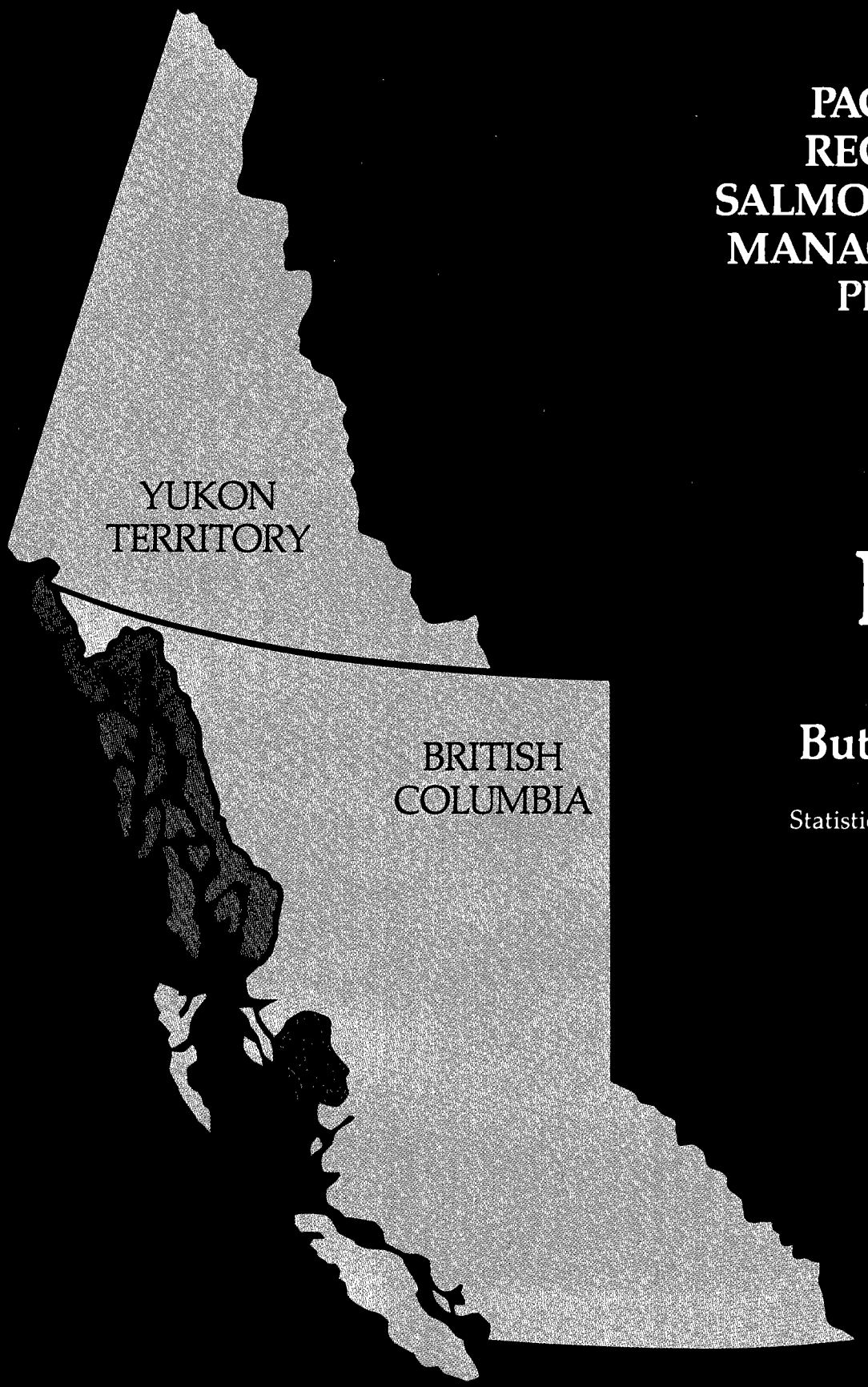
PACIFIC REGION SALMON STOCK MANAGEMENT PLAN



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Butedale

Statistical Area - 6

DISCUSSION DOCUMENT
1986

Fisheries and Oceans
Pêches et Océans
Canada

C O N T E N T S

PACIFIC REGION SALMON STOCK MANAGEMENT PLAN

VOLUME D

STATISTICAL AREA 6

Department of Fisheries and Oceans

1986

Fisheries and Oceans
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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 Butedale 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 Butedale 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. Chamut

P.S. Chamut
Director General
Fisheries - Pacific

Canada

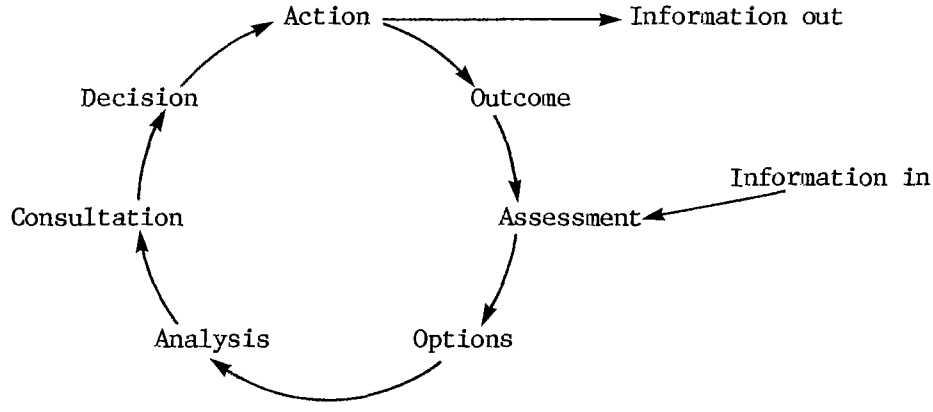
FOREWORD

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

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

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

The Planning Cycle



* 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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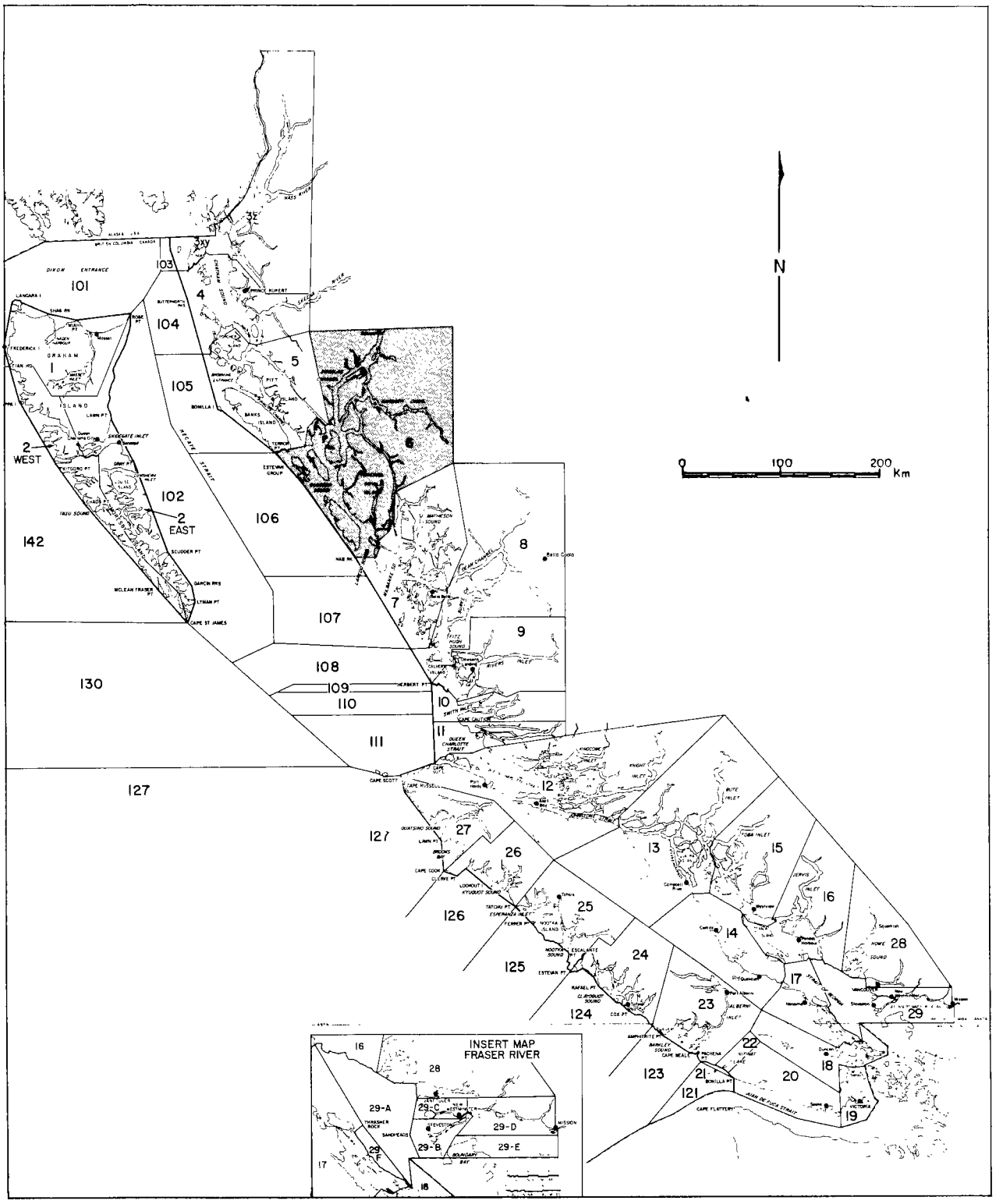

Figure 1. Department of Fisheries and Oceans Statistical Areas, British Columbia.

STATISTICAL AREA 6

Statistical Area 6 covers a large portion of the north Central Coast, centering on Laredo and Caamano Sounds and the complex of fjords and channels at the heads of each Sound.

The topography of Area 6 is typical of the Central British Columbia Coast in that it is fairly rugged, with steep glaciated slopes rising from tidewater to a few hundred metres on the outer coastal islands, and to headwater peaks in the 2700 metre range. Several of the streams have barriers that are impassable to migrating salmon as a result of this topography.

In addition to the rugged terrain, the area is susceptible to heavy precipitation, particularly in late November and early December. Together these factors can contribute to flash flooding.

Statistical Area 6 has been divided into the following seven sub-areas for the purpose of fisheries management and stock description:

1. Gardner Canal
2. Kitimat Arm
3. Douglas, Ursula and Devastation Channels
4. Fraser Reach and Graham Channel (Fraser/Graham)
5. Laredo Sound
6. Campania Sound
7. West Coast Aristazabal Island.

Detailed descriptions of stock attributes, current fishing patterns and habitat status are provided in Appendices I, II and III, respectively, and Appendix IV provides a description of the distribution of fish disease cases. Figure 1 shows the location of Statistical Area 6 in relation to other North Coast areas, while Figure 2 and Table 1 show the location of each Management Unit (M.U.) and salmon-producing streams within Statistical Area 6.

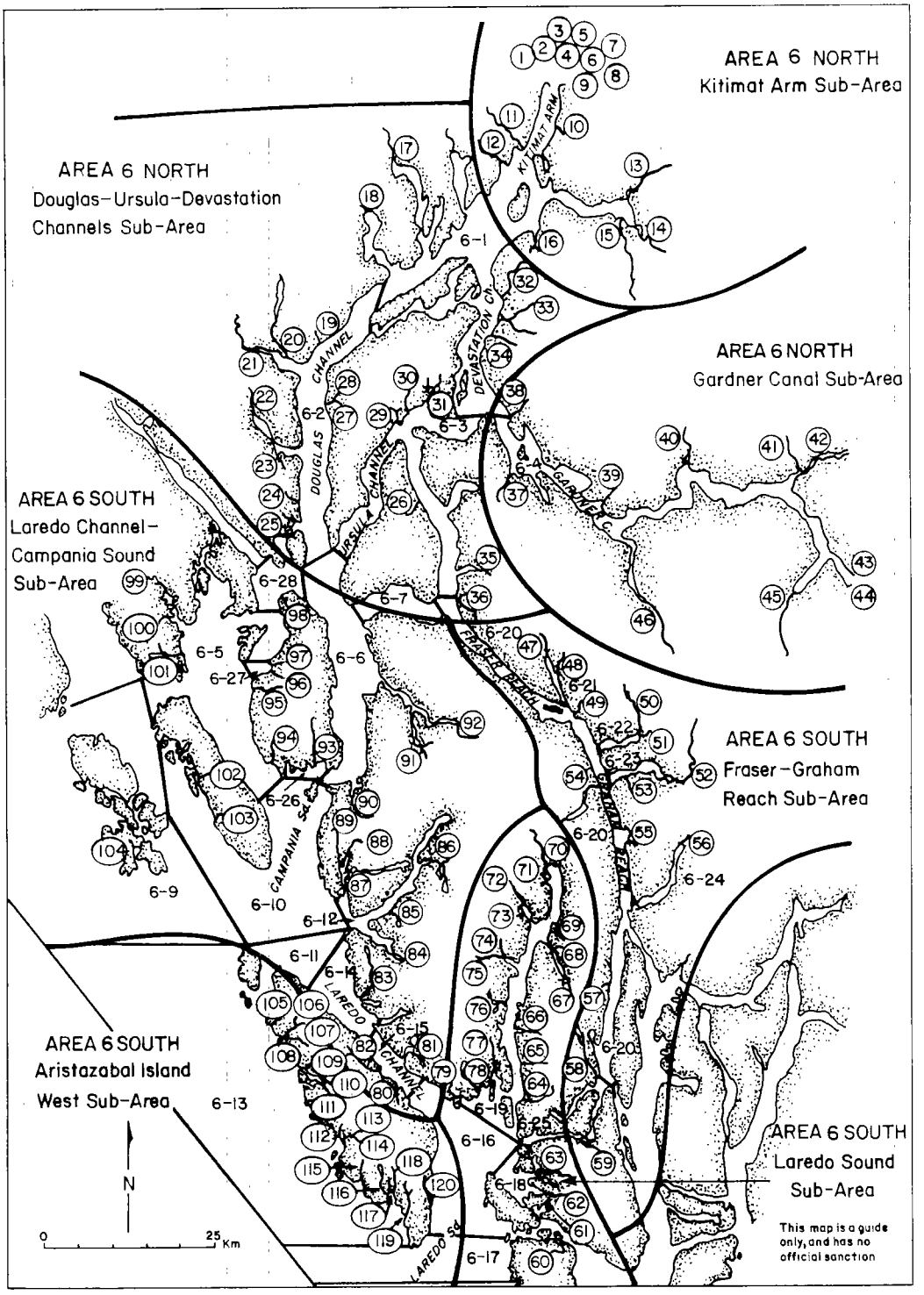

Figure 2. Statistical Area 6, showing Management Units and streams (see Table 1 for key to streams).

Table 1. Statistical Area 6 streams from Figure 2.

50.	Aaltanash River	29.	Fish Trap Bay Creek	117.	Noble Creek
7.	Anderson Creek	113.	Flux Creek	62.	Osment Creek
36.	Angler Cove Creek	18.	Foch Creek	73.	Packe Creek
85.	Argyh Creek	80.	Fury Creek	37.	Paril River
70.	Arnoup Creek	93.	Gil Creek	86.	Penn Creek
90.	Barnard Creek	17.	Gilttoyees Creek	34.	Pike Creek
28.	Big Tillhorn River	35.	Goat River	65.	Powles Creek
2.	Big Wedeene River	56.	Green River	60.	Price Creek
11.	Bish Creek	61.	Gull Creek	75.	Pyne Creek
95.	Blackrock Creek	25.	Hartley Bay Creek	21.	Quaal River
66.	Blee Creek	9.	Hirsch Creek	64.	Quigley Creek
67.	Bloomfield Creek	39.	Hotspring Creek	26.	Riordan Creek
107.	Borrowman Creek	32.	Hugh Creek	86.	Roland Creek
40.	Brim River	4.	Humphrys Creek	71.	Ronald Creek
76.	Busey Creek	116.	Kdelmashan Creek	111.	Salmon Creek
54.	Canoona River	24.	Keesil Creek	48.	Scow Bay Creek
103.	Cartwright Creek	42.	Kemano River	115.	Sentinel Creek
89.	Chapple Creek	52.	Khutze River	57.	Soda Creek
101.	Cherry Creek	19.	Kihess Creek	108.	Stannard Creek
1.	Chist Creek	14.	Kildala River	78.	Steep Creek
114.	Clifford Creek	46.	Kiltuish River	81.	Talmoosa Creek
38.	Crab River	22.	Kiskosh Creek	55.	Taylor Creek
97.	Crane Bay Creek	3.	Kitimat River	77.	Trahey Creek
99.	Cridge Inlet Creek	20.	Kitkiata Creek	109.	Treneman Creek
13.	Dala River	44.	Kitlope River	43.	Tsaytis River
79.	Dallain Creek	47.	Klekane River	96.	Turn Creek
69.	Dally Creek	45.	Kowesas River	98.	Turtle Creek
106.	Devil Creek	63.	Kwakwa Creek	100.	Tuwartz Creek
51.	Dome Creek	82.	Limestone Creek	74.	Tyler Creek
120.	Don Creek	119.	Linnea Creek	30.	Verney Passage Creek
88.	Douglas Creek	27.	Little Tillhorn River	41.	Wahoo River
118.	Duffey Creek	6.	Little Wedeene River	84.	Wale Creek
110.	Eagle Creek	49.	Marmot Cove Creek	10.	Wathe Creek
16.	Eagle Bay Creek	53.	Marshall Creek	33.	Weewanie Creek
92.	East Arm Creek	112.	McDonald Creek	105.	West Creek
12.	Emsley Creek	58.	McKay Creek	91.	West Arm Creek
104.	Estevan Cr.	102.	McMicking Creek	94.	Windy Island
	Gillen Harbour Cr.	8.	M.E.S.S. Creek		
31.	Evelyn Creek	59.	Meyers Pass Creek		
83.	Evinrude Creek	23.	Missed Creek		
15.	Falls River	5.	Nalbeelah Creek		
68.	Fifer Cove Creek	72.	Nias Creek		

1. STOCK DESCRIPTION

An overview of the salmon stocks found in each of the seven sub-areas indicated above is provided in the following sections.

1.1 Gardner Canal

There are two sockeye stocks in the Gardner Canal sub-area. The actively-managed Kitlope stock has been enhanced through the Lake Enrichment Program, and has a target escapement of 20,000. Although average escapements were much higher than this in the 1950's and 1960's (24,000 and 41,000, respectively), they have declined to about 10,000 sockeye in recent years. There is one very minor and passively-managed sockeye stock in this sub-area. The target escapement is 500 and estimated escapements have been about 10% of the target in recent years.[1]

The Kemano and Kitlope rivers are the main coho producers of the ten streams in this sub-area. However, current escapements remain at approximately 10% of the recommended target of 85,000. This target represents 31% of the total for Area 6.[1]

The Kemano River supports the only actively-managed pink stock in the Gardner Canal sub-area and the target escapement for Kemano pinks is 150,000. There are also nine passively-managed pink stocks. Escapements have been increasing over the last three decades, but a flood in 1980 reduced the 1982 escapement to about half of the target level. Since the escapement rebounded to 240,000 in 1984, the Kemano even-year pink stocks are now considered healthy. Historically, the odd-year pink stock in the Kemano has been depressed, but recent escapements (120,000 in 1983) indicate that the odd-year stock is rebuilding towards the 150,000 target. As a result of Alcan's hydroelectric development on the Kemano River, there are presently more constant minimum flows in the river. We believe that this flow regime has improved overwintering conditions and led to an overall increase in the productivity of Kemano pink stocks. The combined escapement target for the passively-managed pink stocks in the Gardner Canal sub-area is 50,000. Both odd- and even-year stocks are severely depressed (less than 10% of target escapements) at the present time.[1]

The Gardner Canal sub-area has only one actively-managed and nine passively-managed chum stocks. Kemano chums are the actively-managed stock with an escapement target of 75,000.[1] Although recent escapements recently have fluctuated below

half the target level, Kemano chums are still considered very healthy relative to other Area 6 chum stocks. As with pinks, the constant minimum flow provided by the hydroelectric diversion on the Kemano system appears to have improved overwintering conditions and therefore chum productivity.

The Kitlope and Kemano rivers are the major producers of the seven streams that support chinook stocks in the sub-area. Current escapements are estimated at less than 10% of the target of 27,400 and the Gardner Canal sub-area accounts for 39% of the overall Area 6 target escapement.[1]

Four streams in the Gardner Canal sub-area (Kemano, Kiltuish, Kitlope and Kowesas rivers) support winter-run steelhead stocks. These stocks are not actively managed, as the recreational in-river sport fishery, which typically runs from March through May, is not heavy. Commercial interceptions are not considered a problem, because these are winter-run steelhead.[2] Escapement data are not well documented.

1.2 Kitimat Arm

The fourteen passively-managed sockeye stocks in the Kitimat Arm sub-area support local Indian food fisheries. There are no actively-managed sockeye stocks in this sub-area. The combined target escapement for the passively-managed stocks is 2500 and present escapements are fluctuating near this level.[1]

The Kitimat River and its tributaries represent the majority of the 16 coho streams in this sub-area. As in many other parts of the B.C. coast, coho escapements are currently depressed at less than 20% of the sub-area target of 83,000.[1] This target is 30% of the total for Statistical Area 6. The Kitimat hatchery coho egg takes for 1983 and 1984 were 600,000 and 800,000, respectively and the total production from each brood could exceed 50,000 adults.[3] Although a proportion of the returning adults will be intercepted in various troll or net fisheries, the returns should still contribute substantially towards the rebuilding of Kitimat River coho stocks.

There are two actively-managed and six passively-managed pink stocks in the Kitimat Arm sub-area. The Kitimat River and six of its tributary streams collectively support one of the actively-managed stocks. The combined escapement target for the group is 220,000. Historically, the even-year cycle of pinks has

been fairly strong, particularly during the 1960's, while the odd-year cycle has not had recorded escapements above 16,000 in the past three decades. Currently, both cycles are severely depressed and near 10% of the target level. The other actively-managed pink stock is the Dala, with an escapement target of 40,000. However, both cycles are presently depressed at about 25% of the target. The escapement target for the passively-managed group of pink stocks is 57,000, but both cycles are depressed, with recent escapements of about 10-20% of the target figure.[1]

The actively- and passively-managed chum stocks in the Kitimat Arm sub-area are the same groupings as the pink stocks described above. The combined target escapement for the Kitimat system is 137,500 although current escapements are extremely depressed, fluctuating and some as low as 1.5% of the target levels.[1] The Dala chum stock is also depressed, but not as severely as the Kitimat system stock. The target for the Dala stock is 25,000, but escapements in recent years (1980-1983) have ranged from 1500 to 4500.[1] The passively-managed group is even more depressed than chum stocks in the Kitimat system, with recent escapements as low as 350 and a target of 26,500.[1] There is a chum hatchery on the Kitimat River system, but the start-up of production has been slow due to a lack of brood stock.

