative to current management the fishery in the Bella Coola Gillnet Area was assumed to be restricted to North Bentinck Arm (Option 1), thereby reducing the impact of the fishery for the Atnarko stock on Kimsquit sockeye. The results of these two scenarios are illustrated in Figures 4 to 7. In

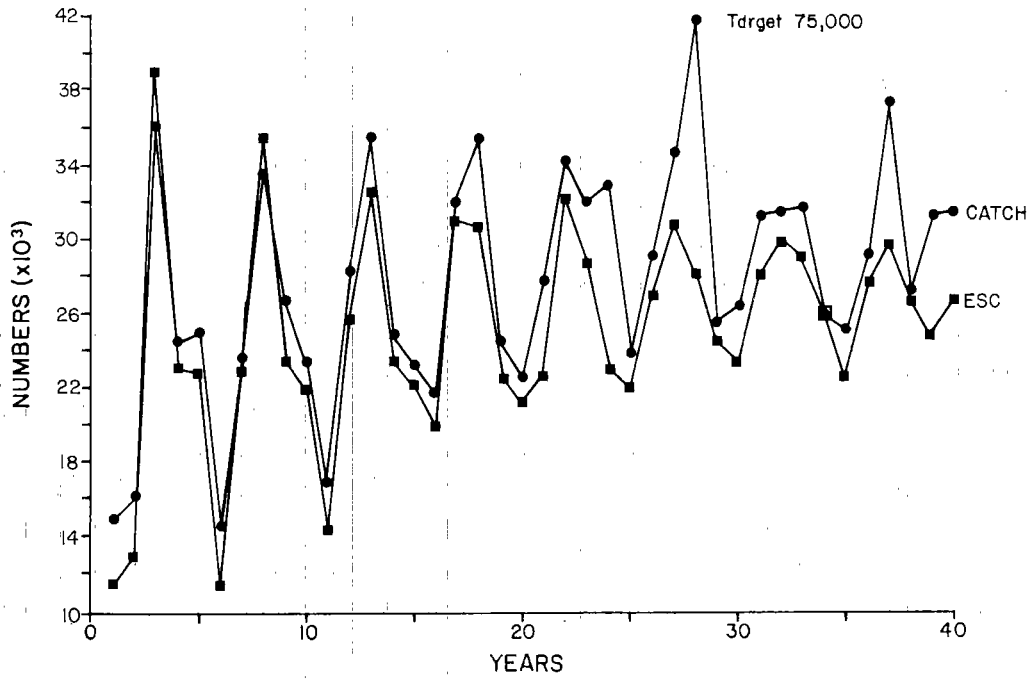


Figure 4. Projected catches and escapements of Atnarko sockeye under the current management regime.

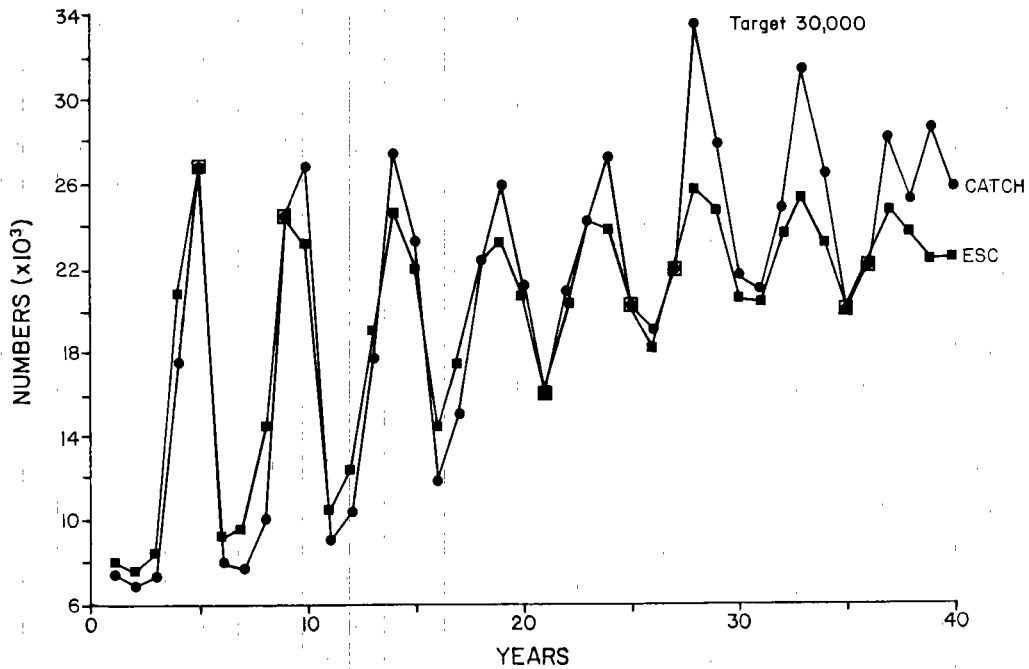


Figure 5. Projected catches and escapements of Kimsquit sockeye under the current management regime.

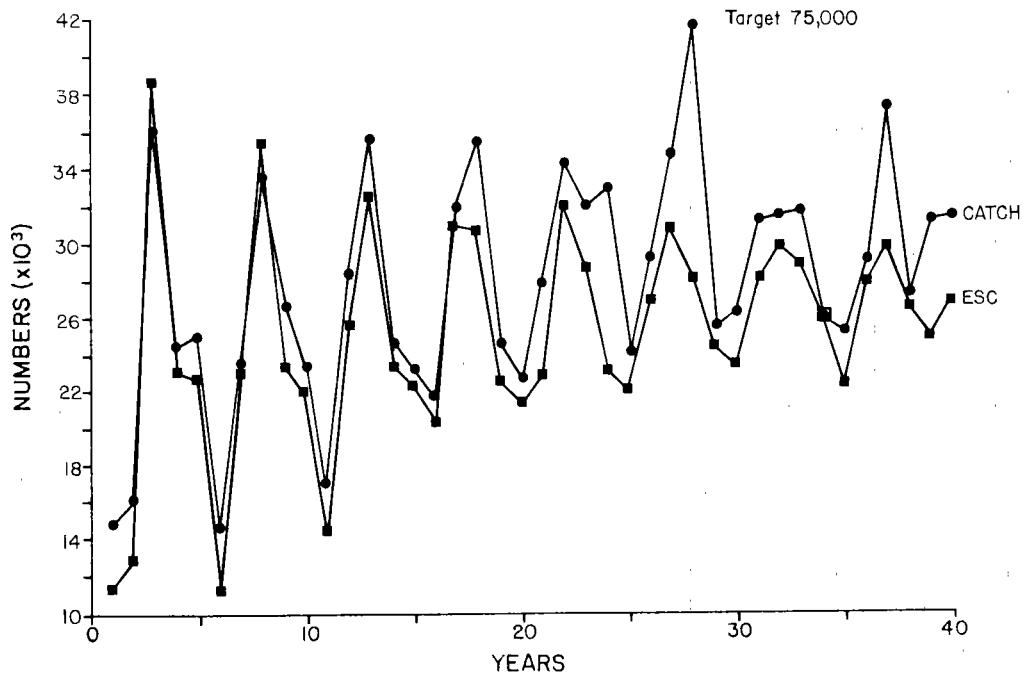


Figure 6. Projected catches and escapements of Atnarko sockeye under Option 1 (restriction of the Bella Coola gillnet fishery).

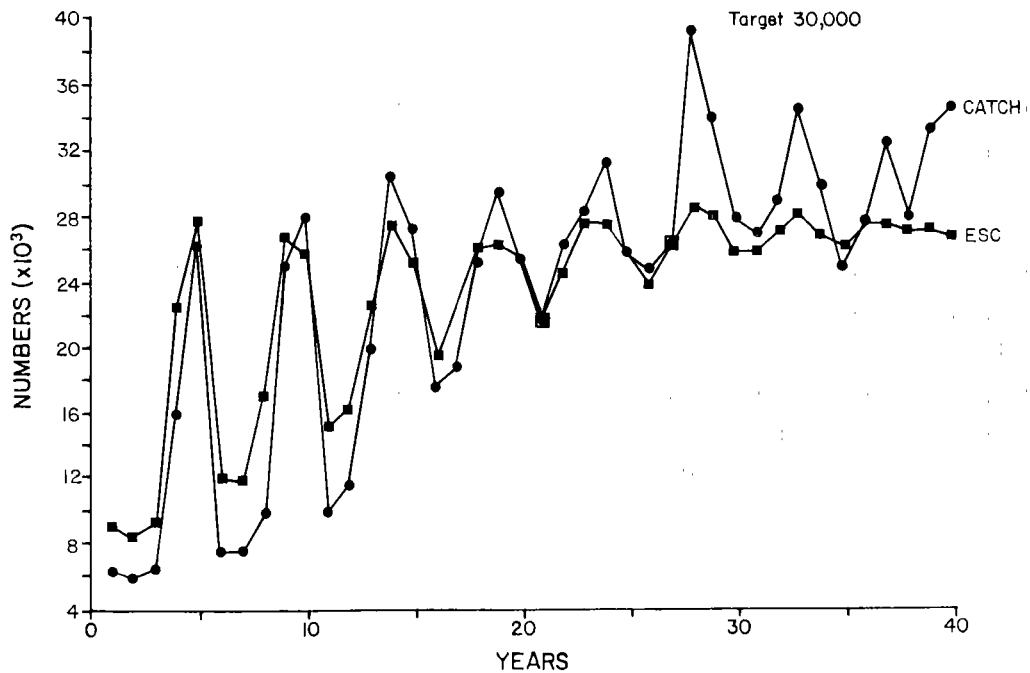


Figure 7. Projected catches and escapements of Kimsquit sockeye under Option 1 (see above).

both management regimes, the model forecasts a slow rebuilding of both sockeye stocks, with the Kimsquit stock recovering faster in Option 1. The value*, for the current management and Option 1 scenarios are \$7.6 million and \$7.9 million, respectively. The slight difference in value is due to the quicker rebuilding of Kimsquit stocks predicted for Option 1.

The Area 8 pink and chum fishery is dominated by the Atnarko pink stock. Other actively-managed stocks are Bella Coola chums, Kimsquit chums and the aggregate chum stock from the Dean Channel Closed sub-area. The remainder of the summer chums and early pinks are treated as a single group of passively-managed chum and pink stocks. To predict the possible outcome of various management and enhancement options on this group of stocks, the simulation model was run with the above stock groups in three fisheries. The fisheries modelled were the Fisher Channel/Fitz Hugh Sound mixed fishery, the Bella Coola gillnet fishery, and the Upper Dean Channel gillnet fishery.

Three fisheries management scenarios were modelled in the analysis of the pink and chum stocks. In addition, one enhancement proposal was modelled. The three management options were: (1) a simulation of current fishery management strategy in Area 8; (2) a simulation of a terminal pink fishery in the Bella Coola Gillnet Area (Section 7.4); and (3) a simulation of the proposal to restrict the Bella Coola Gillnet Area to Management Unit 8-11 in North Bentinck Arm (Section 7.4). The enhancement option examined was a simulation of the proposed Atnarko Channel incorporated into the current fishery management scenario.

The current management regime results in a value* of \$150 million. In this simulation, escapements of Atnarko pink are stable at just over 800,000, while catches fluctuate around 1.8 million. Bella Coola chum escapements are also stable at the target level and the catches are near 210,000. Kimsquit chums, Dean Closed chums, passively-managed pinks, and passively-managed chum stocks were all predicted to decline in both catch and escapement over the forty-year simulation period. The results of the current management simulations are graphically presented in Figures 8 to 13.

* "Value" is the net present value of the projected 40 years of harvest, discounted at 10% per year.

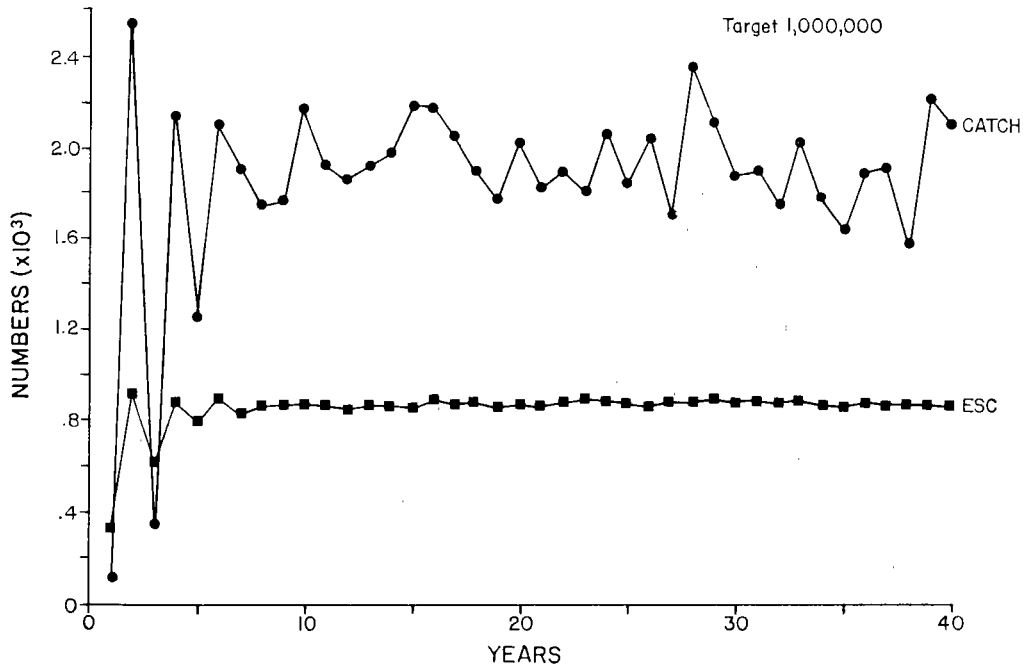


Figure 8. Projected catches and escapements of Atnarko pinks under the current management regime.

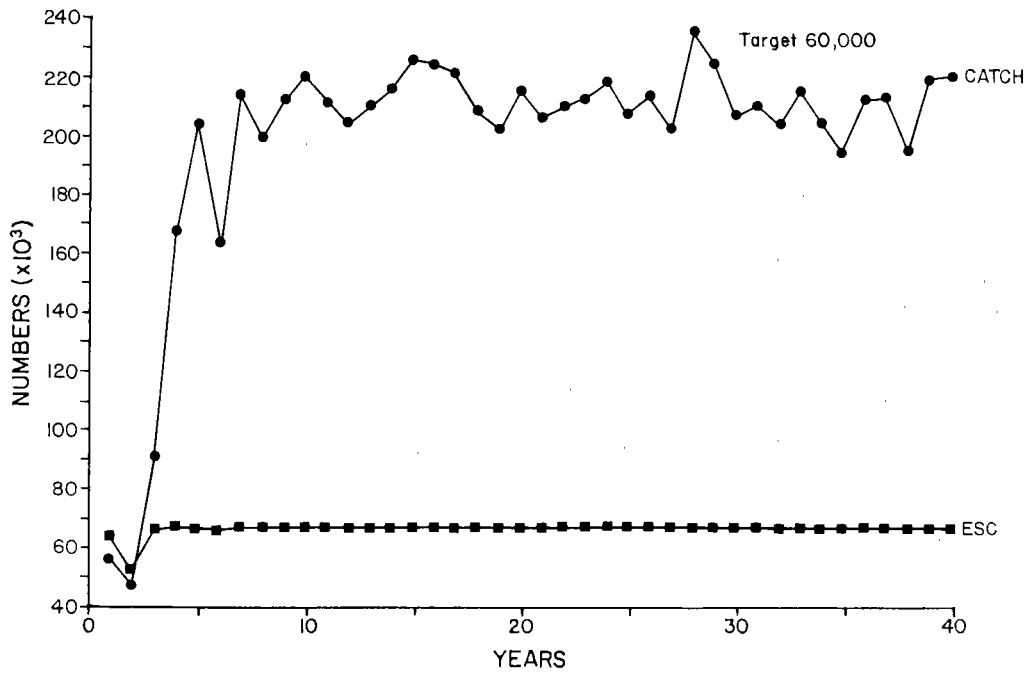


Figure 9. Projected catches and escapements of Bella Coala chums under the current management regime.