The Kitimat River and its tributaries are the major chinook producers in this sub-area, although there is additional production from the Dala and Kildala rivers. Current escapements are at 11% of the target level, but hatchery production is expected to boost escapement to the target of 40,125 within a few cycles. This sub-area accounts for 57% of the overall escapement target for Area 6 chinooks.[1]

Ten streams support populations of winter-run steelhead in the Kitimat Arm sub-area. Of these, the Kitimat River and its tributaries are the most important, supporting an estimated average annual run of 1500 fish, not including the 200-500 steelhead that are taken annually in the Kitimaat Band food fishery. The sport fishery runs typically from March through May and commercial fishery interceptions are thought to be minimal. Enhancement efforts at the Kitimat hatchery are expected to increase the population of steelhead from 40-100%. Once the enhanced fish begin to return in strength it may be possible to restructure the angling regulations, allowing more liberal management for enhanced fish, while protecting wild populations. Management objectives for Kitimat steelhead are to augment stocks commensurate with projected growth in the Kitimat Valley, and to

stocks commensurate with projected growth in the Kitimat Valley, and to draw pressure from the Skeena by improving angler success rate in the Kitimat.[2]

1.3 Douglas, Ursula and Devastation Channel

The four passively-managed sockeye stocks in this sub-area support local Indian food fisheries. The combined escapement target for the group of sockeye stocks is 13,000. At present, escapements are depressed but stable at less than 30% of the target.[1]

The Quaal River is believed to be the major coho producer of the 20 streams in the sub-area. Stock levels are currently at 20% of the target escapement of 45,000. This target represents 15% of the Area 6 total for coho.[1]

There are three actively-managed pink stocks (Quaal, Kitkiata, and a group of 15 streams) and no passively-managed pink stocks in this sub-area. The Quaal River is the major producer, with a target escapement of 200,000. Prior to severe flood in 1980, escapement of pinks to the Quaal had been near the target level. Nevertheless, this stock should recover quickly because of its apparent high productivity. Pink escapements to Kitkiata Creek and the collective group of 15 streams are currently at 50-60% of the target (50,000 for Kitkiata Creek and 81,000 for the remaining group).[1]

There are three actively-managed (referred to as the Douglas chum group) and 13 passively-managed chum stocks in this sub-area. All are very depressed at the present time. The actively-managed group consists of Foch Creek, Gilttoyees Creek and Quaal River stocks. The target escapement for Foch Creek chums is 10,000, although the recent range of escapements has been 200 - 3500, with no apparent trends. The Gilttoyees chum stock has a target escapement of 15,000 and estimated returns have fluctuated from 2000 - 10,000 since 1980. Escapement of Quaal chums in 1981 and 1982 were 15,000, but have otherwise been stable at around 5500, which is well below the target of 25,000. The passively-managed stocks have a combined target escapement of 16,850, but chum escapements have declined to around 1000 over the past three decades.[1]

Chinook production in this sub-area is minor. There are three streams in the sub-area that have supported chinook, with recent escapements only to Gilttoyees Creek. Current escapements for the three streams are only 4% of the target of 2000

chinooks. The sub-area total for chinooks is only 3% of the overall target escapement for Statistical Area 6.[1]

The steelhead population in this sub-area is dominated by the Quaal and Kitkiata stocks. As with the other Area 6 steelhead stocks, these are winter-run fish, with negligible interception in the commercial fishery. Escapement data are not well documented.[2]

1.4 Fraser Reach and Graham Channel

There are no actively-managed sockeye stocks in the Fraser/Graham sub-area. The passively-managed group of stocks from four streams has a target escapement of 3100. Escapements are presently low, but appear to be increasing. In recent years, the sockeye escapements to this sub-area have ranged from 75 to 1000.[1]

The Canoona River is consistently the largest coho producer of the 13 streams in the Fraser Reach and Graham Channel sub-area. Current coho escapements are thought to be 10% of the target of 12,900, although the sub-area contributes only 5% of the overall Area 6 target escapement for coho stocks.[1]

There are five actively-managed and ten passively-managed pink stocks in the Fraser/Graham sub-area. The combined target escapement is 160,000 for the actively-managed stocks, and 29,000 for the passively-managed stocks. The escapement target for the actively-managed stocks is broken down by stream[1] as follows:

Pink Stock	Target Escapement
Khutze	70,000
Green	25,000
Canoona (Indian)	25,000
Scow Bay	15,000
Soda	25,000

In general, both odd-and even-year pink stocks are currently depressed, particularly the even-year stocks. Khutze River odd-year stocks achieved the target escapement in 1983, but the even-year stocks have recently been at less than

5% of the target level. The Green River pink stock nearly reached the target in 1983 (odd cycle), although the even-year stock is severely depressed. For example, the 1982 escapement of 400 pink is just over 1.5% of the target. The Canoona (Indian) River even-year run is depressed (10% of target), but the escapement appears to be increasing slowly. The odd-year run of Canoona pinks is also depressed, but escapements are currently near 50% of the target. Both cycles of Scow Bay pink are also depressed, although the odd cycle appears to be rebuilding, with recent escapements of about 60% of the target. The last actively-managed pink stock in this sub-area is from Soda Creek and returns later than the other stocks. The even-year cycle was increasing in numbers and approaching the target escapement, until the floods in 1980 reduced the subsequent returns to only 750 fish in 1982.[1]

The combined escapement target for the Fraser/Graham passively-managed pink stocks is 28,800. The even-year stocks are at a low level, with escapements below 5000 pink. The odd-year stocks are also depressed and characterized by variable returns, but escapements (e.g., 13,000 in 1983) are slightly higher than those of the even-year stocks.[1]

Chum stocks in the Fraser/Graham sub-area are at extremely low levels and fluctuating. The two actively-managed stocks from the Green and Khutze Rivers have target escapements of 15,000 and 30,000, respectively. Between 1980 and 1983, escapements of the Green River stock ranged from 300 - 16,000. Average escapements over the past three decades have varied from 20 to 50% of the target level. Khutze chums are severely depressed, with some recent escapements at less than 1% of the target. The 11 passively-managed stocks from streams in this sub-area have a combined target escapement of 20,100, but numbers are presently fluctuating at about 10% of this level.[1]

Chinook production from the Fraser/Graham sub-area is minor, and of the three streams that have historically supported chinook, there have only been escapements to the Khutze River in recent years. Current chinook escapements for the three streams in the sub-area are 3% of the target of 1,050, which represents 1% of the total Area 6 target escapement.[1]

Five streams support steelhead in the Fraser/Graham sub-area. These are the Aaltanash, Canoona, Green, Khutze and Klekane Rivers. Escapement data are not well documented; however, timing is thought to be similar to other Kitimat area

steelhead stocks in that they are winter-run fish. Commercial interceptions are not considered to be a problem.[2]

1.5 Laredo Sound

There are seven passively-managed sockeye stocks utilizing streams in the Laredo Sound sub-area. The overall target escapement is 14,900, but returns have been declining since 1962 and have totalled only 5% of the target in two out of the past four years.[1]

There are 20 small coho stocks in the Laredo Sound sub-area. The current combined escapement is approximately 20% of the target of 15,850. This sub-area target is only 6% of the overall total for coho in Area 6.[1]

Laredo Sound pink stocks (3 actively-managed, 17 passively-managed) apparently were severely damaged by the 1980 floods. During 1980, escapements of the three actively-managed stocks reached or exceeded target levels, but the 1982 returns averaged just above 3% of the target escapements. These targets are 35,000 for Arnoup Creek, 20,000 for Nias Creek and 15,000 for Tyler Creek. Odd-year stocks are severely depressed and still decreasing in size. The passively-managed pink stocks, with a combined target escapement of 35,000, are also in poor condition at the present time.[1]

In contrast to pink stocks, Laredo Sound chums are in good condition relative to other Area 6 chum stocks. Escapements to Arnoup Creek have generally been about 50% of the target (5000). The target for Nias stock is 10,000 and recent escapements have achieved 70% of this goal. The escapement target for the Tyler chum stock is 8000 and recent escapements have ranged from 50-75% of the target. Price Creek chums have a later run timing than the other chum stocks in this sub-area and a target escapement of 10,000. However, recent escapements have ranged from 20-70% of the target. The other 16 passively-managed stocks have a collective escapement target of 9000, although recent escapements have averaged about 25% of this level.[1]

There are no chinook or steelhead stocks in the Laredo Sound sub-area.

1.6 Campania Sound

There are no actively-managed stocks of any species in the Campania Sound sub-area. There are six passively-managed sockeye stocks, with a combined target escapement of 2500. However, sockeye stocks in this sub-area are depressed and characterized by variable returns. The passively-managed pink stocks have a combined escapement target of 112,000 although current escapements are only about 20% of this target. In general, the even-year pink stocks have higher returns than do the odd-year stocks. The passively-managed chums from 19 streams in the Campania Sound sub-area are depressed and fluctuating. The target escapement is 9900, and recent escapements have ranged from 300 to 4500. There are 24 small coho-producing streams in the sub-area, and the recent escapement to these streams is 13% of the target of 18,200. The sub-area total is 7% of the overall target escapement for coho in Area 6.[1]

1.7 West Side Aristazabal Island

There are no actively-managed stocks in this sub-area. A passively-managed group of 10 sockeye stocks is currently very low and variable near 20% of the target escapement of 5700. There are 16 passively-managed pink stocks with a combined target escapement of 102,800. The even-year escapement is currently declining and at about 4% of the target. In contrast the odd-year run is increasing in numbers and has an escapement near 10% of the target. There are 16 passively-managed chum stocks in the sub-area with a combined target escapement of 24,000. Escapement (8700 in 1983) of chums has increased slightly in recent years. There are no chinook stocks in this sub-area, although there are 16 small coho-producing streams. Recent coho returns are approximately 10% of the target escapement of 15,850 and the sub-area target is 6% of the total for Area 6.[1]

2. FISHERIES

Area 6 is managed as a major mixed-stock fishery in the Gil Island Area. There is some attempt to match weekly exploitation in fisheries to individual stock surpluses, although this is difficult to achieve because of the complexity of the mixed-stock fishery problem. Management of the commercial fishery is guided by apparent fish abundance in the Gil Island area (as indicated from commercial catches), and current catch data compared to historical catch data for equivalent weeks. In-season escapement information is derived primarily from a subset (key

streams) of the 130 streams in Area 6. The key streams for Area 6 are the Kitimat, Dala, Quaal, Kemano, Kitlope, Canoona and Green rivers and Arnoup, Gilttoyees, Kitkiata and Gil creeks.[4]

There is currently no fishery directed specifically at Area 6 sockeye stocks. The catches of sockeye that do occur in Area 6 are incidental in the pink and chum fisheries, and are largely passing stocks.[4]

The pink and chum fisheries in Area 6 are primarily restricted to waters adjacent to Princess Royal Island, including Whale Channel, Squally Channel, Campania Sound, Laredo Sound, Princess Royal Channel, Fraser Reach and McKay Reach (Management Units 6-5, 6-6, 6-7, 6-10, 6-11, 6-13, 6-14, 6-15, 6-16, 6-20, 6-26 and 6-27). Both gillnets and seines are permitted in all fisheries.[4]

The following general description of commercial fishing areas is intended to outline those areas that would be opened if all stocks had harvestable surpluses. This is not the case because of the current size of some stocks. The fishery would open in early July in Management Units 6-5, 6-6, 6-10, 6-11, 6-26 and 6-27 for Kemano pink and chum stocks, Kitimat pink and chum, Quaal pink and Douglas chum stocks (Figure 3). These stocks are present in the fishery until the end of July. In mid-July, the fishery would be expanded to include Laredo Sound pink and chum stocks in M.U. 6-14, 6-15 and 6-16 and the Fraser-Graham pink and chum stocks in M.U. 6-7 and perhaps 6-20. Finally, the fishery would begin in early August for Aristazabal pinks and chums in M.U. 6-13, and Campania pinks and chums in M.U. 6-10. All commercial fishing activity would end in early September.[4]

3. CURRENT ENHANCEMENT ACTIVITIES

The current enhancement activities in Area 6 are a major hatchery, a smaller CEDP facility, and a Lake Enrichment Project. A pilot hatchery on the Kitimat River for chum and chinook salmon stocks was discontinued when the major hatchery began operating on this river in 1983.[5] The lake enrichment project for Kitlope Lake is continuing, although there is some question regarding its effectiveness in increasing sockeye production.

The Kitimat Hatchery is located approximately 3 km south of Kitimat. The original plan was to enhance nine chum stocks and a variety of chinook and coho

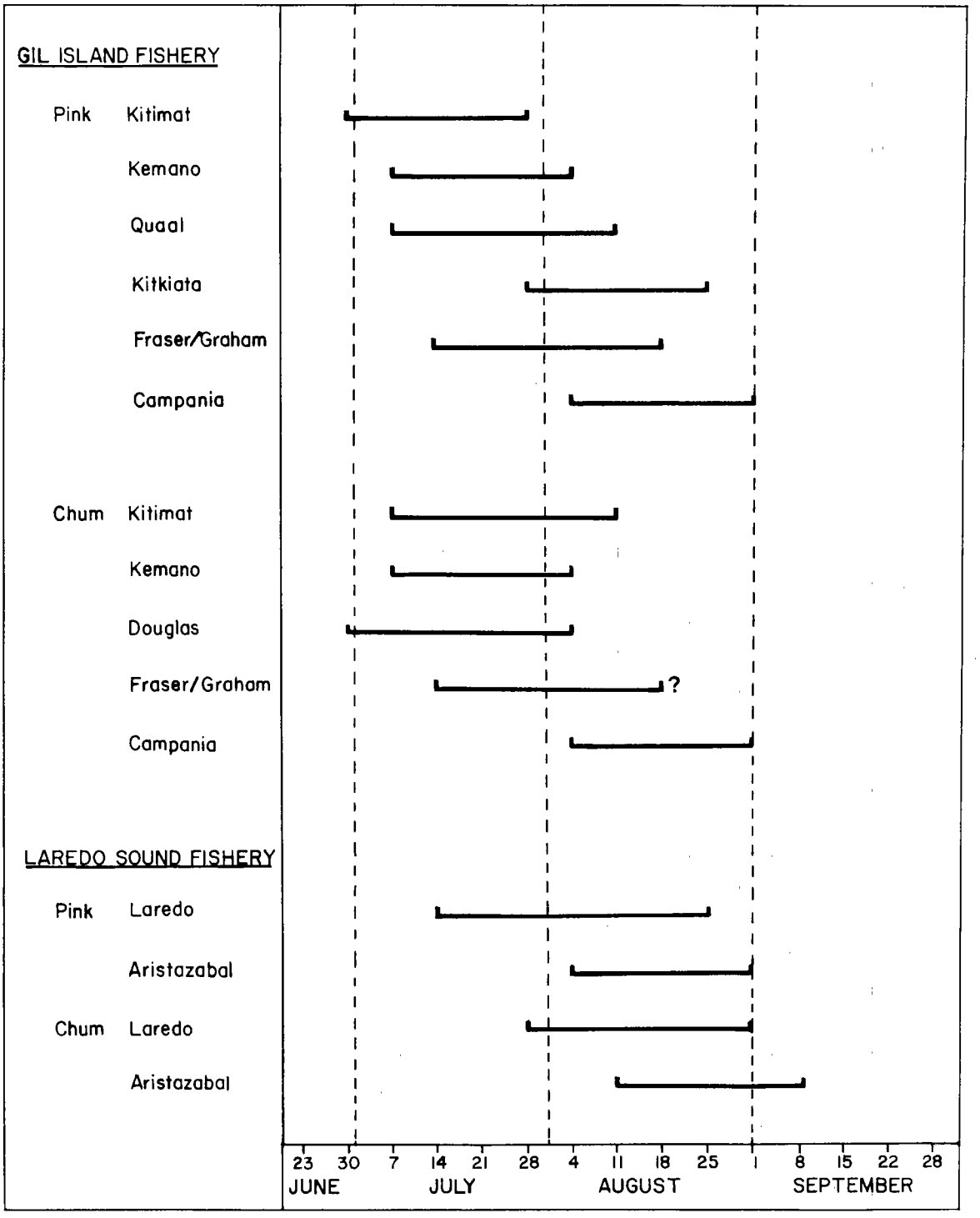

Figure 3. Stock migration timing through Gil Island and Laredo Sound fisheries.

stocks in the Kitimat River and Kildala Arm. There are also plans to incubate and rear small numbers of pink and sockeye salmon and steelhead trout.

The production goals for the Kitimat Hatchery at capacity are:

Species	Egg Take	Adult Production
Chum	11 million	158,400
Chinook	3 million	32,400
Coho	600,000	60,000
Steelhead	55,000	1,000

Egg collection targets for 1984 were 3 million chum and 2 million chinook eggs. The chinook target was achieved. However, because of the depressed state of chum stocks in the Kitimat area, only 30% of the egg target for this species was realized, despite a low exploitation rate in 1983 and 1984. A smaller hatchery has been operated as a Community Economic Development Project by the Hartley Bay Band since 1983. This facility is presently rearing 80,000 coho from Hartley Bay Creek.[5]

4. HABITAT STATUS

Development within Area 6 is limited to the northern, inner coastal area, and was, to a large degree, precipitated by the construction of the Alcan Aluminum Smelter at the head of Kitimat Arm. The aluminum smelter complex included the townsite of Kitimat, the smelter itself, and a port development, all at the head of Kitimat Arm, as well as the Kemano hydro-electric installation midway along Gardner Canal. After the area was opened up by the smelter development, further development occurred in the form of transportation, logging, and increased settlement, followed in late 1960's by a pulp and paper mill, and more recently a petrochemical installation.[6]

Logging began in earnest in the Kitimat River watershed in the early 1950's. The lower elevations have been virtually clear-cut, while timber harvest in the upper elevations has been more selective and limited. At present the infrastructure is being developed to begin logging in the as yet undisturbed Upper Kitimat

drainage. The impacts of past logging have been extensive. Removal of the forest cover, coupled with naturally-occurring fluctuations typical to the coast, has led to habitat loss through scouring, siltation, and debris deposition. The system has now begun to stabilize; however, it is uncertain whether historic productivities will be achieved.[6] In addition to the major logging that has been carried out in the Kitimat watershed, the Kitlope River at the head of Gardner Canal, and several other small river systems throughout the Gardner Canal and Kitimat Arm areas have been subjected to logging. For the most part, impacts in these areas have been low to moderate, and are expected to continue at this rate.[6]

With a few minor exceptions, the remainder of Area 6 is virtually pristine. Exceptions include small, fishing communities of Butedale and Hartley Bay, as well as some small-scale, localized mineral exploration and logging.[6]

The dominant stream contributions to maximum recorded escapements are summarized by sub-area and species in Table 2. The information has been taken from individual stream habitat summaries prepared under contract by H. Paish and Associates[6] for DFO; these are presented in Appendix III.

5. MANAGEMENT CONFLICTS

The most important fisheries management conflicts to be resolved for Area 6 are those problems associated with mixed-stock fisheries and management uncertainties. These conflicts are discussed separately below.

5.1 Management Uncertainties

The primary management uncertainty in Statistical Area 6 is the assessment of stock size (run strength). At present, the primary indicator used for the evaluation of run strength is the seine catch. There are two significant problems with use of this indicator. Firstly, weekly seine catches may not reflect the subsequent escapement to the spawning grounds. For example, high catch rates were achieved in 1983, but the expected escapements were not realized. Secondly, the fishery can quickly harvest a large proportion of the salmon stocks returning to Area 6. In 1984, an overall exploitation rate of 50% of the total return of over 1 million pink was achieved in only four days of fishing. In one day, 16% of all the pinks returning to Area 6 were taken in the Gil Island fishery. Run strength is also estimated from in-season escapement counts.[4] Such counts are imprecise and

Table 2. Summary of streams historically supporting salmon populations in Statistical Area 6.

	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
Gardner Canal	1	1	100	10	8	99	6	10	90	10	7	97	6	5	98
Kitimat Arm	2	1	?	16	11	98	13	11	98	11	10	98	10	7	99
Douglas/ Ursula/Devastation	4	4	100	17	10	96	17	7	95	20	7	95	0		
Fraser/ Graham	4	1	95	13	8	96	12	8	97	13	6	80	1	1	95
Campania/ Laredo Channel	6			21	8	84	21	9	91	24	9	80	0		
Laredo Sound	10	7	91	20	10	85	21	10	82	20	7	86	0		
West coast Aristazabal	10	8	90	16	10	85	16	7	85	16	9	80	0		

[a] = Total number of streams that have historically supported species indicated.
[b] = Significant number of streams which have historically contributed most to production of species indicated.
[c] = Percentage of Maximum Recorded Escapement (MRE) is the percentage contribution of the significant streams to the total maximum recorded escapement.

the projections of expected total escapement are often in error because of uncertainties associated with the temporal and spatial patterns of the adult migration.

5.2 Mixed-Stock Harvests

There are major mixed-stock harvest conflicts in Area 6. Salmon from over 100 streams are harvested in the Gil Island fishing area. The runs of most important stocks overlap in time (Figure 3), and management on a stock-by-stock basis in this area is impossible. For example, a conservative management strategy was followed in 1984; there were no openings until 12 August (i.e., 4 to 6 weeks later than was the case five or six years ago) and the fishery was open for only four days. This resulted in a 50% exploitation rate on pink and a total pink escapement of less than 50% of the target. In addition, the situation is actually worse than it appears because 40% of this escapement was to the Kemano River, which had 240,000 spawners (90,000 more than the target escapement), while chum escapements overall were less than 25% of the desired levels.[4]

The underlying problem in Area 6 is the extreme difference in the productivity of various stocks. For example, the Quaal and Kemano pinks appear to be much more productive than other Area 6 stocks. The presence of Kitimat Hatchery chums will aggravate the situation if the hatchery is operated at full capacity. If the fishery was geared to target on less productive stocks, the catch of more productive stocks would have to be forgone. Conversely, if the fishery was focused on the more productive stocks, the less productive stocks would be severely depleted.

6. STOCK REBUILDING POTENTIAL

The following sections summarize the potential for stock rebuilding in each sub-area of Statistical Area 6.

6.1 Gardner Canal

The potential for rebuilding sockeye stock in the Gardner Canal sub-area is limited. The Lake Enrichment Program at Kitlope Lake has not been considered a success, probably due to the high flushing rate. Both odd- and even-year cycles of Kemano pinks are approaching the optimum escapement. On the other hand, the passively-managed pink stocks are currently at less than 10% of the target and will

be difficult to rebuild by any means other than enhancement. Both actively- and passively-managed Gardner Canal chum stocks are near or below 10% of the target escapement. The potential for rebuilding these chum stocks is limited if the high exploitation of Kemano pinks is continued.

6.2 Kitimat Arm

The sockeye stocks in the Kitimat Arm sub-area are mostly creek sockeye, (which are thought to be less productive than those that rear in lakes) and are within 20% of the target escapement. The rebuilding potential for sockeye is limited, although these stocks should benefit from the reduced exploitation necessary to rebuild the Kitimat pink and chum stocks. Kitimat pink and chum stocks are at less than 10% of the target escapements, although the potential for rebuilding these runs is considered high. Changes in the fishing pattern in Area 6 have significantly reduced the harvest of these stocks. In addition, operation of the Kitimat hatchery will eventually result in an increase in the productivity of chum stocks in the Kitimat system.

6.3 Douglas, Ursula and Devastation Channel

There is limited potential for the rebuilding of sockeye stocks in this sub-area. However, local sockeye interceptions may decline if the fishery for Kitimat and Gardner stocks is moved to a more terminal area than Gil Island. The rebuilding potential for pinks and chums in this sub-area is good. Pinks are currently at 50% of the target escapement, while chum stocks are at 10-20% of the target level. Harvest rates of these stocks could be decreased by implementing changes to fishing patterns.

6.4 Fraser Reach and Graham Channel

The rebuilding potential for sockeye stocks in this sub-area is considered low, although sockeye interceptions will be reduced if fisheries directed at pink and chum stocks are relocated to a more terminal area. The potential for rebuilding pink stocks is good, although odd-year pink escapements have already been near the target level in recent years. The even-year pinks will require special attention if they are to recover from the low escapements caused by floods in 1980. Alteration of the fishing patterns in Area 6 would provide some flexibility to allow protection of these stocks. The rebuilding potential for chum salmon stocks is only fair. Despite the fact that they are currently at only 10% of the

target escapement, it is not likely that they will easily be rebuilt. A major conflict that will significantly affect the rebuilding of chum stocks is the greater strength and productivity of the pink stocks.

6.5 Laredo Sound

Sockeye are not currently harvested in the Laredo Sound sub-area. Consequently, there is little more that can be done to rebuild these stocks, despite the fact that they are currently at only 5% of the target escapement. Even-year pink escapements were at the target level before the 1982 floods, and it is expected that stocks will rebuild fairly quickly if they are not harvested until target escapements are achieved. Odd-year pinks in this sub-area have never had large returns but the rebuilding potential is considered high. Changes to fishing patterns in the Laredo Sound area have already started the rebuilding process for pink stocks. There is also a good potential for the rebuilding of Laredo chums, since exploitation in the sub-area has been greatly reduced.

6.6 Campania Sound

The potential for rebuilding sockeye stocks in this sub-area is considered fair. The most recently recorded escapements were 60% of the target and changes in the Gil Island fishery would continue to reduce the interception of sockeye. There is substantial stream-to-stream variability in the escapement of Campania pink stocks. As with sockeye, changes to the Gil Island fishery may also reduce the interception of both pinks and chums. The rebuilding potential for rebuilding of chum stocks in this sub-area is not as high because of the greater productivity of the Campania pink stocks.

6.7 West Side Aristazabal Island

Sockeye escapements to this sub-area are currently about 20% of the target level. However, these stocks may benefit from changes to the Laredo and Gil Island fisheries. Pink and chum stocks are currently at extremely low levels in relation to the target escapements, although these targets may be unrealistically high. Nevertheless a reduction in the exploitation rate associated with the Laredo Sound fishery should also benefit these stocks.

7. MANAGEMENT STRATEGIES FOR STOCK REBUILDING

7.1 Management Uncertainties

The following options are considered feasible to reduce existing management uncertainties in Statistical Area 6.

1. Continue and expand test fishing programs initiated in 1984: In 1984, a chartered seine boat was used to conduct test fishing programs from 9 July to 4 August in the Gil Island area. Although it was difficult to provide reasonable coverage of the entire area with only one vessel, the test fishery did confirm the expected low returns, without creating unnecessary additional risks to the stocks that are associated with a commercial test fishery. Based on the results of test fishing programs, the commercial openings were delayed by four to six weeks due to apparently poor run strength.

The fishery cannot be managed to produce target escapements unless timely and accurate information regarding escapement is available. Therefore, test fisheries in the terminal areas should be initiated, since they could act as indicators of escapement of stocks past the fishing zone. For example, Gardner Canal and Kitimat Arm are two feasible test fishing areas that would provide early estimates of escapement to these sub-areas if properly calibrated with the true escapement data.

2. Install a fence on the Quaal River and evaluate the potential for counting facilities on other streams: Escapement of salmon stocks to the Quaal River should be a good indicator of total escapement to the Douglas, Ursula and Devastation Channel sub-area. Furthermore, the installation of a fence or counting tower on the Quaal River is considered logistically feasible. The potential for the construction of counting facilities on other streams in Area 6 should also be reviewed and evaluated.

7.2 Mixed-Stock Harvests

Options for resolving some of the conflicts resulting from mixed-stock fisheries are described below:

1. Harvest any Kitlope sockeye surplus in the outer portion of Gardner Canal: Kitlope sockeye are an early-running stock and, therefore, could be

harvested in the outer portion of Gardner Canal (in part of M.U. 6-4) without causing conflicts to other stocks in the region. The ability to control fishing effort would be necessary to properly manage the exploitation of this stock. Quality loss would be minimal if this management option was employed.

2. Conduct fisheries for Kemano pink and chum stocks in outer Gardner Canal: Kemano pink and chum stocks could also be harvested selectively in the outer portion of Gardner Canal (part of M.U. 6-4). A major benefit of this strategy is that the Kitimat, Douglas and Fraser/Graham sub-area stocks would no longer be harvested incidentally to the highly productive Kemano pinks. Unfortunately, the suggested fishing area is quite restricted, and there would likely be some decrease in the quality of the catch.

The Kitlope stocks are suspected to overlap with the Kemano stocks in terms of migration patterns (i.e., the former would be harvested incidentally in M.U. 6-4). There is a great deal of uncertainty associated with the target escapement and productivity of the Kitlope stocks because the stream system is of glacial origin and observation conditions are very poor. Recent escapements to the Kitlope River have been listed as "non-observed" or a few thousand fish.

3. Move the target fishery on Kitimat pink and chum stocks to M.U. 6-4 (inner portion of Douglas and Devastation channels): This option could result in a considerable reduction in the quality of the catch, and impose a new and more restrictive area for the commercial fleet to operate. A compromise solution of moving the fishery a little further out into M.U. 6-2 or 6-3 is not acceptable because there would be a direct conflict with Quaal-Douglas or Gardner Canal stocks (i.e., location of the fleet in M.U. 6-2 or 6-3 is no improvement over the present Gil Island fishery).

Moving the commercial fishery to M.U. 6-1 would not solve all of the mixed-stock problems that are associated with Kitimat pink and chum stocks. The Kitimat Arm stocks are from a combination of tributary streams to the Kitimat and Dala rivers. There will undoubtedly be harvest conflicts among these streams because of geographic proximity. Some mitigation of these conflicts may be possible by controlling the operation of the Kitimat hatchery. Nevertheless, the enhancement of Kitimat chums may eventually pose a threat to pink stocks, since the exploitation rate required for enhanced Kitimat chums may be higher than that required for returning pinks. This potential problem could be reduced through selective

harvesting of chums using gillnets; although a gillnet-only fishery would represent a departure from the historical gear allocation in Area 6.

4. Maintain Gil Island fishery: If the fishery is continued in the Gil Island area, effort should be directed at determination of the overall exploitation rate that would yield the highest total production from the area. The present system of operating a fishery at Gil Island for any suspected surplus from any stream in the area cannot maximize benefits to fishermen. If the Gil Island fishery is maintained there must be a considerable reduction in the overall exploitation rate.

5. Move target fisheries on Fraser/Graham stocks to M.U. 6-7 (McKay Reach) and to the top portion of M.U. 6-20: Fraser/Graham stocks could be harvested in McKay Reach (M.U. 6-7) and in the northerly part of M.U. 6-20. This option would result in some interception of Kitimat, Douglas and Gardner stocks, although any conflicts should be minimal. The fishing area would be more restrictive, but the move is expected to result in little reduction in the quality of the catch.

6. Conduct future fisheries for Laredo Sound stocks in M.U. 6-16: Laredo Sound pink stocks will require complete protection for several years. Therefore, gillnet-only fisheries with large mesh nets should be used to harvest any future chum surplus. A reasonably discrete fishery on chum stocks can be located in M.U. 6-16, since the migration timing of this stock is later than that of the inside Laredo Inlet stocks. Interception of Campania chums should be the only potentially serious conflict.

8. FUTURE STOCK ENHANCEMENT ACTIVITIES

The following is a brief description of future enhancement projects that are considered compatible with current management options. The project number included with each description is from Lill et al. (1983).[7]

8.1 Kemano Pilot Facility and Channel Improvements (Project No. 6-1A)

A pilot experimental facility is proposed and would use the available Kemano infrastructure to the extent possible. This facility would be designed to develop techniques that could be used for the large-scale enhancement of chum, pink, and chinook stocks. The stocks produced by a major facility in the future could be

discretely harvested in Gardner Canal. The techniques expected to be studied at the pilot facility include:

1. Cold-water fish culture techniques for chinook salmon, including the use of heat pumps to provide pulse heating to initiate feeding, since this is difficult at lower temperatures;

2. Channel improvement technologies to improve egg-to-fry survival of pinks and chums homing on the tail-race supply*; and

3. Any feasible outplanting possibilities to assist Kitlope stocks (and possibly other stocks) that are harvested concurrently with Kemano stocks.

Saltwater pen-rearing projects are not considered feasible because surveys have shown that there is a deep freshwater lens in the few potential sites with sufficient shelter for establishing a pen site.

It is believed that warming of the Kemano River by the tail-race supply has possibly benefited Kemano pink and chum salmon stocks by causing earlier emergence from the gravel. This would then permit earlier downstream movement of fry to the estuary and allow them to take advantage of better rearing conditions in nearshore waters before the spring runoff increases turbidity.

The experimental project has tentative targets set at 500,000 chinook and 100,000 coho eggs, which should yield approximately 10,000 and 1500 adults, respectively. The channel improvements would yield approximately 30,000 returning chum adults, or perhaps a mixture of pinks and chums. The facility for coho and chinooks would operate for approximately 5 years, and would then either be closed or expanded to a permanent facility. The channel improvements should have a useful life of at least 10 years with minimum maintenance.

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* Pink and chum salmon returning to the Kemano River exhibit a marked preference for the discharge flow from the powerhouse, probably because the water is warmer and clearer than the Kemano River proper. The intent of the proposed enhancement project is to provide improved spawning substrate in an area where the fish prefer to spawn.

8.2 McKay Creek Side Channel Construction (Project No. 6-8B)

A side channel on McKay Creek in the Kitimat drainage is proposed to enhance stream sockeye production. The channel would be 5000 m^2 in size and is expected to produce approximately 37,000 sockeye.

8.3 Butedale Hatchery Project (Project No. 6-16B)

Butedale is the most attractive of a number of outstanding opportunities for large-scale fish culture facilities in Area 6. Along with the other sites (i.e., Whalen Lake, Yule Lake, Surf Inlet and Redbluff Lake), the Butedale site has a large gravity-fed water supply. Water quality at the site should be good because all of the stream systems have large lakes to act as temperature and sediment buffers. In addition, the Butedale site has an unused cannery/cold storage facility, and parts of this facility could be adapted easily for the purposes of fish culture. Since the present owner is interested in developing the site as both a lodge and aquaculture facility, a co-operative program may be possible at a relatively low cost.

The project could be undertaken in one of two ways: (1) It could serve as a central facility to rehabilitate sub-area chum and pink stocks; or (2) an entirely new fishery could be developed, using transplanted stocks that are sufficiently different in migration timing from local and passing stocks to minimize interception problems. With respect to the latter alternative, chinooks that run in May (or possibly Kitimat chinooks which run in June), or sockeye that run from April to June have been identified as desirable donor stocks. Coho, chum and pink salmon are less desirable species to transplant due to the potential for overlap with existing stocks. Sockeye would probably be incubated at the Butedale facility and then outplanted to nearby hanging lakes* in the Surf Inlet area or possibly Whalen Lake. Surf Inlet is the preferred incubation area. Chinooks would be incubated and reared in artificial ponds at the hatchery site.

* Hanging lakes are lakes which end in an abrupt descent into a valley, or in coastal systems, a fjord. These abrupt descents are often high waterfalls from the lake to the fjord, and hence are barren of salmon. Because there are no natural stocks of salmon, hanging lakes are thought to be excellent rearing areas for hatchery outplant programs.

As a first stage in this enhancement project, a facility that would release about 4000 kg of juveniles of one species is proposed. If only 5-g chinooks were produced the total adult production is expected to be 24,000 fish. On the other hand, total adult production could be 121,000 fish if unfed sockeye fry were outplanted.

There is considerable uncertainty regarding the benefits and probability of relocating Area 6 fisheries to more terminal areas. The contribution of a central enhancement facility to local fisheries is difficult to predict and would require further analysis. If this project were successful, it could create a new commercial fishery and possibly a sports fishery, and there could be negligible interception problems of other stocks. However, additional biological and engineering feasibility studies are required at the proposed site, of the Butedale hatchery.

8.4 Hartley Bay Hatchery (Project No. 6-24)

This is a relatively new pilot project, and currently involves incubation of 160,000 coho eggs. The opportunities for expansion of the facility have not been fully evaluated, although it is recommended that the project be continued until this assessment can be completed.

9. RESULTS OF SIMULATION MODELLING

A number of management conflicts and uncertainties were described in the preceding sections. Mixed-stock fisheries were identified as the major contributor to the problem. As a result, a series of more discrete terminal fisheries were identified as one alternative to the mixed-stock fishery. The rationale for this conclusion was that a reduction in mixed-stock harvests would also minimize the conflicts and uncertainties associated with these fisheries.

In past analyses and discussions, the benefits and costs regarding the shift to more terminal fisheries have been identified. Among the costs are such considerations as reduced fish quality and, at least in the short term, an increase in management uncertainty. This increased uncertainty is associated with the trade off between fishing as early as possible to maintain a high fish quality, and delaying the harvest to ensure that escapement targets are met. Experience from other areas indicates that this uncertainty decreases after about one cycle, because of improvements in migration timing data. Benefits of terminal fisheries

include more precise fishery management, which leads to both increased catch and escapements, as well as a reduction in the interception of passing stocks.

There may be significant merit in moving one segment of the traditional mixed-stock fishery at Gil Island to a terminal fishery. This segment is the early portion of the Gil Island pink and chum fishery, which targets largely on Kitimat Arm and Gardner Canal stocks from the innermost sub-areas of Statistical Area 6. This move could be particularly significant because many sub-areas in Area 6 are not suited to terminal fisheries due to the geography. There is also merit in this strategy because Kitimat Arm stocks are generally very depressed, while Gardner Canal stocks (specifically Kemano pinks and chums) generally are very strong.

The mixed-stock fishery model described in Volume A was used to analyse the implications of such a move. Two simulations were completed as part of this analysis. The first scenario is intended to represent the current fishing patterns in Area 6, and involves early-, middle- and late-season mixed fisheries that target on any available surpluses. The value* of this management scenario over the forty-year simulation is $113.7 million. The second scenario is referred to as Option 1 and represents a departure from current management in one respect only; the early-season segment of the mixed fishery has been replaced with two discrete fisheries; for Gardner Canal, and Kitimat Arm. The Gardner Canal fishery targets on Kemano pinks, while the Kitimat Arm fishery would eventually be directed at Kitimat River chum. The value* of this scenario is $121.7 million and represents a 7% increase over the current management strategy.

The results of the current management simulation for different sub-areas and stocks are presented graphically in Figures 4 to 17. Because of their assumed higher productivity, the Kemano pink and chum stocks (Figures 4 and 5) dominate the early segment of the fishery. The effects of this domination can be clearly seen in the projections for Kitimat Arm pinks (Figure 6). Kitimat River pink stocks are assumed to have a lower than average productivity due to habitat damage in the Kitimat system. Because of the higher productivity associated with the Kitimat hatchery, the escapement and catch of Kitimat River chum are projected to increase (Figure 7).

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* Throughout this discussion, the term "value" is used to describe the net present value of a projected forty years of harvest, discounted at 10% annually.

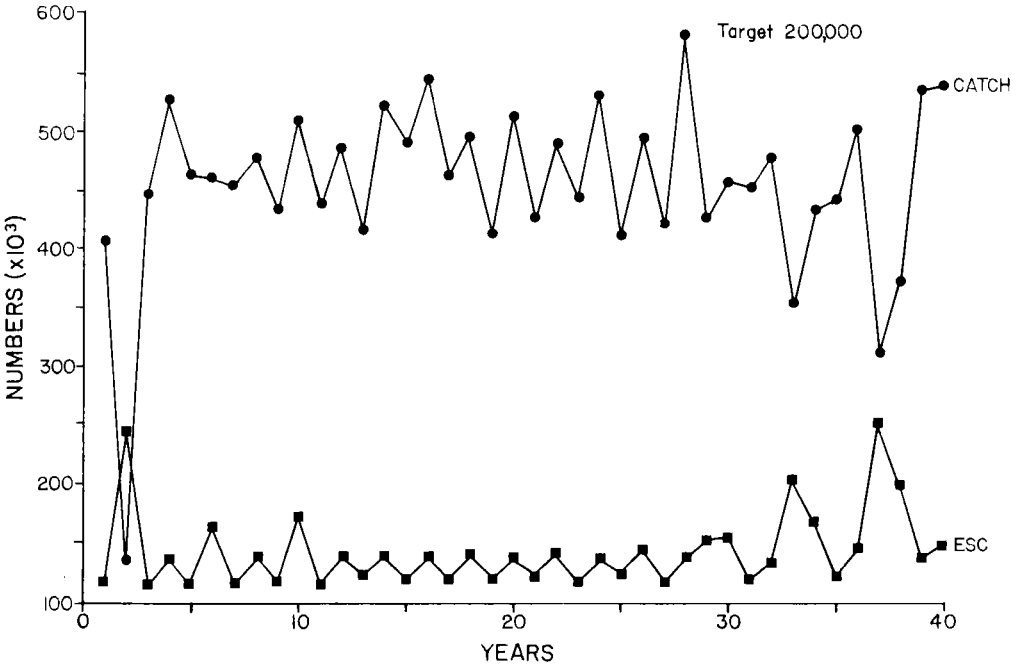

Figure 4. Projected catches and escapements of Gardner Canal pinks under the current management regime.

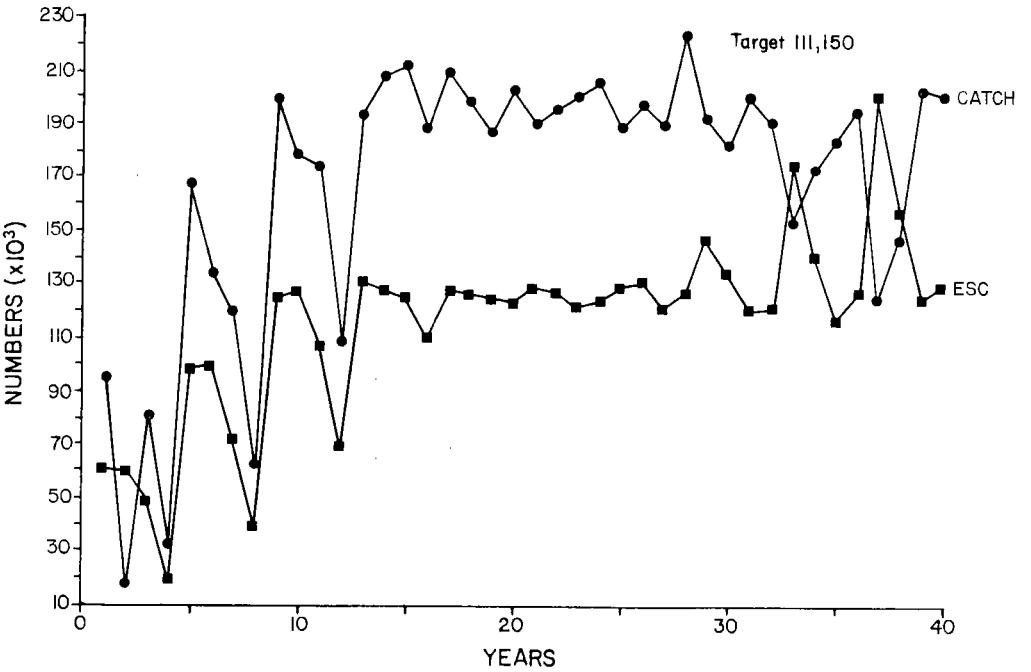

Figure 5. Projected catches and escapements of Gardner Canal chums under the current management regime.

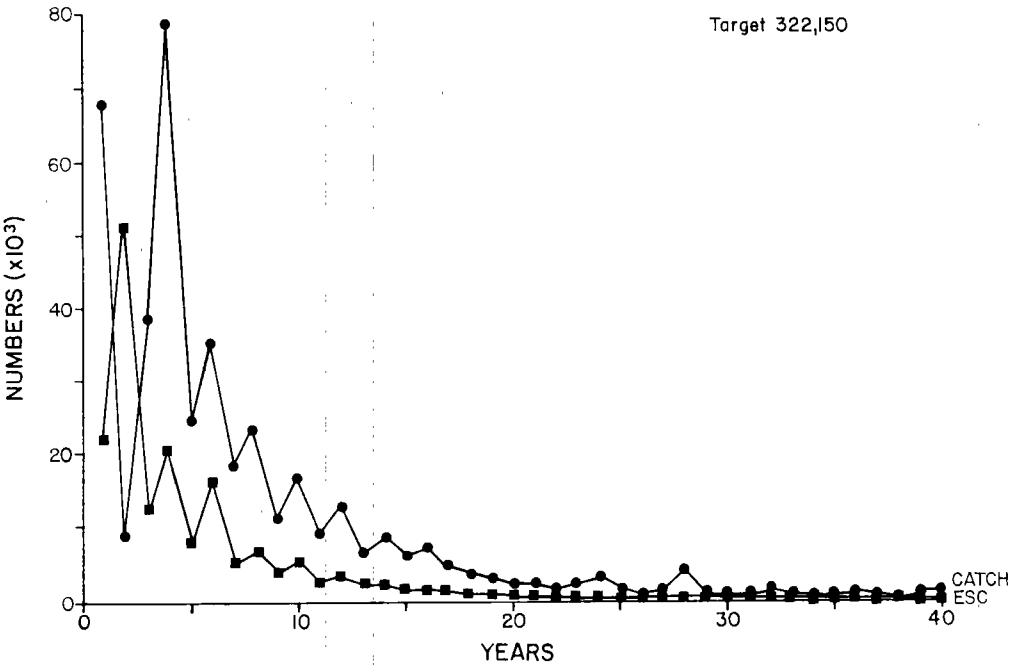

Figure 6. Projected catches and escapements of Kitimat Arm pinks under the current management regime.

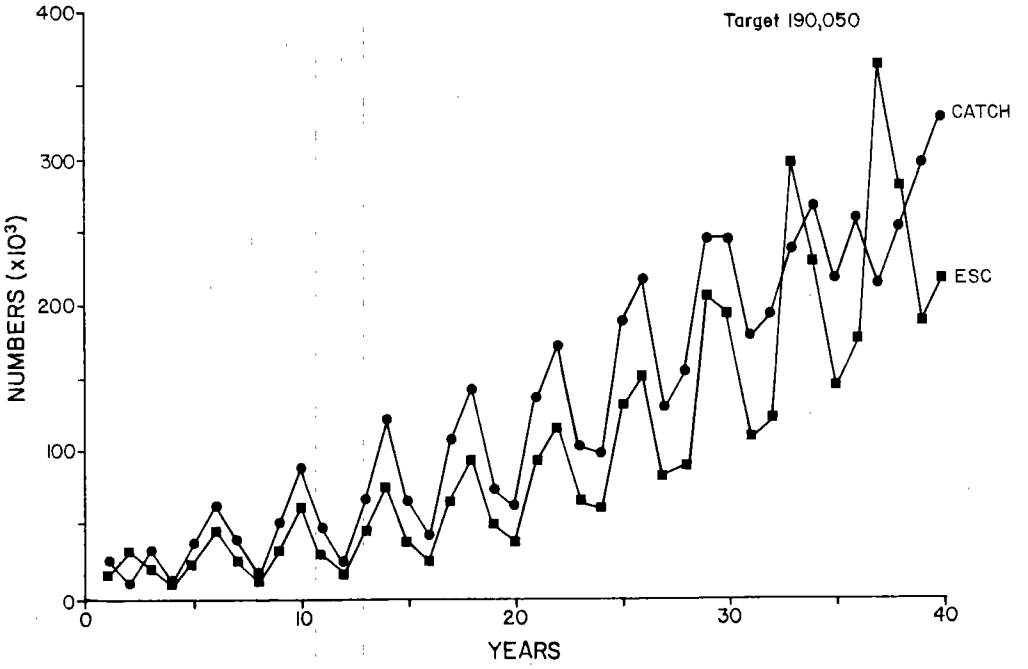

Figure 7. Projected catches and escapements of Kitimat Arm chums under the current management regime.

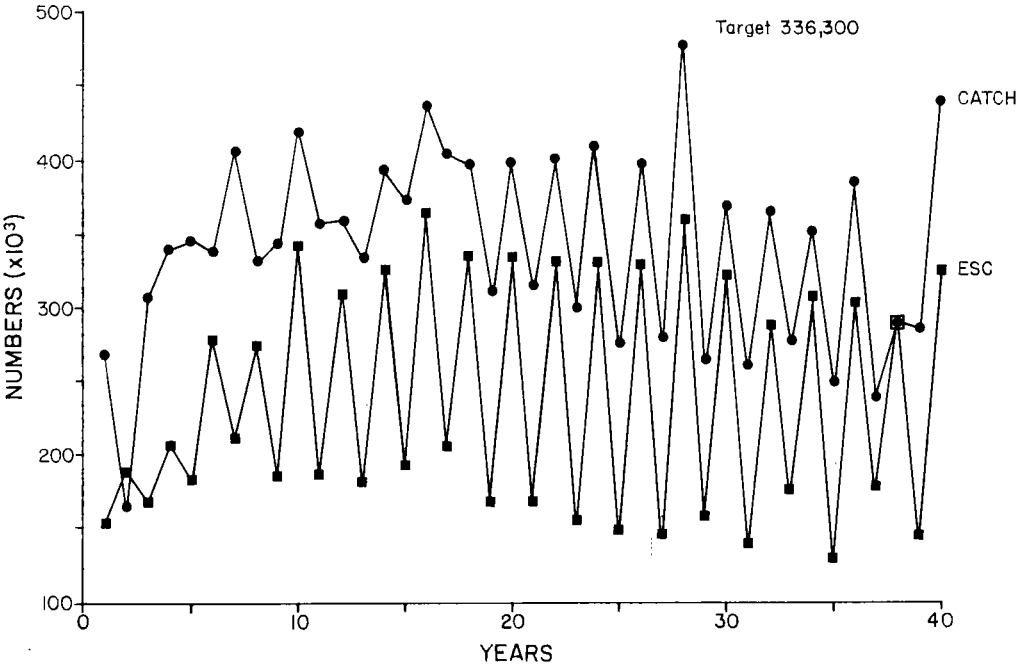

Figure 8. Projected catches and escapements of Douglas/Ursula/Devastation pinks under the current management regime.