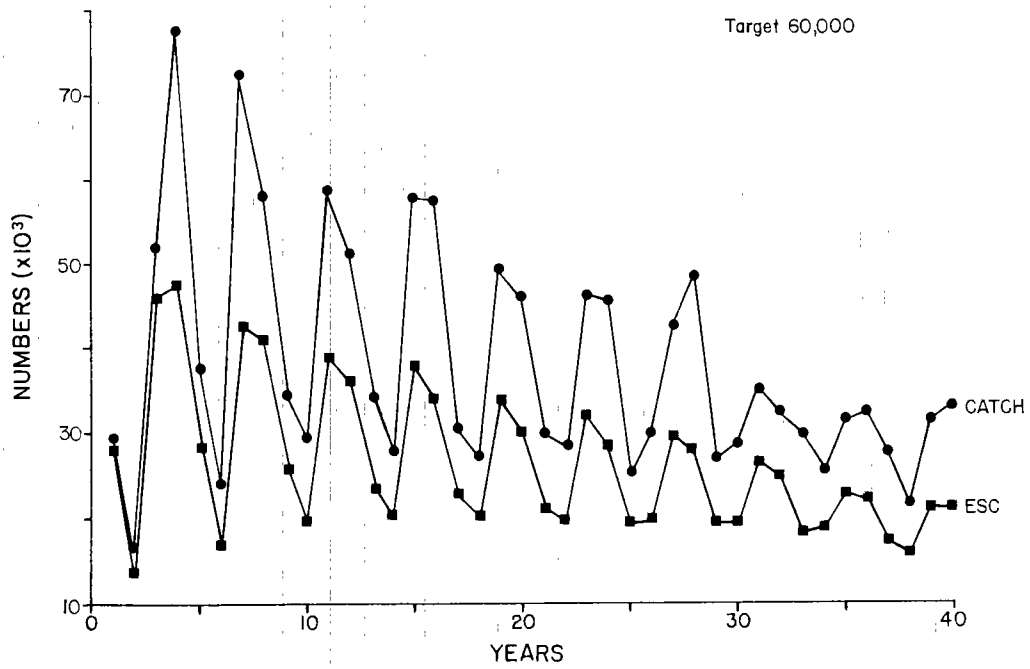


Figure 10. Projected catches and escapements of Kimsquit chums under the current management regime.

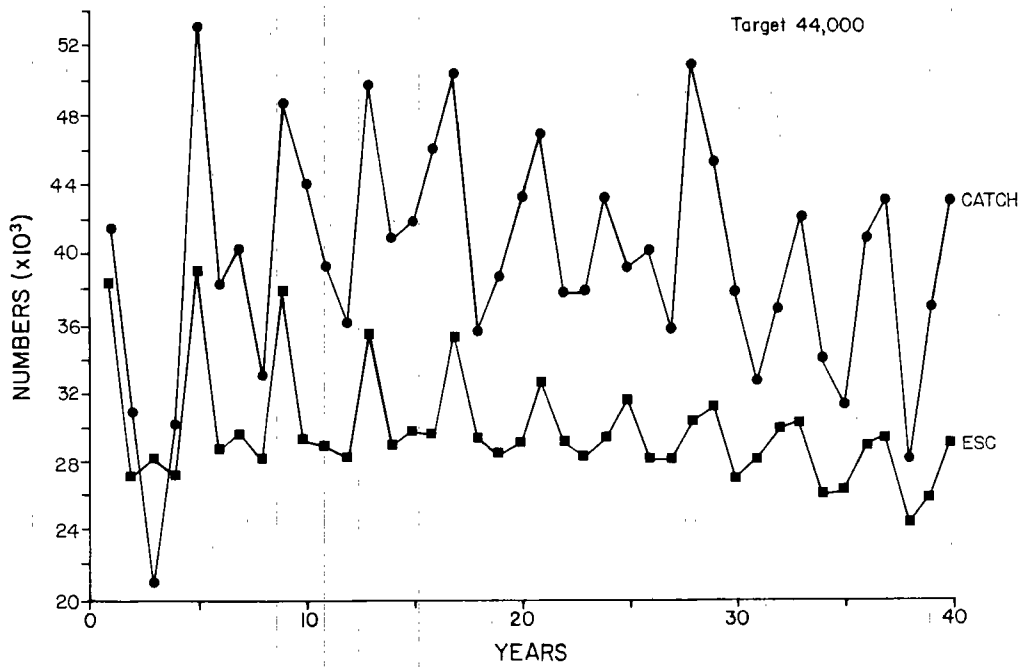


Figure 11. Projected catches and escapements of Dean Channel Closed chums under the current management regime.

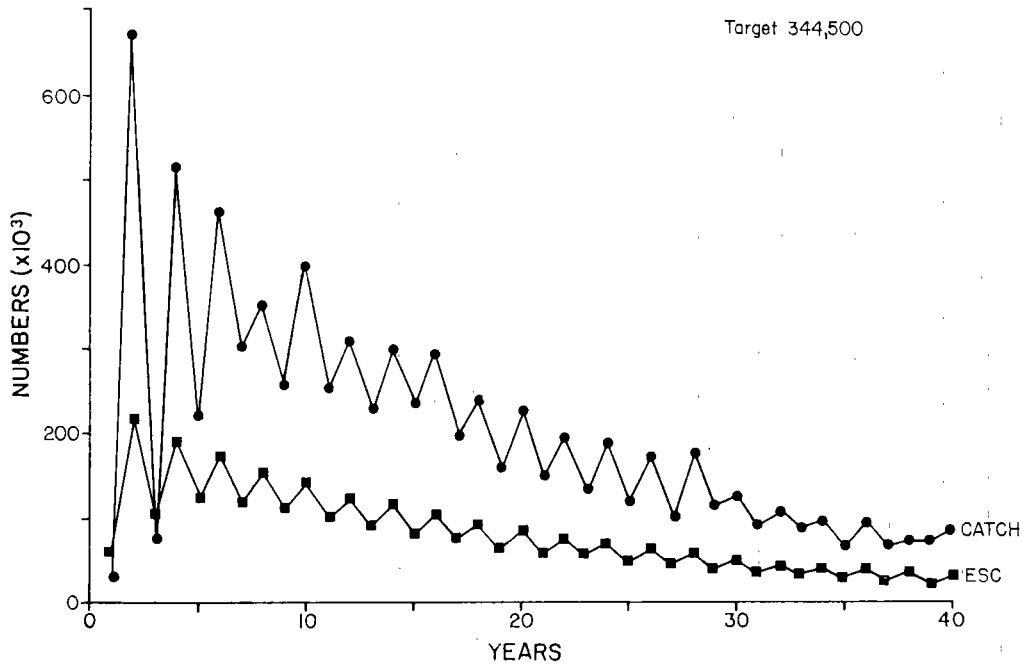


Figure 12. Projected catches and escapements of passively-managed pinks in Area 8 under the current management regime.

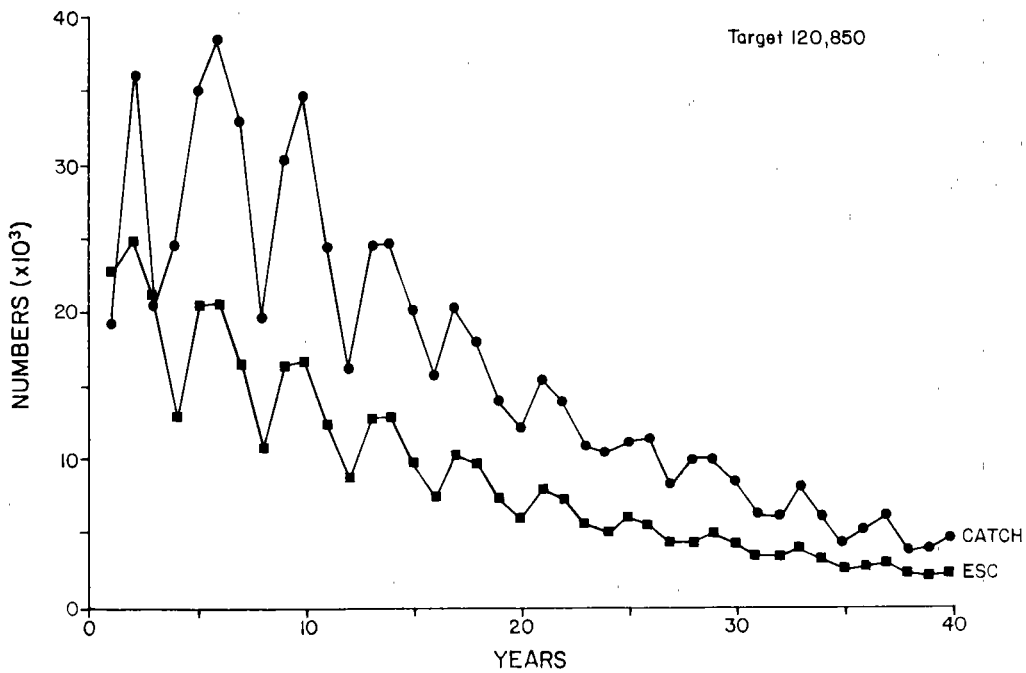


Figure 13. Projected catches and escapements of passively-managed chums in Area 8 under the current management regime.

Option 1 simulates a terminal fishery in the Bella Coola Gillnet Area for Atnarko pink. The value* of this scenario is \$149 million. The slight decrease in value can be attributed to a reduction in the quality of the harvested Atnarko pinks and a smaller catch of passively-managed pinks. This is partially offset by increased catches of Dean Closed, Kimsquit and passively-managed chums. However, the difference in value by itself is insufficient to favour either current management or Option 1. Catch and escapement trends in Atnarko pink and Bella Coola chum stocks are projected to be virtually unchanged from current management. On the other hand, Dean Closed, Kimsquit and passively-managed chums all stabilize and, in some cases, begin to rebuild in the Option 1 scenario, compared to the current management regime where they all decline. Finally, the passively-managed pink stocks exhibit a severe tendency to overescape under this management scenario. Consequently, some level of exploitation of passively-managed pinks may be necessary if the fishery directed at Atnarko pinks is moved to a more terminal area. This would likely increase exploitation of the same chum stocks that relocation of the directed Atnarko fishery was intended to protect, thereby negating any benefits achieved by moving the fishery. Catch and escapement trends projected for Option 1 are illustrated in Figures 14 to 19.

Option 2 simulates the restriction of the Bella Coola Gillnet Area chum fishery to North Bentinck Arm, which has been proposed as a method to protect any Kimsquit or passive (principally South Bentinck Arm) chums that pass through the Gillnet Area. The value* of the Option 2 scenario is \$147 million. This reduction in value from that under current management is largely attributable to the decline in fish quality expected in such a terminal area. Kimsquit chums are projected to benefit from this shift in the Bella Coola chum fishery, but there is little expected effect on the passively-managed chum stocks. All other catch and escapement trends, as illustrated in Figures 20 to 25, do not differ substantially from those under current management.

The highest value* of the above three management options is achieved in the current management scenario. In addition, despite benefits resulting from the protection of weaker stocks, both Options 1 and 2 have some constraining factors that would make either extremely difficult to implement. Therefore, the present

* "Value" is the net present value of the projected 40 years of harvest, discounted at 10% per year.

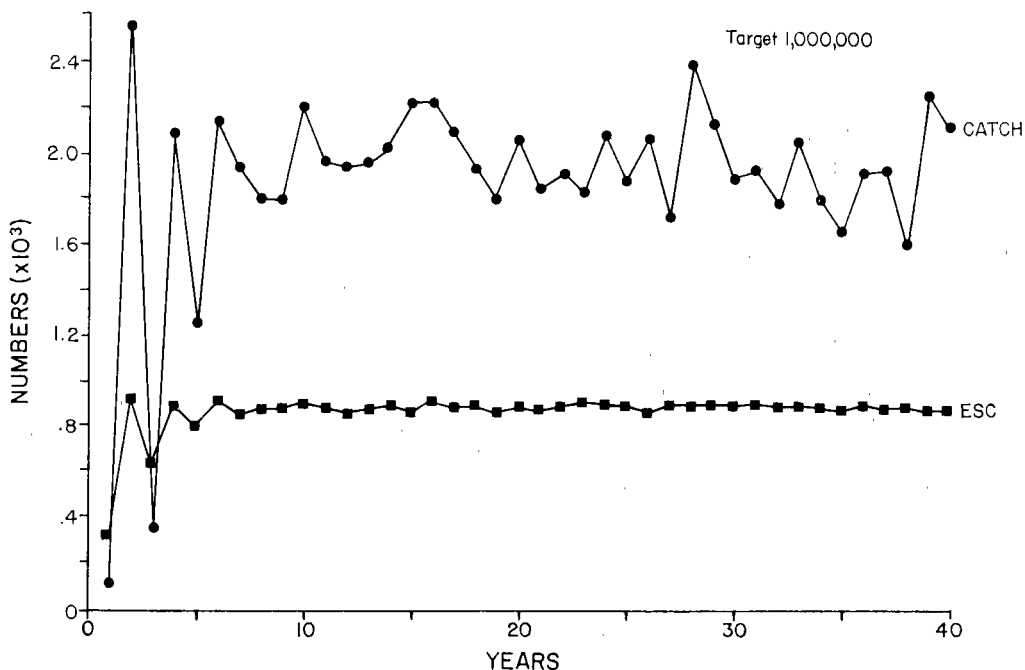


Figure 14. Projected catches and escapements of Atnarko pinks under Option 1 (a terminal fishery for Atnarko pinks in the Bella Coola Gillnet Area).