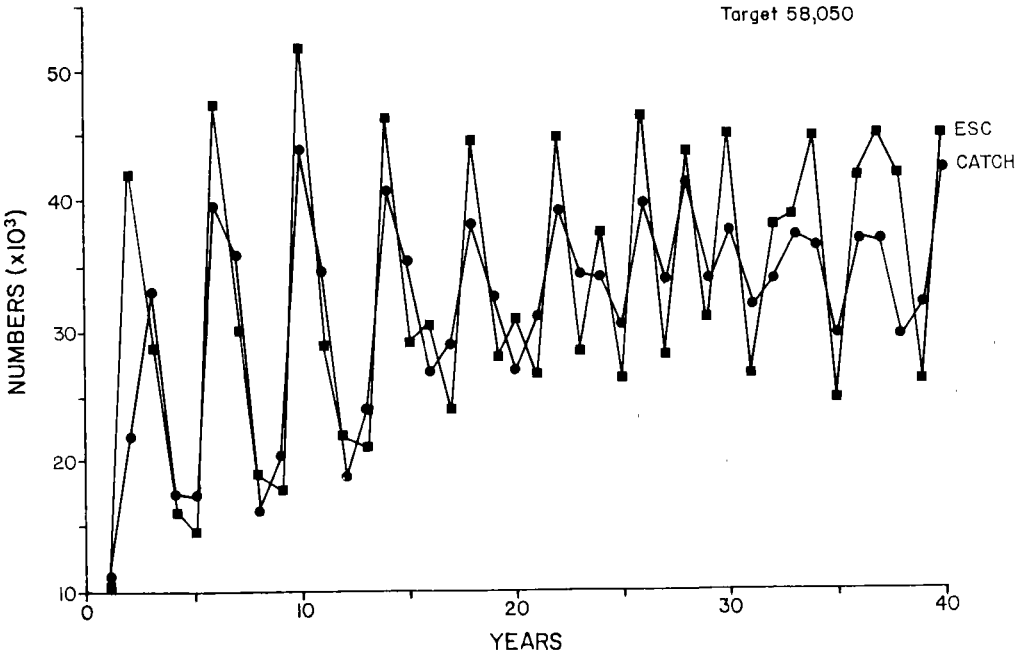

Figure 9. Projected catches and escapements of Douglas/Ursula/Devastation chums under the current management regime.

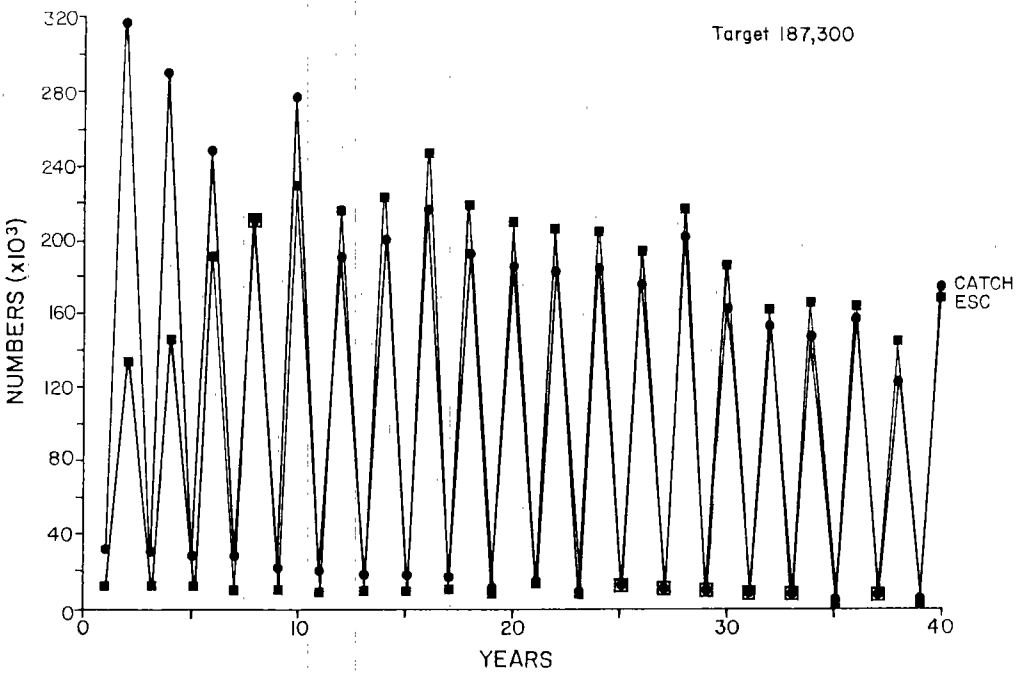

Figure 10. Projected catches and escapements of Fraser/Graham pinks under the current management regime.

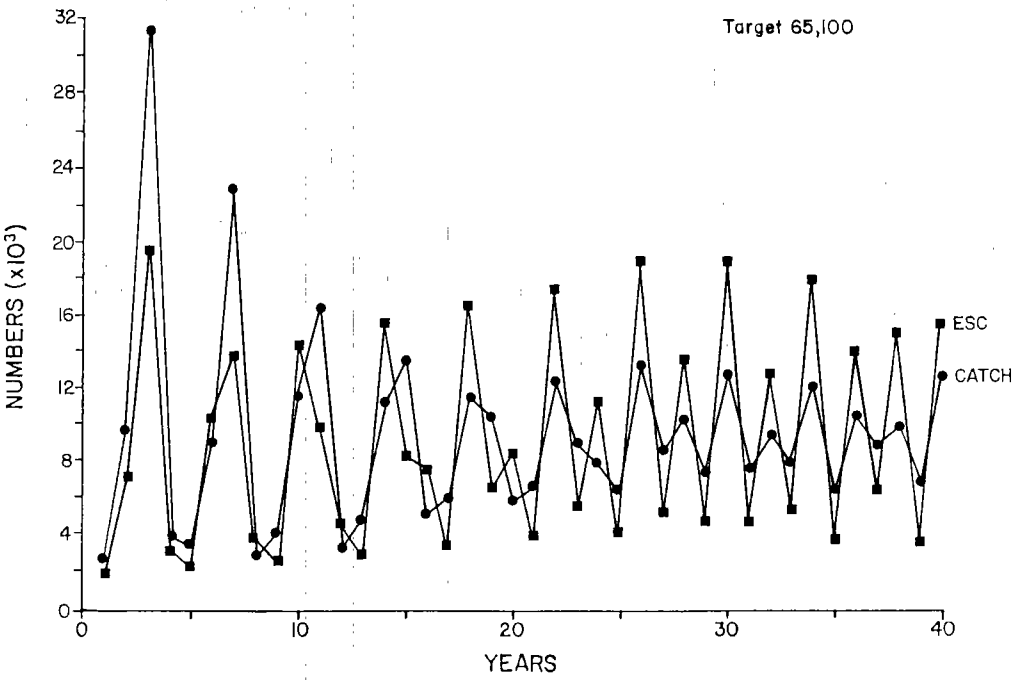

Figure 11. Projected catches and escapements of Fraser/Graham chums under the current management regime.

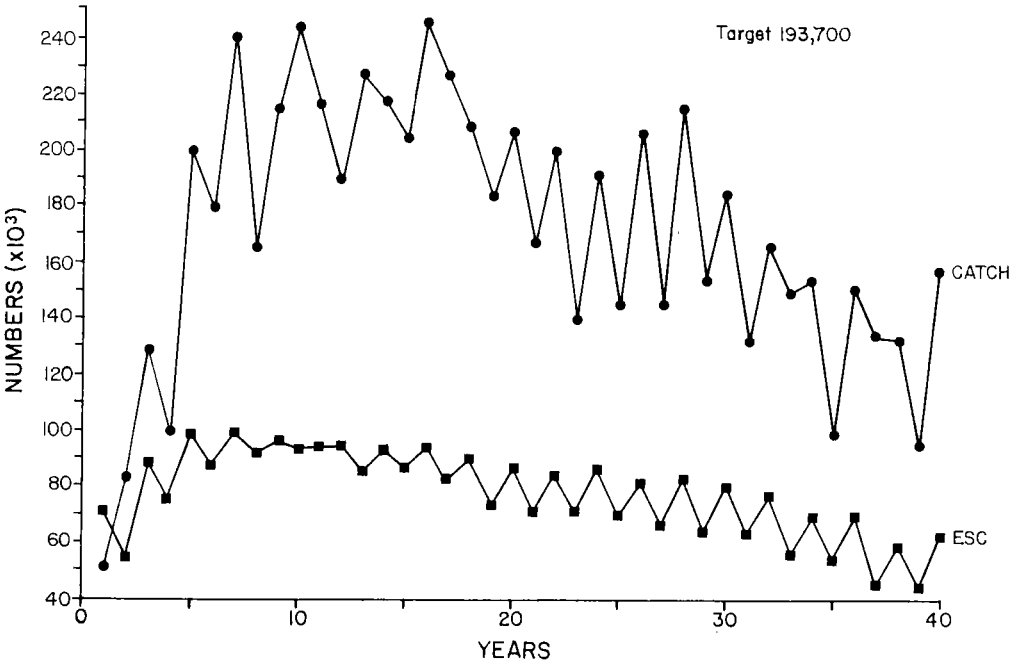

Figure 12. Projected catches and escapements of Campania pinks under the current management regime.

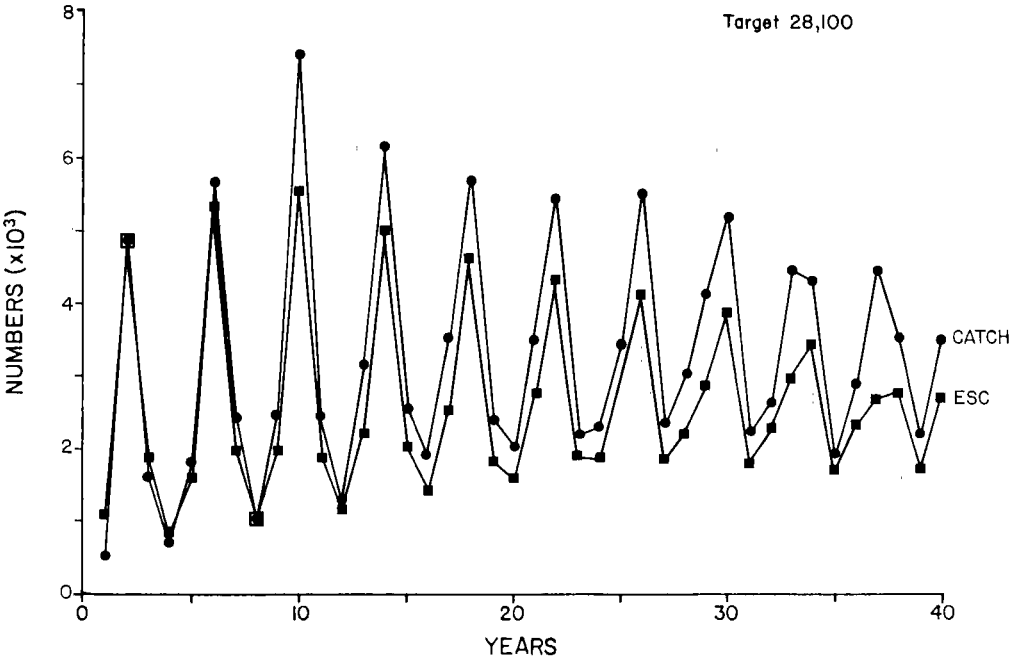

Figure 13. Projected catches and escapements of Campania chums under the current management regime.

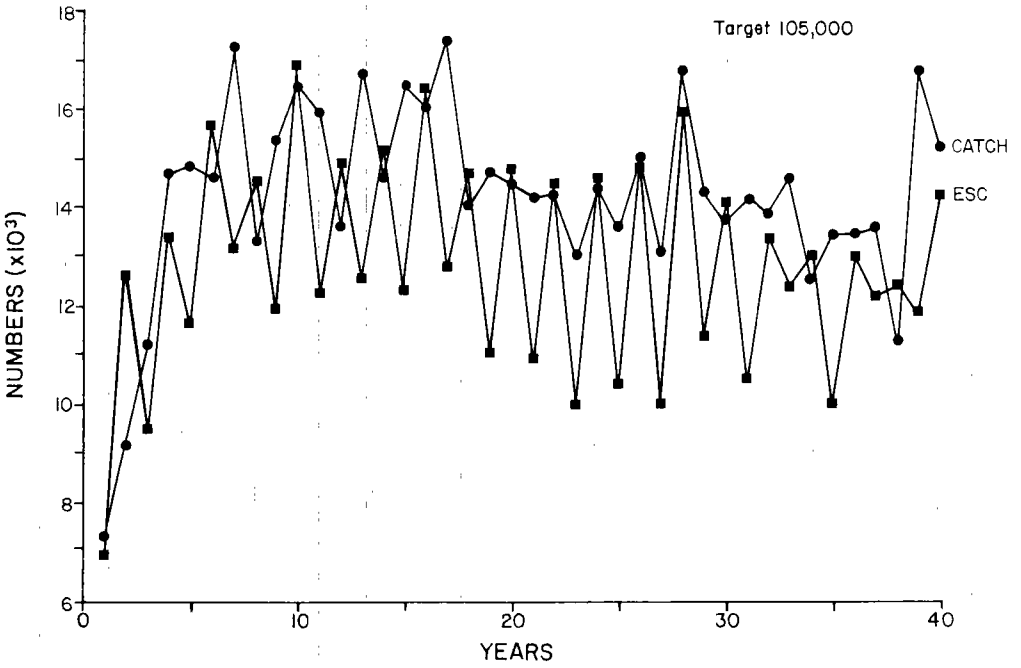

Figure 14. Projected catches and escapements of Laredo Sound pinks under the current management regime.

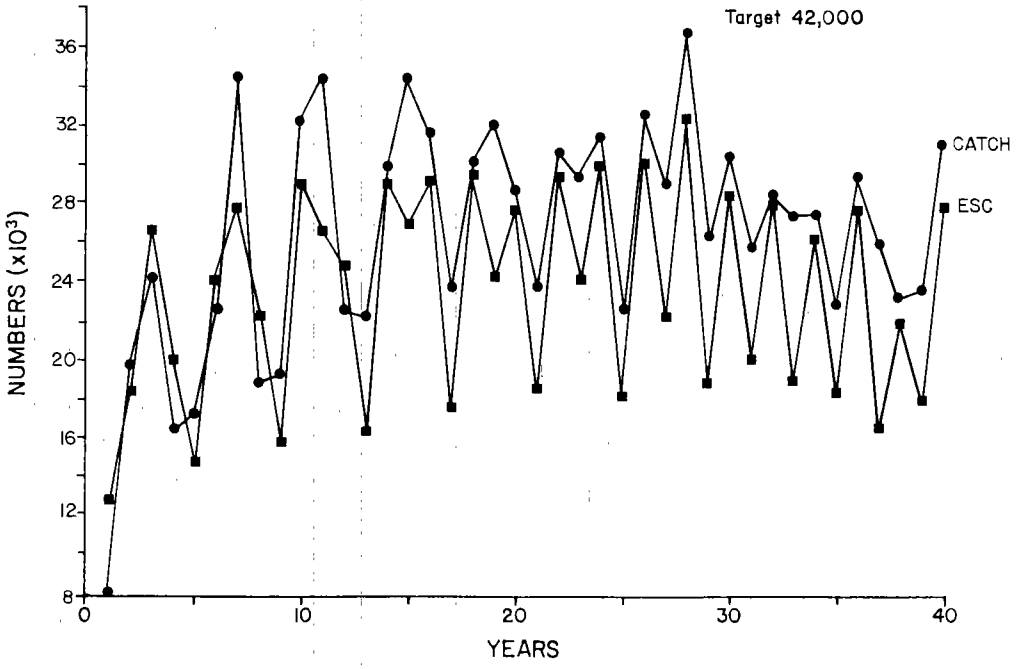

Figure 15. Projected catches and escapements of Laredo Sound chums under the current management regime.

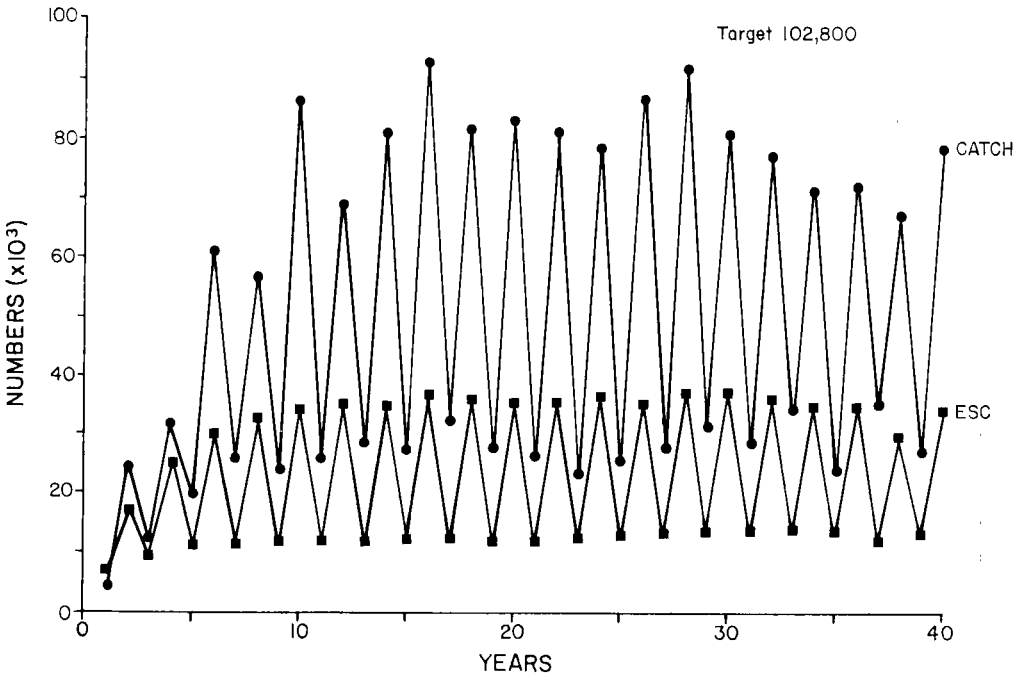

Figure 16. Projected catches and escapements of Aristazabal pinks under the current management regime.

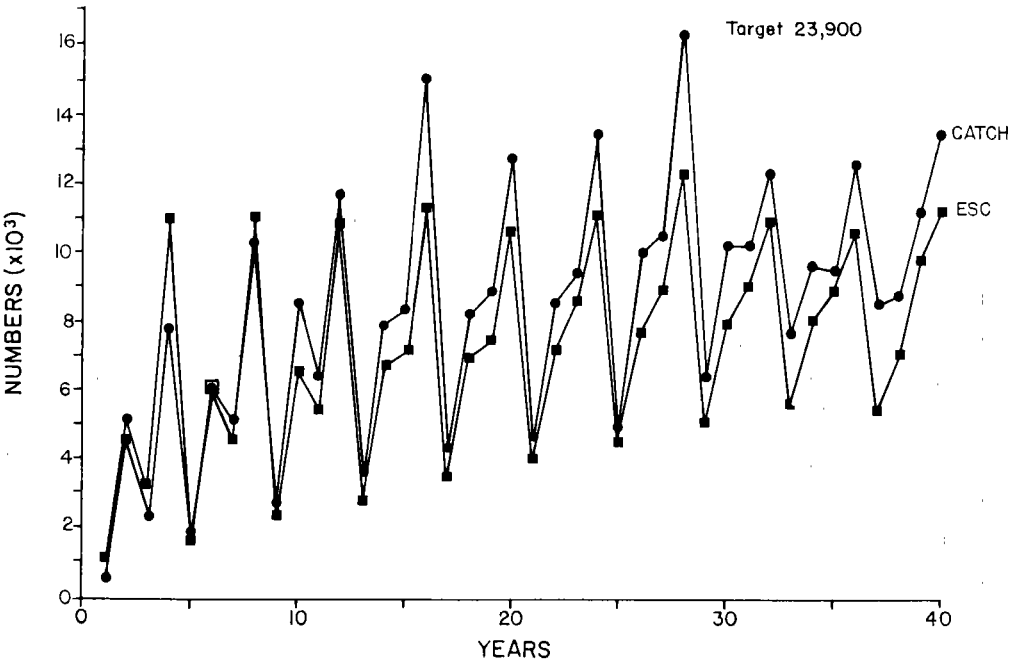

Figure 17. Projected catches and escapements of Aristazabal chums under the current management regime.

The trends exhibited by the balance of pink and chum stocks modelled in the current management scenario have two characteristics in common. Most stocks show some degree of decline over the forty-year simulation, and all are very erratic. In addition, most escapements are well below target levels.

Conversely, in the simulation of Management Option 1, stocks generally exhibit greater stability than in the current management scenario, and with a few notable exceptions, the trends are all towards increased stock strength. Figures 18 to 31 illustrate the results of this simulation (Option 1) in terms of the projected escapement and catch of pink and chum stocks in each sub-area.

Notable exceptions to the general trend of increased stock strength are the Kitimat Arm pinks (Figure 20) and Fraser/Graham pink and chum stocks (Figures 24 and 25).

Kitimat Arm pink stocks exhibit a significant increase in stock strength for the first fifteen years of the simulation, until the Kitimat hatchery builds the chum stock to the target escapement. Once the chum stock is at its target escapement, the consistent fishery that would target on the hatchery production is projected to drive the pink stock virtually to extinction (Figure 20). Despite the modelling results, however, it should be possible to prevent such a decline by selectively harvesting Kitimat chums, possibly with large-mesh gillnets.

In the Option 1 management scenario, Fraser/Graham pinks show a steady decline after ten years, while Fraser/Graham chum stocks decline steadily from the beginning of the simulation (Figures 24 and 25). Fraser/Graham stocks are harvested in the mid-season segment of the Gil Island fishery, along with the Douglas/Ursula/Devastation stocks. Douglas/Ursula/Devastation stocks are present in the region during the early- and mid-season timing segments of the Gil Island fishery. Since the early portion of the fishery has been eliminated in this option in favour of terminal fisheries within Kitimat Arm and Gardner Canal, the Douglas/Ursula/Devastation stocks rebuild very quickly relative to other stocks. The rapid rebuilding leads to a domination of the mid-season fishery by the Douglas/Ursula/Devastation pinks which, because they rebuild so quickly, then precipitate the decline of the Fraser/Graham stocks. However, despite the decline of the Fraser/Graham stocks, the overall escapement is improved in Option 1 over that in the scenario.

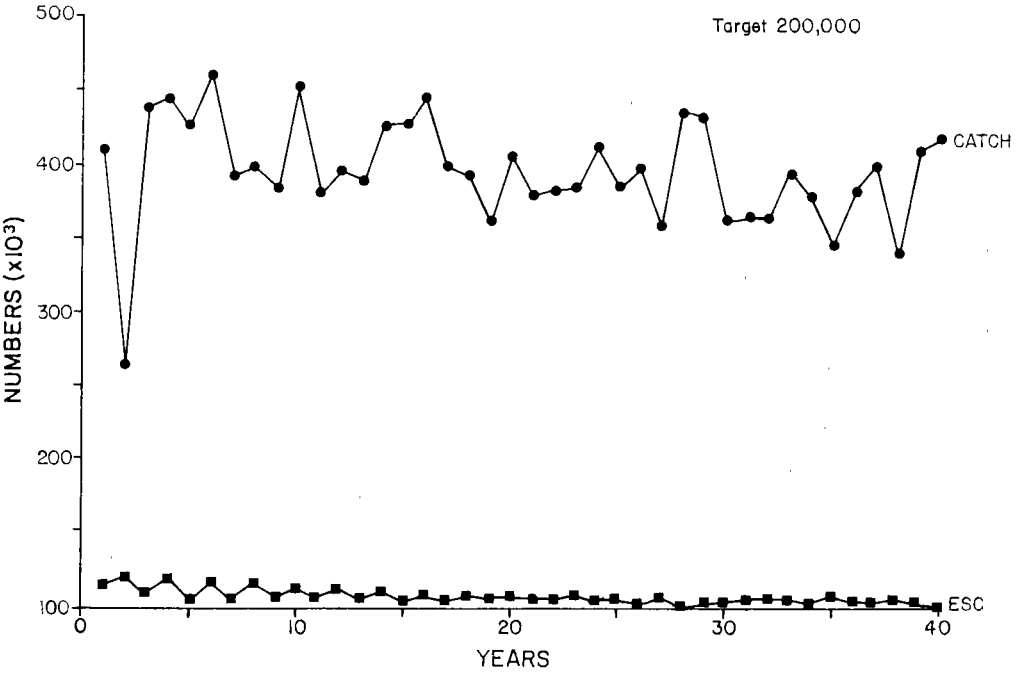

Figure 18. Projected catches and escapements of Gardner Canal pinks under Option 1 (see text for details of option).