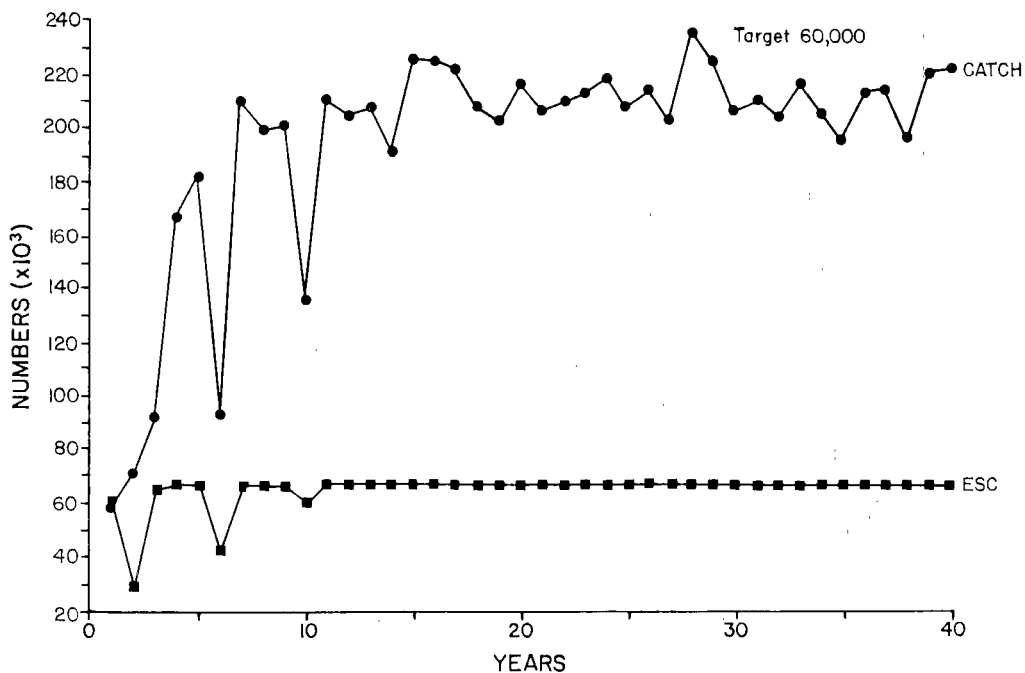


Figure 15. Projected catches and escapements of Bella Coola chums under Option 1 (see above).

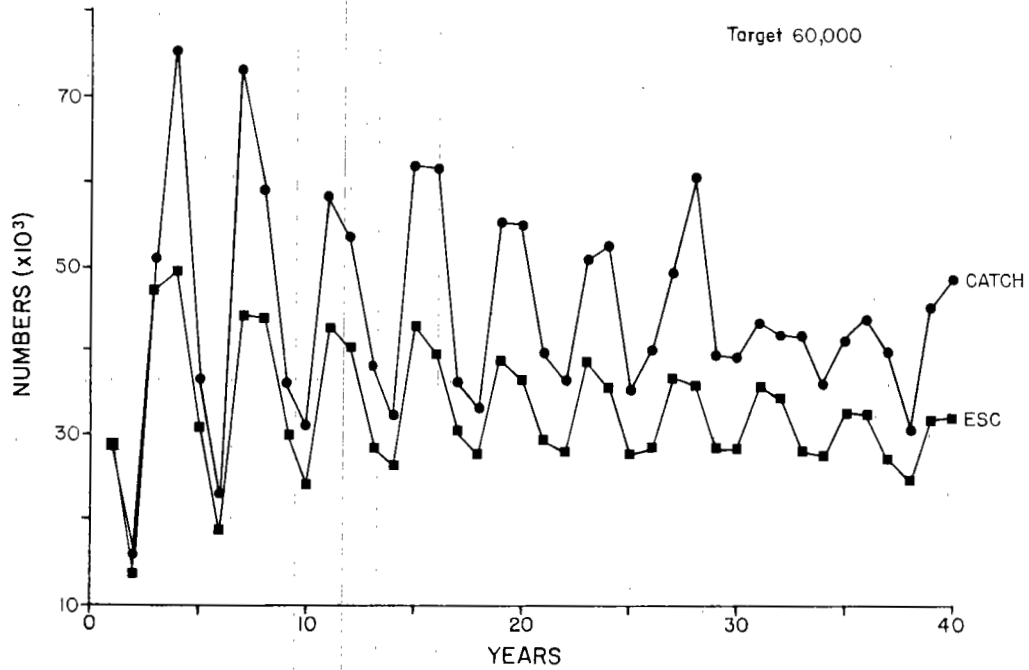


Figure 16. Projected catches and escapements of Kimsquit chums under Option 1 (a terminal fishery for Atnarko pinks in the Bella Coola Gillnet Area).

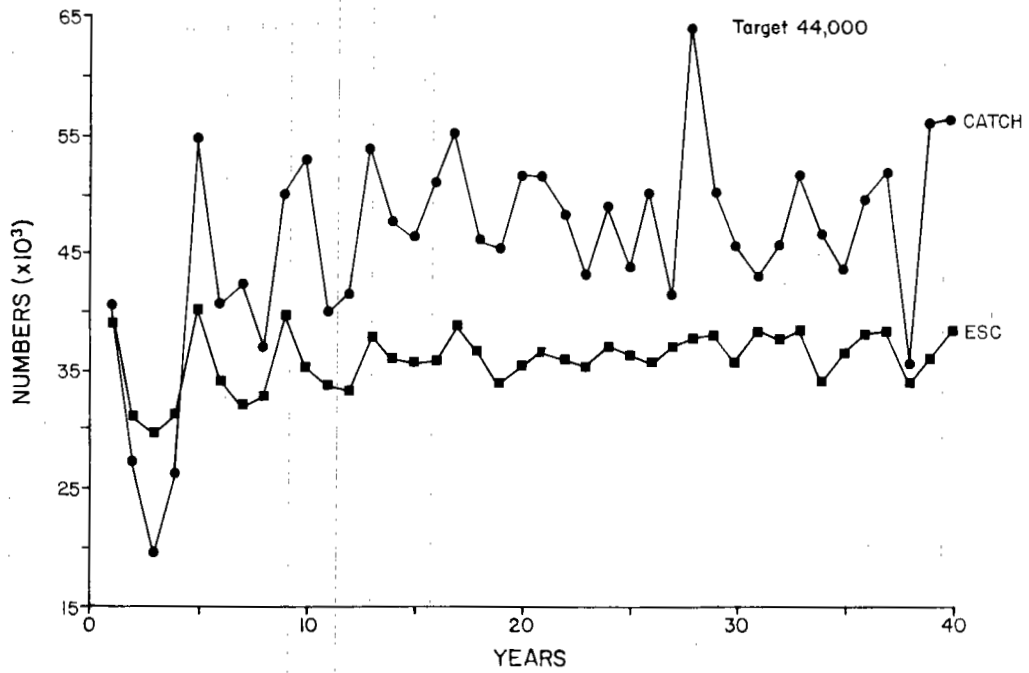


Figure 17. Projected catches and escapements of Dean Channel Closed chums under Option 1 (see above).

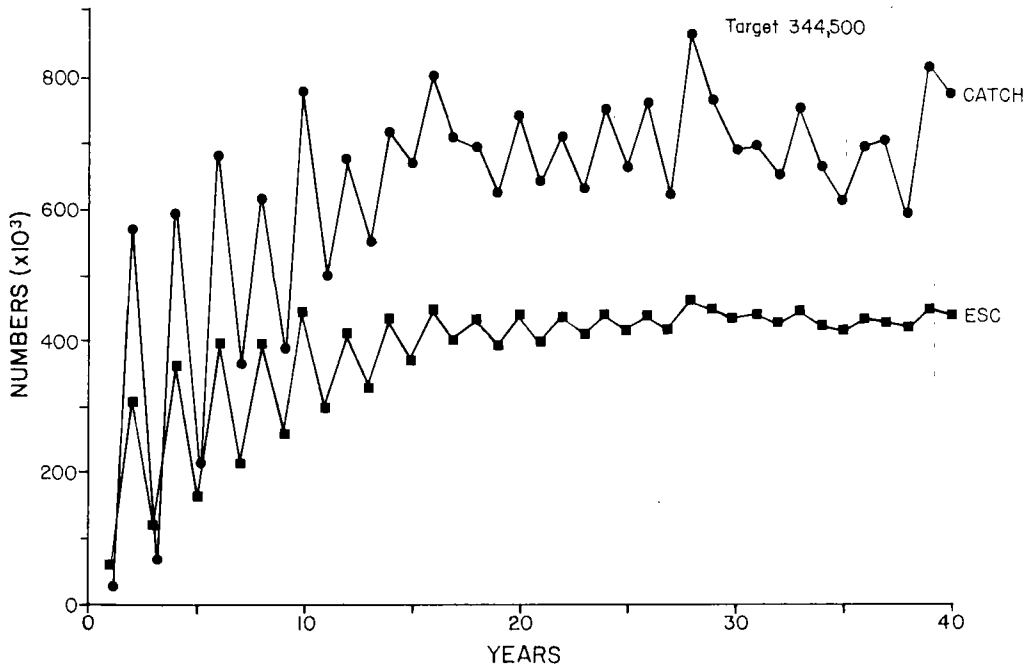


Figure 18. Projected catches and escapements of passively-managed pinks in Area 8 under Option 1 (a terminal fishery for Atnarko pinks in the Bella Coola Gillnet Area).

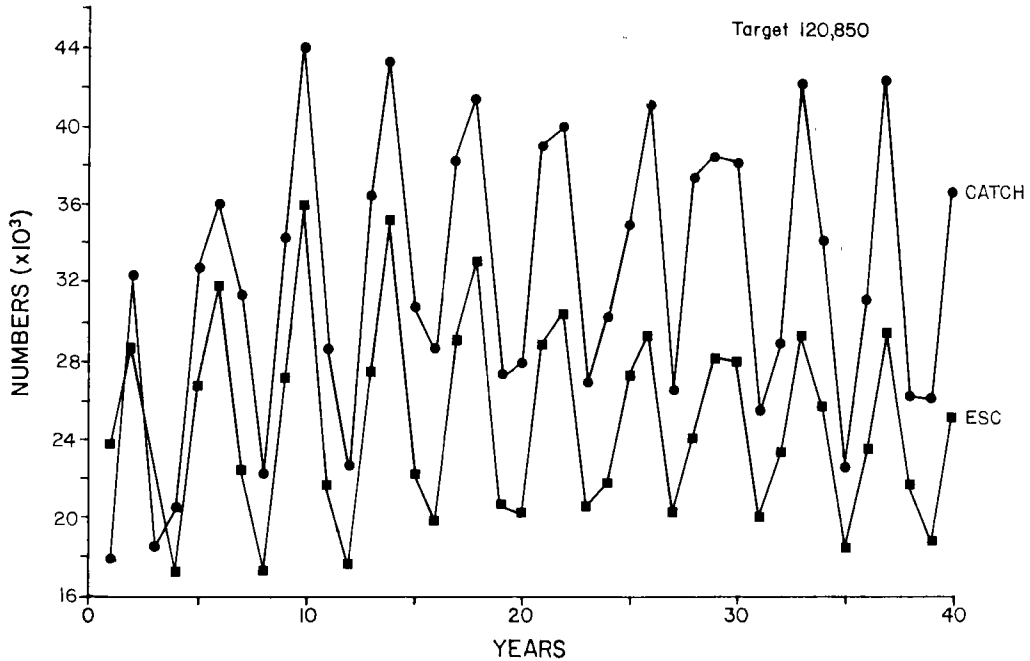


Figure 19. Projected catches and escapements of passively-managed chums in Area 8 under Option 1 (see above).

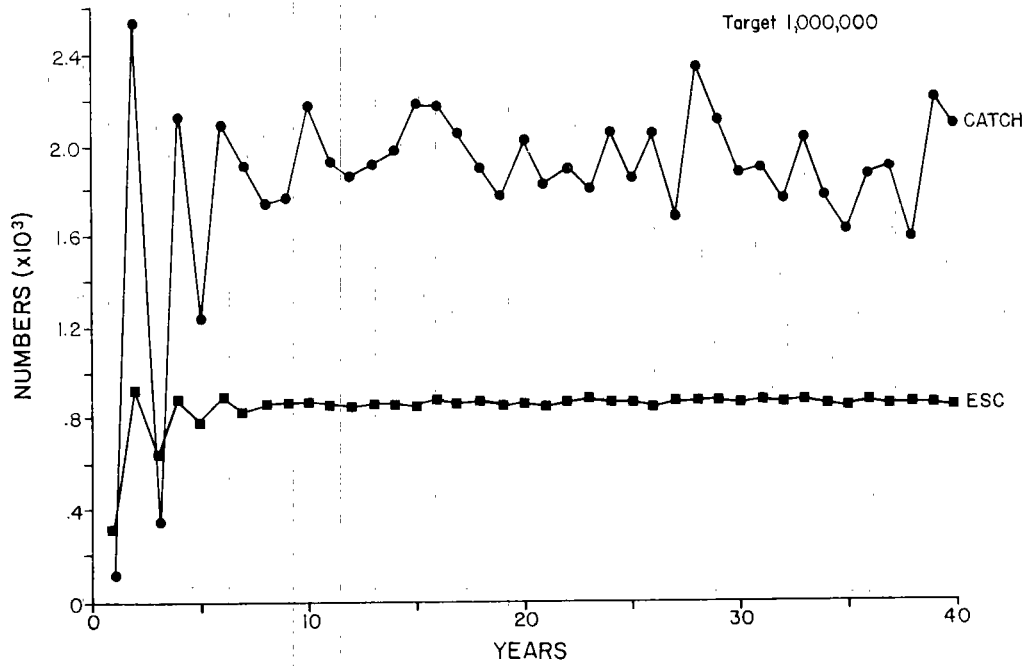


Figure 20. Projected catches and escapements of Atnarko pinks under Option 2 (restriction of Bella Coola Gillnet Area chum fishery).

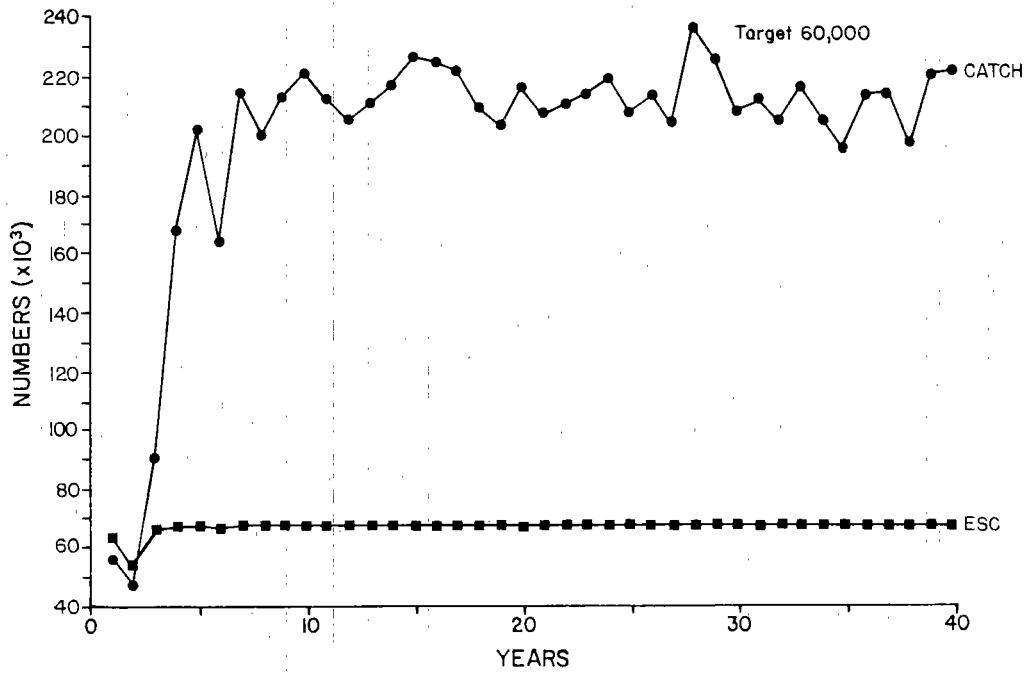


Figure 21. Projected catches and escapements of Bella Coola chums under Option 2 (see above).