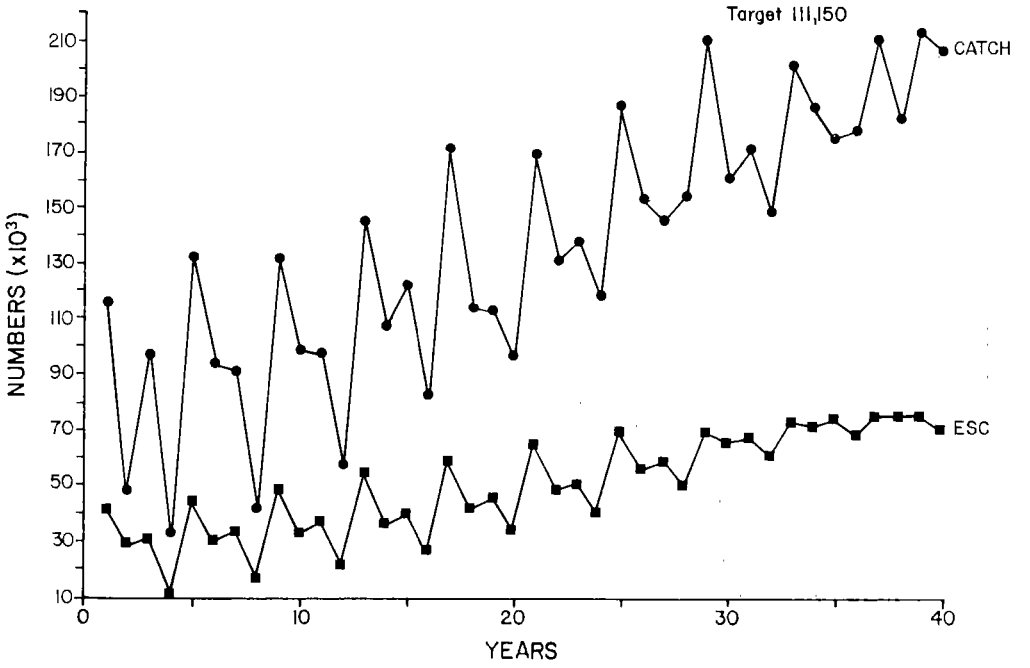

Figure 19. Projected catches and escapements of Gardner Canal chums under Option 1.

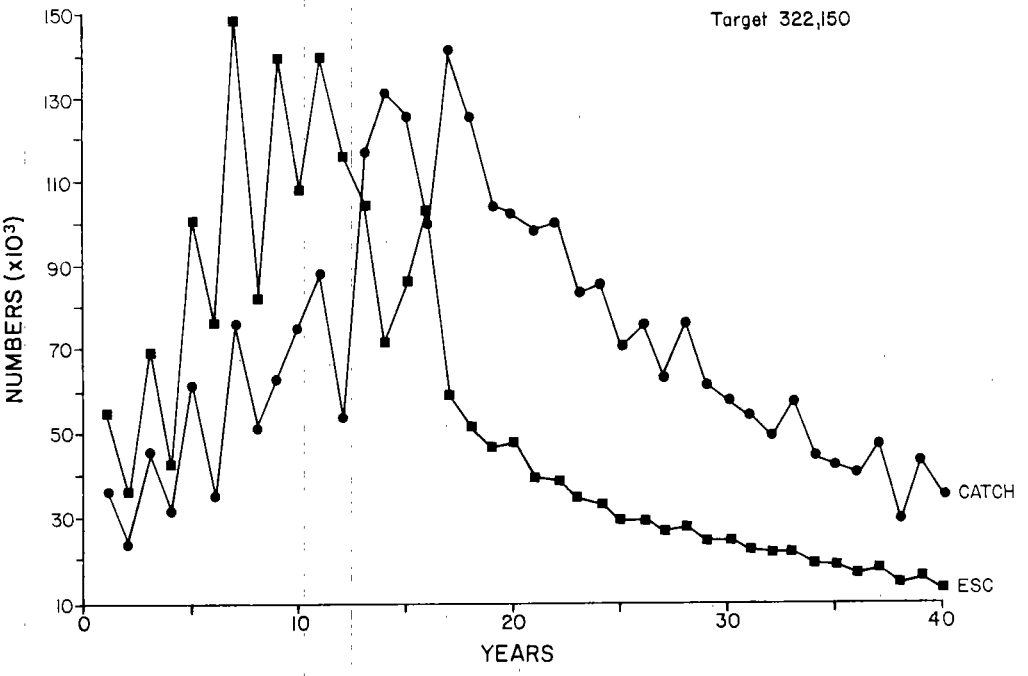

Figure 20. Projected catches and escapements of Kitimat Arm pinks under Option 1.

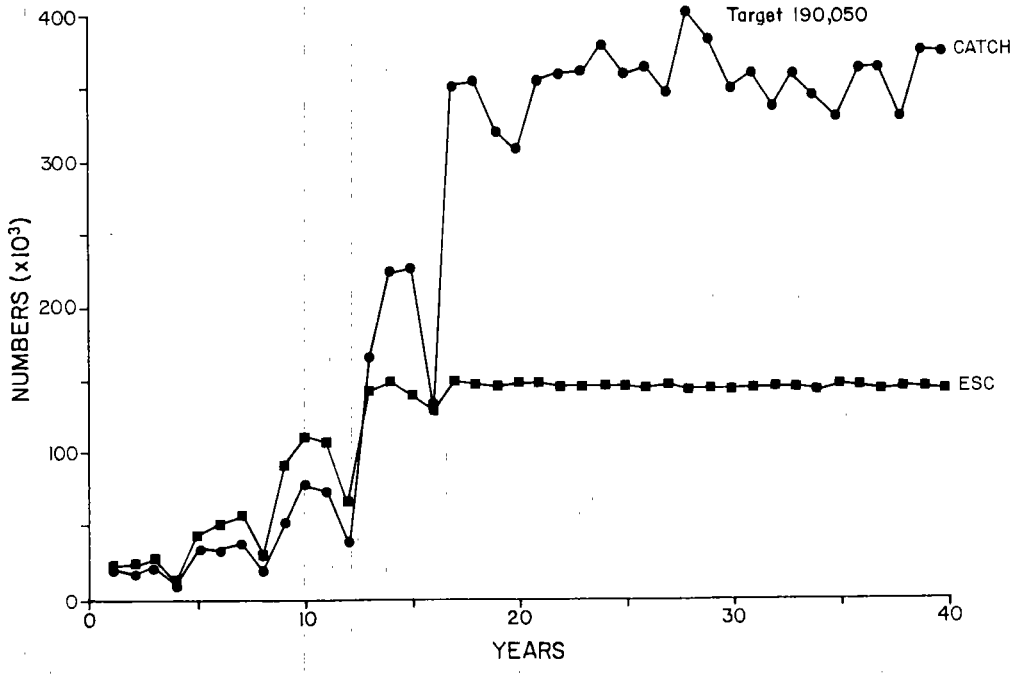

Figure 21. Projected catches and escapements of Kitimat Arm chums under Option 1.

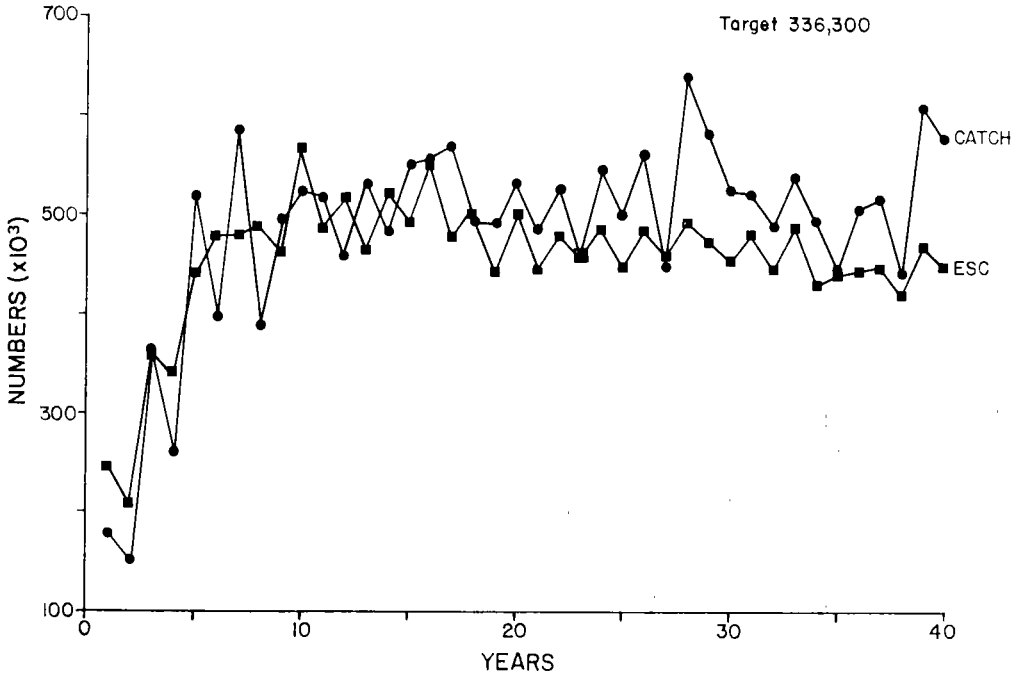

Figure 22. Projected catches and escapements of Douglas/Ursula/Devastation pinks under Option 1.

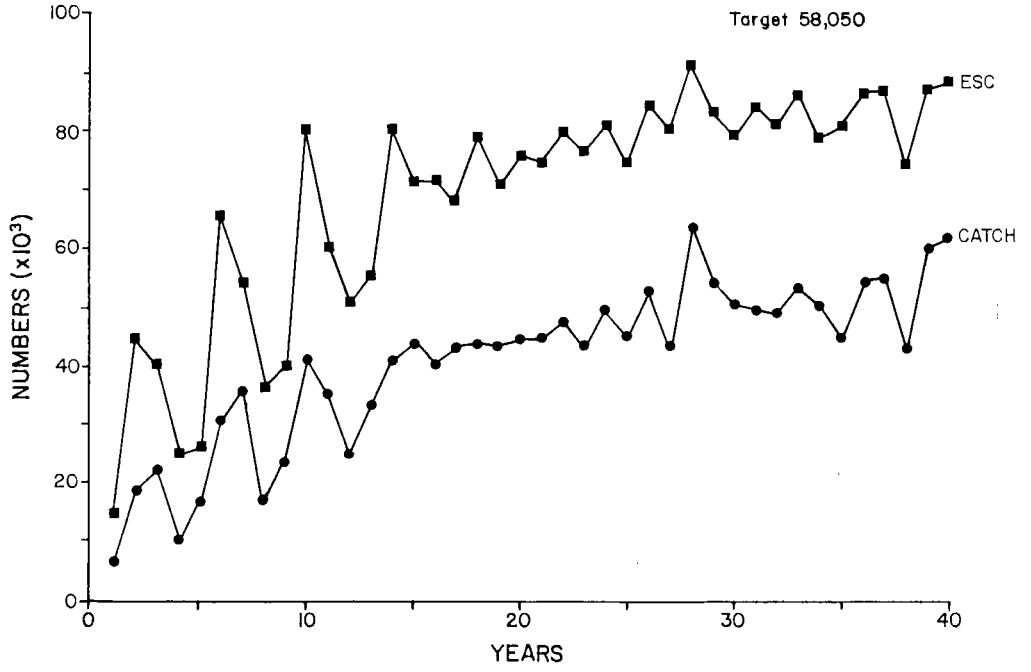

Figure 23. Projected catches and escapements of Douglas/Ursula/Devastation chums under Option 1.

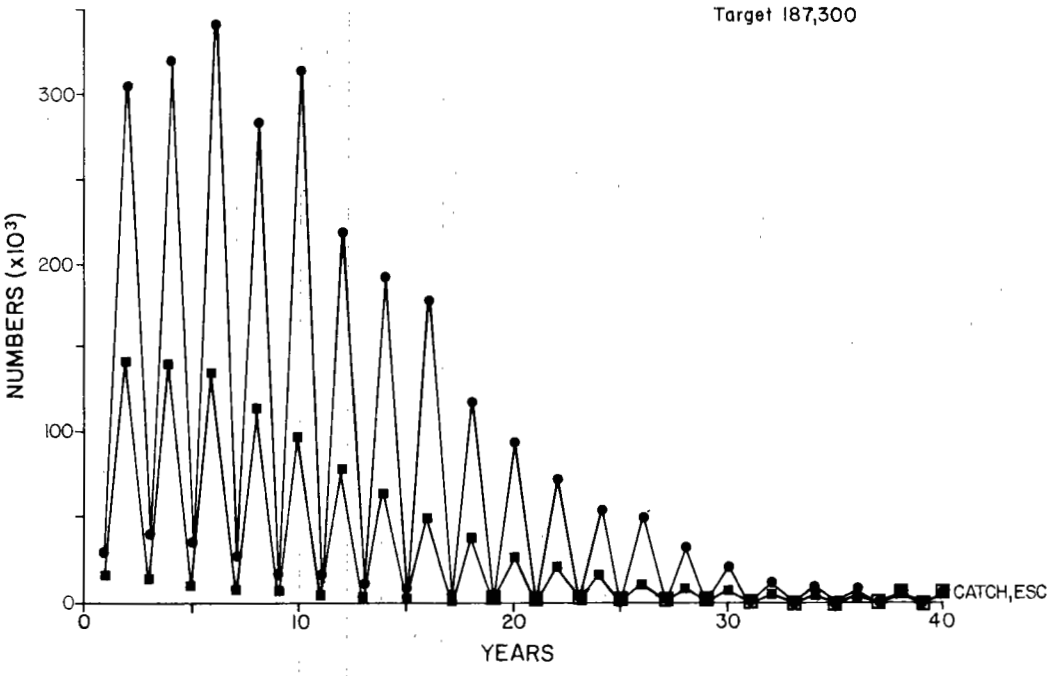

Figure 24. Projected catches and escapements of Fraser/Graham pinks under Option 1.

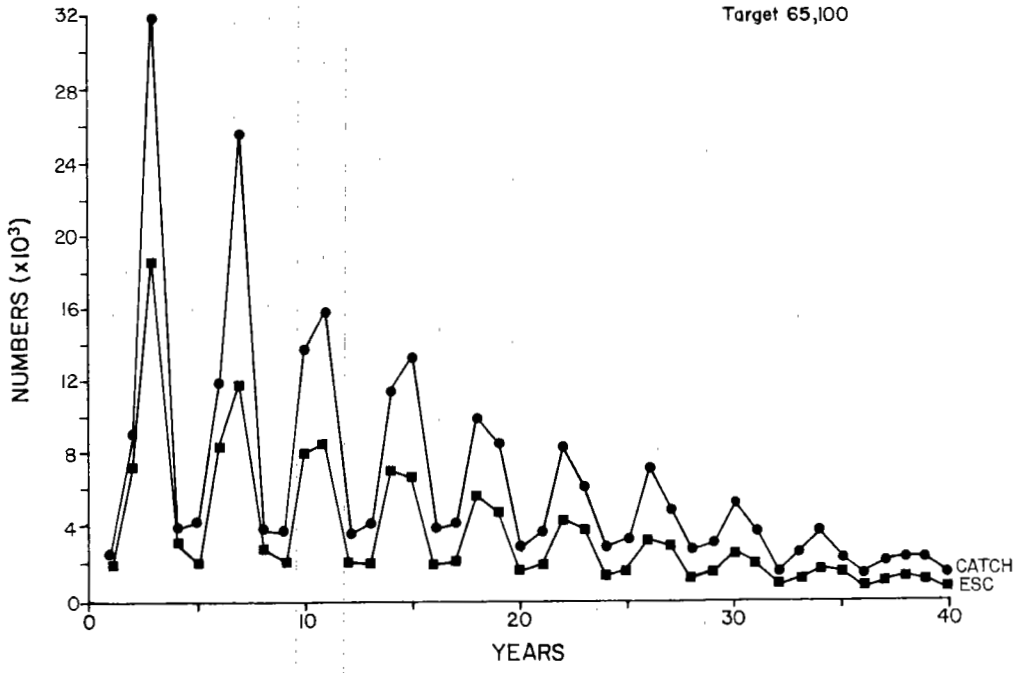

Figure 25. Projected catches and escapements of Fraser/Graham chums under Option 1.

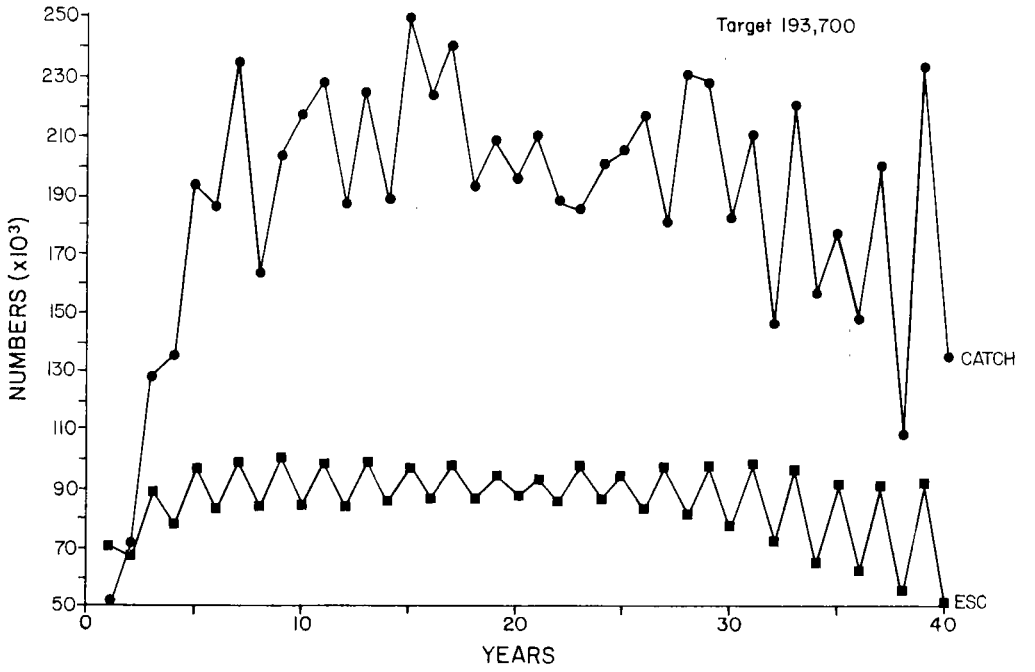

Figure 26. Projected catches and escapements of Campania pinks under Option 1.

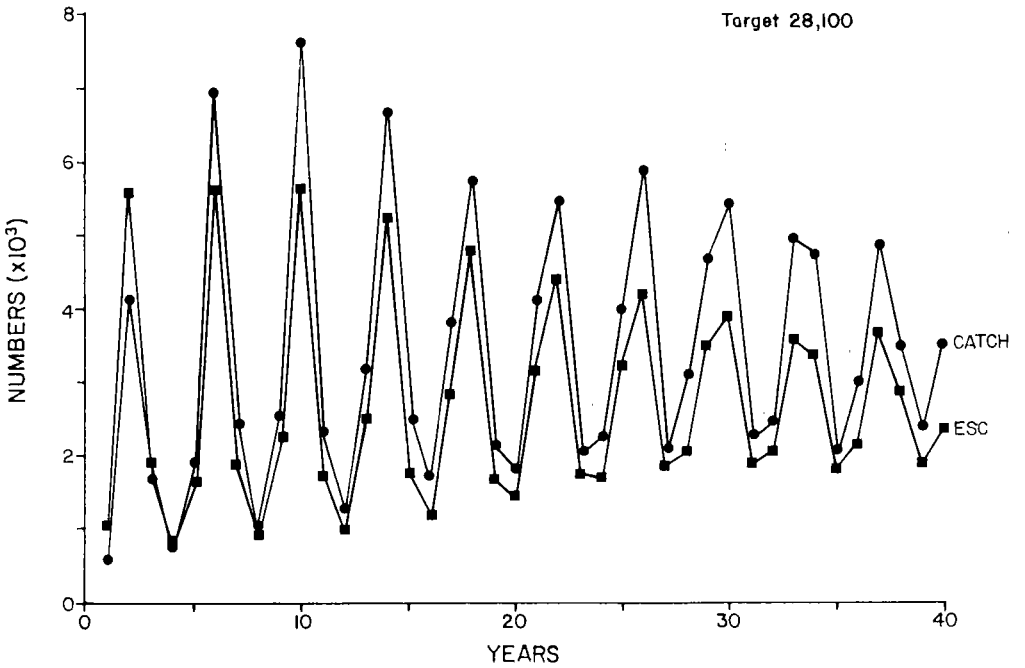

Figure 27. Projected catches and escapements of Campania chums under Option 1.

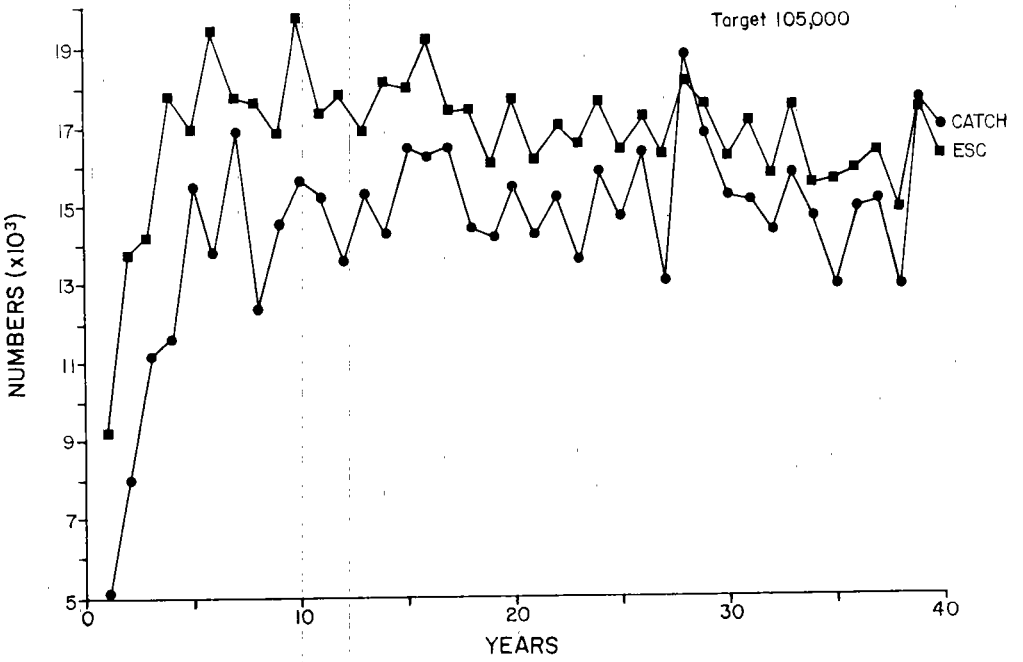

Figure 28. Projected catches and escapements of Laredo Sound pinks under Option 1.

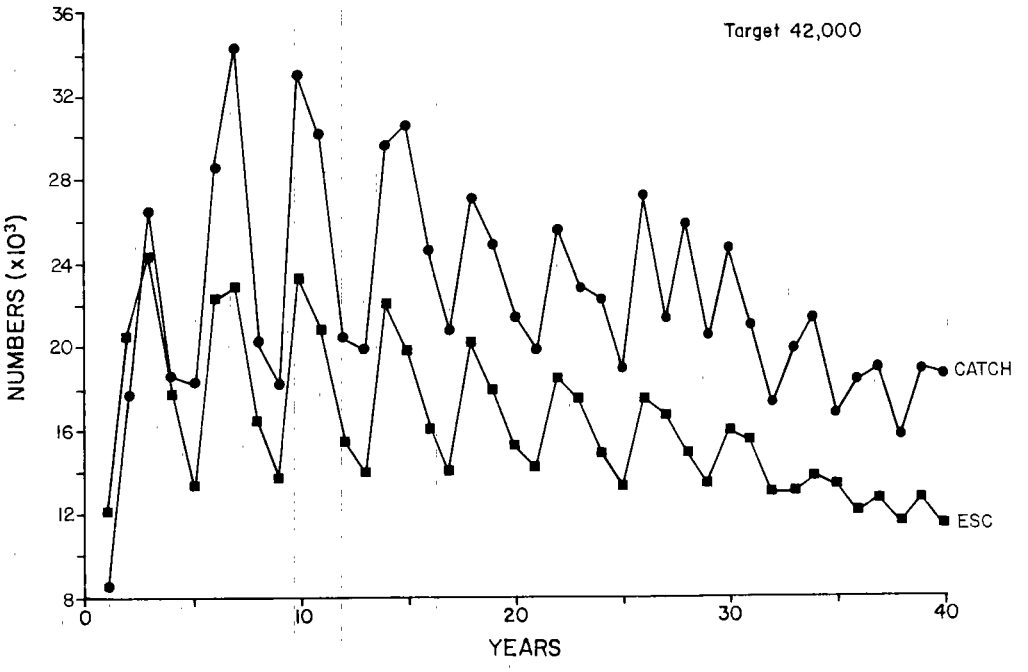

Figure 29. Projected catches and escapements of Laredo Sound chums under Option 1.

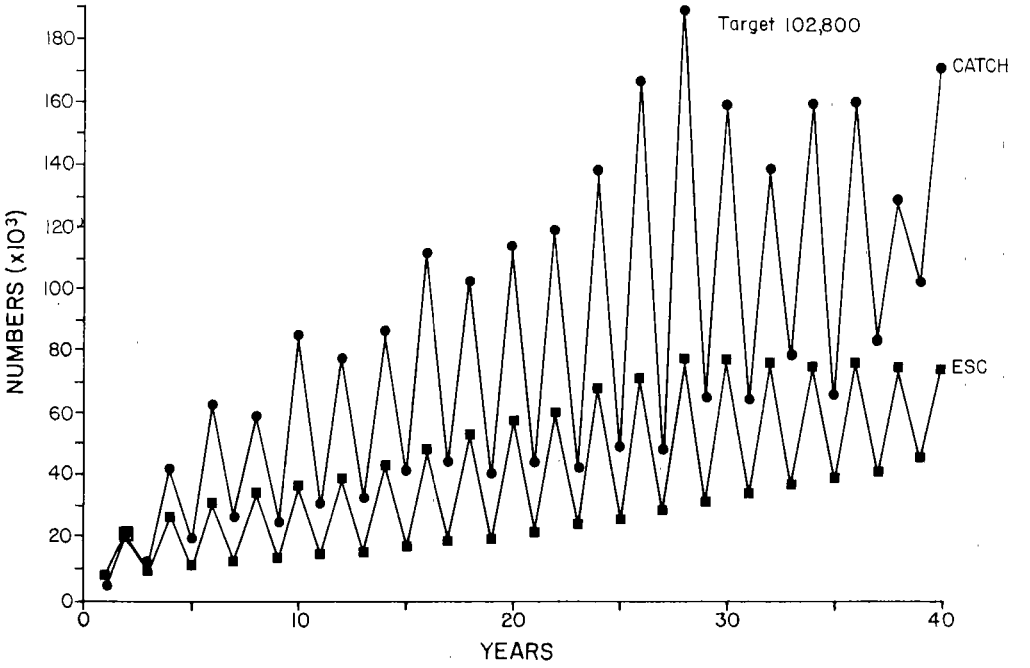

Figure 30. Projected catches and escapements of Aristazabal pinks under Option 1.

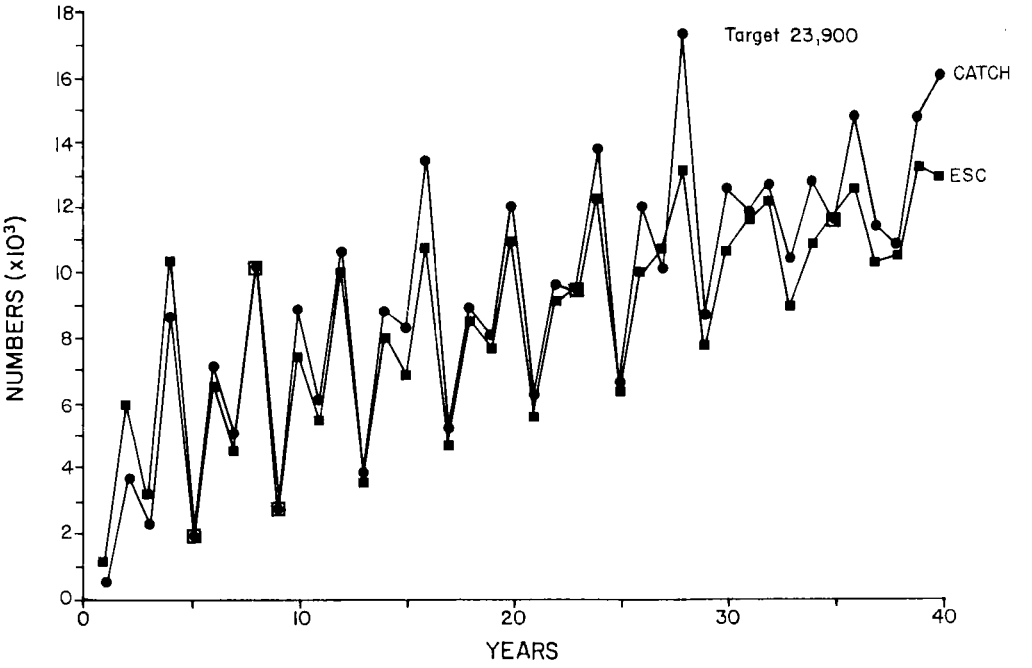

Figure 31. Projected catches and escapements of Aristazabal chums under Option 1.

Improved escapements of most stocks and a higher value*, despite substantially reduced fish quality in the terminal fishing areas, suggest that the option of exploiting Kitimat Arm and Gardner Canal stocks (particularly Kemano pink and chum) in the terminal areas should be pursued.

10. SUMMARY AND CONCLUSION

Area 6 salmon stocks range from those that have recently met only a fraction of their escapement target (e.g., Kitimat pink) to those that have recently produced large surpluses to the required escapement (e.g., Kemano pink). All these stocks are present in the fishing area at virtually the same time. One of the options for addressing this mixed-stock problem involves shifting the fishery to terminal areas where the stocks have separated and, therefore, may be more selectively managed.

This analysis indicates that, despite substantial reductions in fish quality in the terminal harvest areas, the overall increases in production that result from this shift to terminal fisheries should lead to an overall increase in the value* of the Area 6 fishery. Based on this analysis, it is suggested that steps be taken to quantify some of the uncertainties regarding terminal fisheries. If studies of fish quality, migration timing and migration routes support the results of the modelling exercise, then a shift to terminal fisheries could be justified.

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* "Value" is the net present value of a projected forty years of harvest, discounted at 10% annually.

11. REFERENCES

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5. Annual Report of the Salmonid Enhancement Program. 1983. Dep. of Fisheries and Oceans, Vancouver, B.C.

6. Paish, H. and Associates. 1985. Unpublished. Summary Habitat data prepared under contract for Dep. of Fisheries and Oceans, Vancouver.

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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 intentive 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.

IPSFC – 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 th 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 6

PRESENT STOCK STATUS

Stocks	Escapement Ave. 1950's	Ave. 1960's	Ave. 1970's		1980's	Target Escapement	Age Composition	$(\bar{x} \pm s^2)$ Rate of Return
Gardner Canal Sub Area								
Sockeye - Active	24,200	41,200	11,250	'80)	12,000	20,000		
Kitlope				'81)	10,000			
				'82)	20,000			
				'83)	15,000			
Sockeye - Passive	5	200	120	'80)	50	500		
Kemano River				'81)	70			
				'82)	50			
				'83)	25			
Pink - Even - Active	6,600	80,000	138,000	'80)	100,000	150,000	100% Age 2	3.25 ± 4.46
Kemano				'82)	80,000			
Pink - Even -	22,200	109,500	18,400	'80)	4,700	50,000	100% Age 2	3.25 ± 4.46
Passive 9 streams				'82)	2,900			
Brim River	Kowesas River							
Crab River	Parll River							
Hotspring Creek	Tsaytis River							
Kiltuish River	Wahoo River							
Kitlope River								
Pink - Odd - Active	7,100	6,200	12,000	'81)	40,000	Details as for Pink Even above.		
Kemano				'83)	120,000			
Pink - Odd - Passive	23,400	23,900	2,600	'81)	6,400	Details as for Pink Even above.		
9 streams				'83)	4,200			
Brim River	Kowesas River							
Crab River	Parll River							
Hotspring Creek	Tsaytis River							
Kiltuish River	Wahoo River							
Kitlope River								

PRESENT STOCK STATUS

Stocks	Escapement Ave. 1950's	Ave. 1960's	Ave. 1970's		1980's	Target Escapement	Age Composition	$(\bar{x} \pm s^2)$ Rate of Return
Chum - Active	9,700	39,400	46,650	'80)	40,000	75,000	10% Age 3	
Kemano				'81)	15,000		90% Age 4	
				'82)	30,000			
				'83)	6,000			
Chum - Passive	31,400	66,700	7,500	'80)	3,800	36,000	10% Age 3	2.36 ± 1.84
9 streams				'81)	3,300		90% Age 4	
Brim River	Parl l River			'82)	4,300			
Crab River	Tsaytis River			'83)	1,195			
Hotspring Creek	Wahoo River							
Kiltulsh River	Kitlope River							
Kowesas River								
Kitimat Arm Sub Area								
Sockeye - Passive	2,550	613	428	'80)	2,516	2,550		
16 streams				'81)	850			
Anderson Creek	Hirsch Creek			'82)	1,210			
Big Wedeene River	Humphrys Creek			'83)	600			
Bish Creek	Kildala River							
Chist Creek	Kitimat River System							
Dala River	Little Wedeene R.							
Eagle Bay Creek	M.E.S.S. Creek							
Emsley Creek	Nalbeelah Creek							
Falls River	Wathl Creek							

PRESENT STOCK STATUS

Stocks	Escapement Ave. 1950's	Ave. 1960's	Ave. 1970's		1980's	Target Escapement	Age Composition	$(\bar{x} \pm S^2)$ Rate of Return
Pink - Even - Active	100,000	222,300	164,000	'80)	13,400	220,000	100% Age 2	3.25 ± 4.46
Kitimat System				'82)	29,600			
Includes:								
Chist								
Big Wedeene								
Kitimat								
Humphrys								
Nalbeelah								
Little Wedeene								
Hirsch								
Data	4,450	26,450	16,600	'80)	6,000	40,000		
				'82)	10,000			
Pink - Odd - Active							100% Age 2	3.25 ± 4.46
Kitimat System	16,275	10,900	2,658	'81)	7,475			
Includes:				'83)	16,300			
Chist								
Big Wedeene								
Kitimat								
Humphrys								
Nalbeelah								
Little Wedeene								
Hirsch								
Data	4,160	4,625	1,200	'81)	2,000			
				'83)	8,000			

PRESENT STOCK STATUS

Stocks	Escapement Ave. 1950's	Ave. 1960's	Ave. 1970's		1980's	Target Escapement	Age Composition	$(\bar{x} \pm s^2)$ Rate of Return
Pink - Even - Passive								
8 Streams	21,893	50,780	26,519	'80)	22,010	57,050	100% Age 2	3.25 ± 4.46
Anderson Creek				'82)	12,900			
Bish Creek								
Eagle Bay Creek								
Emsley Creek								
Falls River								
Kildala River								
M.E.S.S. Creek								
Wathl Creek								
Pink - Odd - Passive	22,880	8,300	2,370	'81)	13,000			
				'83)	5,400			
Chum - Active	40,533	30,513	26,426	'80)	4,650	137,500	10% Age 3	2.36 ± 1.84
Kitimat System				'81)	8,475		90% Age 4	
Includes:				'82)	13,650			
Chist				'83)	2,050			
Big Wedeene								
Kitimat								
Humphrys								
Nalbeelah								
Little Wedeene								
Hirsch								
Dala	5,517	9,310	6,800	'80)	4,500	25,000		
				'81)	2,000			
				'82)	1,500			
				'83)	1,500			

PRESENT STOCK STATUS

Stocks	Escapement Ave. 1950's	Ave. 1960's	Ave. 1970's		1980's	Target Escapement	Age Composition	$(\bar{x} \pm S^2)$ Rate of Return
Chum - Passive	9,000	6,641	16,000	'80)	6,510	26,550		
8 Streams				'81)	2,025			
Anderson Creek				'82)	1,360			
Bish Creek				'83)	350			
Eagle Bay Creek								
Emsley Creek								
Falls River								
Kildala River								
M.E.S.S. River								
Wathl Creek								
Douglas, Ursula, Devastation Channels Sub Area								
Sockeye - Active								
None								
Sockeye - Passive	7,300	9,500	3,500	'80)	1,556	13,000		
5 streams				'81)	2,450			
Evelyn Creek				'82)	2,400			
Hartley Bay Creek				'83)	1,600			
Kitkiata Creek								
Quaal River								
Weewanie Creek								

PRESENT STOCK STATUS

Stocks	Escapement Ave. 1950's	Ave. 1960's	Ave. 1970's		1980's	Target Escapement	Age Composition	$(\bar{x} \pm s^2)$ Rate of Return
Pink - Even - Active	60,000	505,000	151,000	'80)	225,000	200,000	100% Age 2	3.25 ± 4.46
Quaal				'82)	100,000			
Other major	45,600	122,849	69,605	'80)	110,650	81,200		
19 streams				'82)	54,200			
Angler Cove Creek		Klhess Creek						
Big Tillhorn River		Kishkosh Creek						
Evelyn Creek		Kitklata Creek						
Fish Trap Bay Creek		Little Tillhorn R.						
Foch Creek		Missed Creek						
Gilttoyees Creek		Pike Creek						
Goat River		Riordan Creek						
Hartley Bay Creek		Verney Passage Cr.						
Hugh Creek		Weewanie Creek						
Keesll Creek								
Passive - Kitklata	7,500	56,000	31,000	'80)	60,000	50,000		
				'82)	25,000			
Pink - Odd - Active							100% Age	3.25 ± 4.46
Quaal	35,500	164,000	106,000	'81)	80,000	—		
				'83)	60,000			
Pink - Odd - Passive								
19 streams	70,048	219,067	143,187	'81)	119,840	— Details are as for Pink - Even above.		
Angler Cove Creek				'83)	107,890			
Big Tillhorn River								
Kitklata	8,980	98,250	26,000	'81)	40,000	—		
Evelyn Creek				'83)	17,000			
Fishtrap Bay Creek		Kiskosh Creek						
Foch Creek		Little Tillhorn R.						
Gilttoyees Creek		Missed Creek						
Goat River		Pike Creek						
Hartley Bay Creek		Quaal River						
Hugh Creek		Riordan Creek						
Keesll Creek		Verney Passage Cr.						
Klhess Creek		Weewanie Creek						

PRESENT STOCK STATUS

Stocks	Escapement Ave. 1950's	Ave. 1960's	Ave. 1970's		1980's	Target Escapement	Age Composition	$(\bar{x} \pm s^2)$ Rate of Return
Chum - Active	3,519	8,215	4,407	'80)	200	10,000	10% Age 3	2.36 ± 1.84
Foch				'81)	1,500		90% Age 4	
				'82)	3,500			
				'83)	700			
Glittoyees	2,981	2,190	2,425	'80)	2,300	15,000		
				'81)	10,000			
				'82)	8,000			
				'83)	2,000			
Quaal	5,889	6,000	5,400	'80)	5,000	25,000		
				'81)	15,000			
				'82)	15,000			
				'83)	1,500			
Chum - Passive	6,504	5,815	2,803	'80)	495	16,850	10% Age 3	2.36 ± 1.84
16 streams				'81)	1,315		90% Age 4	
Angler Cove Creek	Kithess Creek			'82)	1,045			
Big Tillhorn River	Kiskosh Creek			'83)	370			
Evelyn Creek	Little Tillhorn R.							
Fishtrap Bay Creek	Missed Creek							
Goat River	Pike Creek							
Hartley Bay Creek	Riordan Creek							
Hugh Creek	Verney Passage Cr.							
Keesil Creek	Weewanie Creek							

PRESENT STOCK STATUS

Stocks	Escapement Ave. 1950's	Ave. 1960's	Ave. 1970's		1980's	Target Escapement	Age Composition	$(\bar{x} \pm s^2)$ Rate of Return
Fraser-Graham Sub Area								
Sockeye - Passive	100	1,683	400	'80)	500	3,100		
2 streams				'81)	75			
Canoona River				'82)	800			
Soda Creek				'83)	1,000			
Pink - Even - Active							100% Age 2	3.25 ± 4.46
Khutze	3,500	16,600	10,600	'80)	750	70,000		
				'82)	3,000			
Green	3,800	54,500	16,200	'80)	650	25,000	100% Age 2	3.25 ± 4.46
				'82)	400			
				'82)	5,000			
Canoona	900	2,400	4,400	'80)	7,500	25,000	100% Age 2	3.25 ± 4.46
				'82)	3,000			
Scow Bay Creek	10,850	18,700	5,250	'80)	4,600	15,000	100% Age 2	3.25 ± 4.46
Later Timing								
Soda Creek	2,500	31,000	6,700	'80)	10,000	25,000	100% Age 2	3.25 ± 4.46
				'82)	750			
Pink - Even -	16,520	35,991	6,929	'80)	3,708	28,800	100% Age 2	3.25 ± 4.46
Passive - 8 streams				'82)	4,900			
Aaltanash River	Marshall Creek							
Dome Creek	Marmot Cove Creek							
Klekane Creek	Meyers Pass Creek							
McKay Creek	Taylor Creek							

PRESENT STOCK STATUS

Stocks	Escapement Ave. 1950's	Ave. 1960's	Ave. 1970's		1980's	Target Escapement	Age Composition	$(\bar{x} \pm s^2)$ Rate of Return
Pink - Odd - Active								
Khutze	4,980	26,375	10,640	'81)	8,000		100% Age 2	3.25 ± 4.46
				'83)	70,000			
Green	2,600	15,400	13,200	'81)	3,000			
				'83)	24,000			
Canoona	31,000	31,000	10,100	'81)	8,000			
				'83)	12,500			
Scow Bay	10,800	27,100	8,140	'81)	5,000			
				'83)	9,500	Details are as for Pink - Even above.		
(Later Timing:)								
Soda Creek	2,700	23,188	9,800	'81)	15,000			
				'83)	8,500			
Pink - Odd - Passive							100% Age 2	3.25 ± 4.46
8 streams	11,733	31,151	6,878	'81)	5,500			
Aaltanash River	Marshall Creek			'83)	12,910	Dome Creek Marmot Cove Creek		
Klekane Creek	Meyers Pass Creek							
McKay Creek	Taylor Creek							
Chum - Active								
Green	2,800	8,260	5,100	'80)	300	15,000	10% Age 3	2.36 ± 1.84
				'81)	15,000		90% Age 4	
				'82)	16,000			
				'83)	1,000			
Khutze	1,561	2,500	6,400	'80)	50	30,000	10% Age 3	2.36 ± 1.84
				'81)	500		90% Age 4	2.36 ± 1.84
				'82)	4,000			
				'83)	300			

PRESENT STOCK STATUS

Stocks	Escapement Ave. 1950's	Ave. 1960's	Ave. 1970's		1980's	Target Escapement	Age Composition	$(\bar{x} \pm S^2)$ Rate of Return
Chum - Passive								
11 streams	13,030	21,694	6,428	'80)	1,427	20,100	10% Age 3	
Aaltanash River	Marshall Creek			'81)	1,890		90% Age 4	2.36 ± 1.84
Canoona River	Meyers Pass Creek			'82)	3,528			
Dome Creek	Scow Bay Creek			'83)	1,800			
Klekane Creek	Soda Creek							
McKay Creek	Taylor Creek							
Marmot Cove Creek								
Laredo Sound Sub Area								
Sockeye - Active								
None								
Sockeye - Passive								
8 streams	10,716	9,186	4,270	'80)	2,200	14,900		
Bloomfield Creek	Kwakwa Creek			'81)	1,750			
Busey Creek	Powles Creek			'82)	2,640			
Dallain Creek	Price Creek			'83)	700			
Gull Creek	Quigley Creek							
Pink - Even - Active								
— Arnoup	2,300	40,700	26,700	'80)	50,000	35,000	100% Age	3.25 ± 4.46
				'82)	2,000			
— Nias	2,700	16,125	7,583	'80)	19,000	20,000		
				'82)	450			
— Tyler	1,315	21,667	2,400	'80)	15,000	15,000		
				'82)	350			

PRESENT STOCK STATUS

Stocks	Escapement Ave. 1950's	Ave. 1960's	Ave. 1970's		1980's	Target Escapement	Age Composition	$(\bar{x} \pm s^2)$ Rate of Return
Pink - Even - Passive								
17 streams	17,700	82,400	17,800	'80)	6,800	35,000	100% Age 2	3.25 ± 4.46
Blee Creek	Packe Creek			'82)	2,300			
Bloomfield Creek	Powles Creek							
Busey Creek	Price Creek							
Dallain Creek	Pyne Creek							
Dally Creek	Quigley Cree							
Fifer Cove Creek	Ronald Creek							
Gull Creek	Steep Creek							
Kwakwa Creek	Trahey Creek							
Osment Creek								
Pink - Odd - Active								
Arnoup	1,020	21,375	2,700	'81)	3,000			
				'83)	700			
Nias	1,635	14,250	5,800	'81)	1,500	Details are as for Pink - Even above.		
				'83)	250			
Tyler	890	4,700	1,400	'81)	600			
				'83)	250			
Pink - Odd - Passive								
17 streams	5,600	22,600	5,800	'81)	3,150	Details are as for Pink - Even above.	100% Age 2	3.25 ± 4.46
Blee Creek	Packe Creek							
Bloomfield Creek	Powles Creek							
Busey Creek	Price Creek							
Dallain Creek	Pyne Creek							
Dally Creek	Quigley Cree							
Fifer Cove Creek	Ronald Creek							
Gull Creek	Steep Creek							
Kwakwa Creek	Trahey Creek							
Osment Creek								

PRESENT STOCK STATUS

Stocks	Escapement Ave. 1950's	Ave. 1960's	Ave. 1970's		1980's	Target Escapement	Age Composition	$(\bar{x} \pm S^2)$ Rate of Return
Chum - Active								
— Arnoup	2,100	1,200	2,000	'80)	250	5,000	10% Age 3	2.36 ± 1.84
				'81)	150		90% Age 4	
				'82)	1,300			
				'83)	2,100			
— Nias	2,000	9,200	3,500	'80)	2,000	10,000		
				'81)	2,000			
				'82)	6,400			
				'83)	7,000			
— Tyler	2,400	6,000	4,600	'80)	4,000	8,000		
				'81)	4,000			
				'82)	6,000			
				'83)	4,000			
Chum - Passive								
Price (later timing)	11,900	5,300	2,400	'80)	2,000	10,000	10% Age 3	2.36 ± 1.84
				'81)	7,000		90% Age 4	
				'82)	6,000			
				'83)	2,000			
16 streams	16,600	25,800	15,000	'80)	7,300	9,000		
	Osment Creek			'81)	8,000			
Blee Creek	Packe Creek			'82)	16,200			
Bloomfield Creek	Powles Creek			'83)	13,900			
Busey Creek	Pyne Creek							
Dallain Creek	Quigley Creek							
Dally Creek	Ronald Creek							
Fifer Cove Creek	Steep Creek							
Gull Creek	Trahey Creek							
Kwakwa Creek								

Please note that Arnoup, Nias and Tyler Creeks are managed collectively as one Laredo Sound Active Chum stock.