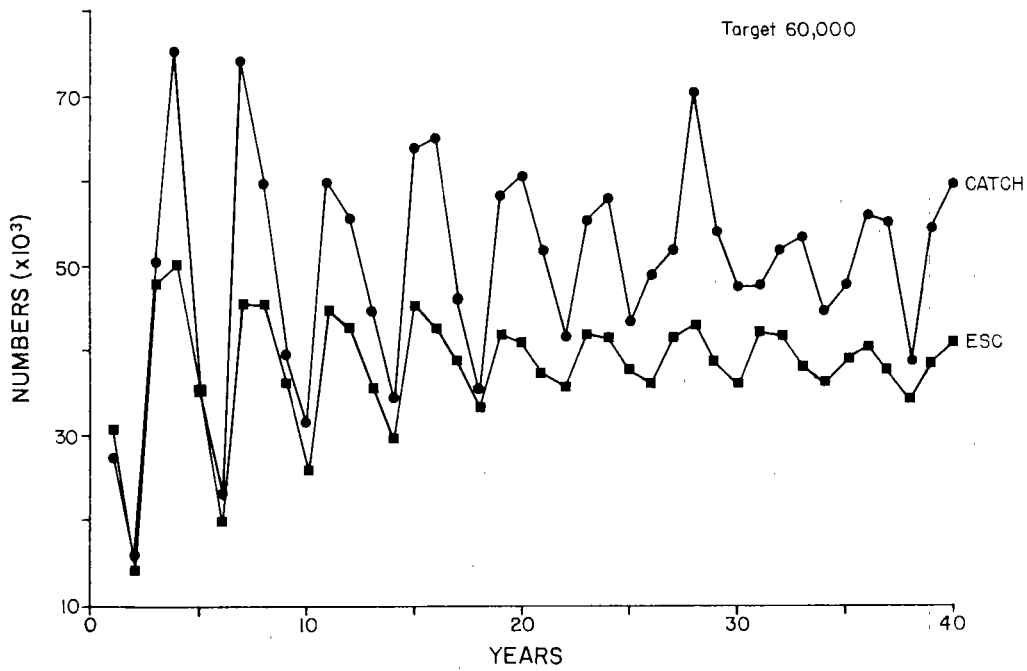


Figure 22. Projected catches and escapements of Kimsquit chums under Option 2 (restriction of Bella Cooola Gillnet Area chum fishery).

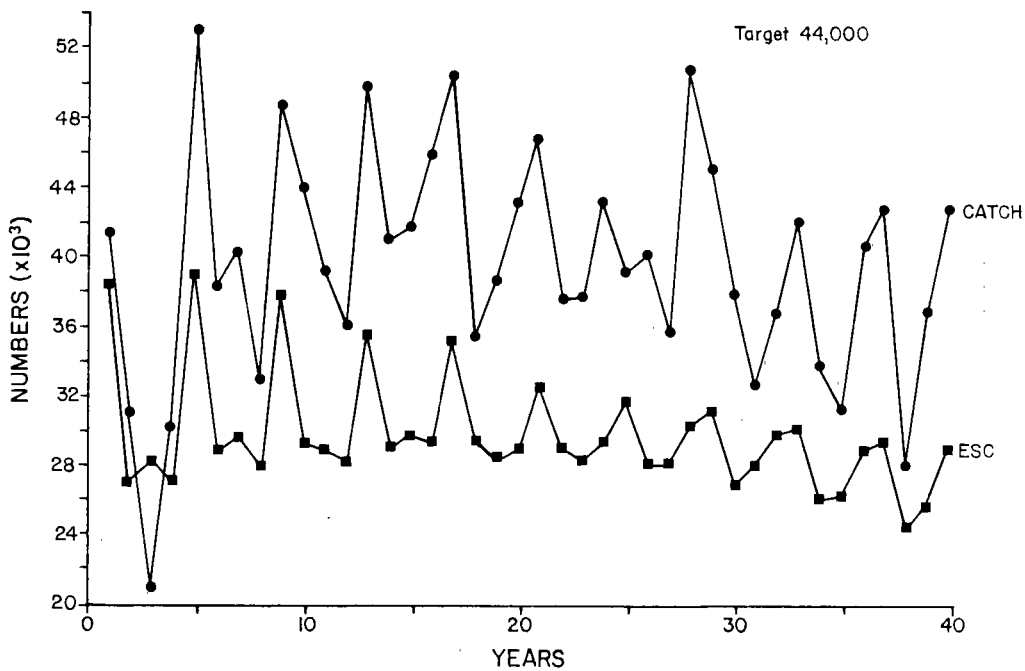


Figure 23. Projected catches and escapements of Dean Channel Closed chums under Option 2 (see above).

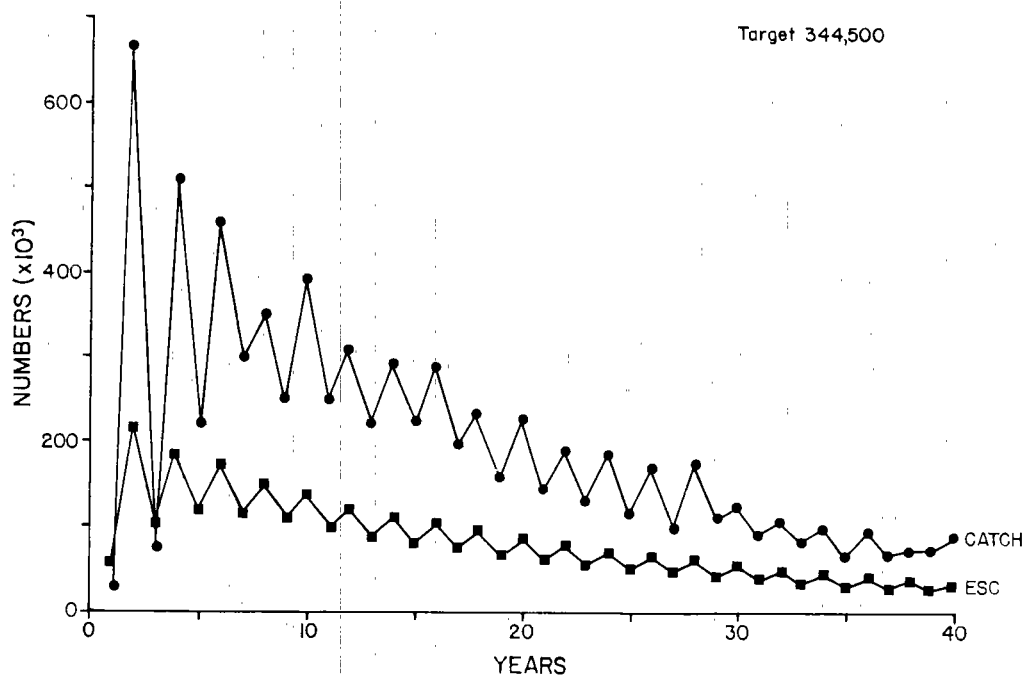


Figure 24. Projected catches and escapements of passively-managed pinks in Area 8 under Option 2 (restriction of Bella Coola Gillnet Area chum fishery).

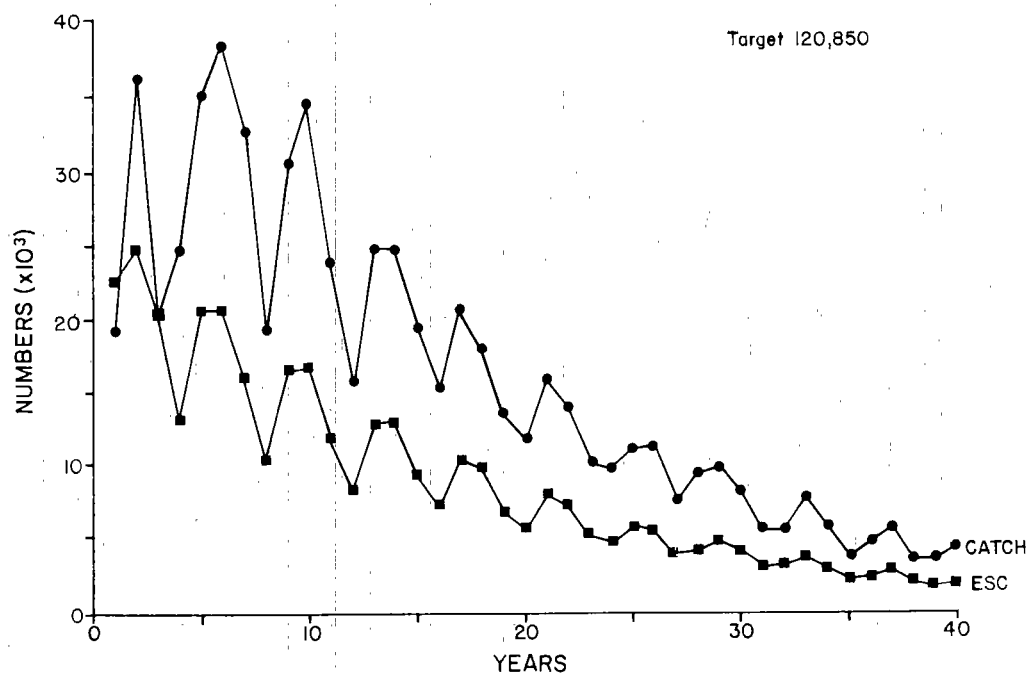


Figure 25. Projected catches and escapements of passively-managed chums in Area 8 under Option 2 (see above).

analysis provides no evidence that would encourage any major changes in the current management regime for pink and chum salmon in Area 8.

A third option which involves stabilization enhancement of Atnarko pinks was also simulated. As indicated earlier, the current fishery management regime was assumed to be in place for the purpose of this simulation. The value* of the enhanced scenario was \$158.5 million. The increase was largely due to the stabilized and slightly increased catch of Atnarko pinks. Catch and escapement trends, as illustrated in Figures 26 to 31, differ little from the current management regime. Trends for Bella Coola, Dean Channel Closed and Kimsquit chum stocks remain essentially unchanged, while the catch and escapement of Atnarko pinks are increased from the current situation.

On the other hand, passively-managed stocks of both pink and chum salmon are projected to exhibit more severe declines in the enhanced scenario than under current management. It is doubtful that these trends would actually occur, because steps could be taken in-season, in the form of area and time controls, to alleviate overharvest of these stocks.

10. SUMMARY AND CONCLUSIONS

The results of simulation modelling suggest that major departures from the current pink and chum fisheries management strategy in Area 8 appear to be unnecessary. Minor changes to protect Dean Channel Closed, Kimsquit and passive chum stocks (especially in South Bentinck Arm) should be investigated and instituted where appropriate. Because of the high value placed on sockeye, accelerating the rebuilding trend of Kimsquit sockeye by reducing the impact of other target fisheries on this stock could result in a substantial increase in net benefits.

Finally, a small spawning channel for Atnarko pinks is predicted to have a stabilizing effect on both catch and escapement, and also result in substantial increases in net benefits.

* "Value" is the net present value of the projected 40 years of harvest, discounted at 10% per year.

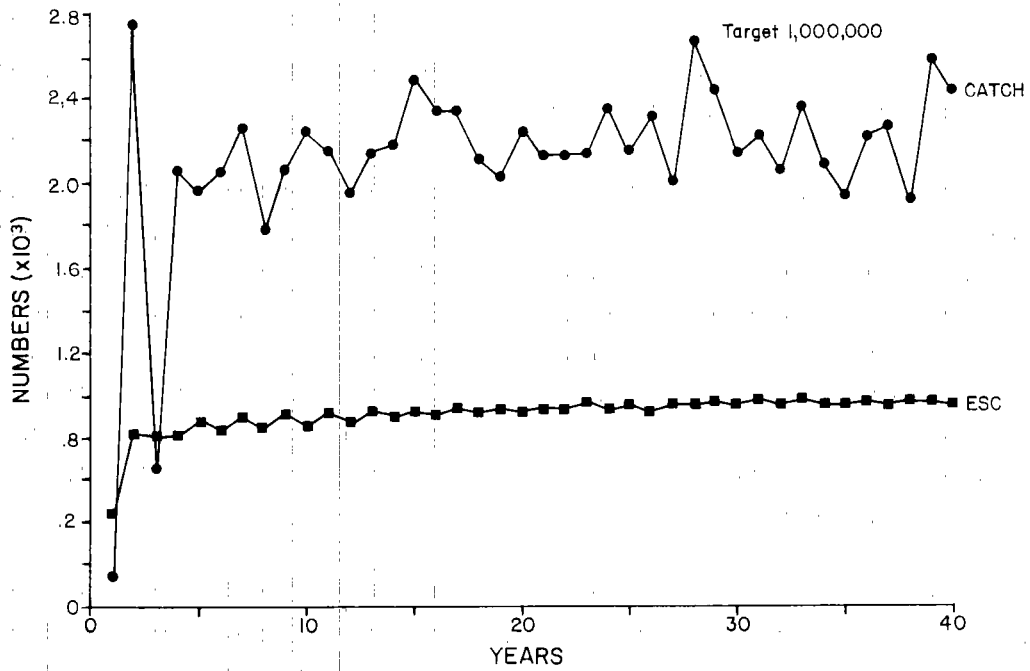


Figure 26. Projected catches and escapements of Atnarko pinks under Option 3 (stabilization enhancement of Atnarko pinks).

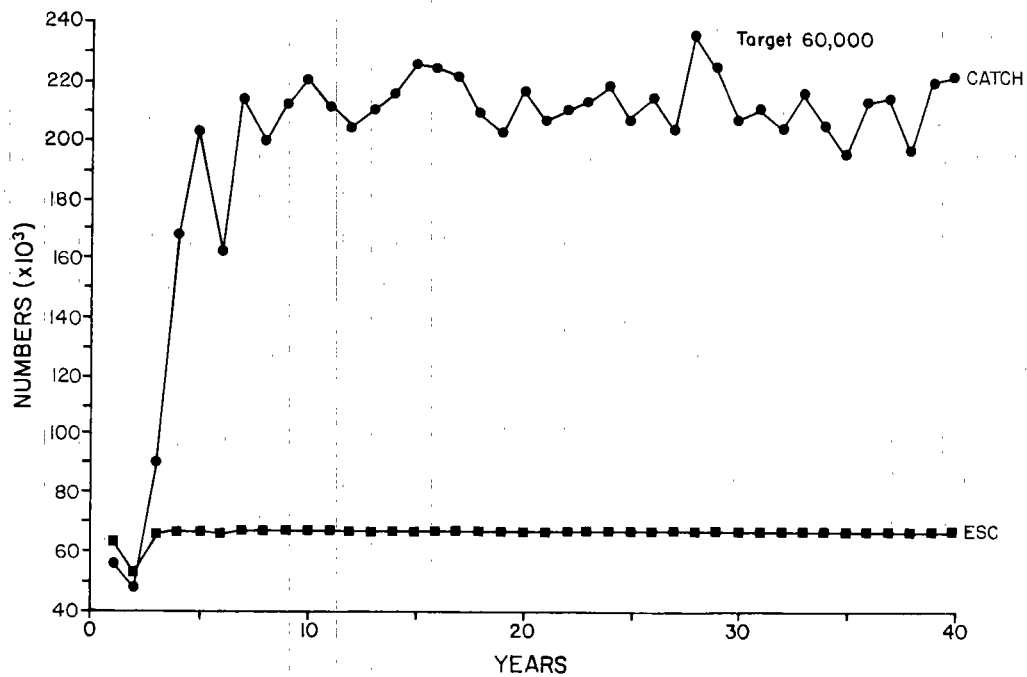


Figure 27. Projected catches and escapements of Bella Coola chums under Option 3 (see above).