PRESENT STOCK STATUS

Stocks	Escapement Ave. 1950's	Ave. 1960's	Ave. 1970's		1980's	Target Escapement	Age Composition	$(\bar{x} \pm s^2)$ Rate of Return
Campania Sound Sub Area								
Sockeye - Active								
None								
Sockeye - Passive								
8 streams	5,800	4,700	2,200	'80)	270	2,600		
Cartwright Creek				'81)	1,700			
Cridge Inlet Creek				'82)	1,700			
Douglas Creek				'83)	200			
Evinrude Creek								
Fury Creek								
Talamoosa Creek								
Wale Creek								
West Arm Creek								

PRESENT STOCK STATUS

Stocks	Escapement Ave. 1950's	Ave. 1960's	Ave. 1970's		1980's	Target Escapement	Age Composition	$(\bar{x} \pm S^2)$ Rate of Return
Pink - Even - Active								
None								
Pink - Even - Passive								
Chapple	2,700	2,200	6,400	'80)	5,500	15,000	100% Age 2	3.25 ± 4.46
				'82)	3,000			
Douglas	265	575	4,300	'80)	19,000	15,000		
				'82)	1,500			
Fury	344	500	9,100	'80)	5,000	15,000		
				'82)	1,500			
Gil	1,400	900	8,600	'80)	20,000	25,000	100% Age 2	3.25 ± 4.46
				'82)	27,000			
Limestone	3,200	9,900	12,500	'80)	5,000	20,000		
				'82)	3,000			
19 streams	37,000	47,600	35,600	'80)	55,900	21,700		
Argyh Creek	Penn Creek			'82)	43,250			
Barnard Creek	Roland Creek							
Black Rock Creek	Talamoosa Creek							
Cartwright Creek	Turn Creek							
Cherry Creek	Turtle Creek							
Crane Bay Creek	Tuwartz Creek							
Cridge Inlet Creek	Wale Creek							
East Arm Creek	West Arm Creek							
Evinrude Creek	Windy Island Creek							
McMicking Creek								
Pink - Odd - Active								
None								

PRESENT STOCK STATUS

Stocks	Escapement Ave. 1950's	Ave. 1960's	Ave. 1970's		1980's	Target Escapement	Age Composition	$(\bar{x} \pm s^2)$ Rate of Return
Pink - Odd - Passive							100% Age 2	3.25 ± 4.46
Chapple	535	575	1,200	'81)	5,000	—		
				'83)	1,000			
Douglas	40	883	1,151	'81)	6,000			
				'83)	1,000			
Fury	150	517	1,430	'81)	750	— Details as for Pink - Even above.		
				'83)	1,000			
Gil	450	400	4,300	'81)	12,000			
				'83)	15,000			
Limestone	1,560	3,160	17,400	'81)	7,000			
				'83)	5,000			
19 streams	7,800	5,000	13,800	'81)	41,900			
Argyh Creek	Penn Creek			'83)	20,900	—		
Barnard Creek	Roland Creek							
Black Rock Creek	Talamoosa Creek							
Cartwright Creek	Turn Creek							
Cherry Creek	Turtle Creek							
Crane Bay Creek	Tuwartz Creek							
Cridge Inlet Creek	Wale Creek							
East Arm Creek	West Arm Creek							
Evinrude Creek	Windy Island Creek							
McMicking Creek								

PRESENT STOCK STATUS

Stocks	Escapement Ave. 1950's	Ave. 1960's	Ave. 1970's		1980's	Target Escapement	Age Composition	$(\bar{x} \pm S^2)$ Rate of Return
Chum - Active								
None								
Chum - Passive								
24 streams	22,800	13,300	5,900	'80)	800	9,900	10% Age 3	2.36 ± 1.84
Argyh Creek	Gil Creek			'81)	5,750		90% Age 4	
Barnard Creek	Limestone Creek			'82)	3,300			
Black Rock Creek	McMicking Creek			'83)	605			
Cartwright Creek	Penn Creek							
Chapple Creek	Roland Creek							
Cherry Creek	Talamposa Creek							
Crane Bay Creek	Turn Creek							
Cridge Inlet Creek	Turtle Creek							
Douglas Creek	Tuwartz Creek							
East Arm Creek	Wale Creek							
Evinrude Creek	West Arm Creek							
Fury Creek	Windy Island Creek							
Sockeye - Active								
None								
Sockeye - Passive								
16 streams	11,500	6,500	2,500	'80)	900	5,700		
Borrowman Creek	Linnea Creek			'81)	1,250			
Clifford Creek	McDonald Creek			'82)	1,050			
Devil Creek	Noble Creek			'83)	900			
Don Creek	Salmon Creek							
Duffey Creek	Sentinel Creek							
Eagle Creek	Stannard Creek							
Flux Creek	Treneman Creek							
Koelmashan Cr.	West Creek							

PRESENT STOCK STATUS

Stocks	Escapement Ave. 1950's	Ave. 1960's	Ave. 1970's	1980's	Target Escapement	Age Composition	$(\bar{x} \pm s^2)$ Rate of Return
Aristazabal Island - W. Side Sub Area							
Pink - Even - Active						100% Age 2	3.25 ± 4.46
None							
Pink - Even - Passive							
16 streams	44,600	34,900	73,500	'80) 17,625	102,800		
Borrowman Creek	Linnea Creek			'82) 6,915			
Clifford Creek	McDonald Creek						
Devil Creek	Noble Creek						
Don Creek	Salmon Creek						
Duffey Creek	Sentinel Creek						
Eagle Creek	Stannard Creek						
Flux Creek	Treneman Creek						
Koelmashan Cr.	West Creek						
Pink - Odd - Passive							
16 streams	16,900	25,600	14,800	'81) 11,800	Details are as for Pink - Even above.		
Borrowman Creek	Linnea Creek			'83) 13,560			
Clifford Creek	McDonald Creek						
Devil Creek	Noble Creek						
Don Creek	Salmon Creek						
Duffey Creek	Sentinel Creek						
Eagle Creek	Stannard Creek						
Flux Creek	Treneman Creek						
Koelmashan Cr.	West Creek						

PRESENT STOCK STATUS

Stocks	Escapement Ave. 1950's	Ave. 1960's	Ave. 1970's		1980's	Target Escapement	Age Composition	$(\bar{x} \pm s^2)$ Rate of Return
Chum - Active								
None								
Chum - Passive								
16 streams	34,300	13,200	7,300	'80)	3,400	23,900	10% Age 3	2.36 ± 1.84
Borrowman Creek	Linnea Creek			'81)	6,500		90% Age 4	
Clifford Creek	McDonald Creek			'82)	7,100			
Devil Creek	Noble Creek			'83)	8,755			
Don Creek	Salmon Creek							
Duffey Creek	Sentinel Creek							
Eagle Creek	Stannard Creek							
Flux Creek	Treneman Creek							
Koelmashan Cr.	West Creek							

APPENDIX II

CURRENT FISHING PATTERNS IN STATISTICAL AREA 6

CURRENT FISHING PATTERNS IN AREA 6

Fishing Week	TARGET STOCK(S) <Tail End of Run >Peak Week	INCIDENTAL CATCH	"STANDARD" FISHING AREAS	GEAR	PRIMARY MANAGEMENT CONSIDERATIONS
June 24 - 30	None	None	None	None	Sockeye presence at Kitkiata and Kwakwa. Pink presence in Campania Sound.
July 1 - 7	<Pink - Kitimat Group <Chum - Douglas Group	None	None	None	Sockeye at Kitlope. Sockeye in Kitkiata and Kwakwa. Pinks in Campania and Whale Channel. Pinks in Sport Fishery; Chum in Kitimat Arm I.F.F.
July 9 - 14	<Pink - Kemano	Sockeye - Kitlope Pink - Kitimat Group - Quaal Chum - Kemano - Kitimat Group - Douglas Group Sockeye - Kitlope	6-5, 6, 10, 26, 28	GN, SN	Expectations Catch Data
	Pink - Kitimat Group	Sockeye - Kitlope Pink - Kemano - Quaal Chum - Kemano - Kitimat Group - Douglas Group	6-5, 6, 10, 26, 28	GN, SN	Expectations Catch data Escapement data
	<Pink - Quaal	Sockeye - Kitlope Pink - Kemano - Kitimat Group Chum - Kemano - Kitimat Group - Douglas Group	6-5, 6, 10, 26, 28	GN, SN	Expectations Catch data Escapement data

CURRENT FISHING PATTERNS IN AREA 6

Fishing Week	TARGET STOCK(S) <Tail End of Run >Peak Week	INCIDENTAL CATCH	"STANDARD" FISHING AREAS	GEAR	PRIMARY MANAGEMENT CONSIDERATIONS
July 9 - 14 (con'd.)	<Chum - Kemano	Sockeye - Kitlope Pink - Kemano - Kitimat Group - Quaal Chum - Kitimat Group - Douglas Group	6-5, 6, 10, 26, 28	GN, SN	Expectations Catch data
	<Chum - Kitimat Group	Sockeye - Kitlope Pink - Kemano - Kitimat Group - Quaal Chum - Kemano - Douglas Group	6-5, 6, 10, 26, 28	GN, SN	Expectations Catch data Escapement data
	Chum - Douglas Group	Sockeye - Kitlope Pink - Kemano - Kitimat Group - Quaal Chum - Kemano - Kitimat Group	6-5, 6, 10, 26, 28	GN, SN	Expectations Catch data Escapement data

CURRENT FISHING PATTERNS IN AREA 6

Fishing Week	TARGET STOCK(S) <Tail End of Run >Peak Week	INCIDENTAL CATCH	"STANDARD" FISHING AREAS	GEAR	PRIMARY MANAGEMENT CONSIDERATIONS
July 15 - 21	Pink - Kemano >Pink - Kitimat Group Pink - Quaal Chum - Kemano Chum - Kitimat Group >Chum - Douglas Group	Fishing areas and fishing gear are as for the previous week for these stocks. In addition to the above incidental catches, Pink-Fraser/Graham and Chum-Fraser Graham are also caught incidentally in all cases.			Catch data Escapement data
	Pink - Laredo Snd. Group	Pink - Kemano - Kitimat Group - Quaal Chum - Kemano - Kitimat Group - Douglas Group	6-16, 17	GN, SN	Expectations
	<Pink - Fraser/ Graham	Chum - Fraser-Graham	6-7, 6-20	GN, SN	Expectations
	<Chum - Fraser/ Graham	Pink - Fraser-Graham	6-7, 6-20	GN, SN	Expectations

CURRENT FISHING PATTERNS IN AREA 6

Fishing Week	TARGET STOCK(S) <Tail End of Run >Peak Week	INCIDENTAL CATCH	"STANDARD" FISHING AREAS	GEAR	PRIMARY MANAGEMENT CONSIDERATIONS
July 22 - 28	>Pink - Kemano <Pink - Kitimat Group >Pink - Quaal >Chum - Kemano >Chum - Kitimat Group Chum - Douglas Group	Details of incidental catches, fishing areas and fishing gear are the same as the previous week for these stocks.			Escapement data Catch data
	>Pink - Laredo Snd. Group	Pink - Kemano - Kitimat Group - Quaal Chum - Kemano - Kitimat Group - Douglas Group	6-16, 17	GN, SN	Catch data Escapement data
	>Pink - Fraser/ Graham	Chum - Fraser/Graham	6-7, 6-20	GN, SN	Catch data Escapement data
	>Chum - Fraser/ Graham	Pink - Fraser/Graham	6-7, 6-20	GN, SN	Catch data Escapement data

CURRENT FISHING PATTERNS IN AREA 6

Fishing Week	TARGET STOCK(S) <Tail End of Run >Peak Week	INCIDENTAL CATCH	"STANDARD" FISHING AREAS	GEAR	PRIMARY MANAGEMENT CONSIDERATIONS
July 29 - Aug 4	<Pink - Kemano >Pink - Quaal <Chum - Kemano Chum - Kitimat Group <Chum - Douglas Group	Details of incidental catches, fishing areas and fishing gear are the same as the previous week for these stocks. Kitimat Group pink stocks are now through the fishing area.			Escapement data Catch data
	>Pink - Laredo Snd. Group	Pink - Kemano - Quaal Chum - Kemano - Kitimat Group - Douglas Group	6-16, 17	GN, SN	Escapement data Catch data
	<Chum - Laredo Snd. Group	As for Pink Laredo Snd. Group	6-16, 17	GN, SN	Expectations
	>Pink - Fraser/ Graham	Chum - Fraser/Graham	6-7, 6-20	GN, SN	Escapement data Catch data
	>Chum - Fraser/ Graham	Pink - Fraser/Graham	6-7, 6-20	GN, SN	Escapement data Catch data

CURRENT FISHING PATTERNS IN AREA 6

Fishing Week	TARGET STOCK(S) <Tail End of Run >Peak Week	INCIDENTAL CATCH	"STANDARD" FISHING AREAS	GEAR	PRIMARY MANAGEMENT CONSIDERATIONS
Aug 5 - 11	>Pink - Quaal	Pink - Campania Pink - Fraser/Graham Pink - Aristazabal Chum - Kitimat Chum - Fraser/Graham Chum - Campania Chum - Aristazabal	6-5, 6, 10	GN, SN	Escapement data Catch data
	<Chum - Kitimat Group	Pink - Quaal - Campania - Fraser/Graham - Aristazabal Chum - Fraser/Graham - Campania - Aristazabal	6-5, 6, 10	GN, SN	Escapement data Catch data
	<Pink - Aristazabal	Chum - Aristazabal	6-13	GN, SN	Expectations
	Chum - Aristazabal	Pink - Aristazabal	6-13	GN, SN	Expectations
	Pink - Campania	Pink - Quaal - Fraser/Graham Chum - Campania - Fraser/Graham - Area 7 (?)	6-10	GN, SN	Expectations
	Chum - Campania	Pink - Campania - Quaal - Fraser/Graham Chum - Fraser/Graham - Area 7 (?)	6-10	GN, SN	Expectations

CURRENT FISHING PATTERNS IN AREA 6

Fishing Week	TARGET STOCK(S) <Tail End of Run >Peak Week	INCIDENTAL CATCH	"STANDARD" FISHING AREAS	GEAR	PRIMARY MANAGEMENT CONSIDERATIONS
Aug. 5 - 11 (cont'd.)	Pink - Laredo Snd.	Pink - Aristazabal Pink - Quaal (?) Pink - Campania Chum - Laredo Snd. - Aristazabal - Campania	6-16	GN, SN	Escapement data Catch data
	Chum - Laredo Snd.	Pink - Aristazabal - Quaal (?) - Campania Chum - Aristazabal - Campania			
	Pink - Fraser/ Graham	Chum - Fraser/Graham	6-7, 6-20	GN, SN	Escapement data Catch data
	Chum - Fraser/ Graham	Pink - Fraser/Graham	6-7, 6-20	GN, SN	Escapement data Catch data

CURRENT FISHING PATTERNS IN AREA 6

Fishing Week	TARGET STOCK(S) <Tail End of Run >Peak Week	INCIDENTAL CATCH	"STANDARD" FISHING AREAS	GEAR	PRIMARY MANAGEMENT CONSIDERATIONS
Aug 12 - 18	<Pink - Quaal	Pink - Aristazabal Chum - Aristazabal Pink - Campania Chum - Campania Pink - Fraser/Graham Chum - Fraser/Graham	6-5, 6, 10	GN, SN	Escapement data Catch data
Assumption of GN USSN Pink-Chum write in for Area 7 or change Area 6.	<Pink - Aristazabal	Chum - Aristazabal	6-13	GN, SN	Escapement Catch expectations
	<Chum - Aristazabal Laredo ?	Pink - Aristazabal	6-13	GN, SN	Expectations Catch
	>Pink - Campania	Pink - Quaal Chum - Campania Pink - Fraser/Graham Chum - Fraser/Graham	6-10	GN, SN	Expectations Catch
	>Chum - Campania	Pink - Quaal Chum - Campania Pink - Fraser/Graham Chum - Fraser/Graham	6-10	GN, SN	Escapements Catch
	Pink - Laredo Snd.	Pink - Campania Chum - Campania Chum - Laredo Snd.	6-16	GN, SN	Escapements Catch
	>Chum - Laredo Snd.	Pink - Campania Chum - Campania	6-16		
	<Pink - Fraser/ Graham	Chum - Fraser/Graham	6-7, 6-20	GN, SN	
	<Chum - Fraser/ Graham	Pink - Fraser/Graham	6-7, 6-20	GN, SN	

CURRENT FISHING PATTERNS IN AREA 6

Fishing Week	TARGET STOCK(S) <Tail End of Run >Peak Week	INCIDENTAL CATCH	"STANDARD" FISHING AREAS	GEAR	PRIMARY MANAGEMENT CONSIDERATIONS
Aug 19 - 25	>Pink - Aristazabal	Chum - Aristazabal Pink - Laredo Snd. Chum - Laredo Snd.	6-13	GN, SN	Escapements Catch
	Chum - Aristazabal	Pink - Aristazabal Pink - Laredo Snd. Chum - Laredo Snd.	6-13	GN, SN	Escapements Catch
	>Pink - Campania	Chum - Campania	6-10	GN, SN	Escapements Catch
	>Chum - Campania	Pink - Campania	6-10	GN, SN	Escapements? Catch
	<Pink - Laredo Snd.	Chum - Laredo Snd.	6-16	GN, SN	Escapements Catch
	Chum - Laredo Snd.	Pink - Laredo Snd.	6-16	GN, SN	
Aug 26 - Sept 1	<Pink - Aristazabal	Chum - Aristazabal Chum - Laredo Snd.	6-13	GN, SN	Escapements Catch
	>Chum - Aristazabal	Pink - Aristazabal Chum - Laredo Snd.	6-13	GN, SN	Escapement Catch
	Pink - Campania	Chum - Campania	6-10	GN, SN	Escapement Catch
	Chum - Campania	Pink - Campania	6-10	GN, SN	Escapement Catch
	<Chum - Laredo Snd.		6-16	GN, SN	Escapement Catch

CURRENT FISHING PATTERNS IN AREA 6

Fishing Week	TARGET STOCK(S) <Tail End of Run >Peak Week	INCIDENTAL CATCH	"STANDARD" FISHING AREAS	GEAR	PRIMARY MANAGEMENT CONSIDERATIONS
Sept 2 - 8	Chum - Aristazabal		6-13	GN, SN	Escapement Catch
	Price Sept, October				

APPENDIX III

HABITAT STATUS
IN STATISTICAL AREA 6

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 Gardner Canal Sockeye Area 6

STOCK DATA	Maximum Recorded Escapement	Target/ Optimum Escapement	Current Average Escapement
Thousands	175	20.5	14

MANAGEMENT STYLE

Active 50%

Passive 50%

No. of Streams 2

No. of Significant Streams 2

(100 % of MRE)

HABITAT NOTES

Almost entirely Kitlope River stock.

Historic Status	Natural flow instability. Logging since late 1960's. Impacts on sockeye habitat are probably low to moderate. (P)
Current Status	Stable. (P) Continued logging. (P)
Future Outlook	
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 is not a major factor in stock decline.

HABITAT INFORMATION TABLE

STOCK GROUP Gardner Canal Chinook Area 6

STOCK DATA	Maximum Recorded Escapement	Target/ Optimum Escapement	Current Average Escapement
Thousands	9.7	26,400	2.3

MANAGEMENT STYLE Active ___ Passive X

No. of Streams 6

No. of Significant Streams 5

(98 % of MRE)

HABITAT NOTES

Historic Status	Natural flow instability. Heavy early winter flooding. Many streams blocked by falls. Logging in Kitlope drainage since late 1960's. Extent and impacts unknown - probably low to moderate. (P) Powerhouse on Kemano River provides flow control potential. Most streams undeveloped.
Current Status	Stable. Continued logging in Kitlope drainage. (P)
Future Outlook	Unchanged with regeneration in logged areas. (P)
Natural Habitat Production Potential	
Improved Production Potential	Chinook would probably benefit from Kemano flow control potential. (P)

SUMMARY

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

Habitat is probably not a factor in stock status.

HABITAT INFORMATION TABLE

STOCK GROUP Gardner Canal Coho Area 6

STOCK DATA	Maximum Recorded Escapement	Target/ Optimum Escapement	Current Average Escapement
Thousands	98	33	7.5

MANAGEMENT STYLE

Active ___

Passive X

No. of Streams 10

No. of Significant Streams 8

(99 % of MRE)

HABITAT NOTES

Dominated by Kitlope and Kemano River stocks.

Historic Status	Natural flow instability. Heavy early winter flooding. Many streams blocked by falls. Logging in Kitlope drainage since late 1960's. Extent and impacts unknown; probably low to moderate. (P) Powerhouse on Kemano River provides flow control potential. Most other streams undeveloped.
Current Status	Stable. Continued logging in Kitlope drainage. (P)
Future Outlook	Unchanged with regeneration in logged areas. (P)
Natural Habitat Production Potential	
Improved Production Potential	Better use could probably be made of flow control from Kemano.(P)

SUMMARY

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

Habitat probably not a major factor in declines, which also occur on pristine systems.

HABITAT INFORMATION TABLE

STOCK GROUP Gardner Canal Chum Area 6

STOCK DATA	Maximum Recorded Escapement	Target/ Optimum Escapement	Current Average Escapement
Thousands	241	111	26

MANAGEMENT STYLE

Active 10%

Passive 90%

No. of Streams 10

No. of Significant Streams 7

(97 % of MRE)

HABITAT NOTES

Dominated by Kemano River.

Historic Status	Natural flow instability. Heavy early winter flooding. Many streams blocked by falls. Logging in Kitlope drainage since late 1960's. Extent and impacts unknown - probably low to moderate. (P) Powerhouse on Kemano River provides flow control potential. Most streams undeveloped.
Current Status	Stable. Continued logging in Kitlope drainage. (P)
Future Outlook	Unchanged with regeneration in logged areas. (P)
Natural Habitat Production Potential	
Improved Production Potential	Better use could probably be made of flow control from Kemano.(P)

SUMMARY

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

Habitat change does not account for stock declines.

HABITAT INFORMATION TABLE

STOCK GROUP Gardner Canal Pink Area 6

STOCK DATA	Maximum Recorded Escapement	Target/ Optimum Escapement	Current Average Escapement
Thousands	228	200	94 - even 89 - odd

MANAGEMENT STYLE

Active 10%

Passive 90%

No. of Streams 10

No. of Significant Streams 6

(98 % of MRE)

HABITAT NOTES

Dominated by Kemano River.

Historic Status	Natural flow instability. Heavy early winter flooding. Many streams blocked by falls. Logging in Kitlope drainage since late 1960's. Extent and impacts unknown - probably low to moderate. (P) Powerhouse on Kemano River provides flow control potential. Most streams undeveloped.
Current Status	Stable. Continued logging in Kitlope drainage. (P)
Future Outlook	Unchanged with regeneration in logged areas. (P)
Natural Habitat Production Potential	
Improved Production Potential	Better use could probably be made of flow control from Kemano.(P)

SUMMARY

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

Habitat probably not a factor in stock declines.

HABITAT INFORMATION TABLE

STOCK GROUP Kitimat Arm Sockeye Area 6

STOCK DATA	Maximum Recorded Escapement	Target/ Optimum Escapement	Current Average Escapement
Thousands	3.5	2.5	1.3

MANAGEMENT STYLE Active ___ Passive X

No. of Streams 2

No. of Significant Streams 2

(100 % of MRE)

HABITAT NOTES

Dominated by Kitimat River and tributaries.

Historic Status	Natural flow instability, compounded by extensive logging since early 1960's. Moderate impacts including siltation and scouring. (GWG/SEP) Industrial harbour and settlement development at Kitimat - moderate impacts. (GWG/SEP)
Current Status	Logging completed at lower elevations and regeneration occurring. (P) Industrial and port development probably stable. (P)
Future Outlook	Logging moving to higher elevations. (P) Possible increasing urban, industrial and recreational use and impacts. (GWG/SEP) Watersheds recovering well. Gravel recruitment probably good over the long-term - 20 to 30 years. (P)
Natural Habitat Production Potential	Probably reduced by lower Kitimat River changes. (P)
Improved Production Potential	

SUMMARY

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

Habitat deterioration has contributed to stock decline. Long-term natural recovery of watershed is likely. (P)

HABITAT INFORMATION TABLE

STOCK GROUP Kitimat Arm Chinook Area 6

STOCK DATA	Maximum Recorded Escapement	Target/ Optimum Escapement	Current Average Escapement
Thousands	26.5	80.1	4.7

MANAGEMENT STYLE

Active ___

Passive X

No. of Streams 10

No. of Significant Streams 7

(99 % of MRE)

HABITAT NOTES

Dominated by Kitimat River and tributaries.