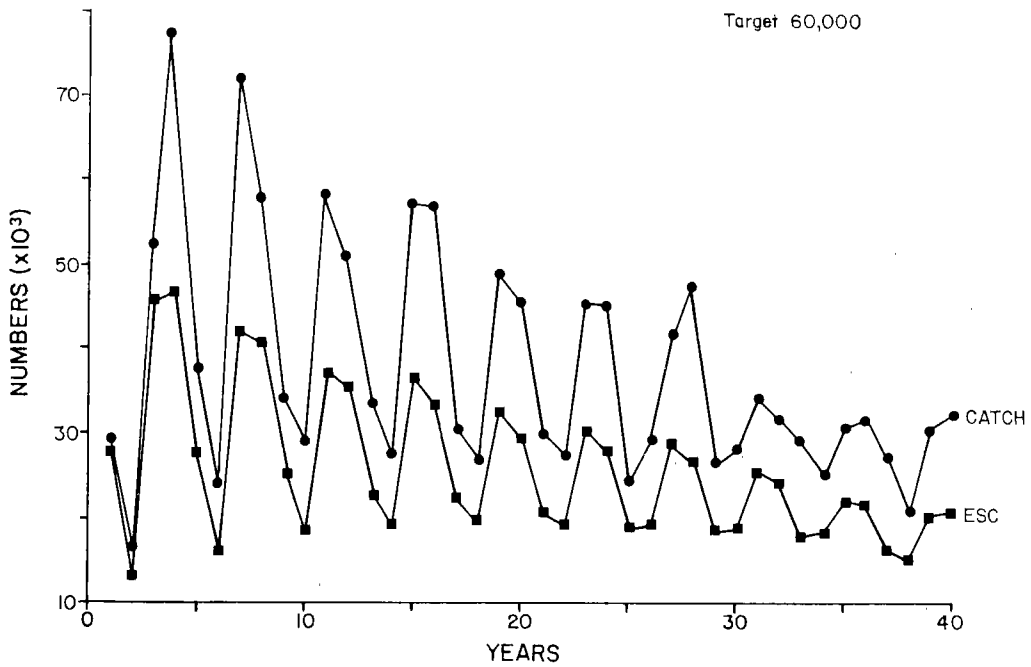


Figure 28. Projected catches and escapements of Kimsquit chums under Option 3 (stabilization enhancement of Atnarko pinks).

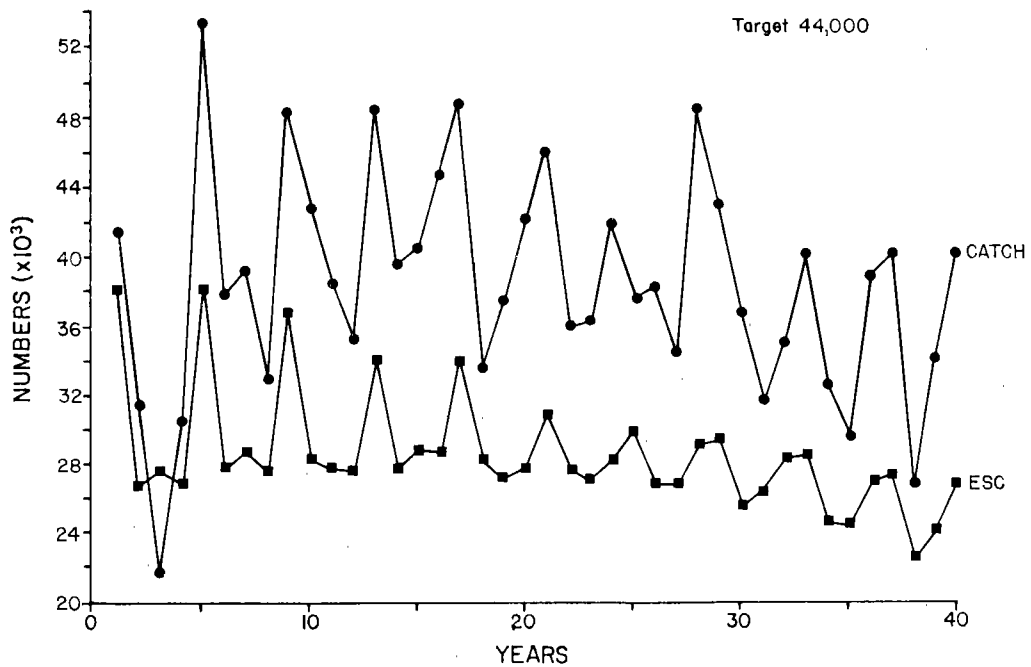


Figure 29. Projected catches and escapements of Dean Channel Closed chums under Option 3 (see above).

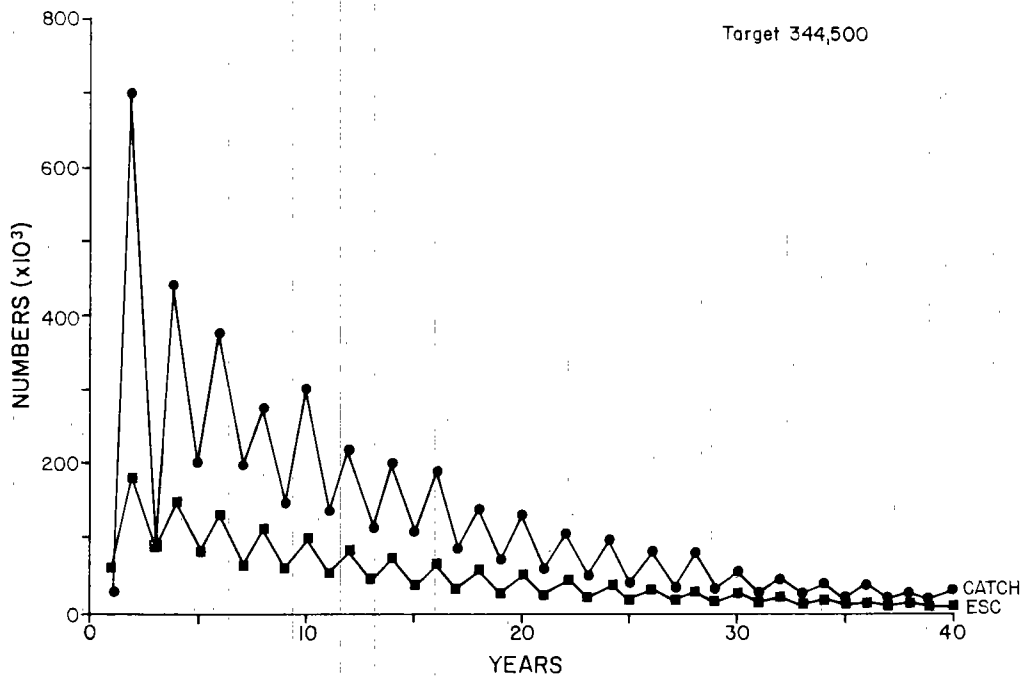


Figure 30. Projected catches and escapements of passively-managed pinks in Area 8 under Option 3 (stabilization enhancement of Atnarko pinks).

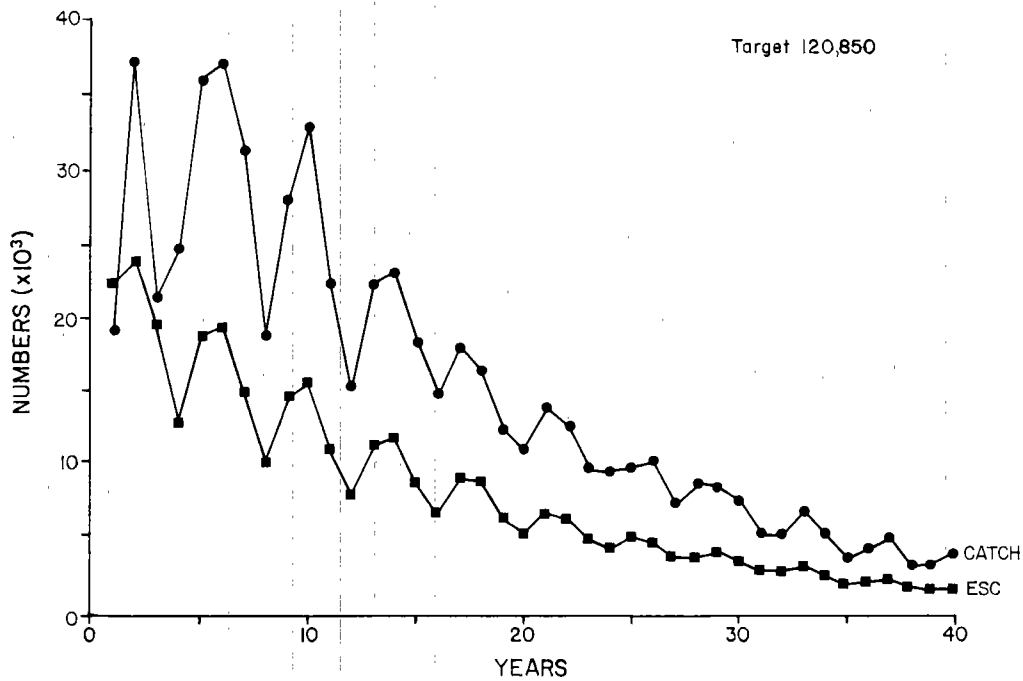


Figure 31. Projected catches and escapements of passively-managed chums in Area 8 under Option 3 (see above).

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12. 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

**PRESENT STOCK STATUS
IN STATISTICAL AREA 8**

AREA 8: BELLA COOLA

11 Oct 85

PRESENT STOCK STATUS

Stocks	Escapement			1980s	Target	Age Composition	$(\bar{x} \pm s^2)$ Rate of Return
	Ave. 1950s	Ave. 1960s	Ave. 1970s				
North Bent Inck Arm							
<u>Sockeye</u>							
Atnarko	74,800	34,400	44,050	79) 80) 81) 82) 83)	18,000 2,400 40,000 20,000 25,000	75,000	30% Age 4 70% Age 5 2.19 ± 1.09
Passive	No passive stocks			84)	45,000		
<u>Pink Even</u>							
Atnarko	220,000	1,640,000	1,160,000	80) 82)	1,000,000 150,000	1,000,000	100% Age 2 3.25 ± 4.46
<u>Pink Odd</u>							
Atnarko	345,000	352,200	233,000	81) 83)	375,000 1,100,000	1,000,000	
Passive Even/Odd 3 streams	Even	7,400	27,500	19,450/	80) (Even)	8,000	36,000
Nec leetsconnay	Odd	8,800	7,500	5,600	81) (Odd)	20,500	
Nieumlamus				82) (Even)	4,700		
Nboseneck				83) (Odd)	8,700		

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Area 8

PRESENT STOCK STATUS

Stocks	Escapement			1980s	Target	Age Composition	$(\bar{x} \pm s^2)$ Rate of Return
	Ave. 1950s	Ave. 1960s	Ave. 1970s				
<u>Chum</u>							
Bella Coola (Including Necletsconny)	57,510	39,400	46,240	80)	31,000	85,000	10% Age 3
				81)	23,000	(65,000 summer	90% Age 4
				82)	35,000	+ 20,000 fall)	
				83)	60,000		
Passive	3,000	2,000	1,100	80)	800	10,500	
Niumlamus				81)	800		
Nboseneck				82)	800		
				83)	600		
<u>South Bentinck Arm</u>							
<u>Sockeye</u>							
Passive	0	0	0	80)	H/O	50	
Asseek				81)	6		
Taleomey				82)	20		
				83)	50		
<u>Pink</u>							
Passive Even/Odd	3,245/	4,700	11,900	80) (Even)	3,025	45,500	100% Age 2
Asseek	4,300	6,500	2,600	81) (Odd)	13,000		3.25 ± 4.46
Larsö Bay				82) (Even)	2,575		
Nbeick				83) (Odd)	11,700		
Taleomey							

PRESENT STOCK STATUS

Stocks	Escapement			1980s	Target	Age Composition	$(\bar{x} \pm s^2)$ Rate of Return
	Ave. 1950s	Ave. 1960s	Ave. 1970s				
<u>Chum</u>							
(4 streams)							
Passive	6,720	1,740	2,660	80)	1,025	10% Age 3 90% Age 4	2.36 ± 1.84
Asseek				81)	1,680		
Larso Bay				82)	1,106		
Noeick				83)	4,300		
Taleomey							
<u>Upper Dean Channel</u>							
<u>Sockeye</u>							
Kimsquit River	7,533	6,600	17,050	79)	8,000	30% Age 4 70% Age 5	2.19 ± 1.09
				80)	7,500		
				81)	5,000		
				82)	12,000		
				83)	30,000		
Passive Dean	390	750	722	80)	100	1,500	
				81)	-		
<u>Pink Even/Odd</u>							
(4 streams)							
Passive	14,850	26,000	37,500	80) (Even)	18,000	100% Age 2	3.25 ± 4.46
Dean	26,355	11,700	3,480	81) (Odd)	8,450		
Deep Bay				82) (Even)	5,300		
Kimsquit River				82) (Odd)	7,550		
Skowquiltz							

PRESENT STOCK STATUS

Stocks	Escapement			1980s	Target	Age Composition	$(\bar{x} \pm s^2)$ Rate of Return
	Ave. 1950s	Ave. 1960s	Ave. 1970s				
Chum							
Kimsquit River	29,611	44,000	43,500	80)	30,000	10% Age 3 90% Age 4	2.36 ± 1.84
				81)	10,000		
				82)	40,000		
				83)	55,000		
Passive (4 streams)							
Kimsquit Bay	18,300	13,400	7,400	80)	7,350	25,100	
Skowquiltz				81)	3,200		
Dean				82)	1,210		
Deep Bay				83)	860		
Dean Channel Closed							
<u>Sockeye</u>							
Passive	0	75	37	80)	0	200	
Cascade				81)	0		
Elcho				82)	35		
				83)	25		
<u>Pink</u> (7 streams)							
Passive (Even)	44,100	34,506	17,000	80) (Even)	11,700	76,500	100% Age 2 3.25 ± 4.46
Cascade (Odd)	17,945	18,100	28,900	81) (Odd)	68,400		
Elcho Cr				82) (Even)	3,400		
Eucott Bay				83) (Odd)	38,300		
Frenchman							
Green							
Jenny Bay							
Martin							

PRESENT STOCK STATUS

Stocks	Escapement			1980s	Target	Age Composition	$(\bar{x} \pm s^2)$ Rate of Return
	Ave. 1950s	Ave. 1960s	Ave. 1970s				
<u>Chum</u> (6 streams)							
Active group	30,700	23,800	20,500	80)	40,000	44,000	10% Age 3 2.36 ± 1.84
Cascade					81)	26,350	90% Age 4
Elcho				82)	20,650		
Eucott Bay				83)	22,500		
Frenchman							
Green							
Jenny Bay							
 <u>Martin</u> (Late timing)							
	198	800	4,100	80)	3,200	15,000	
				81)	20,000		
				82)	16,000		
				83)	2,300		

PRESENT STOCK STATUS

Stocks	Escapement			1980s	Target	Age Composition	$(\bar{x} \pm s^2)$ Rate of Return	
	Ave. 1950s	Ave. 1960s	Ave. 1970s					
Burke Channel								
<u>Sockeye</u>								
Kwatna	0	200	50	80)	0	0		
				82)	N/O			
				83)	100			
<u>Pink Even/Odd</u> (3 streams)								
Passive (Even)	40,650/	67,700	84,700	80) (Even)	41,500	115,000	100% Age 2	3.25 ± 4.46
Kwatna (Odd)	61,685	44,600	64,542	81) (Odd)	104,500			
Nootum				82) (Even)	350			
Quatlana				83) (Odd)	206,000			
<u>Chum</u> (3 streams)								
Passive	25,473	13,838	16,400	80)	8,400	35,000	10% Age 3	2.36 ± 1.84
Kwatna				81)	9,050		90% Age 4	
Nootum				82)	6,000			
Quatlana				83)	5,740			

AREA 8: BELLA COOLA

11 Oct 85

PRESENT STOCK STATUS

Stocks	Escapement			1980s	Target	Age Composition	$(\bar{x} \pm s^2)$ Rate of Return
	Ave. 1950s	Ave. 1960s	Ave. 1970s				
Fisher/Fitzhugh							
<u>Sockeye</u>							
Koeye	2,695	938	4,380	80)	2,500	20,000	
				81)	5,000		
				82)	2,000		
				83)	N/I		
Passive (4 streams)							
Fish Egg Creek	6,700	2,700	4,200	80)	1,200	12,000	
Hook Nose Creek				81)	2,550		
Kisameet				82)	3,500		
Namu				83)	2,600		
<u>Pink</u>							
Koeye (even)	89,700	47,000	102,000	80)	30,000	100,000	100% Age 2
				82)	25,000		3.25 ± 4.46
Koeye (odd)	106,700	42,500	82,500	81)	100,000	As for even	
				83)	40,000		
Passive Even/Odd (6 streams)							
Evans Inlet	28,800	14,400	18,400	80) (Even)	15,500	30,000	
Hook Nose	4,349	3,000	15,500	81) (Even)	4,100		
Kilitik				80) (Odd)	46,500		
Kisameet				82) (Odd)	8,000		
Namu							
Sagar							

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Area 8

PRESENT STOCK STATUS

Stocks	Escapement			1980s	Target	Age Composition	$(\bar{x} \pm s^2)$ Rate of Return
	Ave. 1950s	Ave. 1960s	Ave. 1970s				
Fisher/Fitzhugh (cont'd)							
<u>Chum</u>							
Passive	16,700	9,000	10,400	80)	1,700	29,000	10% Age 3 2.36 ± 1.84
Evans Inlet				81)	13,010		90% Age 4
Hock Nose				82)	8,500		
Klittik Cove				83)	3,545		
Klismet							
Koeye							
Namu							
Sagar							

APPENDIX II

**CURRENT FISHING PATTERNS
IN STATISTICAL AREA 8**

CURRENT FISHING PATTERNS IN AREA 8

FISHING WEEK	TARGET STOCK(S) <Tail End of Run >Peak Week	INCIDENTAL CATCH (Assume Pink Incidental Catch Is by SN Only)	STANDARD FISHING AREAS	GEAR	PRIMARY MANAGEMENT CONSIDERATIONS
June 24-30	None	None	None	None	I.F.F. catches off Koeye and in Bella Coola River
July 1-7	>Sockeye Atmarko	Chinook Atmarko	8-3,4,8-10,11,12,15	GN	I.F.F. catches Bella Coola
	<Sockeye Kimsquit	Chinook Atmarko Chinook Dean Sockeye Atmarko	8-5,8-8	GN	Catch data Bella Coola GN Fisher-Fitz GN Dean Channel GN
July 8-14	<Sockeye Atmarko	Chinook Atmarko Sockeye Kimsquit Pink Atmarko Chum Bella Coola Chum Kimsquit	8-3,4,8-10,11,12,15	GN	I.F.F. catches Bella Coola River Fisher GN (Bella Coola) Catch data Bella Coola GN
	Sockeye Kimsquit	Chinook Atmarko Sockeye Kimsquit Pink Atmarko Chum Bella Coola Chum Kimsquit	8-5, 8-8	GN	Catch data Dean GN Fisher GN Charter test fishery data

CURRENT FISHING PATTERNS IN AREA 8

FISHING WEEK	TARGET STOCK(S) <Tail End of Run >Peak Week	INCIDENTAL CATCH (Assume Pink Incidental Catch Is by SN Only)	STANDARD FISHING AREAS	GEAR	PRIMARY MANAGEMENT CONSIDERATIONS
July 15-21	<Sockeye Atnarko	Sockeye Kimsquit Pink Atnarko Chum Bella Coola Chum Kimsquit	8-10,11,12,15	GN	Catch data I.F.F. Catch in Bella Coola
	>Sockeye Kimsquit	Sockeye Atnarko Pink Atnarko Chum Bella Coola Chum Kimsquit	8-8,8-5	GN	Catch data Dean Channel Charter test fishing data
	Pink Atnarko (<< even) (no odds)	Sockeye Atnarko Sockeye Kimsquit Chum Bella Coola Chum Kimsquit	8-3,4	GN,SN	Catch data SN Fitzhugh-Hakai Area 7 fishery Seaforth SN
	<<Chum Bella Coola	Sockeye Kimsquit Pink Atnarko	8-3,4	GN,SN	Catch data Proportion hatchery fish

CURRENT FISHING PATTERNS IN AREA 8

FISHING WEEK	TARGET STOCK(S) <Tail End of Run >Peak Week	INCIDENTAL CATCH (Assume Pink Incidental Catch 1s by SN Only)	STANDARD FISHING AREAS	GEAR	PRIMARY MANAGEMENT CONSIDERATIONS
July 22-28	Pink Atmarko (even) (<odd)	Chum Bella Coola Chum Kimsquit	8-10,15	GN	Expectations Catch data
		Chum Bella Coola Chum Kimsquit	8-3,4,5	GN,SN	
	Chum Bella Coola	Pink Atmarko Chum Kimsquit	8-3,4	GN,SN	Expectations Catch data Escapement Bella Coola
		Chum Kimsquit	8-10,15	GN	Proportion hatchery fish
	Chum Kimsquit	Pink Atmarko Chum Bella Coola	8-5 8-8	GN,SN	Expectations Catch data Charter test fish data
		Chum Bella Coola		GN	
July 29-Aug. 4	Pink Atmarko (>even) (odd)	Chum Bella Coola Chum Kimsquit	8-2,3,4,5	GN,SN	Catch data
		Chum Bella Coola Chum Kimsquit	8-10,15	GN	
	>Chum Bella Coola	Pink Atmarko Chum Kimsquit	8-3,4	GN,SN	Catch data Proportion hatchery fish Escapement Bella Coola River Quality data
		Chum Kimsquit	8-10,15	GN	

CURRENT FISHING PATTERNS IN AREA 8

FISHING WEEK	TARGET STOCK(S) <Tail End of Run >Peak Week	INCIDENTAL CATCH (Assume Pink Incidental Catch Is by SN Only)	STANDARD FISHING AREAS	GEAR	PRIMARY MANAGEMENT CONSIDERATIONS
July 29-Aug. 4 (cont'd)	>Chum Kimsquit	Pink Atnarko Chum Bella Coola Chum Dean Closed	8-5	GN,SN	Quality data Charter test fish data
		Chum Bella Coola Chum Dean Closed	8-8	GN	
Aug. 5-11	Pink Atnarko (<even) (>odd)	Chum Bella Coola Chum Kimsquit Chum Dean Closed	8-3,4,5 (odd)	GN,SN GN	Catch data Quality (even) Atnarko tower count (even)
		Chum Bella Coola Chum Kimsquit Chum Dean Closed	8-10,15	GN	
	Chum Bella Coola	Pink Atnarko Chum Kimsquit Dean Closed	8-3,4	GN,SN	Catch data Proportion hatchery fish Escapement data Quality
		Chum Kimsquit Chum Dean Closed	8-10,15	GN	
	Chum Kimsquit	Pink Atnarko Chum Bella Coola Chum Dean Closed	8-5	GN,SN	
		Chum Bella Coola Chum Dean Closed	8-8	GN	
	Chum Dean Closed	Chum Kimsquit	8-5	GN,SN	

CURRENT FISHING PATTERNS IN AREA 8

FISHING WEEK	TARGET STOCK(S) <Tail End of Run >Peak Week	INCIDENTAL CATCH (Assume Pink Incidental Catch Is by SN Only)	STANDARD FISHING AREAS	GEAR	PRIMARY MANAGEMENT CONSIDERATIONS
Aug. 12-18	Pink Atmarko (<odd)	Chum Bella Coola Chum Kimsquit	8-10,15	GN	Catch data Atmarko tower counts
	Pink Koeye	Chum Dean Closed	8-2,4,16 (8-3 if increased exploitation required)	GN,SN	Expectation Fish quality information in Fitzhugh catches
	<Chum Bella Coola	Pink Atmarko Chum Kimsquit	8-10,15	GN	Escapement data Catch data Proportion hatchery fish
	>Chum Dean Closed		8-5	GN,SN	Expectations, escapement Catch data
Aug. 19-25	Chum Dean Closed	Pink Koeye Coho Area 8	8-5 (8-4 if increased exploitation required)	GN,SN	Catch data Escapement data
Aug. 25-Sept. 1	None	None	None	None	Fish only if strong late run of summer chums and/or strong early run of fall chums
Sept. 2-8	<Chum Bella Coola (fall)	Coho Area 8	8-10,15 8-4?	GN	Expectations Catch data Quality
	<Chum Martin	Local Coho	8-5	GN	Catch data Presence of fish in Cousins Inlet

CURRENT FISHING PATTERNS IN AREA 8

FISHING WEEK	TARGET STOCK(S) <Tail End of Run >Peak Week	INCIDENTAL CATCH (Assume Pink Incidental Catch Is by SN Only)	STANDARD FISHING AREAS	GEAR	PRIMARY MANAGEMENT CONSIDERATIONS
Sept. 9-15	>Chum Bella Coola (fall)	Local Coho	8-10,15	GN	Escapement data Catch data coho
	>Chum Martin	Local Coho	8-5	GN	Escapements Catch coho
Sept. 16-22	None	None	None	None	Only fish this week if escapement met for fall chums; otherwise closed

APPENDIX III

**HABITAT STATUS
IN STATISTICAL AREA 8**

INTRODUCTION

The habitat information tables were prepared by Howard Paish and Associates under contract to the Department of Fisheries and Oceans. Each table summarizes habitat status for one species in one Sub-area (e.g., Rivers Inlet Sockeye, Gardner Canal Pink, Cumshewa Chum). These sub-area summaries form the basis for the Habitat Overview in the Salmon Stock Management Plan.

The purpose of the Habitat Overview is to link stock and escapement information to information on habitat status and development. Each table has five sections:

1. Stock Group
2. Stock Data
3. Management Style
4. Habitat Notes
5. Summary

The Stock Group section identifies the stock or group of stocks by species and management unit covered in the table. The Stock Data section summarizes current, target, and maximum recorded escapements in an attempt to link stock status, (current escapement) to habitat status and potential (target and maximum recorded escapements). The Management Style Section indicates whether the stock is actively or passively managed.

The Habitat Notes describe the historic and current status of habitat and the future outlook. This information facilitates interpretation of the Stock Data linking actual and potential stock production to habitat status. The production potential of the natural habitat, and of only improved habitat are also indicated. Source materials for the Habitat Notes are given in parentheses and elaborated upon in the Data Source sheets that follow the tables.

The Summary section contains subjective gradings of habitat in terms of ability to achieve current targets, current status and future outlook, and the production potential from natural and improved habitat.

HABITAT INFORMATION TABLE

STOCK GROUP		North Bentinck Sockeye			Area 8	
STOCK DATA	Maximum Recorded Escapement	Target/Optimum Escapement	Current Average Escapement	MANAGEMENT STYLE	Active	X
					Passive	
Thousands	150	75	27		No. of Streams	1
					No. of Significant Streams	1

(100 % of MRE)

HABITAT NOTES

Bella Coola - Atnarko System.

Historic Status	Natural flow instability, aggravated by logging. Logged since 1950's with moderate impacts, including siltation and scouring. Settlement activity and diking in Bella Coola River Valley. Important sport and native fisheries. Sockeye rearing habitat not seriously affected by development.(P)
Current Status	Logging has probably peaked. (P) Other development stable; probably continued diking. (P)
Future Outlook	Modest increase in development in Bella Coola Valley. (P) Sockeye rearing habitat probably unaffected. (P) Natural regeneration of logged areas. (P)
Natural Habitat Production Potential	
Improved Production Potential	

SUMMARY

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

HABITAT INFORMATION TABLE

STOCK GROUP	North Bentinck Chinook			Area 8	
<u>STOCK DATA</u>	Maximum Recorded Escapement	Target/Optimum Escapement	Current Average Escapement	<u>MANAGEMENT STYLE</u>	Active _____
					Passive <u>X</u>
Thousands	35	25	7		No. of Streams <u>1</u>
					No. of Significant Streams <u>1</u>
					(100 % of MRE)

HABITAT NOTES

Atnarko River.

Historic Status	Natural flow instability, aggravated by logging. Logged since 1950's with moderate impacts, including siltation and scouring. Settlement activity and diking in Bella Coola River Valley. Limited development at chinook spawning areas. Important sport and native fisheries.
Current Status	Hatchery at Snootli Creek for chum and chinook. Logging has probably peaked. (P) Other development stable; probably continued diking. (P)
Future Outlook	Modest increase in development in Bella Coola Valley. (P) Natural regeneration of logged areas. (P)
Natural Habitat Production Potential	
Improved Production Potential	

SUMMARY

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

Habitat does not account for stock decline. (P)

HABITAT INFORMATION TABLE

STOCK GROUP		North Bentinck Coho		Area 8	
STOCK DATA	Maximum Recorded Escapement	Target/Optimum Escapement	Current Average Escapement	MANAGEMENT STYLE	Active
	Thousands	82	83	13.5	
					No. of Streams <u>3</u>
					No. of Significant Streams <u>3</u>
(100 % of MRE)					

HABITAT NOTES

Historic Status	Natural flow instability, aggravated by logging. Logged since 1950's with moderate impacts, including siltation and scouring. Logging has probably had a disproportionate impact on coho habitat. (P) Settlement activity and diking in Bella Coola River Valley. Important sport and native fisheries.
Current Status	Logging has probably peaked. (P) Other development stable; probably continued diking. (P)
Future Outlook	Modest increase in development in Bella Coola Valley. (P) Natural regeneration of logged areas. (P)
Natural Habitat Production Potential	
Improved Production Potential	Small scale restoration. (P)

SUMMARY

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

Habitat does not account for stock decline. (P)

HABITAT INFORMATION TABLE

STOCK GROUP		North Bentinck Chum		Area 8	
STOCK DATA	Maximum Recorded Escapement	Target/Optimum Escapement	Current Average Escapement	MANAGEMENT STYLE	Active 75%
					Passive 25%
Thousands	113	95	3.8		No. of Streams 4
					No. of Significant Streams 3
					(99 % of MRE)

HABITAT NOTES

Dominated by Bella Coola River (90% of MRE).