Historic Status	Natural flow instability, compounded by extensive logging since early 1960's. Moderate impacts including siltation and scouring. (GWG/SEP) Industrial harbour and settlement development at Kitimat - moderate impacts. (GWG/SEP)
Current Status	Logging completed at lower elevations and regeneration occurring. (P) Industrial and port development probably stable. (P)
Future Outlook	Logging moving to higher elevations. (P) Possible increase in urban, industrial and recreation activity and impacts. (GWG/SEP) Watersheds recovering well. Gravel recruitment probably good over the long-term - 20 to 30 years. (P)
Natural Habitat Production Potential	Probably reduced by lower Kitimat River changes. (P)
Improved Production Potential	

SUMMARY

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

Habitat deterioration has contributed to stock decline. Long-term natural recovery of watershed is likely. (P)

HABITAT INFORMATION TABLE

STOCK GROUP Kitimat Arm Coho Area 6

STOCK DATA	Maximum Recorded Escapement	Target/ Optimum Escapement	Current Average Escapement
Thousands	44.4	83.4	14

MANAGEMENT STYLE Active ___ Passive X

No. of Streams 16

No. of Significant Streams 11

(98 % of MRE)

HABITAT NOTES

Historic Status	Natural flow instability, compounded by extensive logging since early 1960's. Moderate impacts including siltation and scouring. (GWG/SEP) Industrial harbour and settlement development at Kitimat - moderate impacts. (GWG/SEP) Sport fishery for chinook, coho and steelhead.
Current Status	Logging completed at lower elevations and regeneration occurring. (P) Industrial and port development probably stable. (P)
Future Outlook	Logging moving to higher elevations. (P) Possible increase in urban, industrial and recreation activity and impacts. (GWG/SEP) Watersheds recovering well. Gravel recruitment probably good over the long-term - 20 to 30 years. (P)
Natural Habitat Production Potential	Probably reduced by lower Kitimat River changes. (P)
Improved Production Potential	Small stream enhancement potential. (GWG/SEP)

SUMMARY

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

Habitat deterioration has contributed to stock decline. Long-term natural recovery of watersheds is likely. (P)

HABITAT INFORMATION TABLE

STOCK GROUP Kitimat Arm Chum Area 6

STOCK DATA	Maximum Recorded Escapement	Target/ Optimum Escapement	Current Average Escapement
Thousands	144	190	12.3

MANAGEMENT STYLE

Active 25%

Passive 75%

No. of Streams 11

No. of Significant Streams 8

(95 % of MRE)

HABITAT NOTES

Dominated by Kitimat River and tributaries.

Historic Status	Natural flow instability, compounded by extensive logging since early 1960's. Moderate impacts including siltation and scouring. (GWG/SEP) Industrial harbour and settlement development at Kitimat - moderate impacts. (GWG/SEP)
Current Status	Logging completed at lower elevations and regeneration occurring. (P) Industrial and port development probably stable. (P)
Future Outlook	Logging moving to higher elevations. (P) Possible increase in urban, industrial and recreation activity and impacts. (GWG/SEP) Watersheds recovering well. Gravel recruitment probably good over the long-term - 20 to 30 years. (P)
Natural Habitat Production Potential	Probably reduced by lower Kitimat River changes. (P)
Improved Production Potential	

SUMMARY

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

Habitat deterioration has contributed to stock decline. Long-term natural recovery of watershed is likely. (P)

HABITAT INFORMATION TABLE

STOCK GROUP Kitimat Arm Pink Area 6

STOCK DATA	Maximum Recorded Escapement	Target/ Optimum Escapement	Current Average Escapement
Thousands	440	322	48 - even 26 - odd

MANAGEMENT STYLE Active 25%

Passive 75%

No. of Streams 13

No. of Significant Streams 11

(98 % of MRE)

HABITAT NOTES

Dominated by Kitimat River and tributaries.

Historic Status	Natural flow instability, compounded by extensive logging since early 1960's. Moderate impacts including siltation and scouring. Industrial harbour and settlement development at Kitimat - moderate impacts. (GWG/SEP)
Current Status	Logging completed at lower elevations and regeneration occurring. (P) Industrial and port development probably stable. (P)
Future Outlook	Logging moving to higher elevations. (P) Possible increase in urban, industrial and recreation activity and impacts. (GWG/SEP) Watersheds recovering well. Gravel recruitment probably good over the long-term - 20 to 30 years. (P)
Natural Habitat Production Potential	Probably reduced by lower Kitimat River changes. (P)
Improved Production Potential	

SUMMARY

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

Habitat deterioration has contributed to stock decline. Long-term natural recovery of watershed is likely. (P)

HABITAT INFORMATION TABLE

STOCK GROUP Douglas - Ursula Sockeye Area 6

STOCK DATA	Maximum Recorded Escapement	Target/ Optimum Escapement	Current Average Escapement
Thousands	13.2	12.5	2

MANAGEMENT STYLE

Active ___

Passive X

No. of Streams 4

No. of Significant Streams 4

(100 % of MRE)

HABITAT NOTES

Historic Status	Natural flow instability. Very limited logging development. Most of area appears pristine.
Current Status	Virtually pristine.
Future Outlook	No change. (P)
Natural Habitat Production Potential	To historic level. (P)
Improved Production Potential	

SUMMARY

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

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

HABITAT INFORMATION TABLE

STOCK GROUP Douglas - Ursula Chinook Area 6

STOCK DATA	Maximum Recorded Escapement	Target/ Optimum Escapement	Current Average Escapement
Thousands	.2	1.5	.07

MANAGEMENT STYLE

Active ___

Passive X

No. of Streams 2

No. of Significant Streams 2

(100 % of MRE)

HABITAT NOTES

Giltoyees River and Foch Creek.

Historic Status	Natural instability. No development.
Current Status	Pristine.
Future Outlook	No change. (P)
Natural Habitat Production Potential	To historic level. (P)
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 declines. (P)

HABITAT INFORMATION TABLE

STOCK GROUP Douglas - Ursula Coho Area 6

STOCK DATA	Maximum Recorded Escapement	Target/ Optimum Escapement	Current Average Escapement
Thousands	30	44	9

MANAGEMENT STYLE Active ___ Passive X

No. of Streams 17

No. of Significant Streams 10

(96 % of MRE)

HABITAT NOTES

Historic Status	Natural flow instability. Very limited logging development. Most of area appears pristine.
Current Status	Virtually pristine.
Future Outlook	No change. (P)
Natural Habitat Production Potential	To historic level. (P)
Improved Production Potential	

SUMMARY

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

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

HABITAT INFORMATION TABLE

STOCK GROUP Douglas - Ursula Chum Area 6

STOCK DATA	Maximum Recorded Escapement	Target/ Optimum Escapement	Current Average Escapement
Thousands	88	58	17

MANAGEMENT STYLE

Active 18%

Passive 28%

No. of Streams 20

No. of Significant Streams 7

(93 % of MRE)

HABITAT NOTES

Historic Status	Natural flow instability. Very limited logging development. Most of area appears pristine.
Current Status	Virtually pristine.
Future Outlook	No change. (P)
Natural Habitat Production Potential	To historic level. (P)
Improved Production Potential	

SUMMARY

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

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

HABITAT INFORMATION TABLE

STOCK GROUP Douglas - Ursula Pink Area 6

STOCK DATA	Maximum Recorded Escapement	Target/ Optimum Escapement	Current Average Escapement
Thousands	865	336	142 - odd 244 - even

MANAGEMENT STYLE Active X Passive ___

No. of Streams 17

No. of Significant Streams 7

(95 % of MRE)

HABITAT NOTES

Historic Status	Natural flow instability. Very limited logging development. Most of area appears pristine.
Current Status	Virtually pristine.
Future Outlook	No change. (P)
Natural Habitat Production Potential	To historic level. (P)
Improved Production Potential	

SUMMARY

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

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

HABITAT INFORMATION TABLE

STOCK GROUP Fraser - Graham Sockeye Area 6

STOCK DATA	Maximum Recorded Escapement	Target/ Optimum Escapement	Current Average Escapement
Thousands	3.5	3.1	.59

MANAGEMENT STYLE

Active ___

Passive X

No. of Streams 4

No. of Significant Streams 1

(95 % of MRE)

HABITAT NOTES

Dominated by Canoona River.

Historic Status	Low level logging in mid 1970's. (GWG/SEP)
Current Status	
Future Outlook	No increase in activity foreseen. (GWG/SEP)
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 Fraser - Graham Chinook Area 6

STOCK DATA	Maximum Recorded Escapement	Target/ Optimum Escapement	Current Average Escapement
Thousands	1.9	1.1	.09

MANAGEMENT STYLE Active ___ Passive X

No. of Streams 3

No. of Significant Streams 1

(95 % of MRE)

HABITAT NOTES

Dominated by Khutze River.

Historic Status	Pristine.
Current Status	
Future Outlook	No change.
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 INFORMATION TABLE

STOCK GROUP Fraser - Graham Coho Area 6

STOCK DATA	Maximum Recorded Escapement	Target/ Optimum Escapement	Current Average Escapement
Thousands	27	12.9	1.3

MANAGEMENT STYLE Active ___ Passive X

No. of Streams 13

No. of Significant Streams 8

(96 % of MRE)

HABITAT NOTES

Dominated by Canoona River.

Historic Status	Low level logging on Canoona River in mid 1970's.
Current Status	
Future Outlook	No increase in logging foreseen.
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 cause of stock declines. (P)

HABITAT INFORMATION TABLE

STOCK GROUP Fraser - Graham Chum Area 6

STOCK DATA	Maximum Recorded Escapement	Target/ Optimum Escapement	Current Average Escapement
Thousands	59.5	65	11.4

MANAGEMENT STYLE

Active 15%

Passive 85%

No. of Streams 13

No. of Significant Streams 6

(80 % of MRE)

HABITAT NOTES

Historic Status	Pristine. Natural flow instability.
Current Status	
Future Outlook	No change.
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 declines.

HABITAT INFORMATION TABLE

STOCK GROUP Fraser - Graham Pink Area 6

STOCK DATA	Maximum Recorded Escapement	Target/ Optimum Escapement	Current Average Escapement
Thousands	265	187	22 - even 90 - odd

MANAGEMENT STYLE

Active 30%

Passive 70%

No. of Streams 12

No. of Significant Streams 8

(97 % of MRE)

HABITAT NOTES

Historic Status	Natural flow instability. Low level logging on Canoona River in mid 1970's. (GWG/SEP)
Current Status	
Future Outlook	No increase in logging foreseen. (GWG/SEP)
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 of stock declines.

HABITAT INFORMATION TABLE

STOCK GROUP Laredo Sound Sockeye Area 6

STOCK DATA	Maximum Recorded Escapement	Target/ Optimum Escapement	Current Average Escapement
Thousands	27	14.9	1.8

MANAGEMENT STYLE Active ___ Passive X

No. of Streams 10

No. of Significant Streams 7

(91 % of MRE)

HABITAT NOTES

Historic Status	Natural flow instability. Pristine.
Current Status	
Future Outlook	No change. (GWG/SEP)(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 declines. (P)

HABITAT INFORMATION TABLE

STOCK GROUP Laredo Sound Coho Area 6

STOCK DATA	Maximum Recorded Escapement	Target/ Optimum Escapement	Current Average Escapement
Thousands	23	15.8	3.4

MANAGEMENT STYLE Active ___ Passive X

No. of Streams 20

No. of Significant Streams 11

(85 % of MRE)

HABITAT NOTES

Historic Status	Natural flow instability. Pristine.
Current Status	
Future Outlook	No change. (GWG/SEP)(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 declines. (P)

HABITAT INFORMATION TABLE

STOCK GROUP Laredo Sound Chum Area 6

STOCK DATA	Maximum Recorded Escapement	Target/ Optimum Escapement	Current Average Escapement
Thousands	91	42	15

MANAGEMENT STYLE

Active 15%

Passive 85%

No. of Streams 20

No. of Significant Streams 7

(86 % of MRE)

HABITAT NOTES

Historic Status	Natural flow instability. Pristine.
Current Status	
Future Outlook	No change. (GWG/SEP)(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 declines. (P)

HABITAT INFORMATION TABLE

STOCK GROUP Laredo Sound Pink Area 6

STOCK DATA	Maximum Recorded Escapement	Target/ Optimum Escapement	Current Average Escapement
Thousands	232	105	48 - even 5 - odd

MANAGEMENT STYLE

Active 15%

Passive 85%

No. of Streams 21

No. of Significant Streams 10

(82 % of MRE)

HABITAT NOTES

Historic Status	Natural flow instability. Pristine.
Current Status	
Future Outlook	No change. (GWG/SEP)(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 declines. (P)

HABITAT INFORMATION TABLE

STOCK GROUP Campania/Laredo Sockeye Area 6

STOCK DATA	Maximum Recorded Escapement	Target/ Optimum Escapement	Current Average Escapement
Thousands	9.6	4.5	1.0

MANAGEMENT STYLE

Active ___

Passive X

No. of Streams 3

No. of Significant Streams 3

(100 % of MRE)

HABITAT NOTES

Historic Status	Natural instability. Minor mining and estuary activity and impacts on Limestone Creek. (GWG/SEP) Remainder pristine.
Current Status	
Future Outlook	No increase in activity foreseen. (GWG/SEP)
Natural Habitat Production Potential	
Improved Production Potential	

SUMMARY

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

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

HABITAT INFORMATION TABLE

STOCK GROUP Campania/Laredo Coho Area 6

STOCK DATA	Maximum Recorded Escapement	Target/ Optimum Escapement	Current Average Escapement
Thousands	25	18	2.3

MANAGEMENT STYLE

Active ___

Passive X

No. of Streams 21

No. of Significant Streams 8

(84 % of MRE)

HABITAT NOTES

Historic Status	Natural instability. Minor mining and estuary activity and impacts on Limestone Creek. (GWG/SEP) Remainder pristine.
Current Status	
Future Outlook	No increase in activity foreseen. (GWG/SEP)
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 declines. (P)

HABITAT INFORMATION TABLE

STOCK GROUP Campania/Laredo Chum Area 6

STOCK DATA	Maximum Recorded Escapement	Target/ Optimum Escapement	Current Average Escapement
Thousands	52	28	2.6

MANAGEMENT STYLE

Active ___

Passive X

No. of Streams 24

No. of Significant Streams 9

(80 % of MRE)

HABITAT NOTES

Historic Status	Natural instability. Pristine.
Current Status	
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 declines. (P)

HABITAT INFORMATION TABLE

STOCK GROUP Campania/Laredo Pink Area 6

STOCK DATA	Maximum Recorded Escapement	Target/ Optimum Escapement	Current Average Escapement
Thousands	140	193	94 - even 58 - odd

MANAGEMENT STYLE

Active ___

Passive X

No. of Streams 21

No. of Significant Streams 9

(91 % of MRE)

HABITAT NOTES

Historic Status	Natural instability. Minor mining and estuary activity and impacts on Limestone Creek. (GWG/SEP) Remainder pristine.
Current Status	
Future Outlook	No increase in activity foreseen. (GWG/SEP)
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 declines. (P)

HABITAT INFORMATION TABLE

STOCK GROUP Aristazabal Sockeye Area 6

STOCK DATA	Maximum Recorded Escapement	Target/ Optimum Escapement	Current Average Escapement
Thousands	20	5.7	1.0

MANAGEMENT STYLE

Active ___

Passive X

No. of Streams 10

No. of Significant Streams 8

(90 % of MRE)

HABITAT NOTES

Minor stock.

Historic Status	Natural flow instability. Pristine.
Current Status	
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 declines. (P)

HABITAT INFORMATION TABLE

STOCK GROUP Aristazabal Coho Area 6

STOCK DATA	Maximum Recorded Escapement	Target/ Optimum Escapement	Current Average Escapement
Thousands	48	15.8	1.4

MANAGEMENT STYLE Active ___ Passive X

No. of Streams 16

No. of Significant Streams 10

(85 % of MRE)

HABITAT NOTES

Historic Status	Natural flow instability. Pristine.
Current Status	
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 declines. (P)

HABITAT INFORMATION TABLE

STOCK GROUP Aristazabal Chum Area 6

STOCK DATA	Maximum Recorded Escapement	Target/ Optimum Escapement	Current Average Escapement
Thousands	48	24	6.5

MANAGEMENT STYLE Active ___ Passive X

No. of Streams 16

No. of Significant Streams 9

(80 % of MRE)

HABITAT NOTES

Historic Status	Natural flow instability. Pristine.
Current Status	
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 declines. (P)

HABITAT INFORMATION TABLE

STOCK GROUP Aristazabal Pink Area 6

STOCK DATA	Maximum Recorded Escapement	Target/ Optimum Escapement	Current Average Escapement
Thousands	144.2	102.8	12.2 - even 12.6 - odd

MANAGEMENT STYLE

Active ___

Passive X

No. of Streams 16

No. of Significant Streams 7

(85 % of MRE)

HABITAT NOTES

Historic Status	Natural flow instability. Pristine.
Current Status	
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 declines. (P)

DATA SOURCES FOR INFORMATION TABLES — STATISTICAL AREA 6

Maximum Recorded Escapement

Stream Catalogues: modified as described in the Introduction.

Leaney-East, A.J., C.E. Manzon and D.E. Marshall. 1982. Catalogue of salmon streams and spawning escapements of Statistical Area 6 - South (Butedale). Can. Data Rep. Fish. Aquat. Sci. #299.

Manzon, C.E. and D.E. Marshall. 1981. Catalogue of salmon streams and spawning escapements of Statistical Area 6 - North (Kitimat Arm). Can. Data Rep. Fish. Aquat. Sci. #300.

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 Area 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 April 1985 SRMP, Volumes I and II, 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 6

DISTRIBUTION OF IMPORTANT SALMONID DISEASE AGENTS AND PARASITES IN STATISTICAL AREA 6[1]

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 important salmonid disease agents and parasites included in the analysis.

Fish health surveys have been undertaken in three watersheds in Statistical Area 6: the Kemano River, the Kitimat River and the Kitlope River (Table IV-1 and Figure IV-1). Data from several fish health surveys undertaken for the Kemano Completion Hydroelectric Development were reported by Envirocon Ltd. (1984).[2]

None of the important salmonid disease agents or parasites were found in the Kemano River for a sample of 100 chum salmon in 1984. Smaller samples of pink (30) and chinook (4) salmon also showed none of the important diseases. However, Envirocon Ltd. (1984) found enteric redmouth disease agents in chum and pink salmon.[2]

It the Kitimat River no important diseases were found in large samples of chinook (70), chum (82) and pink salmon (120) in 1977 and 1978. No important diseases were also found in smaller samples of coho salmon (21) and Dolly Varden (5) and rainbow trout. Furunculosis bacteria were found in steelhead from the Kitimat hatchery.

In the Kitlope River system, a sample of 60 sockeye salmon was found to contain fish with infectious hematopoietic necrosis (IHN) and ceratomyxosis (C. shasta) in 1984. No Henneguya were found in a sample of 190 sockeye from Kitlope Lake in 1980.

Table IV-1. Distribution of salmonid disease agents and parasites in Statistical Area 6. [3,4]

Location			Findings* by Species**								
Area	Sample Site	Total No. Examined	No Disease	F	PKD	BKD	IHN	C.S.	ERM	HEN	Other Disease
6	Kemano General Area	30									PK
6	Kemano General Area	100									CM
6	Kemano General Area	4	CN								
6	Kemano River[2]	322							CM		
6	Kemano River[2]	31							PK		
6	Kitimat Hatchery	25									CN
6	Kitimat Hatchery	12									CM
6	Kitimat Hatchery	21	CO								
6	Kitimat Hatchery	44		ST							
6	Kitimat River	284									PK
6	Kitimat River	34	(No HEN in CN)								
6	Kitimat River	60	(No HEN in CN)								
6	Kitimat River	5									DV
6	Kitimat River	160									CM
6	Kitimat River	77	CN								CN
6	Kitimat River										RT
6	Kitimat River	90	(No HEN in PK)								
6	Kitimat River	22	CO								CO
6	Kitimat River	2	CT								
6	Kitlope General Area	60					SK	SK			SK
6	Kitlope Lake	190	(No HEN in SK)								

* 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

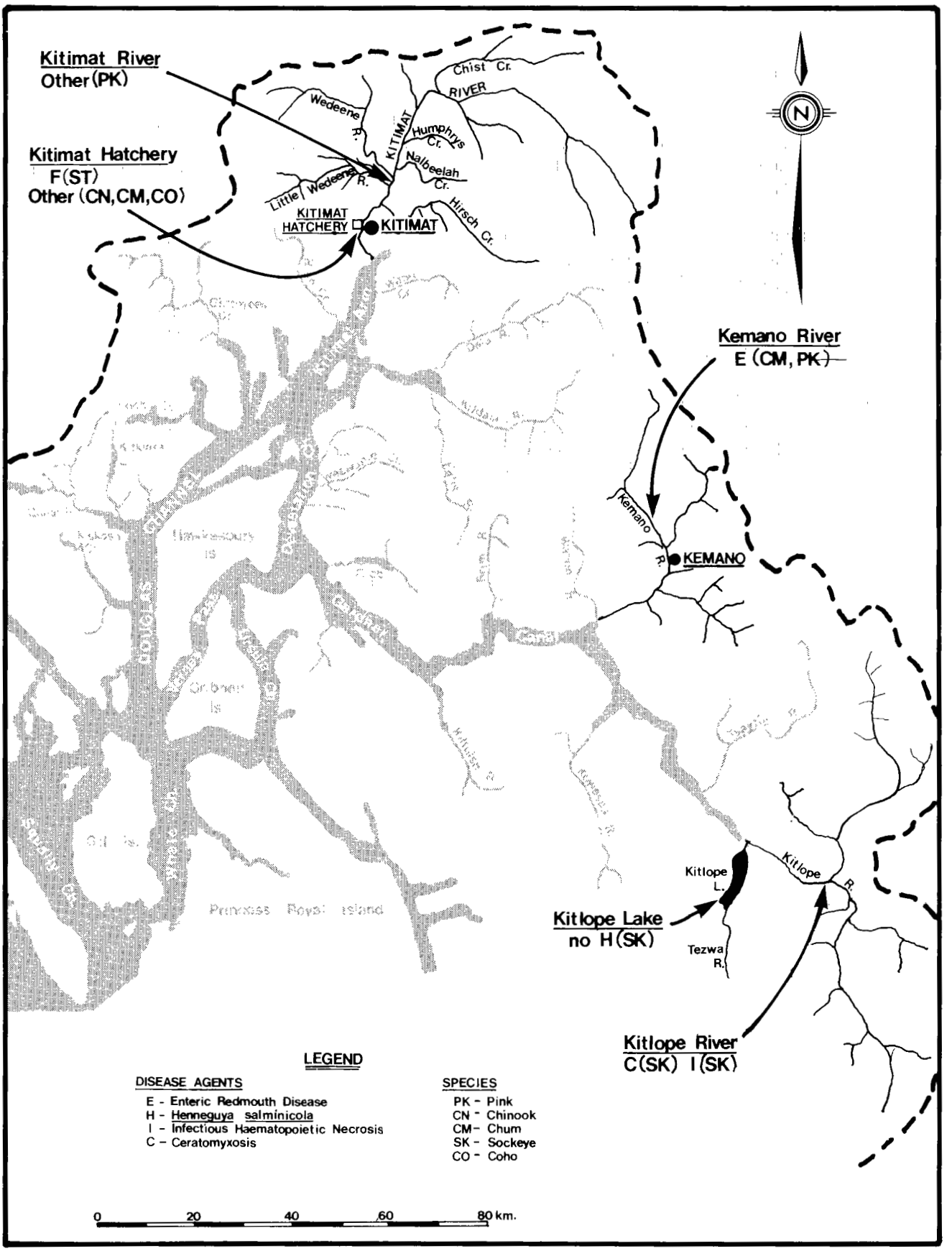

Figure IV-1. Distribution of important salmonid agents and parasites in Statistical Area 6.

REFERENCES

1. McDougal, R.D. and Associates. 1986. Distribution of important salmonid disease agents and parasites in the Queen Charlotte Islands. Prepared under contract for DFO in consultation with Fish Health and Diagnostics Section, Pacific Biol. Sta., Nanaimo, B.C.

2. Envirocon Limited. 1984. Environmental studies associated with the proposed Kemano Completion Hydroelectric Development, Vol. 7. Fish diseases and parasites baseline information. Vancouver.

3. DFO. 1985. Fish health data base. Updated September 1985. Can. Dep. Fisheries and Oceans, Vancouver, B.C.

4. 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.