Historic Status	Natural flow instability, aggravated by logging. Logged since 1950's with moderate impacts, including siltation and scouring. Settlement activity and diking in Bella Coola River Valley. Important sport and native fisheries.
Current Status	Hatchery at Snootli Creek for chum and chinook. Logging has probably peaked. (P) Other development stable; probably continued diking. (P)
Future Outlook	Modest increase in development in Bella Coola Valley. (P) Natural regeneration of logged areas. (P)
Natural Habitat Production Potential	
Improved Production Potential	

SUMMARY

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

HABITAT INFORMATION TABLE

STOCK GROUP		North Bentinck Pink			Area 8	
STOCK DATA	Maximum Recorded Escapement	Target/Optimum Escapement	Current Average Escapement	MANAGEMENT STYLE	Active	25%
					Passive	75%
Thousands	3,930	1,036 even & odd	0 - even 581 - odd		No. of Streams	4
					No. of Significant Streams	3
						(99 % of MRE)

HABITAT NOTES

Subarea MRE accounts for 86% of total Area 8 pink MRE.
Dominated by Bella Coola River.

Historic Status	Natural flow instability, aggravated by logging. Logged since 1950's with moderate impacts, including siltation and scouring. Settlement activity and diking in Bella Coola River Valley. Important sport and native fisheries.
Current Status	Logging has probably peaked. (P) Other development stable; probably continued diking. (P)
Future Outlook	Modest increase in development in Bella Coola Valley. (P) Natural regeneration of logged areas. (P)
Natural Habitat Production Potential	
Improved Production Potential	

SUMMARY

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

HABITAT INFORMATION TABLE

STOCK GROUP		South Bentinck Chinook		Area 8	
STOCK DATA	Maximum Recorded Escapement	Target/Optimum Escapement	Current Average Escapement	MANAGEMENT STYLE	Active _____
					Passive <u>X</u>
Thousands	.75	1.0	.065	No. of Streams	<u>2</u>
				No. of Significant Streams	<u>2</u>
(100 % of MRE)					

HABITAT NOTES

Historic Status	Natural flow instability and some natural siltation. Heavily logged from late 1950's to 1970's. Moderate to heavy impacts. (GWG/SEP) Major gravel loss on most streams.
Current Status	Logging probably complete. (P)(I) Forest regeneration over 20 to 30 years. (P)
Future Outlook	Gravel recruitment uncertain. (P)
Natural Habitat Production Potential	
Improved Production Potential	

SUMMARY

Current Target Achievability	Current Status	Future Outlook	Natural Production Potential	Improved Production Potential
Low	Low	Medium		

Habitat has almost certainly contributed to stock declines. (P)

HABITAT INFORMATION TABLE

STOCK GROUP	South Bentinck Coho			Area 8	
STOCK DATA	Maximum Recorded Escapement	Target/Optimum Escapement	Current Average Escapement	MANAGEMENT STYLE	Active _____ Passive <u>X</u>
	Thousands	4.5	6.7	.3	No. of Streams <u>3</u> No. of Significant Streams <u>3</u> (100 % of MRE)

HABITAT NOTES

Historic Status	Natural flow instability and some natural siltation. Heavily logged from late 1950's to 1970's. Moderate to heavy impacts. (GWG/SEP) Major gravel loss on most streams.
Current Status	Logging probably complete. (P)(I) Forest regeneration over 20 to 30 years. (P)
Future Outlook	Gravel recruitment uncertain. (P)
Natural Habitat Production Potential	
Improved Production Potential	

SUMMARY

Current Target Achievability	Current Status	Future Outlook	Natural Production Potential	Improved Production Potential
Low	Low	Medium		

Habitat has almost certainly contributed to stock declines. (P)

HABITAT INFORMATION TABLE

STOCK GROUP		South Bentinck Chum		Area 8	
STOCK DATA	Maximum Recorded Escapement	Target/Optimum Escapement	Current Average Escapement	MANAGEMENT STYLE	Active <u> </u> Passive <u>X</u>
	Thousands	23.5	21.2	2	No. of Streams <u>4</u> No. of Significant Streams <u>2</u>

(80 % of MRE)

HABITAT NOTES

Historic Status	Natural flow instability and some natural siltation. Heavily logged from late 1950's to 1970's. Moderate to heavy impacts. (GWG/SEP) Major gravel loss on most streams.
Current Status	Logging probably complete. (P)(I) Forest regeneration over 20 to 30 years. (P)
Future Outlook	Gravel recruitment uncertain. (P)
Natural Habitat Production Potential	
Improved Production Potential	

SUMMARY

Current Achievability	Target	Current Status	Future Outlook	Natural Production Potential	Improved Production Potential
Low		Low	Medium		

Habitat has almost certainly contributed to stock declines. (P)

HABITAT INFORMATION TABLE

STOCK GROUP		South Bentinck Pink			Area 8	
STOCK DATA	Maximum Recorded Escapement	Target/Optimum Escapement	Current Average Escapement	MANAGEMENT STYLE	Active	Passive
	Thousands	29	45		2.8 - even 12.3 - odd	
					No. of Streams	4
					No. of Significant Streams	2
(87 % of MRE)						

HABITAT NOTES

Historic Status	Natural flow instability and some natural siltation. Heavily logged from late 1950's to 1970's. Moderate to heavy impacts. (GWG/SEP) Major gravel loss on most streams.
Current Status	Logging probably complete. (P)(I) Forest regeneration over 20 to 30 years. (P)
Future Outlook	Gravel recruitment uncertain. (P)
Natural Habitat Production Potential	
Improved Production Potential	

SUMMARY

Current Target Achievability	Current Status	Future Outlook	Natural Production Potential	Improved Production Potential
Low	Low	Medium		

Habitat has almost certainly contributed to stock declines. (P)

HABITAT INFORMATION TABLE

STOCK GROUP		Upper Dean Channel Sockeye		Area 8	
STOCK DATA	Maximum Recorded Escapement	Target/Optimum Escapement	Current Average Escapement	MANAGEMENT STYLE	Active
					Passive <u>X</u>
Thousands	40	31.5	13.7	No. of Streams	<u>3</u>
				No. of Significant Streams	<u>3</u>
				(100 % of MRE)	

HABITAT NOTES

Historic Status	Natural flow instability. Extensive logging on Dean River has had moderate impacts, including some scouring. Logging on Kimsquit River since later 1970's. Sockeye probably least affected by habitat changes. (P) Popular steelhead fishery on Dean River.
Current Status	Dean River watershed regenerating. Appears to be no permanent impacts on lower Dean River. (P)(I) Logging continuing on Kimsquit River. (I)
Future Outlook	Continued logging on Kimsquit River, increasing over the next 5 - 10 years. (I)
Natural Habitat Production Potential	With control of logging impacts, no significant change need occur. (P)(I)
Improved Production Potential	

SUMMARY

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

Some habitat impacts but probably not enough to account for stock decline. (P)

HABITAT INFORMATION TABLE

STOCK GROUP	Upper Dean Channel Chinook			Area 8	
STOCK DATA	Maximum Recorded Escapement	Target/Optimum Escapement	Current Average Escapement	MANAGEMENT STYLE	Active _____
					Passive <u>X</u>
Thousands	7.5	16*	2.2	No. of Streams	<u>2</u>
				No. of Significant Streams	<u>2</u>
				(100 % of MRE)	

HABITAT NOTES

Historic Status	Natural flow instability. Extensive logging on Dean River has had moderate impacts, including some scouring. Logging on Kimsquit River since later 1970's. Popular steelhead fishery on Dean River.
Current Status	Dean River watershed regenerating. Appears to be no permanent impacts on lower Dean River. (P)(I) Logging continuing on Kimsquit River. (I)
Future Outlook	Continued logging on Kimsquit River, increasing over the next 5 - 10 years. (I)
Natural Habitat Production Potential	With control of logging impacts, no significant change need occur. (P)(I)
Improved Production Potential	

SUMMARY

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

* Assume that artificial augmentation accounts for high target. (P)

HABITAT INFORMATION TABLE

STOCK GROUP	Upper Dean Channel Coho			Area 8	
STOCK DATA	Maximum Recorded Escapement	Target/Optimum Escapement	Current Average Escapement	MANAGEMENT STYLE	Active
					Passive X
Thousands	26.8	51	3.8		No. of Streams 3
					No. of Significant Streams 3
					(100 % of MRE)

HABITAT NOTES

Historic Status	Natural flow instability. Extensive logging on Dean River has had moderate impacts, including some scouring. Logging on Kimsquit River since later 1970's. Logging impacts probably more severe on coho than on other species. (P) Popular steelhead fishery on Dean River.
Current Status	Dean River watershed regenerating. Appears to be no permanent impacts on lower Dean River. (P)(I) Logging continuing on Kimsquit River. (I)
Future Outlook	Continued logging on Kimsquit River, increasing over the next 5 - 10 years. (I)
Natural Habitat Production Potential	With control of logging impacts, no significant change need occur. (P)(I)
Improved Production Potential	Probably scope for tributary restoration. (P)

SUMMARY

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

Target seems very optimistic. (P)

HABITAT INFORMATION TABLE

STOCK GROUP Upper Dean Channel Chum			Area 8		
STOCK DATA	Maximum Recorded Escapement	Target/Optimum Escapement	Current Average Escapement	MANAGEMENT STYLE	Active 20%
					Passive 80%
Thousands	195	85	37		No. of Streams <u>5</u>
					No. of Significant Streams <u>4</u>
(96 % of MRE)					

HABITAT NOTES

Dominated by Kimsquit River.

Historic Status	Natural flow instability. Extensive logging on Dean River has had moderate impacts, including some scouring. Logging on Kimsquit River since later 1970's. Popular steelhead fishery on Dean River.
Current Status	Dean River watershed regenerating. Appears to be no permanent impacts on lower Dean River. (P)(I) Logging continuing on Kimsquit River. (I)
Future Outlook	Continued logging on Kimsquit River, increasing over the next 5 - 10 years. (I)
Natural Habitat Production Potential	With control of logging impacts, no significant change need occur. (P)(I)
Improved Production Potential	

SUMMARY

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

Some habitat impacts but probably not enough to account for stock decline. (P)

HABITAT INFORMATION TABLE

STOCK GROUP			Area 8		
STOCK DATA	Maximum	Target/	Current	MANAGEMENT	Active
	Recorded	Optimum	Average		STYLE
	Escapement	Escapement	Escapement		
Thousands	107	71	11.6 - even 8 - odd		No. of Streams <u>5</u>
					No. of Significant Streams <u>3</u>
(95 % of MRE)					

HABITAT NOTES

Dominated by Kimquit River.

Historic Status	Natural flow instability. Extensive logging on Dean River has had moderate impacts, including some scouring. Logging on Kimsquit River since later 1970's. Popular steelhead fishery on Dean River.
Current Status	Dean River watershed regenerating. Appears to be no permanent impacts on lower Dean River. (P)(I) Logging continuing on Kimsquit River. (I)
Future Outlook	Continued logging on Kimsquit River, increasing over the next 5 - 10 years. (I)
Natural Habitat Production Potential	With control of logging impacts, no significant change need occur. (P)(I)
Improved Production Potential	

SUMMARY

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

Some habitat impacts but probably not enough to account for stock decline. (P)

HABITAT INFORMATION TABLE

STOCK GROUP			Dean Channel Closed Chinook		Area 8	
<u>STOCK DATA</u>	Maximum Recorded Escapement	Target/Optimum Escapement	Current Average Escapement	<u>MANAGEMENT STYLE</u>	Active	Passive
						<u>X</u>
Thousands	n/d	.1*	.004*		No. of Streams	<u>1</u>
					No. of Significant Streams	<u>1</u>
					(___ % of MRE)	

HABITAT NOTES

Minor stock on Elcho Creek.

Historic Status	Pristine.
Current Status	Pristine.
Future Outlook	Pristine.
Natural Habitat Production Potential	
Improved Production Potential	

SUMMARY

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

No habitat reason for stock decline.

* These numbers are correct. Target and current escapements are very low.

HABITAT INFORMATION TABLE

STOCK GROUP	Dean Channel Closed Coho			Area 8	
STOCK DATA	Maximum Recorded Escapement	Target/Optimum Escapement	Current Average Escapement	MANAGEMENT STYLE	Active
					Passive <u>X</u>
Thousands	13	24	2.1		No. of Streams <u>6</u>
					No. of Significant Streams <u>4</u>
					(<u>80</u> % of MRE)

HABITAT NOTES

No single major productive stream.

Historic Status	Natural flow instability and scouring. Logging on 40% of the streams in the 1950's and 1960's. Low to moderate impacts. Coho probably affected most by logging. (GWG/SEP)(P) Remainder, pristine.
Current Status	No activity.
Future Outlook	Possible small scale logging. (GWG/SEP) Natural recovery of watersheds. (P)
Natural Habitat Production Potential	At historic level. (P)
Improved Production Potential	

SUMMARY

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

HABITAT INFORMATION TABLE

STOCK GROUP		Dean Channel Closed Chum			Area 8	
STOCK DATA	Maximum Recorded Escapement	Target/Optimum Escapement	Current Average Escapement	MANAGEMENT STYLE	Active	X
					Passive	
Thousands	115	65.5	37.7		No. of Streams	7
					No. of Significant Streams	6
(93 % of MRE)						

HABITAT NOTES

No single major productive stream.

Historic Status	Natural flow instability and scouring. Logging on 40% of the streams in the 1950's and 1960's. Low to moderate impacts. (GWG/SEP) Remainder, pristine.
Current Status	No activity.
Future Outlook	Possible small scale logging. (GWG/SEP) Natural recovery of watersheds. (P)
Natural Habitat Production Potential	At historic level. (P)
Improved Production Potential	

SUMMARY

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

HABITAT INFORMATION TABLE

STOCK GROUP			Dean Channel Closed Pink	Area 8	
<u>STOCK DATA</u>	Maximum Recorded Escapement	Target/Optimum Escapement	Current Average Escapement	<u>MANAGEMENT STYLE</u>	Active _____
	Thousands	111	76.5	7.5 - even 53 - odd	Passive <u>X</u>
				No. of Streams	<u>7</u>
				No. of Significant Streams	<u>6</u>
(98 % of MRE)					

HABITAT NOTES

No single major productive stream.

Historic Status	Natural flow instability and scouring. Logging on 40% of the streams in the 1950's and 1960's. Low to moderate impacts. (GWG/SEP) Remainder, pristine.
Current Status	No activity.
Future Outlook	Possible small scale logging. (GWG/SEP) Natural recovery of watersheds. (P)
Natural Habitat Production Potential	At historic level. (P)
Improved Production Potential	

SUMMARY

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

HABITAT INFORMATION TABLE

STOCK GROUP		Burke Channel Chinook			Area 8	
STOCK DATA	Maximum Recorded Escapement	Target/Optimum Escapement	Current Average Escapement	MANAGEMENT STYLE	Active	Passive
	Thousands	1.5	.5	.07		
					No. of Streams	1
					No. of Significant Streams	1
(100 % of MRE)						

HABITAT NOTES

Kwatna River.

Historic Status	Natural instability. Logging began in 1971. Heavy impacts.
Current Status	Logging winding down. (I)
Future Outlook	Long-term recovery probable. (P)
Natural Habitat Production Potential	Long-term recovery to target. (P)
Improved Production Potential	

SUMMARY

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

Habitat loss has been a major factor. (P)

HABITAT INFORMATION TABLE

STOCK GROUP Burke Channel Coho Area 8

STOCK DATA	Maximum Recorded Escapement	Target/Optimum Escapement	Current Average Escapement	MANAGEMENT STYLE	Active
	Thousands	18.5	17.6	2.3	

No. of Streams 3

No. of Significant Streams 2

(99 % of MRE)

HABITAT NOTES

Dominated by Kwatna River.

Historic Status	Natural flow instability and scouring. 2 streams logged in 1960's and 1970's. Moderate level of activity with moderate to high impacts. (GWG/SEP)
Current Status	Logging virtually finished on Kwatna River. (I)
Future Outlook	Probable logging on Nootum River. Slow recovery for Kwatna River. (I)
Natural Habitat Production Potential	
Improved Production Potential	

SUMMARY

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

HABITAT INFORMATION TABLE

STOCK GROUP		Burke Channel Chum			Area 8	
STOCK DATA	Maximum Recorded Escapement	Target/Optimum Escapement	Current Average Escapement	MANAGEMENT STYLE	Active	Passive
	Thousands	77	35	7.3		
					No. of Streams	3
					No. of Significant Streams	2
(90 % of MRE)						

HABITAT NOTES

Historic Status	Natural flow instability and scouring. 2 streams logged in 1960's and 1970's. Moderate level of activity with moderate to high impacts. (GWG/SEP)
Current Status	Logging virtually finished on Kwatna River. (I)
Future Outlook	Probable logging on Nootum River. Slow recovery for Kwatna River. (I)
Natural Habitat Production Potential	
Improved Production Potential	

SUMMARY

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

Habitat is probably not the main factor in stock decline. (P)

HABITAT INFORMATION TABLE

STOCK GROUP Burke Channel Pink

Area 8

STOCK DATA	Maximum Recorded Escapement	Target/Optimum Escapement	Current Average Escapement	MANAGEMENT STYLE	Active
	Thousands	167	115	21 - even 155 - odd	
					No. of Streams <u>3</u>
					No. of Significant Streams <u>3</u>

(100 % of MRE)

HABITAT NOTES

Dominated by Kwatna River.

Historic Status	Natural flow instability and scouring. 2 streams logged in 1960's and 1970's. Moderate level of activity with moderate to high impacts. (GWG/SEP)
Current Status	Logging virtually finished on Kwatna River. (I)
Future Outlook	Probable logging on Nootum River. Slow recovery for Kwatna River. (I)
Natural Habitat Production Potential	
Improved Production Potential	

SUMMARY

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

HABITAT INFORMATION TABLE

STOCK GROUP		Fisher - Fitzhugh Sockeye			Area 8	
STOCK DATA	Maximum Recorded Escapement	Target/Optimum Escapement	Current Average Escapement	MANAGEMENT STYLE	Active	_____
					Passive	X
Thousands	22.4	32	4.8		No. of Streams	5
					No. of Significant Streams	4
						(99 % of MRE)

HABITAT NOTES

Historic Status	Natural flow instability. Virtually no development activity.
Current Status	Virtually pristine.
Future Outlook	Unchanged. (P)
Natural Habitat Production Potential	
Improved Production Potential	

SUMMARY

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

Habitat is not a factor in stock decline. (P)

HABITAT INFORMATION TABLE

STOCK GROUP Fisher - Fitzhugh Chinook Area 8

<u>STOCK DATA</u>	Maximum Recorded Escapement	Target/Optimum Escapement	Current Average Escapement	<u>MANAGEMENT STYLE</u>	Active <input type="checkbox"/> Passive <input type="checkbox"/>
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Thousands	n/d	n/d	20	No. of Streams	1
				No. of Significant Streams	1

(% of MRE)

HABITAT NOTES

Minor stock on Koeve River.

Historic Status	Pristine.
Current Status	
Future Outlook	
Natural Habitat Production Potential	
Improved Production Potential	

SUMMARY

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

HABITAT INFORMATION TABLE

STOCK GROUP	Fisher - Fitzhugh Coho			Area 8	
<u>STOCK DATA</u>	Maximum Recorded Escapement	Target/Optimum Escapement	Current Average Escapement	<u>MANAGEMENT STYLE</u>	Active _____
					Passive <u>X</u>
Thousands	16	32	1.7		No. of Streams <u>8</u>
					No. of Significant Streams <u>4</u>
					(<u>87</u> % of MRE)

HABITAT NOTES

Historic Status	Natural flow instability. Virtually no development activity.
Current Status	Virtually pristine.
Future Outlook	Unchanged. (P)
Natural Habitat Production Potential	
Improved Production Potential	

SUMMARY

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

Target seems high. (P)

Habitat is not a factor in stock decline. (P)

HABITAT INFORMATION TABLE

STOCK GROUP	Fisher - Fitzhugh Chum			Area 8	
<u>STOCK DATA</u>	Maximum Recorded Escapement	Target/Optimum Escapement	Current Average Escapement	<u>MANAGEMENT STYLE</u>	Active <input type="checkbox"/>
					Passive <input checked="" type="checkbox"/>
Thousands	44	29.6	6.7		No. of Streams <u>11</u>
					No. of Significant Streams <u>6</u>
					(<u>96</u> % of MRE)

HABITAT NOTES

Historic Status	Natural flow instability. Virtually no development activity.
Current Status	Virtually pristine.
Future Outlook	Unchanged. (P)
Natural Habitat Production Potential	
Improved Production Potential	

SUMMARY

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

Habitat is not a factor in stock decline. (P)

HABITAT INFORMATION TABLE

STOCK GROUP		Fisher - Fitzhugh Pink		Area 8	
<u>STOCK DATA</u>	Maximum Recorded Escapement	Target/Optimum Escapement	Current Average Escapement	<u>MANAGEMENT STYLE</u>	Active 16%
					Passive 84%
Thousands	263	131 Even & Odd	37 - even 97 - odd		No. of Streams 10
					No. of Significant Streams 4
(96 % of MRE)					

HABITAT NOTES

Historic Status	Natural flow instability. Virtually no development activity.
Current Status	Virtually pristine.
Future Outlook	Unchanged. (P)
Natural Habitat Production Potential	
Improved Production Potential	

SUMMARY

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

Habitat is not a factor in stock decline. (P)

DATA SOURCES HABITAT INFORMATION TABLES — STATISTICAL AREA 8**Maximum Recorded Escapement**

Stream Catalogue: modified as described in the Introduction.

Manzon, C.E. and D.E. Marshall. 1980. Catalogue of salmon streams and spawning escapements of Statistical Area 8 (Bella Coola). Can. Data Rep. Fish. Aquat. Sci. #219.

Target/Optimum and Current Average Escapements

DFO Pacific Region (Prince Rupert), Target and Current Escapement (1980-84) for sockeye, chinooks, coho, chums and pinks for Statistical Areas 6 - 10, March 1985 (See Information Sources). Substock Summary figures represent the sum of streams above and below the MRE cutoff.

Management Style

Active and passive management status were derived from the April 1985 SRMP, Volumes I and II (See Information Sources).

Number of Streams and Stream Lists

Sub-area stream lists were derived from the Optimum and Current Escapement information noted above.

Habitat Notes

Stream Catalogues, the SRMP Volumes I and II, April 1985, and the GWG/SEP (Geographic Working Group/Salmonid Enhancement Program) provided habitat information.

Data sources are referenced on Habitat Information Tables as described in the Introductory material and Information Sources.

APPENDIX IV

**DISTRIBUTION OF IMPORTANT SALMONID DISEASE AGENTS AND PARASITES
IN STATISTICAL AREA 8**

**DISTRIBUTION OF IMPORTANT SALMONID DISEASE AGENTS AND PARASITES
IN STATISTICAL AREA 8¹**

An introduction to the analysis of the distribution of salmonid disease agents and parasites in British Columbia is provided in Volume A. The introduction includes a discussion of data sources and notes on all of the importance salmonid disease agents and parasites included in the analysis.

Fish health surveys have been undertaken in four river systems in Statistical Area 8: the Atnarko and Bella Coola Rivers, the Kwatna River, the Noeick River and Tarrant Creek (tributary of Taleomey River). Findings are listed in Table IV-1 and mapped in Figure IV-1.

In the Atnarko River, a tributary of Bella Coola River, agents of furunculosis, bacterial kidney disease (BKD) and infectious hematopoietic necrosis were found in chinook salmon. No important salmonid disease agents or parasites were found in samples of 31 pinks in 1982 or 14 coho, 34 Dolly Varden and 59 cutthroat trout taken in 1976.

In the Bella Coola River system, Henneguya cysts were found in a sample of 52 coho in 1980 and BKD was found in one sockeye taken in 1981. A large number of samples have been taken from the Snootli Creek hatchery. No important disease agents or parasites have been found at this facility to date in chinooks, chums, coho, cutthroat or steelhead.

Furunculosis bacteria were found in a sample of four chums taken from the Kwatna River in 1983. No important disease agents or parasites were found in a sample of 68 pinks in 1983.

No important disease agents or parasites were found in samples of 60 pinks and 60 chums at Tarrant Creek and from a sample of nine pinks at Noeick River in 1984.

Table IV-1. Distribution of salmonid disease agents and parasites in Statistical Area 8.^{2,3}

Location		Total No. Examined	Findings* by Species**								
Area	Sample Site		No Disease	F	PKD	BKD	IHN	CS	ERM	HEN	Other Disease
8	Atnarko River	59	CT								
8	Atnarko River	34									DV
8	Atnarko River	15									CO
8	Atnarko River	72		CN			CN				CN
8	Atnarko River	31									PK
8	Bella Coola General Area	1				SK					SK
8	Bella Coola River	52							CO		
8	Bella Coola River	1									
8	Kwatna River	1	SK								
8	Kwatna River	4		CM							
8	Kwatna River	68									PK
8	Noeick River	9									PK
8	Ocean Falls Inshore	1									CO
8	Snootli Hatchery	110	CN								CN
8	Snootli Hatchery	8	CT								CT
8	Snootli Hatchery	42	CO								CO
8	Snootli Hatchery	78	ST								ST
8	Snootli Hatchery	192									CM
8	Tarrant Creek	60									PK
8	Tarrant Creek	60									CM

* Disease/Agents and Parasites:

F - Furunculosis
 PKD - Proliferative kidney disease
 BKD - Bacterial kidney disease
 IHN - Infectious hematopoietic necrosis
 CS - Ceratomyxa shasta
 HEN - Henneguya salminicola
 ERM - Enteric redmouth disease

**Salmonid Species:

CN - Chinook
 CM - Chum
 CO - Coho
 SK - Sockeye
 PK - Pink
 ST - Steelhead
 RT - Rainbow Trout
 DV - Dolly Varden
 BR - Brown Trout

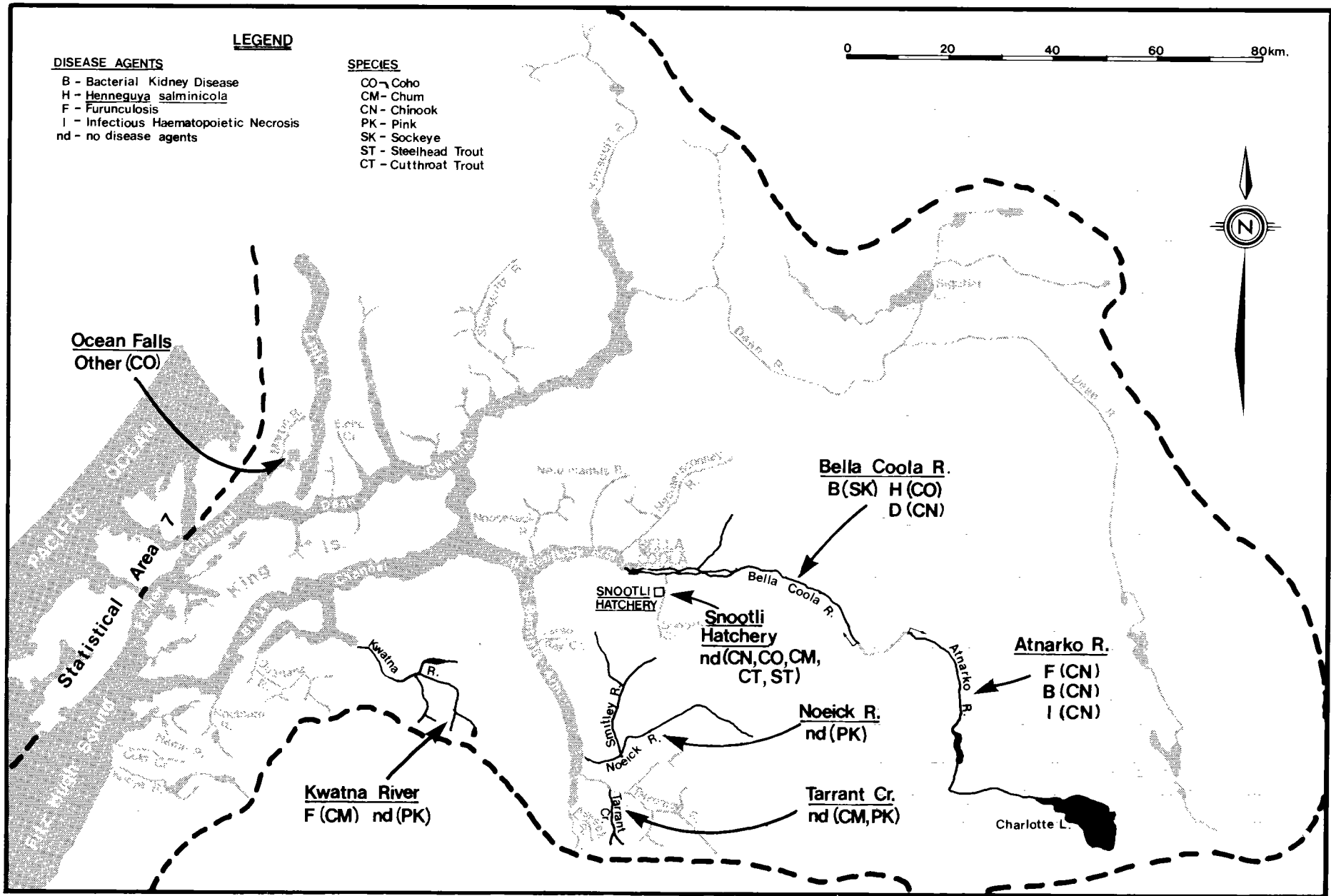


Figure IV-1. Distribution of salmonid disease agents and parasites in Statistical Area 8.

REFERENCES

1. McDougal, R.D. and Associates. 1986. Distribution of important salmonid disease agents and parasites in the Queen Charlotte Islands. Prep. under contract for DFO in consultation with Fish Health and Diagnostics Section, Pacific Biol. Sta., Nanaimo, B.C.
2. DFO. 1985. Fish health data base. Updated September 1985. Can. Dep. Fisheries and Oceans, Vancouver, B.C.
3. Boyce, N.P., Z. Kabata and L. Margolis. 1985. Investigations of the distribution, detection, and biology of Henneguya salmonicola (Protozoa, Myxozoa), a parasite of the flesh of Pacific Salmon. Can. Tech. Rep. Fish. Aquat. Sci. 1405: 55 p.